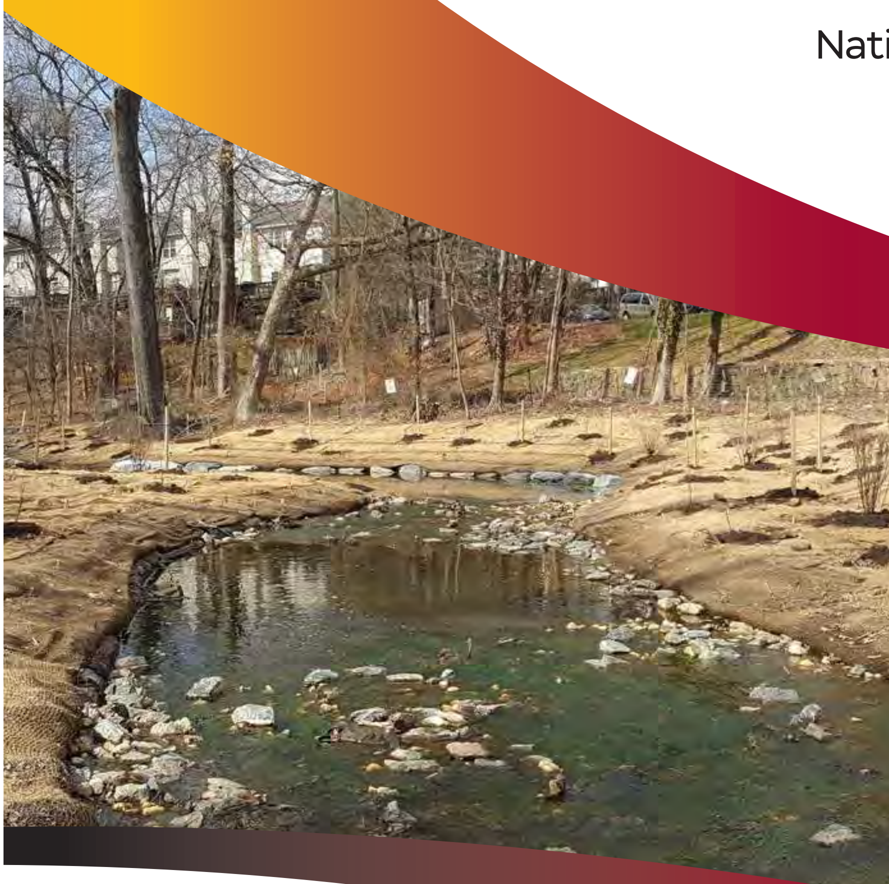
Annual Report

October 9, 2019

National Pollutant Discharge Elimination System
Municipal Separate Storm Sewer System
Permit No. 11-DP-3313 MD0068276
Permit Term
October 2015 to October 2020



Submitted to:
Sediment, Stormwater, and Dam Safety Program
Water and Science Administration
Maryland Department of the Environment
1800 Washington Boulevard
Baltimore, MD 21230

Submitted by:
Maryland Department of Transportation
State Highway Administration
Office Of Environmental Design
707 North Calvert Street, C-303
Baltimore, MD 21202

MDOT
MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

October 9, 2019

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

Dear Mr. Comstock:

The Maryland Department of Transportation State Highway Administration (MDOT SHA), Office of Environmental Design (OED) is pleased to submit this fourth annual report to the Maryland Department of the Environment (MDE), Water and Science Administration's (WSA) Sediment, Stormwater & Dam Safety Program (SSDS) addressing conditions under the MDOT SHA National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) discharge permit (#11-DP-33133 MD 0068276) effective October 9, 2015. The report covers compliance efforts for fiscal year 2019 from July 1, 2018 to June 30, 2019.

Noteworthy items related to this report have been summarized in Attachment A. In accordance with Part V.C. of the permit, Attachment B contains an executive summary of the NPDES MS4 program administered by MDOT SHA that serves as the MDOT SHA reapplication for coverage under the MS4 individual permit for large or medium jurisdictions. An updated Gantt chart of programmed projects for fiscal year 2020 to meet the current permit term twenty percent restoration goal is provided in Attachment C. Included also is one hard copy of the report and a compact disc containing an electronic version with accompanying digital geodatabase.

If you have any questions or need additional information regarding this delivery, please contact Ms. Karen Coffman at 410-545-8407 and kcoffman@mdot.maryland.gov or me at 410-545-8640 and sram@mdot.maryland.gov. Ms. Coffman and I will be happy to assist you.

Sincerely,

Sonal Ram, P.E.
Director
Office of Environmental Design

Attachments

cc: Mr. Brian Cooper, SSDS, WSA, MDE
Ms. Dorothy Morrison, Director, Office of Environment, MDOT
Ms. Karen Coffman, Chief, Water Programs Division, OED, MDOT SHA
Mr. Kevin Wilsey, Deputy Director, OED, MDOT SHA

ATTACHMENT A

NOTEWORTHY COMPONENTS OF THIS MDOT SHA FOURTH ANNUAL REPORT

The following list highlights important components of this fourth annual report for MDE consideration:

- MDE supplied comments to MDOT SHA dated September 16, 2019 related to the results of the MDE review of the MDOT SHA third annual report (2018). In accordance with Part V.A.3. of the MS4 permit, within 12 months and before September 16, 2020, MDOT SHA responses addressing the September 16, 2019 MDE comments will be submitted to MDE subsequent to this fourth annual report.

- The MDOT SHA annual report to MDE for the Delegation of Sediment and Stormwater Approval Authority is not included as an appendix to this fourth annual MS4 report (as was done with the 2018 annual report) but is instead submitted concurrently with it to better align with the requirements described in Section 8.B.ii. of the Memorandum of Understanding between MDOT SHA and MDE, executed July 8, 2014, that granted MDOT SHA the approving authority for erosion and sediment control and stormwater management plans for MDOT SHA projects.

- In accordance with commitments made by MDOT SHA in its third annual report (2018) and with requirements established by MDE in its review of that report, MDOT SHA is providing with this fourth annual report both Appendix B, an updated Part II of the Impervious Restoration and Coordinated Total Maximum Daily Load (TMDL) Implementation Plan (referred to as “Implementation Plan” hereafter) that integrates the MDE-approved impervious baseline and twenty percent restoration goal of 4,621 acres, and Appendix D, a 2019 revision to the MDOT SHA Restoration Modeling Protocol.

- In accordance with commitments made during an interagency meeting between MDE and MDOT SHA on April 10, 2017, as documented in Attachment III of the letter to MDOT SHA from MDE dated April 26, 2017 regarding its review of the first annual report (2016) submitted by MDOT SHA for the current permit term, Appendix C is provided with this fourth annual report and contains an addendum to Table 3-2, submitted with Part III of the revised Implementation Plan on October 9, 2018, that includes targeted WLAs in addition those included as Attachment B of the permit as requested by MDE.

- Memorandums were distributed by MDE to the MS4 regulated community on October 17, 2018 and April 30, 2019 regarding clarifications for stream restoration crediting for MS4 permitting purposes. In response, MDOT SHA has updated its credit accounting for stream restoration projects and provides a summary of the adjustments in Table 23 found in Section E.2.a. of this fourth annual report.

ATTACHMENT B

MDOT SHA Reapplication for NPDES MS4 Stormwater Discharge Permit Permit Number: 11-DP-3313 (MD0068276) October 9, 2019

Introduction

MDOT SHA is reapplying for authorization under the NPDES MS4 individual discharge permit for large or medium jurisdictions. The current permit expires October 8, 2020. There are four areas that the permit requires we address at a minimum in this re-application. They are:

1. *SHA's NPDES stormwater program goals;*

2. *Program summaries for the permit term regarding:*

   a. *Illicit discharge detection and elimination results;*

   b. *Restoration plan status including SHA totals for impervious acres, impervious acres controlled by stormwater management, the current status of watershed restoration projects and acres managed, and documentation of progress toward meeting stormwater WLAs developed under EPA approved TMDLs and compliance with Part VI.A.;*

   c. *Pollutant load reductions as a result of this permit and an evaluation of whether applicable TMDLs are being achieved;*

   d. *Impervious acres compared to the baseline and twenty percent restoration requirement in PART IV.E.2.a.; and*

   e. *Other relevant data and information for describing applicable SHA programs;*

3. *Program operation and capital improvements costs for the permit term; and*

4. *Descriptions of any proposed permit condition changes based on analyses of the successes and failures of SHA's efforts to comply with the conditions of this permit.*

1. MDOT SHA NPDES MS4 Program Goals

MDOT SHA views the MS4 permit and NPDES program as an important tool that gives our Administration needed resources to address MDOT SHA impacts to local waters and the Chesapeake Bay. Our Administration has sought to partner with MDE and other MS4 jurisdictions in achieving the water quality goals stated in Part III of the permit as summarized below:

- To effectively prohibit pollutants in stormwater discharges or other unauthorized discharges into the MS4 as necessary to comply with Maryland's receiving water quality standards;
- To work to attain wasteload allocations (WLAs) for each established or approved TMDL for each receiving water body consistent with State and federal regulations; and
- To comply with all other provisions and requirements contained in the MS4 permit, and in plans and schedules developed in fulfillment of the MS4 permit.

MDOT SHA is very proud of its comprehensive MS4 internet site that provides many valuable resources to the public regarding the MDOT SHA MS4 program including:

- MDOT SHA MS4 Permit and Annual Reports,
- TMDL Implementation Plans developed by MDOT SHA and submitted to MDE,
- Opportunity for public review of draft Implementation Plans and submittal of comments,
- Educational Outreach and Contacts,
- Bay Restoration Strategies describing BMPs used for pollutant reductions and impervious surface restoration, and
- Chesapeake Bay Viewer tool to view MDOT SHA restoration projects in a GIS environment.

The website can be accessed from this link:
https://www.roads.maryland.gov/Index.aspx?PageId=333

2. Program Summaries for Permit Term

Illicit Discharge Detection and Elimination (IDDE)

Our current IDDE program has proven effective at discovering illicit discharges. The results of the MDOT SHA IDDE program are summarized in **Table 1**, including total screenings performed and the number of discharge reports submitted in follow up to those screenings. **Table 2** provides a summary of illicit discharges, discovered by the IDDE program and other MDOT SHA operations, that were subsequently reported to the appropriate jurisdiction or to MDE for follow up elimination enforcement.

Table 1: Illicit Discharge Screenings to Date (Fiscal Year 2016 through Fiscal Year 2019)*

County	Outfalls Screened	Outfalls W/ Flow Observed	Illicit Discharge Reports
Anne Arundel	94	17	
Baltimore	153	33	1
Cecil	40	19	
Frederick	121	48	
Harford	19	5	
Montgomery	96	21	
Prince George's	76	38	1
Washington	12	0	
Totals	**611**	**181**	**2**

**Fiscal year 2016 was a transition year from calendar year to fiscal year reporting; 180 screenings were performed for calendar year 2016 and 62 screenings were performed for fiscal year 2016 (instead of the minimum 150)*

Table 2: Illicit Discharges Requiring Follow-up (Fiscal Year 2016 through Fiscal Year 2019)

Illicit Discharge Report Number	County	MDOT SHA Structure Number	Potential Pollutant	Date Identified	Year Delivered to Surrounding Jurisdiction	Status
1*	Prince George's	1600052.001	Detergents	08/03/2016	2016	Closed
2	Baltimore	BMP 0305091	Fats and Grease	03/30/2017	2017	Closed
3	Frederick	BMP 100085	Solids	05/10/2017	2017	Closed
4	Prince George's	BMP 160660	Detergents	10/04/2017	2018	Open, referred to MDE
5	Harford	1202700.001	Detergents	08/09/2018	2019	Closed
6*	Baltimore	300806.001	Chlorine	06/27/2019	2019	Open, referred to County

**Denotes a discharge report in response to detection via the required outfall screenings, as referenced in Table 1*

Impervious Surface Restoration

MDOT SHA completed and resubmitted an impervious accounting to MDE on June 29, 2018. As documented in the MDE review of that submission, MDOT SHA has 25,663.5 acres of impervious surfaces within 12 MS4 jurisdictions. Of this, 9.9 percent, or 2,558.7 impervious acres, is recognized as "baseline treatment" or treatment provided by stormwater management prior to October 21, 2010. The MDE-approved baseline for untreated impervious surfaces owned by MDOT SHA is 23,104.8 acres. The MDE-approved 20 percent restoration goal is 4,621 acres restored by October 8, 2020.

The MDOT SHA Impervious Restoration Plan, summarized in Part II of the MDOT SHA Impervious Restoration and Coordinated TMDL Implementation Plan (referred to hereafter as the "Implementation Plan"), includes capital projects that implement stormwater management and alternative best management practices (BMPs) such as new stormwater controls, retrofits to existing stormwater control structures, impervious surface elimination, outfall stabilization, stream restoration, and tree planting as well as annual operational activities, such as inlet cleaning and street sweeping, that provide water quality improvements. Part II of the Implementation Plan was revised and resubmitted as Appendix B to the fiscal year 2019 (FY19) MS4 annual report.

During the first four reporting years of its current MS4 permit, MDOT SHA has implemented built and annual BMPs that have cumulatively treated 3,472 impervious acres. Table 22 and Figure 21 in Section E. of the FY19 MS4 annual report can be referenced for the current status of MDOT SHA water quality improvement projects.

At the conclusion of FY19, MDOT SHA has achieved 75 percent of the necessary treatment to meet the 4,621 acres restoration goal. Table 21 in Section E. of the FY19 MS4 annual report can be referenced for a summary of this progress. It is anticipated that MDOT SHA will surpass the established restoration goal and intends to allocate restoration credit in excess of this permit goal towards the next permit restoration compliance.

Pollutant Load Reduction

Parts III and IV of the revised 2018 Implementation Plan document current strategies and targeted end dates for meeting EPA approved WLAs. Individual TMDL implementation plans for TMDLs issued subsequent to the 2018 Implementation Plan and submitted to MDE for approval can be found on the MDOT SHA website at the link provided above. These Implementation Plans are still under review by MDE and are anticipated for approval within the next annual reporting cycle by October 2020.

MDOT SHA has consistently documented its progress toward meeting stormwater WLAs in its annual reports submitted to MDE throughout the current permit term. Table 25 and Figures 23 through 26 in Section E. of the FY19 MS4 annual report can be referenced for the current MDOT SHA progress toward reduction targets and pollutant reductions as a result of this permit.

Based on modeling at the end of FY19, MDOT SHA is on schedule to meet 14 TMDLs by 2020. Projects to be implemented beyond 2020, the end of this current permit term, have not yet been programmed for design and construction so reductions expected beyond 2020 are difficult to estimate. MDOT SHA is committed to working with MDE to reduce pollutants to meet WLAs by target years established in the Implementation Plans.

3. Program Operation and Capital Improvement Costs

The MDOT SHA NPDES program has spent over $405.7 million over the course of the current permit term. During the final year, MDOT SHA anticipates spending another $113.3 million, bringing the total up to over $519 million.

4. Proposed Permit Condition Changes

Maintaining compliance with the NPDES MS4 permit is a high priority for MDOT SHA and fluid and clear communication between MDE and MDOT SHA throughout the current permit term has been vital to MDOT SHA. MDOT SHA appreciates the collaboration, cooperation, and support provided by MDE this permit term and looks forward to future work toward improved water quality and ultimately a restored Chesapeake Bay. Several topics are presented that can foster discussion for the next permit.

Transportation Separate Storm Sewer System (TS4)

MDOT SHA recognizes that, in the past, MDE has worked to craft and tailor the MS4 permit language to address the unique nature of MDOT SHA as a transportation corridor rather than a county or municipality. Some of the challenges encountered by MDOT SHA in administering the MS4 include:

- Because MDOT SHA is not a governing authority, it cannot enact laws and regulations and therefore lack enforcement authority over both users of and residents/businesses adjacent to MDOT SHA facilities;
- MDOT SHA roadways traverse many different MS4 jurisdictions and watersheds making coordination at the local level complicated and compliance at the local watershed level complex; and
- MDOT SHA facilities serve a transient population of drivers and passengers making communicating a sense of ownership and community impossible.

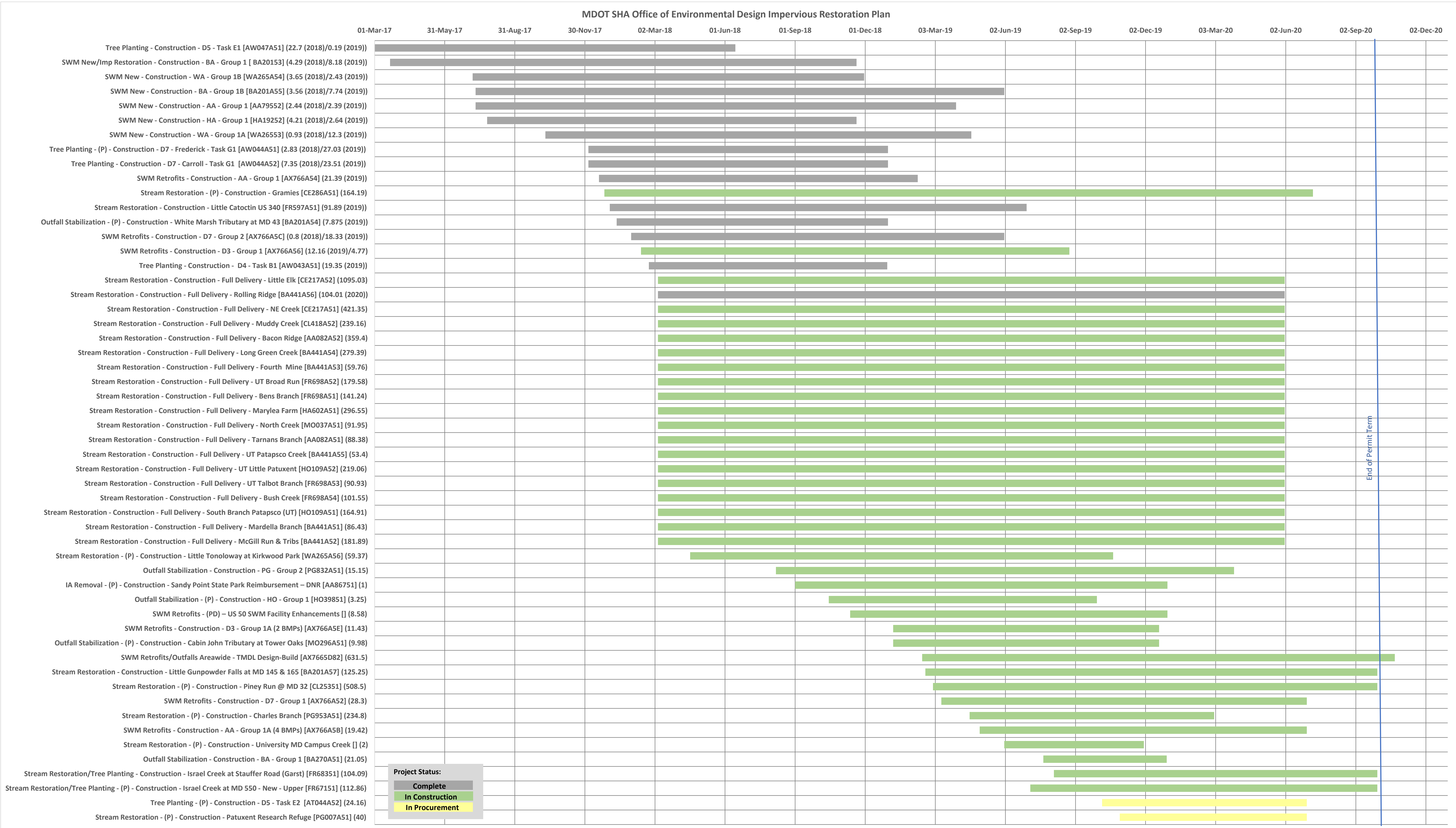
With the increasing importance of TMDL compliance and anticipated expansion of permit coverage, MDOT SHA requests that MDE continue to recognize these challenges when negotiating development of the next permit for MDOT SHA MS4 coverage.

Expanded Coverage

The current MDOT SHA MS4 permit includes designated Phase II areas of Washington County, Cecil County, and the city of Salisbury in Wicomico County. Until the reissuance of the current Phase II General Permit for State and Federal Agencies on April 27, 2018, the requirements for MDOT SHA in these areas was much more restrictive with the 20 percent restoration and TMDL compliance conditions than the requirements placed on these counties and city under the previous Phase II permit. Coverage under the new Phase II permit expanded to include Calvert, Queen Anne's, St. Mary's and Wicomico Counties plus the City of Easton in Talbot County. MDOT SHA recognizes that MDE allowed us to refrain from submitting Notice of Intent for coverage under this MS4 Phase II permit and will include the expanded coverage areas in the next generation of the MS4 individual permit for MDOT SHA. While incorporating these areas into one comprehensive permit is convenient for MDOT SHA when preparing data and reporting compliance, MDOT SHA asks MDE to qualify any conditions that cover Phase I jurisdictions as not being required for the Phase II areas under this combined permit. MDOT SHA is not requesting to separate the permit coverage.

ATTACHMENT C

GANTT CHART OF REMAINING PROJECTS TO MEET 2020 RESTORATION GOAL



October 23, 2019

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

Dear Mr. Comstock:

The Maryland Department of Transportation State Highway Administration (MDOT SHA) submitted its MS4 fourth annual report to the Maryland Department of the Environment (MDE) on October 9, 2019. Following that submittal, MDOT SHA proactively identified some discrepancies that it wishes to correct with this submittal. See the enclosed *List of Revisions* for additional details.

Enclosed you will find pages intended to replace those where issues were identified. Pages are numbered to correspond exactly with the pages in the annual report. Also enclosed is a new set of compact discs that contain the revised pages, integrated into the annual report PDFs, and a revised MS4 geodatabase.

If you have any questions or need additional information regarding this submission, please contact Mr. Christopher Zink at 410-545-5501 and czink@mdot.maryland.gov or me at 410-545-8407 and kcoffman@mdot.maryland.gov. Mr. Zink and I will be happy to assist you.

Sincerely,

For Karen Coffman, Chief
Water Programs Division
Office of Environmental Design

Enclosures

cc: Mr. Brian Cooper, SSDS, WSA, MDE
Ms. Dorothy Morrison, Director, Office of Environment, MDOT
Ms. Sonal Ram, Director, OED, MDOT SHA
Mr. Kevin Wilsey, Deputy Director, OED, MDOT SHA
Mr. Christopher Zink, Team Leader, Water Programs Division, OED, MDOT SHA

List of Revisions

The following list summarizes revisions to the MDOT SHA MS4 fourth annual report (initially submitted to MDE on October 9, 2019) included in the submittal to MDE dated October 23, 2019.

- In Attachment B to the cover letter (*MDOT SHA Reapplication for NPDES MS4 Stormwater Discharge Permit*), revised language on page 6, correcting the number of TMDLs MDOT SHA is on schedule to meet by 2020 to 14.

- In the annual report, pages 75 through 80, corrected Table 25 (*Local TMDL Pollutant Reduction Progress Through June 30, 2019*). Adjusted columns, "MDOT SHA Reduction Target" and "2020 Interim Reduction Target", such that data entries match those reported to MDE in the revised MDOT SHA Impervious Restoration and Coordinated Total Maximum Daily Load Implementation Plan, submitted to MDE on October 9, 2018 (referred to as "Implementation Plan" hereafter). Adjusted data entries in the "% Reduction Achieved Relative to Total Reduction Target" and "% Reduction Achieved Relative to 2020 Target" columns in response to adjusted targets as necessary. Data entries describing progress in the "Reduction Achieved as of 6/30/2019" column are unchanged.

- In the annual report, pages 81 and 82, corrected MDOT SHA "Target Load Reductions" as labeled on respective bars in Figure 23 (*Sediment Reductions Achieved to Date*) and Figure 24 (*Phosphorus Reductions Achieved to Date*).

- In the annual report, page 83, removed incorrect bar labels "Antietam Creek" and "Catoctin Creek" from the x-axis and replaced with appropriate labels "Mattawoman Creek" and "Non-Tidal Back River" on Figure 25 (*Nitrogen Reductions Achieved to Date*).

- In Appendix C to the annual report, Table 3-2 (*MDOT SHA Additional Attachment B Nutrient, Sediment, and Bacteria Modeling Results*), corrected "MDOT SHA Proposed 2020 Interim Reduction Target" data entries to not exceed "MDOT SHA Reduction Target". Retitled three columns/column headers as follows:
    - "% 2020 Reduction Relative to Baseline" changed to "% 2020 Reduction Relative to Reduction Target"

  - "% 2025 Reduction Relative to Baseline" changed to ""% 2025 Reduction Relative to Reduction Target"
  - "% Target Year Reduction Relative to Baseline" changed to ""% Target Year Reduction Relative to Reduction Target"

  Updated data entries and in these three percentage columns so they are representative of progress relative to corresponding data in the "MDOT SHA Reduction Target" column rather than data in the "MDOT SHA Baseline Load" column.

- In Appendix E (Optional Worksheets for MS4 Stormwater WLA Implementation Progress Documentation) to the annual report, all pages were edited to adjust the "Treated Baseline Load" and "Target Load" to align with BMP treatment data and modelling in the Implementation Plan (October 9,2018 revision).

- In the MS4 geodatabase, changes were made to data entries in the "BASELINE_LOAD" and "TARGET_LOAD" fields of the "*LocalStormwaterWatershedAssessment*" geodatabase table (identifying code: LSW) to ensure baseline load and target load data matches what was reported to MDE in the Implementation Plan (October 9, 2018 revision) and the 2018 MS4 annual report.

National Pollutant Discharge Elimination System
Municipal Separate Storm Sewer System
Permit No. 11-DP-3313 MD0068276
Permit Term October 9, 2015 to October 8, 2020

Fourth Annual Report
October 9, 2019

Submitted to:
Sediment, Stormwater, and Dam Safety Program
Water and Science Administration
Maryland Department of the Environment
1800 Washington Boulevard
Baltimore, MD 21230

Submitted by:
Maryland Department of Transportation
State Highway Administration
Office of Environmental Design
707 North Calvert Street, C-303
Baltimore, MD 21202

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

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List of Abbreviations

AAH	Adopt-A-Highway
AB	As-Built
ABE	As-Built Engineer
ADE	Assistant District Engineer
AMT	Automated Modeling Tool
BMP	Best Management Practice
CFR	Code of Federal Regulations
COMAR	Code of Maryland Regulations
CWA	Clean Water Act
CCMS	Customer Care Management System
CSCE	Comprehensive Site Compliance Evaluations
DEC	District Environmental Coordinator
DLA	Direct Liquid Application
ECD	Environmental Compliance Division
ECU	Environmental Crimes Unit
EPA	Environmental Protection Agency
ESC	Erosion and Sediment Control
ESCM	Erosion and Sediment Control Manager
ESD	Environmental Site Design
FY	Fiscal Year
GIS	Geographic Information System
GP	General Permit
HEC-2	Hydrologic Engineering Centers – Water Surface Profiles
HEC-RAS	Hydrologic Engineering Centers River Analysis System
HHD	Highway Hydraulics Division
HSPF	Hydrologic Simulation Program – Fortran
HOV	High Occupancy Vehicle
ID	Illicit Discharge
IDDE	Illicit Discharge Detection and Elimination
IVMM	Integrated Vegetation Management Manual
JPA	Joint Permit Application
lbs.	Pounds
LDG	Landscape Design Guide
LMG	Landscape Maintenance Guide
LOD	Limit of Disturbance
MBSS	Maryland Biological Stream Survey
MD	Maryland
MDE	Maryland Department of the Environment
MDOT SHA	Maryland Department of Transportation State Highway Administration
MET	Maryland Environmental Trust
MES	Maryland Environmental Service
MEP	Maximum Extent Practicable
MOU	Memorandum of Understanding
MTBMA	Maryland Transportation Builders and Materials Association
MS4	Municipal Separate Storm Sewer System
N	Nitrogen
NOI	Notice of Intent
NTP	Notice to Proceed
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resources Conservation Service
NTWP	Nontidal Wetland Permit
OAG	Office of the Attorney General

OC	Office of Communication
OED	Office of Environmental Design
OHD	Office of Highway Development
OHDU	OHD University
OOM	Office of Maintenance
P	Phosphorus
PCB	Polychlorinated Biphenyls
PDF	Portable Document Format
PRD	Plan Review Division
QA	Quality Assurance
REC	Regional Environmental Coordinator
RBP	Rapid Bioassessment Protocol
ROW	Right-of-way
S	Sediment
SAH	Sponsor-A-Highway
SHA	State Highway Administration
SMP	Salt Management Plan
SOIRP	Storm Drain and Outfall Inspection and Remediation Program
SOP	Standard Operating Procedure
SPCC	Spill Prevention, Control, and Countermeasure
SWM	Stormwater Management
SWPPP	Stormwater Pollution Prevention Plan
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorous
TPH	Petroleum Hydrocarbons
TSS	Total Suspended Solids
TWIS	Truck Weigh Inspection Station
WLA	Waste Load Allocation
WSA	Water and Science Administration
WPD	Water Programs Division
WQ	Water Quality
WQv	Water Quality Volume

Introduction

The Maryland Department of Transportation State Highway Administration (MDOT SHA) is committed to continuing its National Pollution Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Program efforts and is pleased to partner with the Maryland Department of the Environment (MDE) Water and Science Administration (WSA), the Environmental Protection Agency (EPA), and other NPDES jurisdictions to achieve the program goals.

The original MDOT SHA NPDES Phase I permit, MS-SH-99-011, was issued on January 8, 1999 and expired in 2004. This permit guided MDOT SHA through establishment of its NPDES MS4 program.

The Phase II State and Federal Small MS4 General Permit (GP), 05-SF-5501, MDR 055501, was issued November 12, 2004 and expired November 12, 2009. MDOT SHA submitted a Notice of Intent (NOI) for coverage under the Phase II MS4 GP and received authorization for coverage May 25, 2005. Under the authority of this Phase II permit, MDOT SHA extended the same MS4 program elements established under the Phase I permit to the MDOT SHA storm drain systems in Phase II areas.

The next Phase I permit (99-DP-3313, MD0068276, issued October 21, 2005 and expired on October 21, 2010) focused on improving water quality benefits, developing an impervious accounting database, and developing a watershed-based outlook for stormwater management and MS4 program elements.

MDOT SHA submitted a re-application for the Phase I permit on October 21, 2009 and a new permit was issued to MDOT SHA on October 9, 2015. This current permit covers MDOT SHA storm sewer systems in both the originally designated, Phase I jurisdictions as well as those designated for Phase II. This report covers compliance with the permit that was issued in 2015. MDOT SHA has provided the permit general information in the Permit Information table (PER) as specified in the May 2017 MDE Geodatabase Guideline format.

Report Format and Deliverables

This fourth annual report covers Fiscal Year 19 (FY19) from July 1, 2018 through June 30, 2019, in accordance with Part V.A.1. of the current permit. Geographically, this report covers MDOT SHA compliance for storm drain systems owned or operated by MDOT SHA located within the NPDES counties of Anne Arundel, Baltimore, Carroll, Cecil, Charles, Frederick, Harford, Howard, Montgomery, Prince George's, and Washington, as well as the City of Salisbury (See **Figure 1**).

Hereafter, this report lists permit conditions and discusses MDOT SHA compliance activities throughout the FY19 reporting period. Wherever possible, future activities and schedules for completion are provided.

A compact disk is included with this report that contains portable document format (PDF) files of the report, database tables, and spatial Geographic Information System (GIS) data in accordance with Part V.A.2. of the permit.

MDE Comments on MDOT SHA 2018 MS4 Annual Report

MDE supplied comments dated September 16, 2019 related to the results of the MDE review of the MDOT SHA 2018 MS4 annual report and data submittal. In accordance with Part V.A.3. of the MS4 permit, within 12 months and before September 16, 2020, MDOT SHA responses addressing the September 16, 2019 MDE comments will be submitted to MDE subsequent to this fourth annual report.

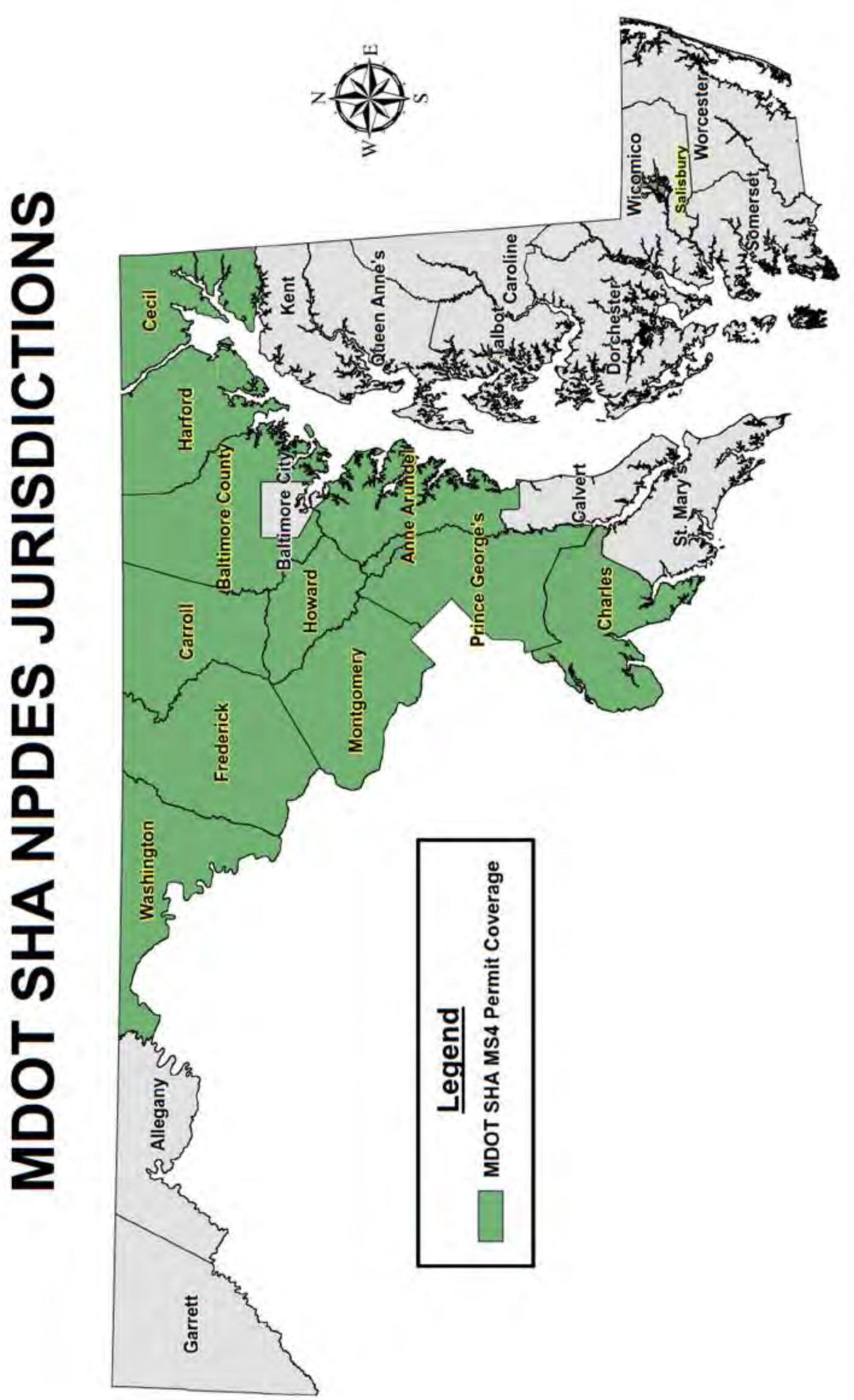


Figure 1: Municipal Separate Storm Sewer System (MS4) Jurisdictions

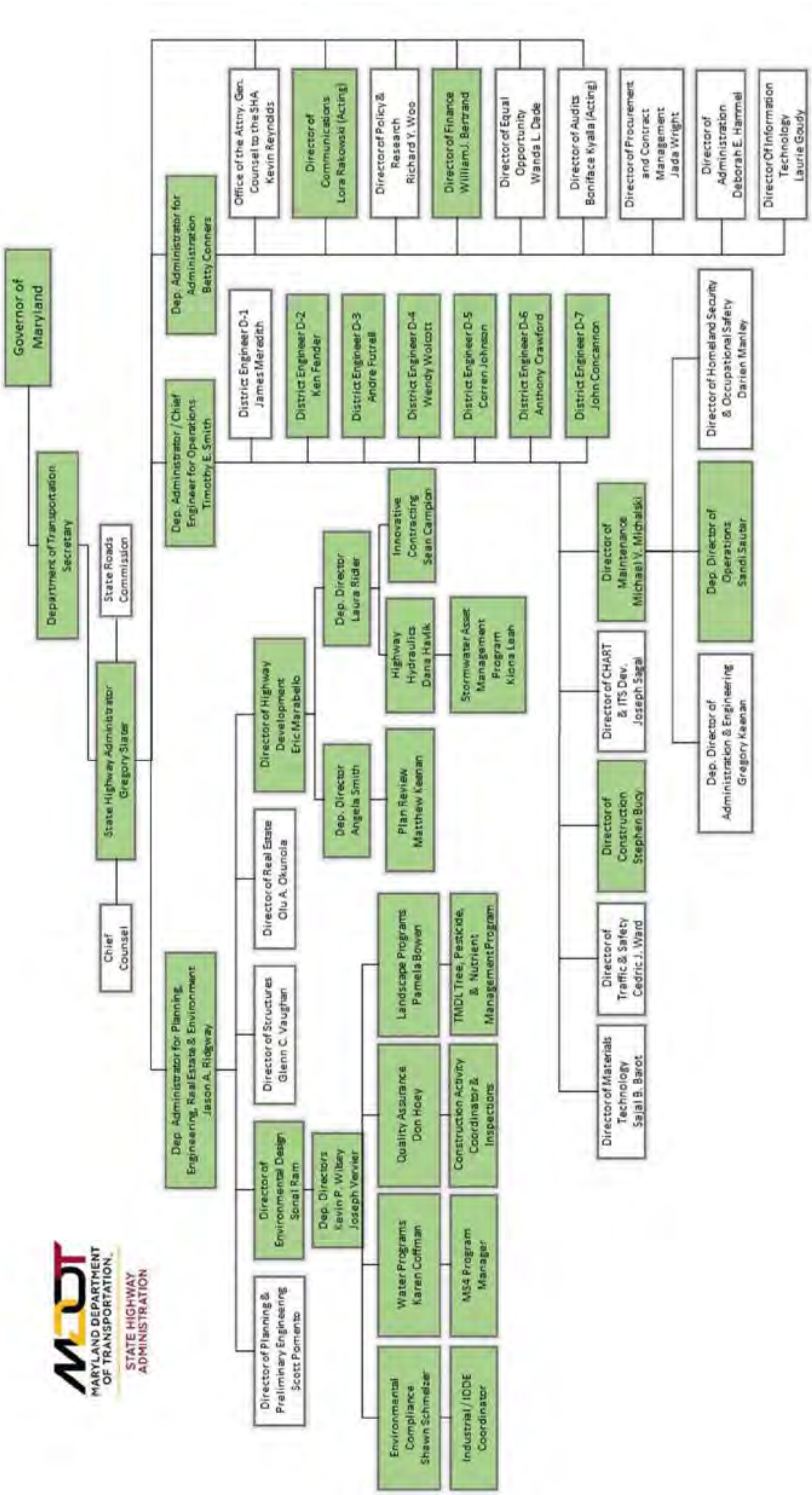


Figure 2: 2019 Organizational Chart for MDOT SHA NPDES MS4 Permit Administration

A. Permit Administration

The MDOT SHA liaison and coordinator for the NPDES Program is listed below and an organizational chart detailing personnel responsible for major program components is included in **Figure 2**.

Mr. Kevin Wilsey
Deputy Director
Office of Environmental Design
(410) 545-8605
kwilsey@mdot.maryland.gov

The MDOT SHA Program Manager for the MS4 permit is:

Ms. Karen Coffman
Division Chief
Water Programs Division
Office of Environmental Design
(410) 545-8407
KCoffman@mdot.maryland.gov

B. Legal Authority

A description of the legal authority maintained by MDOT SHA was included in the first annual report dated October 9, 2016 and remains unchanged.

C. Source Identification

According to the permit language, sources of pollutants in stormwater runoff should continue to be identified and linked to specific water quality impacts on a watershed basis. The data collected through source identification should be used by MDOT SHA and surrounding NPDES counties for watershed restoration planning.

Requirements under this condition include submitting MDOT SHA stormwater infrastructure data within the permit area in GIS format on an annual basis:

1. *Storm drain system: Delineate all infrastructure, major outfalls, inlets, and associated drainage areas;*
2. *Industrial and commercial sources: Identify industrial and commercial land uses and sites that have the potential to contribute significant pollutants to SHA storm drain systems;*
3. *Urban best management practices (BMPs): Collect stormwater management facility data including outfall locations and delineated drainage areas;*
4. *Impervious surfaces: Delineate SHA-owned and private land owned (if within SHA BMP drainage area) controlled and uncontrolled impervious areas based on, at a minimum, Maryland's hierarchical eight-digit sub-basins;*
5. *Monitoring locations: Locations established for chemical, biological, and physical monitoring of watershed restoration efforts and the 2000 Maryland Stormwater Design Manual; and*
6. *Water quality improvement projects: Projects proposed, under construction, and completed with associated drainage areas delineated, when applicable.*

C.1 Storm Drain System

MDOT SHA continues to maintain and improve its inventory of storm drain infrastructure, major outfalls, stormwater management facilities, and associated drainage areas utilizing a spatial GIS database. All storm drains associated with SWM facilities are mapped as they are inspected and MDOT SHA continues to populate missing data within database fields to add outfall drainage areas and other records such as City, State, and zip codes. Research has continued to add as-built (AB) information for drainage outfalls, conveyances, and stormwater management facilities built before regulations were established requiring detailed documentation.

MDOT SHA has provided the outfall structure information in the Outfall feature class (OUT) and the Outfall Drainage Area feature class (ODA) as specified in the May 2017 MDE update to its NPDES MS4 *Geodatabase*

Design and User's Guide (referred to hereafter as "2017 MDE Geodatabase Guide").

During FY19, development of a new inspection schema and support tool continued. Once complete and implemented, the schema and tool should allow MDOT SHA to better track outfall condition information.

Data update schedules have been aligned with the triennial SWM facility inspection cycle. Storm drain infrastructure data will be updated based on that schedule in the future. **Table 1** presents the number of BMP inspections performed in FY19, as well as BMP inspections planned for FY20 and FY21. Industrial and Commercial Sources

Included with the MS4 geodatabase submission for this FY19 MS4 annual report is the GIS layer developed to identify industrial sites within MDOT SHA right-of-way that have the potential to contribute pollutants to MDOT SHA storm drain systems, including MDOT SHA 12-SW permitted industrial sites but also garages, parking lots, rest areas, and other highly trafficked or material storage areas as requested by MDE. There are no commercial sites on MDOT SHA properties.

C.2 Urban Best Management Practices (BMPs)

In FY19, inventory updates continued to include newly constructed SWM BMPs, associated outfalls, and delineated drainage areas. New inspection tools were launched with great success in 2019 resulting in a record number of inspections performed and many updates to the inventory. The MS4 geodatabase submitted with this FY19 MS4 annual report provides urban BMP information in the BMP Point of Investigation feature class (BMPPOI) and the BMP table (BMP)

C.3 Impervious Surfaces

MDOT SHA performed a reevaluation of its impervious baseline accounting to fall in line with MDE's 2014 *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, Guidance for National Pollutant Discharge Elimination System Stormwater Permits* (referred to hereafter as "2014 MDE

Table 1: Storm Drain System Source ID Update Schedule

Jurisdiction	Fiscal Year 2019 BMP Inspections Performed	Fiscal Year 2020 BMP Inspections Required	Fiscal Year 2021 BMP Inspections Required
Anne Arundel County	809	93	340
Baltimore County	431	115	39
Carroll County	135	112	89
Cecil County	131	200	2
Charles County	659	53	17
Frederick County	642	88	5
Harford County	203	56	216
Howard County	975	54	20
Montgomery County	394	310	280
Prince George's County	878	406	116
Washington County	340	128	78
Salisbury	21	17	33
Total	**5,618**	**1,632**	**1,235**

Accounting Guidance") and expectations for a baseline year of 2002. The previous baseline had been established as 2010 to coincide with the expiration of the last MDOT SHA MS4 permit on October 21, 2010. Revised impervious surfaces were developed using available photogrammetry data that was closest to 2002 for each MS4 jurisdiction and the resulting baseline years range from 2002 to 2005. **Table 2** shows the MDOT SHA impervious surface baseline year by MS4 jurisdiction.

An associated GIS layer is not redelivered with this report but was included in the MDOT SHA Supplemental 2018 Geodatabase, submitted to MDE with the June 29, 2018 impervious surface accounting resubmission by *MDOT SHA* titled, "*Final Impervious Baseline Assessment.*" In the MS4 geodatabase submitted with this FY19 MS4 annual report, MDOT SHA has provided data related to its impervious area accounting in the Impervious Surface (IMP) table.

Table 2: MDOT SHA Impervious Surface Baseline Dates by County

County	Baseline Date
Anne Arundel	12/31/2005
Baltimore	12/31/2005
Carroll	12/31/2005
Cecil	12/31/2005
Charles	12/31/2004
Frederick	12/31/2005
Harford	12/31/2004
Howard	12/31/2002
Montgomery	12/31/2004
Prince George's	12/31/2005
Washington	12/31/2005
Wicomico (Salisbury)	12/31/2006

C.4 Monitoring Locations

Monitoring site locations and location information, to meet conditions described in Section IV.F. of the MS4 permit, are provided in the Chemical Monitoring (CHE), Biological Monitoring (BIO), Monitoring Site feature class (MSI), and Monitoring Drainage Area feature class (MDA) tables of the MS4 geodatabase submitted with this FY19 MS4 annual report. The MDE approved monitoring plans, developed by MDOT SHA to satisfy these permit conditions, were appended to the MDOT SHA 2016 (FY16) and 2017 (FY17) annual reports. A description of the monitoring locations and FY19 monitoring activities can be found in **Sections F.1 and F.2** of this annual report with additional details and analyses provided **Appendices F and G**.

C.5 Water Quality Improvement Projects

In the MS4 geodatabase submitted with this FY19 MS4 annual report, MDOT SHA has provided water quality improvement project information for completed projects through FY19 (restoration BMPs) using the following feature classes:

- Restoration BMP feature class (RST)
- Alternate BMP Polygon feature class (APY)
- Alternate BMP Line feature class (ALN)
- Stream Restoration Protocols table (SRP)

The submitted data includes only currently completed projects and does not include projects that are in planning or design phases or under construction. Further discussion on progress toward restoration goals and TMDL compliance is included in **Section E** of this report.

D. Management Programs

A management program is required to limit the discharge of stormwater pollutants to the maximum extent practicable (MEP). The idea is to eliminate pollutants before they enter waterways. This program includes provisions for stormwater management, erosion and sediment control, IDDE, trash and litter reduction, property management and maintenance, and public education concerning stormwater and pollutant minimization.

D.1 Stormwater Management

The continuance of an effective stormwater management program is the emphasis of this permit condition. Requirements under this condition include:

a) *Implement the stormwater management design principles, methods, and practices found in the 2000 Maryland Stormwater Design Manual;*

b) *Maintain programmatic and implementation information including but not limited to number of plans received, number of projects received, number of exemptions issued, and number and type of waivers received and issued;*

c) *Maintain construction inspection information according to COMAR 26.17.02 for all ESD treatment practices and structural stormwater management facilities; and*

d) *Conduct preventative maintenance inspections according to COMAR 26.17.02 of all ESD treatment systems and structural stormwater management facilities at least on a triennial basis.*

D.1.a Implement 2000 SW Design Manual and Regulations

MDOT SHA continues to comply with State and federal laws and regulations regarding SWM as well as MDE permit requirements. MDOT SHA also continues to implement the practices established in the *2000 Maryland Stormwater Design Manual* and the *MDOT SHA Sediment and Stormwater Guidelines and Procedures* (October 6, 2017) for all projects and remains in compliance with the Stormwater Management Act of 2007 (2007 SW Act), including the revised Chapter 5 of the *2000 Maryland Stormwater Design Manual*, by implementing environmental site design (ESD) to the MEP for all new and redevelopment projects.

The MDOT SHA and MDE signed a Memorandum of Understanding (MOU), dated July 8, 2014, designating MDOT SHA as an approving authority for both erosion and sediment control and stormwater management for all MDOT SHA projects. This authority was given by a letter of authorization from MDE on February 24, 2015. The MDOT SHA approval authority lies with the Plan Review Division (PRD) under the Office of Highway Development (OHD). PRD's sole responsibility is to review and approve MDOT SHA stormwater management and erosion and sediment control plans. PRD is separate and distinct from the OHD design divisions. In addition, the OHD design divisions are supervised by a different Deputy Director than PRD.

PRD tracks MDOT SHA progress toward satisfying requirements of the 2007 SW Act and identifies and reports problems and modifications needed to implement ESD to the MEP in its annual reports to MDE. However, in the FY19 reporting period, no changes were made to the PRD Sediment and Stormwater Guidelines and Procedures and Current Technical Practices documents. PRD is mandated to submit its annual report to MDE to satisfy the requirements of the MDOT SHA delegated review and approval authority.

D.1.b Maintain Programmatic and Implementation Information

PRD maintains a database to track stormwater management submittals, reviews, and approval progress for all MDOT SHA projects. PRD has also incorporated components in the database to facilitate the review and analysis of water quality and quantity waivers and variances. These requests are associated with specific Points of Investigation (POIs) for each project. The information stored in the database includes reference to the specific regulation for which a waiver or variance is sought, documentation for why the waiver or variance is appropriate, and actions taken in response to a given request. The database now allows PRD to query and summarize requests and approvals associated with MDOT SHA development plans and to provide that information in support of the MS4 annual report. In the MS4 geodatabase submitted with this FY19 MS4 annual report, the stormwater management program information is provided in the SWM table.

Table 3 presents a summary of PRD activities for the FY19 reporting period, by MS4 jurisdiction, including submissions received, comment memoranda issued; approvals for concept design, site development, and final design; and SWM quantity or quality control waivers and variance requests for SWM quantity control that were granted. Most project reviews that originated at MDE have now been transferred to PRD for further review and approval.

Table 3: Stormwater Management Review and Approval

Jurisdiction	Number of Projects	Review Submissions	Comment Memoranda	Concept Design Submittal Approvals	Site Development Stage Approvals	Final Approvals	Granted SWM Waivers	Granted SWM Variances
Anne Arundel	66	181	88	19	13	41	65	9
Baltimore	40	118	63	10	10	9	11	0
Carroll	15	47	24	5	6	4	13	8
Cecil	9	17	4	2	2	2	1	2
Charles	9	28	18	2	2	3	3	0
Frederick	34	92	51	4	6	14	63	9
Harford	13	52	38	3	4	4	22	5
Howard	36	108	60	6	9	25	8	0
Montgomery	37	107	53	10	13	14	65	10
Prince George's	50	151	98	15	12	7	23	7
Washington	21	65	36	9	8	7	56	5
Salisbury	1	2	0	0	0	1	0	0
MS4 Totals	**331**	**968**	**533**	**85**	**85**	**131**	**330**	**55**
Outside MS4	94	328	185	33	28	29	146	17
Statewide Total	**425**	**1296**	**718**	**118**	**113**	**160**	**476**	**72**

Notes:

1. Projects included in the total number above include any project that had activity during the permit term. Activity can include submittal of any plan type, waiver or variance request, or the receipt of comments or issuance of approvals.
2. Granted SWM waivers or variances include only those requests associated with final design plans that have been approved during the reporting term.

D.1.c Maintain Construction Inspection Information

COMAR 26.17.02.10 details regulations for SWM facility inspections to be conducted during construction. MDOT SHA administers and continues to improve the SWM facility AB certification process in compliance with the SWM approval and COMAR requirements. The AB certification process facilitates the documentation and verification of the construction of SWM facilities.

A detailed description as well as a flow chart demonstrating the AB certification process was submitted with the FY18 MS4 annual report. MDOT SHA also created a shortened version of the SWM facility AB certification specification for use on remediation work orders. For future functionality inspections, copies of accepted AB packages, as well as data related to the shortened AB certification process for remediation work, are retained and integrated into the GIS inventory database previously described in **Section C**. of this FY19 MS4 annual report.

MDOT SHA standard specifications, including those related to contractor submittals for AB certification, are available on-line at: https://www.roads.maryland.gov/Index.aspx?PageId=689

D.1.d Preventative Maintenance

During the FY19 reporting period, MDOT SHA continued to conduct triennial preventative maintenance inspections in accordance with COMAR 26.17.02.11. In the MS4 geodatabase submitted with this FY19 MS4 annual report, MDOT SHA has provided the inspection program information in the following tables:

- BMP Inspections table (BIN),
- Alternative BMP Line Inspections table (LIN),
- Alternative BMP Poly Inspections table (YIN), and
- Restoration BMP Inspections table (RIN).

Included with this FY19 MS4 annual report as **Appendix A** is a revised protocol that clarifies MDOT SHA procedures for handling any BMP designated to provide baseline treatment or impervious restoration credit when it receives a failing field inspection rating. Because timeframes for remediating failures can vary based on the BMP type (SWM or alternative) and severity of the condition, this standardized method is used to determine when baseline treatment or restoration credit is removed from MDOT SHA impervious accounting and at what point it will be added back to the accounting framework.

Triennial Inspections of SWM Facilities

During the FY19 reporting period, MDOT SHA continued to locate, inspect, evaluate, and remediate SWM facilities to sustain their functionality, improve water quality and stability, protect sensitive water resources, and provide an aesthetic and safe transportation system. MDE requires all facilities be inspected at least on a triennial basis and maintained or remediated as appropriate to ensure they continue to function as originally designed and permitted. The triennial inspection protocol was included in Part Two of the FY18 MS4 annual report titled, "*Drainage and Stormwater Asset Program*".

MDOT SHA began utilizing an upgraded field inspection tool in FY19 and improved inspection efficiency, allowing inspectors to move more quickly in the field. The tool uses modern user-friendly devices running customized versions of Survey 123 and ArcCollector. While developing the training materials, rating teams created a brief visual guide to supplement the specific items called out in the Standard Operating Procedures (SOPs). The SOPs were incorporated into the new Inspection Field Tool to provide inspectors immediate access to proper inspection techniques. The tool facilitates the inspectors to submit incremental batches of inspection results for engineering reviews in a more timely and efficient manner. Teams can now upload small batches of reports instead of submitting several hundred at a time. This also allows remediation (action) ratings to occur more frequently with multiple, smaller submissions occurring throughout the year.

Procedures have been created that assist with decisions on minor maintenance, remediation, or full retrofit of drainage or SWM assets. Engineers perform a desktop analysis of inspection records in order to assign an action rating to each facility. These ratings are then tied to the inspection protocol ratings that are then used to prioritize completion of maintenance, remedial workorders, design, and permitting.

SWM Facility Remediation Program

Routine and preventive maintenance is performed by MDOT SHA District maintenance shops as part of their roadside maintenance and other operational activities. MDOT SHA completed an operational manual for stormwater and drainage assets during FY16. The manual was distributed to all shops within MDOT SHA during the following 2 years. The practices outlined in each manual are specific to facility type and input from several offices and divisions was pooled to provide valuable information on the proper procedures and equipment needed. The manuals contain maps of the locations of all SWM facilities within the area of influence of the shop.

Major maintenance and remediation of SWM facilities is prioritized based on severity of condition, public safety, funding levels, and availability of construction contracts. The goal is to complete remediation within several years after a field inspection has demonstrated moderate problems will result in maintenance that can still be done within the facility footprint but that maintenance need is beyond the capacity of the MDOT SHA Maintenance Shops. Construction activities are directed by prescriptive work orders that have been marked on the original design plans. These abbreviated plan sets are produced for all sites and generally incur fewer design costs than full design projects. Sites that disturb over 5,000 square feet and 100 cubic yards of earth movement will require permitting activities, similar to a full design project. These activities include the following:

- Concept, Site Development, and Final SWM/ESC Approval by MDOT SHA PRD.

- Joint Permit Application (JPA) permitting process because facilities develop vegetation and wildlife habitat that resemble natural wetland environments over time. These facilities are then considered jurisdictional wetlands or Waters of the US and therefore require MDE Non-Tidal Wetland Permits (NTWP) for routine maintenance and remedial activities.

- Work in the ‘Embankment Facility Maintenance Pilot Program’ to establish agreed upon embankment remediation procedures on the AX9295482 contract. This is a phased process that incudes remedial actions that MDE feels comfortable to allow MDOT SHA PRD to approve on their behalf in order to allow some remediation efforts to proceed without approval from MDE on Small Ponds or Dam Safety. The program was outlined with a total of five phases. During FY19, Phase 0 was completed for all facilities included in the program and

MDOT SHA is preparing reports required in Phase 1 for approximately 8 of the facilities included in the program. Remediation of the 34 ponds originally outlined was performed at a much slower rate than anticipated because of issues with the contractor. At this time, it is unclear how many of the original facilities will have full reporting.

- Facilities located within the Severn River Watershed, require a secondary approval from Anne Arundel County Soil Conservation District (AASCD) in order to receive full MDOT SHA PRD approval. MDOT SHA worked with Anne Arundel County to verify all needed information for their approval.

MDOT SHA has prioritized completing the maintenance for BMPs published in the FY18 MS4 annual report.

Table 4 details remediation commitments for failed stormwater BMPs that require maintenance. This table has been updated to include BMPs that have recently exceeded the three-year timeframe since inspection. The table provides notes indicating status and identifies BMP remediation projects that may require additional approvals; such as a JPA permit or a small pond, dam safety, or NRCS Code 378 review; and provides commitment dates for maintenance completion.

A notable change in this presentation, relative to the similar Table 1-4 provided in Part One of the FY18 MS4 annual report, is replacement of the "Last Field Inspection Grade" column with a "Pass/Fail" column that more explicitly designates the result of the last BMP field inspection. The MDOT SHA standard for determining the impact of this result, with respect to MDOT SHA retaining or removing associated water quality treatment relative to its MS4 credit accounting, is described in **Appendix A** provided with this FY19 MS4 annual report.

Table 4 also reflects remediation progress achieved during the reporting period and below are several actions completed by MDOT SHA to further advance the maintenance and remediation program:

- Allocated funding for remediation contracts
- Established a new Area Wide contract in Anne Arundel County with capacity to perform SWM facility remediation. Worked with contractor on the remediation contract specifically for prioritized facilities with 2019 commitment dates (AX9295482)
- Allocated resources for additional engineering design, work order development, and permit processing
- Enhanced SWM remediation tracking system

During the reporting period, MDOT SHA completed remediation of 16 SWM facilities as shown in **Table 4.** To date, three previously reported SWM facilities have exceeded their completion commitment date, as shown in **Table 4**, and associated water quality treatment has been removed from reported MS4 credit in accordance with the procedures described in **Appendix A** of this FY19 MS4 annual report.

Table 4: MDOT SHA SWM Facilities for Remediation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	2019 Remediation Comments
020003	Infiltration basin	Pass	AX9295482		FY18 Construction Complete
020013	Wet pond	Fail	AX9295482	6/30/2020	Work Order Approved - Under Construction Contract
020014	Micropool extended detention pond	Pass			FY17 Construction Complete
020015	Wet pond	Pass			FY17 Construction Complete
020026	Wet pond	Fail		9/30/2020	
020036	Infiltration trench	Pass	AX9295482		FY18 Construction Complete
020038	Infiltration trench	Pass			FY17 Construction Complete
020039	Infiltration trench	Pass			FY17 Construction Complete
020040	Infiltration trench	Pass			FY17 Construction Complete
020052	Infiltration basin	Fail		6/30/2022	BMP Added to List in FY19
020061	Infiltration basin	Fail		9/30/2020	
020092	Infiltration trench	Fail		9/30/2021	In Design and Permitting Process
020094	Infiltration trench	Fail	XX1725174	6/30/2020	Work Order Approved - Under Construction Contract
020103	Wet pond	Fail	XX1725174	6/30/2022	BMP Added to List in FY19, In Design and Permitting Process
020110	Wet pond	Fail	AX9295482	6/30/2020	Work Order Approved - Under Construction Contract
020114	Wet pond	Fail	XX1725174	6/30/2022	BMP Added to List in FY19, In Design and Permitting Process
020124	Wet pond	Fail	AX9295482	6/30/2020	Work Order Approved - Under Construction Contract
020143	Infiltration trench	Pass	AX9295482		FY18 Construction Complete
020167	Dry pond	Fail		9/30/2020	
020177	Dry swale	Fail		9/30/2021	
020196	Infiltration trench	Pass	AX9295482		FY18 Construction Complete
020217	Infiltration trench	Pass	AX9295482		FY18 Construction Complete
020218	Infiltration trench	Pass	AX9295482		FY18 Construction Complete
020231	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
020240	Infiltration basin	Pass	AX9295482		FY19 Construction Complete
020241	Infiltration trench	Pass	AX9295482		FY18 Construction Complete
020242	Infiltration trench	Pass	AX9295482		FY18 Construction Complete
020243	Infiltration trench	Pass	AX9295482		FY18 Construction Complete
020244	Infiltration trench	Fail	AX3565274	6/30/2020	In Design and Permitting Process

Table 4: MDOT SHA SWM Facilities for Remediation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	2019 Remediation Comments
020257	Wet pond	Fail	AX7665D82	6/30/2020	Site Under Evaluation
020258	Infiltration basin	Fail	AA8225174		BMP Added to List in FY19, Under Construction, Facility is being retrofit.
020260	Infiltration basin	Fail	AA8225174		Under Construction
020268	Infiltration basin	Fail	AA8225174	6/30/2020	Under Construction
020271	Infiltration basin	Fail		6/30/2022	BMP Added to List in FY19, In Design and Permitting Process
020272	Wet pond	Fail		6/30/2022	BMP Added to List in FY19
020276	Wet pond	Fail	AX7665D82	6/30/2020	Site Under Evaluation
020277	Wet pond	Fail		6/30/2022	BMP Added to List in FY19, MDOT Considering Abandonment
020307	Infiltration trench	Pass	AX9295482		FY19 Construction Complete
020308	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19, In Design and Permitting Process
020338	Infiltration basin	Fail		9/30/2021	
020339	Infiltration basin	Fail		6/30/2020	
020354	Infiltration trench	Pass	AX9295482		FY18 Construction Complete
020357	Infiltration trench	Fail	AX9295482	6/30/2020	Work Order Approved - Under Construction Contract
020360	Infiltration trench	Pass	AX9295482		FY18 Construction Complete
020363	Infiltration basin	Fail		9/30/2020	
020388	Infiltration basin	Fail		9/30/2020	
020394	Infiltration basin	Fail		9/30/2020	
020396	Infiltration basin	Fail	XX1725174	6/30/2022	BMP Added to List in FY19, In Design and Permitting Process
020398	Infiltration trench	Pass	AX9295482		FY18 Construction Complete
020399	Infiltration basin	Fail		6/30/2020	
020403	Infiltration trench	Fail	XX1725174	6/30/2022	BMP Added to List in FY19, In Design and Permitting Process
020406	Dry pond	Fail		6/30/2022	BMP Added to List in FY19
020409	Infiltration trench	Fail		6/30/2020	
020410	Infiltration trench	Fail		6/30/2020	
020429	Infiltration trench	Fail	AX3565274	6/30/2020	In Design and Permitting Process
020436	Wet pond	Pass	AX9295482		FY19 Construction Complete
020480	Wet pond	Fail		6/30/2022	BMP Added to List in FY19
020484	Infiltration trench	Fail	XX1725174	6/30/2022	BMP Added to List in FY19, In Design and Permitting Process

Table 4: MDOT SHA SWM Facilities for Remediation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	2019 Remediation Comments
020486	Wet pond	Fail	XX1725174	6/30/2022	BMP Added to List in FY19, In Design and Permitting Process
020489	Infiltration basin	Fail		9/30/2020	
020490	Infiltration trench	Fail	AX7665D82		Remediation / Maintenance not completed on schedule; WQ treatment temporarily removed from reported MS4 credit.
020494	Infiltration basin	Fail		6/30/2020	
020514	Infiltration basin	Fail		6/30/2020	
020516	Infiltration trench	Fail		6/30/2020	
020517	Infiltration trench	Fail		6/30/2020	
020520	Infiltration trench	Fail		6/30/2020	
020522	Wet pond	Fail		6/30/2022	BMP Added to List in FY19
020528	Infiltration trench	Pass	AX9295482		FY19 Construction Complete
020532	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
020544	Wet pond	Fail		6/30/2022	BMP Added to List in FY19
020554	Infiltration trench	Pass	AX9295482		FY18 Construction Complete
020561	Infiltration basin	Fail		6/30/2020	
020565	Infiltration trench	Fail	AX3565274	6/30/2022	BMP Added to List in FY19, In Design and Permitting Process
020584	Wet extended detention pond	Fail		6/30/2022	BMP Added to List in FY19
020603	Bioretention	Fail		6/30/2022	BMP Added to List in FY19
020608	Bioretention	Fail		6/30/2022	BMP Added to List in FY19
020747	Grass Swale	Fail		6/30/2020	
020757	Infiltration basin	Fail	XX1725174	6/30/2022	BMP Added to List in FY19, In Design and Permitting Process
020760	Infiltration basin	Fail		6/30/2022	BMP Added to List in FY19, In Design and Permitting Process
020761	Infiltration basin	Fail		6/30/2022	BMP Added to List in FY19
020774	Infiltration trench	Fail	XX1725174	6/30/2022	BMP Added to List in FY19, In Design and Permitting Process
020782	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
020787	Infiltration trench	Fail		6/30/2020	
020795	Infiltration trench	Fail	AX3565274	6/30/2022	BMP Added to List in FY19, In Design and Permitting Process
020801	Infiltration basin	Fail	AX7665D82	6/30/2020	Site Under Evaluation
020807	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19, MDOT Considering Abandonment
020809	Wet Pond	Pass	AX9295483		FY19 Construction Complete

Table 4: MDOT SHA SWM Facilities for Remediation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	2019 Remediation Comments
020810	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
020811	Infiltration trench	Fail		6/30/2020	
020812	Infiltration trench	Pass	AX9295482		FY19 Construction Complete
020817	Surface sand filter	Fail		6/30/2022	BMP Added to List in FY19
020818	Surface sand filter	Fail	AX7665D82	6/30/2020	Site Under Evaluation
020820	Surface sand filter	Fail		6/30/2022	BMP Added to List in FY19
020823	Infiltration basin	Fail	AX7665D82	6/30/2020	Site Under Evaluation
020827	Wet pond	Fail		6/30/2022	BMP Added to List in FY19
020845	Infiltration basin	Fail	XX1725174	6/30/2022	BMP Added to List in FY19, In Design and Permitting Process
020849	Infiltration trench	Pass	AX9295482		FY18 Construction Complete
020850	Infiltration basin	Fail		9/30/2020	
020880	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
020892	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19, MDOT Considering Abandonment
020893	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19, MDOT Considering Abandonment
020896	Grass Swale	Fail		6/30/2022	BMP Added to List in FY19
030001	Grass Channel Credit	Fail	AX3565274	6/30/2020	In Design and Permitting Process
030011	Wet pond	Fail		6/30/2020	In Design and Permitting Process
030113	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
030116	Infiltration basin	Fail		6/30/2020	
030117	Dry extended detention pond	Pass			FY17 Construction Complete
030124	Infiltration trench	Fail		6/30/2020	In Design and Permitting Process
030136	Infiltration basin	Fail		6/30/2020	
030137	Infiltration basin	Fail		9/30/2020	
030175	Dry pond	Fail		6/30/2020	
030183	Infiltration basin	Fail		6/30/2022	BMP Added to List in FY19
030189	Infiltration basin	Fail		9/30/2020	
030198	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
030200	Infiltration basin	Fail		6/30/2020	In Design and Permitting Process
030214	Infiltration basin	Fail		9/30/2020	
030215	Infiltration basin	Fail		6/30/2020	

Table 4: MDOT SHA SWM Facilities for Remediation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	2019 Remediation Comments
030220	Infiltration trench	Fail		6/30/2020	In Design and Permitting Process
030225	Infiltration trench	Pass	XX1675274		FY17 Construction Complete
030226	Infiltration trench	Pass	XX1675274		FY17 Construction Complete
030227	Infiltration trench	Pass	XX1675274		FY18 Construction Complete
030227	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
030228	Infiltration trench	Pass	XX1675274		FY18 Construction Complete
030229	Infiltration trench	Pass	XX1675274		FY17 Construction Complete
030242	Infiltration trench	Pass	XX1675274		FY18 Construction Complete
030244	Infiltration trench	Pass	XX1675274		FY18 Construction Complete
030244	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
030245	Infiltration trench	Fail		6/30/2020	In Design and Permitting Process
030252	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
030253	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
030256	Infiltration trench	Fail	AX3565274		Remediation / Maintenance not completed on schedule; WQ treatment temporarily removed from reported MS4 credit.
030269	Dry pond	Fail		6/30/2022	BMP Added to List in FY19
030274	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
030284	Bioretention	Fail		6/30/2022	BMP Added to List in FY19
030333	Infiltration trench	Fail		6/30/2020	In Design and Permitting Process
030385	Surface sand filter	Fail		6/30/2020	In Design and Permitting Process
030505	Micro-Bioretention	Fail		6/30/2022	BMP Added to List in FY19
060104	Dry pond	Fail	AX7665D82	6/30/2020	Sites being evaluated
"080007"	Wet pond	Fail		6/30/2020	
080019	Infiltration basin	Fail		6/30/2022	BMP Added to List in FY19
080027	Wet Swale	Fail		6/30/2022	BMP Added to List in FY19
080028	Wet Swale	Fail		6/30/2022	BMP Added to List in FY19
080069	Wet pond	Fail		6/30/2022	BMP Added to List in FY19
080070	Wet pond	Fail		6/30/2022	BMP Added to List in FY19
080071	Wet pond	Fail		6/30/2022	BMP Added to List in FY19
080074	Wet pond	Fail		6/30/2022	BMP Added to List in FY19

Table 4: MDOT SHA SWM Facilities for Remediation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	2019 Remediation Comments
100004	Surface sand filter	Fail		6/30/2020	
100012	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
100060	Infiltration basin	Fail	AX7665D82	6/30/2020	Sites being evaluated
100061	Infiltration basin	Fail		6/30/2020	
100065	Dry pond	Fail	AX9295482	6/30/2020	Work Order Approved - Under Construction Contract
100099	Wet pond	Fail		6/30/2020	
100129	Wet swale	Fail		6/30/2022	BMP Added to List in FY19
100143	Dry swale	Fail		6/30/2022	BMP Added to List in FY19
100171	Dry extended detention pond	Pass	AX7665C82		FY19 Construction Complete
100471	Other filtering	Fail	AX3565274	6/30/2020	In Design and Permitting Process
120008	Dry pond	Fail	AX7665D82	6/30/2020	Site Under Evaluation
120009	Dry pond	Fail		6/30/2020	
120017	Infiltration trench	Fail	AX3565274	6/30/2020	In Design and Permitting Process
120019	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
120039	Infiltration trench	Fail	HA4285174	9/30/2020	
120042	Infiltration trench	Fail	HA4285174	9/30/2020	
120063	Infiltration trench	Fail	AX3565274	6/30/2020	In Design and Permitting Process
120066	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
120095	Infiltration basin	Fail		6/30/2020	
120105	Dry extended detention pond	Fail		9/30/2020	
120106	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
120112	Infiltration trench	Fail	AX3565274	6/30/2020	In Design and Permitting Process
120133	Infiltration basin	Fail		9/30/2020	
120203	Wet extended detention pond	Fail		6/30/2020	
120208	Surface sand filter	Fail		6/30/2020	
120291	Wet pond	Fail		6/30/2020	In Design and Permitting Process
130013	Dry extended detention pond	Fail		6/30/2022	BMP Added to List in FY19
130027	Dry extended detention pond	Fail		9/30/2020	
130050	Infiltration basin	Fail		6/30/2022	BMP Added to List in FY19
130072	Dry extended detention pond	Fail	AX7665282	9/30/2020	Retrofit under construction

Table 4: MDOT SHA SWM Facilities for Remediation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	2019 Remediation Comments
130073	Wet pond	Fail	AX7665282	9/30/2020	Retrofit under construction
130074	Micropool extended detention pond	Fail		9/30/2020	
130077	Wet pond	Fail		9/30/2020	
130078	Dry pond	Fail		6/30/2022	BMP Added to List in FY19
130134	Wet pond	Fail		6/30/2022	BMP Added to List in FY19
130136	Infiltration trench	Pass	AX9295482		FY19 Construction Complete
130136	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
130161	Infiltration trench	Pass	AX9295482		FY19 Construction Complete
130167	Infiltration basin	Fail	AX9295482	6/30/2020	Work Order Approved - Under Construction Contract
130169	Wet pond	Pass			FY17 Construction Complete
130180	Grass Swale	Fail		6/30/2022	BMP Added to List in FY19
130198	Micropool extended detention pond	Pass			FY17 Construction Complete
130204	Infiltration basin	Fail	AX9295482	6/30/2020	Work Order Approved - Under Construction Contract
130206	Wet pond	Fail		9/30/2020	
130208	Infiltration trench	Fail	AX9295482	6/30/2020	In Design and Permitting Process
130210	Wet pond	Fail		6/30/2022	BMP Added to List in FY19
130220	Dry extended detention pond	Fail		9/30/2020	
130228	Shallow marsh	Pass	AX9295482		FY19 Construction Complete
130237	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
130251	Surface sand filter	Fail		6/30/2020	
130259	Surface sand filter	Fail		6/30/2020	
130263	Surface sand filter	Fail		6/30/2022	BMP Added to List in FY19
130271	Dry pond	Fail	AX7665D82	6/30/2020	Site Under Evaluation
130292	Other infiltration	Fail	AX9295482	6/30/2020	Work Order Approved - Under Construction Contract
130294	Other infiltration	Fail	AX9295482	6/30/2020	Work Order Approved - Under Construction Contract
130317	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
130319	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
130323	Infiltration basin	Pass	AX9295482		FY19 Construction Complete

Table 4: MDOT SHA SWM Facilities for Remediation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	2019 Remediation Comments
130325	Shallow marsh	Pass	AX9295482		FY19 Construction Complete
130332	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
130341	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
130357	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19, MDOT Considering Abandonment
130358	Infiltration trench	Pass	AX9295482		FY18 Construction Complete
130365	Infiltration trench	Pass	AX9295482		FY19 Construction Complete
130366	Infiltration trench	Pass	AX9295482		FY19 Construction Complete
130366	Infiltration trench	Fail	AX9295482	6/30/2022	BMP Added to List in FY19
130369	Shallow marsh	Fail	AX9295482	6/30/2020	Work Order Approved - Under Construction Contract
130370	Infiltration trench	Pass	AX9295482		FY19 Construction Complete
130375	Infiltration basin	Fail		9/30/2020	
130377	Infiltration basin	Pass	AX9295482		FY19 Construction Complete
130417	Grass Swale	Fail	AX9295482	6/30/2020	Work Order Approved - Under Construction Contract
130421	Wet pond	Fail		6/30/2020	
130544	Bio-Swale	Fail		6/30/2022	BMP Added to List in FY19
130629	Bio-Swale	Fail		6/30/2022	BMP Added to List in FY19
130631	Bio-Swale	Fail		6/30/2022	BMP Added to List in FY19
130632	Bio-Swale	Fail		6/30/2022	BMP Added to List in FY19
132056	Micro-Bioretention	Fail		6/30/2020	
150036	Infiltration trench	Fail		6/30/2020	
150059	Wet pond	Fail		6/30/2022	BMP Added to List in FY19
150066	Dry pond	Fail		6/30/2020	
150081	Infiltration basin	Fail		6/30/2020	
150201	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
150217	Infiltration basin	Fail		6/30/2022	BMP Added to List in FY19
150232	Infiltration trench	Fail		6/30/2020	
150285	Dry pond	Fail		6/30/2020	
150295	Bioretention	Fail	AX3565274	6/30/2020	In Design and Permitting Process
150304	Surface sand filter	Fail		6/30/2020	
150312	Dry extended detention pond	Fail		9/30/2020	

Table 4: MDOT SHA SWM Facilities for Remediation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	2019 Remediation Comments
150348	Wet pond	Fail		6/30/2022	BMP Added to List in FY19
150352	Dry pond	Fail		6/30/2022	BMP Added to List in FY19, In Design and Permitting Process
150355	Wet pond	Fail		6/30/2020	
150400	Dry pond	Fail		6/30/2022	BMP Added to List in FY19
150638	Infiltration basin	Fail		6/30/2022	BMP Added to List in FY19, MDOT Considering Abandonment
150643	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
150650	Dry pond	Fail		6/30/2022	BMP Added to List in FY19
150680	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
150706	Infiltration trench	Fail	AX3565274	6/30/2020	In Design and Permitting Process
150749	Other	Fail		6/30/2022	BMP Added to List in FY19
150750	Other	Fail		6/30/2022	BMP Added to List in FY19
160061	Wet pond	Fail		6/30/2022	BMP Added to List in FY19
160131	Infiltration trench	Fail		6/30/2020	
160176	Dry extended detention pond	Fail		6/30/2020	
160187	Wet swale	Fail		6/30/2020	In Design and Permitting Process
160197	Infiltration trench	Fail		6/30/2022	BMP Added to List in FY19
160203	Shallow marsh	Fail		6/30/2020	
160224	Infiltration trench	Fail		6/30/2020	
160225	Infiltration trench	Fail		9/30/2021	
160230	Infiltration trench	Fail	AX3565274	6/30/2020	In Design and Permitting Process
160232	Infiltration trench	Fail	AX3565274	6/30/2020	In Design and Permitting Process
160378	Dry pond	Fail		6/30/2020	
160408	Infiltration trench	Fail	AX3565274	6/30/2020	In Design and Permitting Process
160427	Infiltration trench	Fail		6/30/2020	
160429	Infiltration trench	Fail		6/30/2020	
160505	Wet pond	Fail		6/30/2020	In Design and Permitting Process
160624	Infiltration trench	Fail		6/30/2020	
160662	Wet pond	Fail		6/30/2022	BMP Added to List in FY19
160737	Wet pond	Pass	AT0865182		FY18 Construction Complete
160747	Wet extended detention pond	Fail		6/30/2022	BMP Added to List in FY19, In Design and Permitting Process

Table 4: MDOT SHA SWM Facilities for Remediation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	2019 Remediation Comments
160749	Infiltration trench	Fail		6/30/2020	
160806	Wet pond	Fail		6/30/2020	
210003	Dry swale	Fail	XY1695174	6/30/2020	In Design and Permitting Process
210009	Infiltration basin	Fail	XY1695174		Remediation / Maintenance not completed on schedule; WQ treatment temporarily removed from reported MS4 credit.

D.2 Erosion and Sediment Control

Requirements under this condition include:

a) *Implement program improvements identified in any MDE evaluation of SHA's erosion and sediment control program;*

b) *Ensure construction site operators have received training regarding erosion and sediment control compliance and hold a valid Responsible Personnel Certification as required by MDE;*

 c) *Record program activity on MDE's annual report database and submitted as required in Part V of this permit;*

d) *Ensure all applicable construction projects obtain a notice of intent (NOI) for stormwater associated with construction activity.*

D.2.a SHA's Erosion and Sediment Control Program

MDOT SHA continues to comply with Maryland State and federal laws and regulations for erosion and sediment control (ESC) as well as MDE requirements for permitting. MDOT SHA maintains compliance with the NPDES Stormwater Construction Activity permit for projects that disturb at least one acre of land. MDOT SHA continues to submit applications for coverage under this general permit for all qualifying roadway projects as described under **Section D.2.d** below.

As discussed in **Section D.1** above, MDOT SHA and MDE signed an MOU designating MDOT SHA as an approving authority for stormwater management and erosion and sediment control for all MDOT SHA projects. PRD maintains a database to track SWM and ESC submittals and design progress on all MDOT SHA projects.

MDOT SHA does not issue standard grading permits; the approval of final development plans typically indicates that all relevant regulations have been addressed and that work may proceed. In certain circumstances, additional approvals from other agencies may be required prior to initiating development activities.

Table 6 presents, a summary of approvals statewide projects as well as those within MS4 areas. Included also are summaries for acres of land disturbance.

In the MS4 geodatabase submitted with this FY19 MS4 annual report, MDOT SHA has provided the grading permit program information in the Quarterly Grading Permit feature class (QGP) and the Quarterly Grading Permit information table (QPI).

MDOT SHA ESC Quality Assurance Division (QAD)

The QA Program is now under the newly formed Quality Assurance Division within the MDOT SHA Office of Environmental Design. In FY19, the QA Program ensures that permits and plan approval conditions are adhered to by performing unannounced inspections at project sites applying the same protocols described in the FY18 MS4 annual report. No court enforcement actions were initiated in FY19; however, MDOT SHA utilizes liquidated damages against the contractors responsible for improper ESC activities.

Table 6 summarizes QA inspections and resultant MDOT SHA pursuit of liquidated damages for projects inside and outside MS4 jurisdictions**.** It is important to note that plans reviewed and approved by PRD will not necessarily correlate directly to the number of permits issued during any reporting period. This reflects the fact that PRD approval by itself does not constitute permit issuance as projects must meet additional regulatory criteria beyond MDE SWM and ESC standards. Additionally, the number of inspections and the associated number of projects on which these inspections were performed include projects whose approvals were issued during previous fiscal years and are therefore not included in the sum of permit activity presented.

D.2.b MDE Responsible Personnel Certification

MDE Responsible Personnel Certification is required for anyone overseeing the installation and maintenance, or performing the installation and maintenance, of erosion and sediment control practices and measures in Maryland. All PRD personnel are required to hold a valid MDE Responsible Personnel Certification.

The MDE Responsible Personnel Certification is currently only available through an online training course through MDE's website, so the amount of individual MDOT SHA personnel certified through that website is not reported here.

MDOT SHA Erosion and Sediment Control Certification (Yellow Card)

MDOT SHA, in cooperation with the Maryland Transportation Builders and Materials Association (MTBMA), continues to offer updated erosion and sediment control training, initiated in 2004. This erosion and sediment control online training is mandatory for MDOT SHA contractor superintendents and ESC managers and is highly recommended for contractor project managers, field personnel, and personnel responsible for erosion and sediment control.

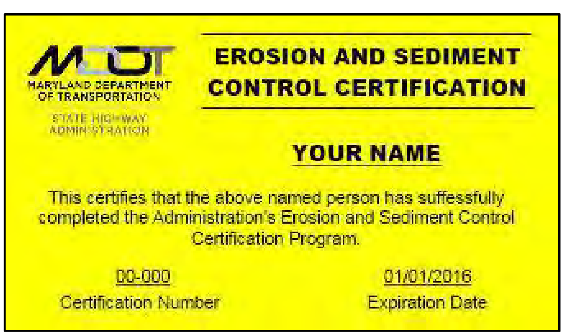


Figure 3: MDOT SHA Yellow Card Certification

The Quality Assurance Toolkit continues to track MDOT SHA's Erosion and Sediment Control Certification (Yellow Card) information related to individuals working on MDOT SHA projects, allowing QA inspectors to conduct audits of these credentials. Yellow Card Certification (see **Figure 3**) is a prerequisite for MDOT SHA's Erosion and Sediment Control Certification for designers, described in the following sections. The number of MDOT SHA personnel certified during the reporting period is summarized in **Table 5.**

MDOT SHA Erosion and Sediment Control Re-Certification (Yellow Card Re-Certification)

MDOT SHA Erosion and Sediment Control Re-Certification (Yellow Card Re-Certification) is only available for those that have previously completed the MDOT SHA Yellow Card Certification. Re-certification is contingent upon passing an exam and re-certification is valid for three years. MDOT SHA provides on-line re-certification training. The number of MDOT SHA personnel re-certified during the reporting period is summarized in **Table 5.**

Table 5: MDOT SHA ESC Training

Type of Training	Number Certified
MDOT SHA Erosion and Sediment Control Certification (Yellow Card)	502
MDOT SHA Erosion and Sediment Control Re-Certification (Yellow Card Re-Certification)	277

D.2.c Recording Program Activity

In the MS4 geodatabase submitted with this FY19 MS4 annual report, MDOT SHA has provided the erosion and sediment control program information in the Erosion Sediment Control table (ESC).

Table 6: Erosion and Sediment Control Permits and Disturbance Acreage

Jurisdiction	Number of Permits Issued	Acreage of Disturbance	Violations (Non-Compliance Inspections)	D-Grade Inspections (Shut Down Grading)	F-Grade Inspections (Shut Down Entire Project)	No-Grade Inspections (Extenuating Circumstances)	Liquidated Damages per IFB	Liquidated Damages in Progress	Liquidated Damages Taken	Liquidated Damages Outstanding	Court Cases
Anne Arundel	41	42.79	3	2	1	0	$18,468.00	3 Completed	$18,468.00	$0.00	
Baltimore	9	26.45	1	1	0	0	$2,849.00	1 Not Started		$2,849.00	
Carroll	4	102.64	0	0	0	0	--	--	--	--	
Cecil	2	4.71	2	0	1	1	$14,000.00	1 In Progress		$14,000.00	
Charles	3	1.61	1	1	0	0	$2,849.00	1 In Progress		$2,849.00	
Cumberland	--	--	0	0	0	0	--	--	--	--	
Frederick	14	82.71	7	3	3	1	$48,807.00	3 In Progress 3 Not Started		$48,807.00	
Harford	4	3.49	0	0	0	0	--	--	--	--	
Howard	25	325.736	2	1	1	0	$5,619.00	2 In Progress		$5,619.00	
Montgomery	14	54.69	8	4	4	0	$37,962.00	2 In Progress 3 Not Started 2 Completed	$11,028.00	$26,934.00	
Prince George's	7	12.93	3	0	3	0	$49,207.00	1 In Progress 1 Not Started 1 Completed	$4,015.00	$45,192.00	
Washington	7	9.83	2	2	0	0	$6,232.00	2 In Progress		$6,232.00	
Salisbury	1	0.59	0	0	0	0	--	--	--	--	
State Wide*	--	--	6	2	4	0	$0.00	--	$0.00	$0.00	
MS4 County Total	**131**	**668.176**	**35**	**16**	**17**	**2**	**$185,993.00**		**$33,511.00**	**$152,482.00**	
Non-MS4	29	165.43	3	0	3	0	$37,727.00	1 In Progress 2 Not Started		$37,727.00	
Total	**160**	**833.606**	**38**	**16**	**20**	**2**	**$223,720.00**		**$33,511.00**	**$190,209.00**	

*Certain groups within MDOT SHA conduct statewide operations – these contracts span multiple counties and sometimes districts.

D.2.d Notice of Intent for Stormwater Associated with Construction Activity

In accordance with the General Permit for Stormwater Associated with Construction Activity (State discharge permit number 14GP, effective January 1, 2015; expiring December 31, 2019), projects that disturb one acre or more of earth must obtain coverage under a General or Individual Permit for Stormwater Associated with Construction Activity (NPDES-CA) before beginning any earth disturbance.

The OHD Highway Hydraulics Division (HHD) reviews the limits of disturbance for all MDOT SHA projects and also reviews all subsequent approval modifications, to determine if a modification to the permit coverage is needed. HHD submits completed NOI applications online via the MDE e-Permits Portal. HHD tracks the status of each NOI application and ensures that coverage under any applicable permit is obtained prior to the issuance of Notice-To-Proceed (NTP) for construction. The QA program verifies all necessary permits are in hand prior to contractors initiating earth-disturbing activities. Both the documentation of NPDES-CA coverage and a copy of the General NPDES-CA permit are posted at each applicable construction site. During the reporting period, between July 1, 2018 and June 30, 2019, a total of 93 MDOT SHA construction projects receiving NTP required coverage under an NPDES-CA permit. Due to the upcoming expiration date for the General NPDES-CA permit, MDE has extended project-specific NPDES-CA coverage for advertised MDOT SHA projects by default until a new permit is issued.

D.3 Illicit Discharge Detection and Elimination

Requirements under this condition include:

a) *Field screen at least 150 outfalls annually;*

b) *Conduct annual visual surveys of commercial and industrial areas to discover, document and eliminate pollutant sources;*

c) *Maintain program to address and, if necessary, respond to illegal discharges, dumping and spills;*

d) *Use appropriate procedures to investigate and report illicit discharges, illegal dumping and spills to local or State authorities as applicable for control or clean-up. Report significant discharges to MDE for enforcement and/or permitting.*

e) *Coordinate with surrounding jurisdictions when illicit connections originate from beyond SHA's rights-of-way; and*

f) *Report illicit discharge detection and elimination activities as specified in Part V of this permit.*

D.3.a Illicit Discharge Screening

IDDE screening is coordinated by the MDOT SHA Office of Environmental Design, Environmental Compliance Division (ECD). ECD considered pollution potential during the FY19 outfall selection process. Outfalls selected and screened during FY19 were located in commercial and industrial areas determined to be "stormwater hotspots." ECD included pipes 12" diameter and greater throughout Anne Arundel, Baltimore, and Prince George's Counties.

To meet the minimum annual requirement, a total of 182 primary (field) screenings were performed at outfalls along sections of Maryland Route 40, Route 2, Route 140, and Route 30. Of the screened outfalls with a discernible dry-weather flow that were consequently sampled, only one illicit discharge (ID) was identified in Baltimore County. Additional screenings were performed across Baltimore, Montgomery, and Prince George's Counties as a result of information regarding potential IDs received from either citizen reporting or other MDOT SHA contractors working in our ROW. One ID resulted from these additional screenings, in Prince George's County. Details regarding any closed or open ID investigations are provided below in Section D.3.e.

Table 7 below summarizes primary and additional field screening efforts for the reporting period. In the MS4 geodatabase submitted with this FY19 MS4 annual report, MDOT SHA has provided the illicit discharge detection and elimination program information in the IDDE table (IDD).

Table 7: Field Screening Summary

County	Number of Outfalls Field Screened FY 19	Discharges requiring follow-up
Anne Arundel	62	0
Baltimore	112	1
Prince George's	11	1
Montgomery	1	0
Totals	**186**	**2**

D.3.b Annual Visual Surveys of Commercial and Industrial Areas

As discussed in **Section 0**, a GIS layer has been developed to identify industrial sites within MDOT SHA right-of-way that have the potential to contribute pollutants to MDOT SHA storm drain systems.

The MDOT SHA sites include industrial NPDES 12-SW general permitted facilities. As a best management practice, MDOT SHA sites not permitted under MDE's 12-SW permit are also included in the state-wide inspection program. These additional sites include salt domes, satellite shops, truck weigh inspection stations (TWIS), office buildings, draw bridges, and rest areas. These MDOT SHA facilities will be inspected using the same Facility Compliance Inspection tool used for general permitted activities. In FY19, 129 non-permitted sites were inspected.

There are three types of inspections performed at MDOT SHA facilities:

- Routine Facility Inspections
- Comprehensive Site Compliance Evaluations (CSCE)
- 12-SW Quarterly Visual Monitoring.

The MDOT SHA facility inspection program includes two inspections:

1. A weekly/monthly routine facility inspection performed by shop personnel
2. A routine inspection is performed by ECD's District Environmental Coordinator (DEC) on either an annual, semi-annual or quarterly basis depending on the type of facility

Inspection checklists are completed and uploaded to the MDOT SHA web-based database for both types of inspections. A separate summary report is generated by the DECs following each inspection.

For 12-SW permitted facilities an annual CSCE is performed in the fourth quarter of every calendar year. The CSCE report is generated prior to January 31 each year.

D.3.c Illegal Discharge, Dumping, and Spill Program

ECD manages a program to address and respond to illegal discharges, dumping, and spills. As part of the overarching program, ECD continues to coordinate with MDE, surrounding jurisdictions, and property owners to eliminate IDs and clean up spills and dumping.

Implementation of a new IDDE management tool is queued for FY21. The implementation will leverage a new strategic platform for application deployment and will align with MDOT SHA processes for tracking and follow-up for ID cases.

As IDs are identified through the ID screening process and other sources, ECD utilizes an agreement with Maryland Environmental Service (MES) to follow-up and collect samples for laboratory analysis in accordance with the process submitted in Appendix F of the FY18 MS4 annual report.

Discharges are deemed illicit based on two main criteria: dry weather flow and exceedance of discharge parameter(s). Any no-flow outfalls showing signs of potential pollution are investigated further to ensure no stormwater pollution is occurring.

D.3.d Investigation and Report of Illicit Discharge, Illegal Dumping and Spills

The dry weather screening process for IDs implemented by ECD is described previously in **Section D.3.a**. and the investigation and reporting process implemented by ECD was described in detail in the FY18 MS4 annual report. The investigation and reporting process did not change during the FY19 reporting period.

If an ID is still present at a site after the standard investigation and reporting steps have been taken, ECD contacts the MDE Sediment, Stormwater and Dam Safety Program for assistance. The expectation is that MDE's Stormwater program manages the investigation through to resolution. To ensure resolution, ECD will then add the reported outfall to the following year's IDDE screening list.

D.3.e Annually Report Illicit Discharge Detection and Elimination Activities

The following updates provide details regarding the status of open or reopened IDs from previous annual reports, as well as any FY19 IDs that required investigation.

1. <u>A FY18 ID investigation in Frederick County at Rising Ridge Road in Mt. Airy associated with BMP # 100085</u> was closed during this reporting period. The location of this ID is a 15" reinforced concrete pipe flowing from an inlet on an off-site property. A grey milky discharge flowing into the BMP was found to be the result of a stone cutting operation in the parking lot and adjacent building. The flow is causing additional sedimentation from the cutting byproduct and staining of the downstream channel material. Frederick County representatives contacted the Mt. Airy Department of Public Works to address the ID. ECD has added this outfall to the FY20 primary screening locations to ensure the issue has been addressed.

2. <u>In the FY18 annual report, MDOT SHA also reported an ID in Prince George's County at structure #1600828.001, which discharges into BMP# 160660</u>. This ID was identified in a commercially developed area along the on-ramp to Interstate 495 from Ritchie Marlboro Road in Largo, MD. Since the initial identification, ECD has worked with Prince George's (PG) County code enforcement to eliminate the ID. PG County has taken the following steps to correct the issue: performed site visits, compiled stormwater mapping, and met with property owners. It is our understanding that to date no single responsible party has been identified. During this reporting period, ECD performed a follow up inspection and field

Table 8: Illicit Discharges Requiring Follow-up

Number	County	MDOT SHA Structure #	Date Identified	Potential Pollutant	Status
1	Frederick	BMP 100085	05/10/2017	Solids	Closed
2	Prince George's	BMP 160660	10/04/2017	Detergents	Open, referred to MDE
3	Harford	1202700.001	08/09/2018	Detergents	Closed
4	Baltimore	0300806.001	06/27/2019	Chlorine	Open, referred to County

testing. This follow up effort confirmed that issues with pH and detergents remain. This ID has been referred to MDE for closure and will be added to the FY20 primary screening locations.

3. In August 2018, MDE informed MDOT about a citizen complaint regarding a potential ID at Bel Air Rd in Harford County. The complaint had been relayed to MDE by EPA Region III. ECD determined that this compliant was related to a past ID that was originally identified in 2014, and subsequently closed upon referral to MDE in 2015. The original ID and recent complaint involved detergents that were found to be discharging from car washing activities. In October 2018, the property owner was again contacted and inspected by MDE and directed to resolve the repeat vehicle washing violation. In response, the property owner installed a berm to prevent wash water from leaving the vehicle wash facility (See **Figure 4)**. This corrective action was confirmed by MDE Compliance Program.

4. An ID involving chlorinated discharge was identified during the FY19 primary outfall screening along Rt. 40 near the intersection with Charing Cross Road in Baltimore County. The ID is suspected to be a water line break and has been referred to the County for correction.

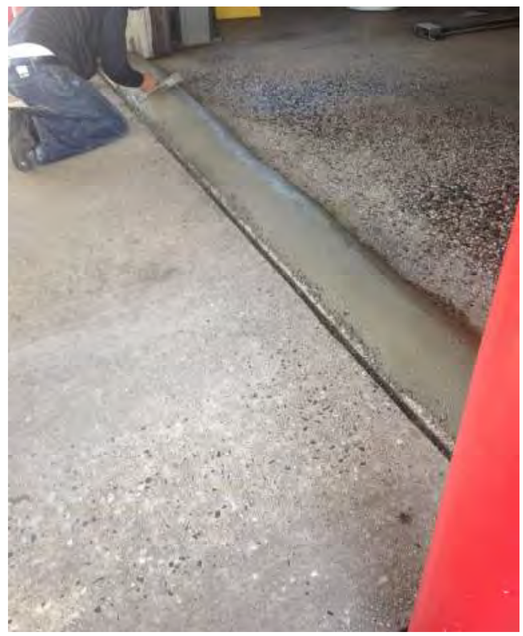


Figure 4: Wash Water Berm Install

Table 8 above summarizes the above information for IDs requiring follow-up.

D.4 Trash and Litter

Requirements under this condition include:

a) *Document litter problems on properties, ways of eliminating litter, and opportunities for overall improvement;*

b) *Within one year of permit issuance, as part of the public education program, SHA shall develop and implement a public education and outreach program with specific performance goals to reduce littering. This shall include:*

i) *Educating the transportation community on the importance of reducing, reusing, and recycling;*

ii) *Disseminating information by using signs, articles and other media outlets; and*

iii) *Promoting educational programs for SHA employees, consultants, contractors, travelling/trucking public, vacationers and commuters, etc.;*

c) *Evaluate annually the effectiveness of the education program; and*

d) *Submit an annual report that details progress toward implementing the public education and outreach program and trash reduction strategies.*

D.4.a Litter Control Problems and Methods for Elimination

The MDOT SHA has long maintained an anti-litter program and continues to implement improvements to this program to minimize litter. This helps to increase safety, improve the health of our environment, and keep our state beautiful. MDOT SHA currently collects a substantial amount of litter and trash including pick-up along state roads, inlet cleaning, and structural stormwater control structures.

MDOT SHA uses a multi-pronged approach to control litter utilizing MDOT SHA employees, state workers, contractors, correctional services, as well as labor donated through the Sponsor-A-Highway (SAH) program and partnerships with Adopt-A-Highway (AAH) volunteers. This approach was described comprehensively in the FY18 MS4 annual report. Updates relative to the various components of MDOT SHA's litter control program are provided here.

MDOT SHA Maintenance Crew and Contracted Clean-ups

MDOT SHA currently has 28 maintenance shops across the state, and 17 are responsible for areas within the MS4 jurisdictions. Each maintenance shop is responsible to perform several routine activities including trash clean-up as well as mowing, plowing, and other activities to ensure safety and environmental stewardship along the ROW.

In addition to MDOT SHA maintenance crew clean-ups, MDOT SHA enters contractual agreements for supplemental clean-ups along the right-of-way. This includes contracts with private companies as well as inmate crews contracted with various state penitentiaries. MDOT SHA provides dump trucks, maintenance of traffic, crash attenuators, and other safety precautions for field crews working to pick up trash along the roadway. Contracted clean-up activities occur throughout the state, including MS4 jurisdictions. Trash pick-up by MS4 Jurisdiction is summarized in **Table 9**.

Table 9: Maintenance/Contracted/Inmate Right-of-Way Trash/Litter Removal

Jurisdiction	Truckloads	Conversion to Pounds
Anne Arundel	913	319,550
Baltimore	1,966	688,100
Carroll	77	26,793
Cecil	166	57,995
Charles	162	56,840
Frederick	202	70,700
Harford	147	51,552
Howard	360	126,070
Montgomery	312	109,340
Prince George's	1,121	392,196
Washington	135	47,089
Totals	**5,561**	**1,946,225**
Data extracted for period 7/1/2018 to 6/30/2019		

Adopt-A-Highway Program (AAH)

Since the AAH program's conception in 1989, MDOT SHA has partnered with thousands of civic organizations and volunteer groups to pick up litter along one to two mile stretches of non-interstate roadways four times a year for a two-year period. MDOT SHA provides each group with training, safety vests, trash bags, and tips on how to pick-up trash and recyclables. The trash collected is placed in bags that are picked up by MDOT SHA maintenance crews. MDOT SHA will also place signs recognizing the organization or group at both ends of the adopted roadside.

Table 10 identifies the participation for the AAH program throughout the current reporting period.

Table 10: AAH Program Right-of-Way Trash/Litter Removal

Jurisdiction	# of Groups	Number of Bags	Miles Adopted
Anne Arundel	2	21	2
Baltimore	36	355	38
Carroll	4	52	4
Cecil	20	218	21
Charles	1	2	1
Frederick	3	27	3
Harford	15	177	16
Howard	12	176	13
Montgomery	0	0	0
Prince George's	3	17	3
Washington	5	29	1
Salisbury	0	0	0
Totals	**101**	**1,074**	**102**
Data extracted from the AAH database for the period 07/01/2018 to 06/30/2019.			

Sponsor-A-Highway Program (SAH)

The MDOT SHA corporate sponsorship program allows corporations to sponsor sections of Maryland roadways by funding contracted clean-ups for one-mile sections. The sponsor enters into an agreement with a maintenance provider to remove litter from the sponsored highway segment, typically an interstate roadway. Maintenance providers are then responsible for removal of trash per the terms of the agreement.

Each sponsor is acknowledged by a sign containing a recognition panel that is placed by MDOT SHA at the beginning of the highway segment they are sponsoring. MDOT SHA does not receive any reimbursement from the corporate sponsor or maintenance provider. MDOT SHA ensures that litter removal is properly performed and sponsor recognition signs are installed to standards established in the Federal Highway Administration's "*Manual on Uniform Traffic Control Devices*". Additionally, MDOT SHA manages the inventory of segments available for sponsorship, reviews additional areas for inclusion in the program, and approves artwork submitted for sponsor recognition signs.

Table 11 shows the miles currently being sponsored through the SAH program within the MS4 jurisdictions.

Table 11: SAH Program

Jurisdiction	Available Miles	Miles Sponsored
Anne Arundel	37	91
Baltimore	13	112
Carroll	2	-
Cecil	-	-
Charles	20	4
Frederick	9	15
Harford	8	1
Howard	15	41
Montgomery	1	50
Prince George's	20	72
Washington	11	6
Salisbury	3	2
Totals	139	394
Data extracted from the SAH database for the period 07/01/2018 to 06/30/2019.		

D.4.b Public Education and Outreach

In addition to the programs described previously in **Section D.4.a**. that directly reduce and control litter along roadways, which ultimately reduces litter to local waterways, MDOT SHA continues to make impacts through its multi-faceted public education program with goals to educate the public on environmental stewardship and litter reduction. Some key components of the

MDOT SHA public education program are discussed below.

Outreach

The MDOT SHA Office of Communication (OC) and Office of Maintenance (OOM) collaborate on program components which include disseminating information through press releases, websites, social media (See **Figure 5)**, informational materials, and special events. Special event locations include, but are not limited to schools, festivals, and civic events. The program offers materials such as coloring books, brochures, and speakers to educate the public.

MDOT SHA hosts a webpage entitled 'Educational Outreach' which provides resources to members of the transportation community interested in reducing pollutants in local waterways and the Chesapeake Bay. The webpage includes outreach materials to the public that discourages littering behavior, including information on proper litter and trash disposal, and links to learn more about plastics in the aquatic environment, and ways to reduce the volume of trash entering our waterways. The webpage also encourages individuals or groups to participate in trash cleanups through MDOT SHA's AAH and SAH programs. This website can be found at the follow address:

https://www.roads.maryland.gov/Index.aspx?pageid=48.

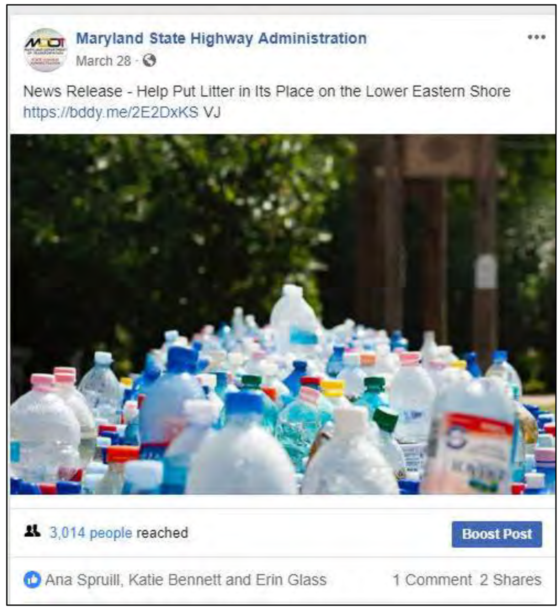


Figure 5: Example of MDOT SHA's Use of Social Media in Promoting Litter Education

Litter Education and Prevention

MDOT SHA's statewide 'Where Does It Go?' campaign is an education effort to help citizens realize the harmful effects of litter on our natural resources and roadways. This campaign is currently focused on increasing its outreach through social media and special events.

As part of the campaign, MDOT SHA hosted an exhibit at the 2018 MD State Fair where staff interacted directly with MDOT SHA customers about MDOT SHA services and spread the word about MDOT SHA's, "From Roadways to Waterways: Where Does It Go?" litter campaign. Talking points focused on conveying to Maryland residents how a bottle discarded from a car window will eventually find its way into their treasured Chesapeake Bay. The campaign was incorporated into MDOT SHA's Maryland State Fair display where children had the opportunity to remove litter from a pool and win a prize (**Figure 6**).

Figure 6: MDOT SHA Tweet Promoting MD State Fair Booth

Earth Day

MDOT SHA held Earth Day events from April 22-25 to promote environmental education to all MDOT SHA employees, consultants, contractors and the public. On April 23rd, MDOT SHA hosted nature interpreters from the Maryland Department of Natural Resources (DNR) "Wings and Things" interactive Lunch and Learn program. The intended outcome was to increase awareness of native Maryland wildlife and the associated impact of human behaviors, such as littering. Over 100 employees attended the DNR presentation.

Figure 7: Earth Day "Wings and Things" Event

On April 24th over 30 MDOT SHA employees attended a workshop to construct bird feeders from plastic bottles with the goal of demonstrating how to reuse plastic materials. Employees could take home their personally constructed feeders as a reminder that plastic materials can be repurposed to reduce plastic consumption and waste.

Figure 8: MDOT SHA Tweet About "Build a Bird Feeder" Workshop

In addition to these events, MDOT SHA's Environmental Action Team distributed agency-wide emails the month of April, highlighting ways to be a good steward of the environment. These e-mails included facts regarding the effects of waste and litter on our environment, as well as things each of us can do to keep litter off our roads and waterways.

PARK(ing) Day

On September 21, 2018, MDOT SHA participated in the 13th annual, worldwide PARK(ing) Day event, where artists, designers and citizens transform metered parking spots into temporary public parks. The mission of PARK(ing) Day is to call attention to the need for more urban open spaces, to generate critical debate around how public space is created and allocated, and to improve the quality of urban human habitat.

MDOT SHA volunteers, in cooperation with Baltimore City Department of Transportation converted a parking space located at the corner of Calvert Street and Monument Street in Mt. Vernon into an urban garden for the day. The MDOT SHA theme was "A Tale of Two Parks", with one half of the parking space showing impacts of litter, and the other side illustrating a litter-free park. MDOT SHA volunteers remained on-site to answer questions from MDOT SHA staff and the public. Volunteers also engaged participants through trivia, focusing on how plastic harms the environment and ways to reduce plastic consumption.

Figure 9: MDOT SHA's 2018 PARK(ing) Day Display

Keep Maryland Beautiful Grant Program

The Maryland Environmental Trust (MET) awards grants to nonprofits, community groups, and schools to support cleaning and greening activities, environmental education and stewardship practices across the state. In Fiscal Year 2019, 71 grants were awarded totaling $215,505. These annual grants are funded by MET, the Maryland Department of Housing and Community Development (DHCD), and MDOT.

D.4.c Evaluation and Effectiveness

The MDOT Excellerator is a performance management system that is updated and publicly shared on a quarterly basis. This report is available at the following link:

http://www.mdot.maryland.gov/newMDOT/Planning/Excellerator/MDOTExcellerator

The MDOT Excellerator includes performance measures focused on the positive impact MDOT has on the Statewide litter problem.

Performance Measure 9.2A – Office Waste Recycled

This performance measure is focused on the percentage of office waste diverted from the landfill or incineration through recycling.

Office Waste Includes:

- Commingled containers (glass, metal, and plastic);
- Glass (fluorescent light tubes, mixed glass containers);
- Metals (mixed cans, and tin/steel cans);
- Paper (corrugated cardboard, mixed paper, shredded paper and newspaper);
- Plastic (mixed plastic bottles, other plastics);
- Electronics; and
- Printer cartridges

Performance Measure 9.2B – Non-Office Waste Recycled

This performance measure is focused on the percentage of non-office waste diverted from the landfill or incineration through recycling.

Non-Office Waste Includes:

- Lead-acid batteries (vehicle);
- Compostables (grass, leaves, brush, branches, mixed yard trimmings, food waste, and other);
- Metals (white goods - refrigerators, stoves, washing machines, dryers,
- water heaters, and air conditioners);
- Animal protein/solid fat;
- Tires;
- Antifreeze;
- Industrial fluids;
- Motor oil;
- Scrap automobiles; and
- Scrap metals.

Performance Measure 9.2D – Litter Pickup

This performance measure is focused on addressing litter across the MDOT transportation system. As discussed in **Section D.4.a**, MDOT SHA addresses roadside litter with internal forces, correctional personnel, SAH, and AAH efforts.

D.5 Property Management and Maintenance

Requirements under this condition include:

a) Ensure that an NOI has been submitted to MDE and a pollution prevention plan developed for each SHA-owned facility requiring NPDES stormwater general permit coverage. The status of the pollution prevention plan development and implementation for each SHA-owned municipal facility shall be reviewed, documented and submitted to MDE annually;

b) Continue to implement a program to reduce pollutants associated with maintenance activities at SHA-owned facilities including garages, roadways parking lots, rest areas and park and rides. The maintenance program shall include, but not be limited to, these activities:

i) Street sweeping;

ii) Inlet inspection and cleaning;

iii) Minimizing the use of pesticides, herbicides, fertilizers and other pollutants associated with vegetation management through increased use of integrated pest management;

iv) Minimize to the MEP the use of winter weather deicing materials through research, continual testing and improvement of materials, equipment calibration, employee training and effective decision-making; and

v) Ensure that all SHA staff receives adequate training in pollution prevention and good housekeeping practices.

SHA shall report annually on the changes in any maintenance practices and the overall pollutant reductions resulting from the maintenance program. Within one year of permit issuance, an alternative maintenance program may be submitted for MDE approval indicating the activities to be undertaken and associated pollutant reductions.

D.5.a 12-SW NOI Submission and Pollution Prevention Plan Development

As described in detail within the FY18 MS4 annual report, MDOT SHA has implemented an Environmental Management System (EMS) to ensure multi-media compliance at maintenance facilities statewide.

The EMS includes routine multimedia compliance inspections of 162 MDOT SHA facilities. These inspections include recommendations for stormwater improvements and pollution prevention. As shown in **Table 12**, certain facilities are currently covered under the General Discharge Permit (12-SW). Actions taken during this reporting period to meet 12-SW requirements include:

- Updated Storm Water Pollution Prevention Plans (SWPPP) and maps following site changes and renovations

- Performed quarterly visual monitoring and reporting
- Continued to train staff on developed standard operation procedures
- Updated internal self-assessment compliance checklists for routine and annual inspections
- Trained shop personnel on pollution prevention requirements and incorporated updates in annual environmental awareness training provided to all MDOT SHA maintenance staff
- Completed annual comprehensive site compliance evaluations

Table 12: Industrial NPDES Permit Status

District	Maintenance Facility	Permit Type
1	Berlin	General
	Cambridge	General
	Princess Anne	General
	Salisbury	General
	Snow Hill	General
2	Centreville	General
	Chestertown	General
	Denton	General
	Easton	General
	Elkton	General
3	Fairland	General
	Gaithersburg	General
	Laurel	General
	Marlboro	General
4	Churchville	General
	Golden Ring	General
	Hereford	General
	Owings Mills	General
5	Annapolis	General
	Glen Burnie	General
	La Plata	General
	Leonardtown	General
	Prince Frederick	General
	Hanover Auto Shop	General
6	Hagerstown	General
	Keyser's Ridge	Individual – GW
	La Vale	General
	Oakland	General
7	Dayton	General
	Frederick	General
	Thurmont	General
	Westminster	General
Notes: SW = Surface Water, GW = Groundwater		

Table 12: Industrial NPDES Permit Status

The MDOT SHA maintenance facility staff are continuing to perform monthly inspections and the ECD continues to perform inspections at all MDOT SHA facilities through its DECs and manage resultant maintenance needs identified in accordance with the process previously described in the FY18 MS4 annual report

As a MS4 permit holder, MDOT SHA has assessed the Bay Restoration requirement for facilities covered under the 12-SW permit and included them in the MDOT SHA MS4 20 percent impervious baseline and restoration implementation.

MDOT SHA continues to maintain an effective Industrial Stormwater NPDES Program through its ECD to ensure pollution prevention and permit requirements are being met at MDOT SHA maintenance facilities. Annually, and as change dictates, MDOT SHA updates its SWPPP and Spill Prevention, Control, and Countermeasure (SPCC) Plans. As a continuing best management practice, MDOT SHA has developed SWPPPs for facilities that are typically not required to have one (e.g. salt storage facilities).

Throughout the reporting year, MDOT SHA continued to address potential stormwater pollution issues by implementing BMPs and designing/constructing capital improvements. BMPs were identified during pollution prevention plan updates and routine facility inspections. The status of BMP implementation for maintenance facilities is tracked by each DEC during routine inspections. Potential capital improvements are prioritized based on risk to human health and the environment, and funding availability. The following list details the major pollution prevention efforts and maintenance facility improvements since the last annual report.

Completed Projects:

- 12-SW quarterly visual monitoring and annual comprehensive site compliance evaluations
- Standard Operating Procedure creation and updates to ensure compliance with 12-SW permit
- Updating existing and creation of a new training program to ensure compliance with 12-SW permit
- Petroleum storage tank system upgrades at various MDOT SHA maintenance facilities

Ongoing Projects / Efforts:

- Statewide brine tank upgrades and replacement
- Salt barn repair and replacement
- Statewide discharge sampling and reporting program for facilities with Individual Discharge Permits
- Compliance inspections at all MDOT SHA facilities
- Annual multimedia compliance training provided to maintenance shop personnel

Table 13 shows MDOT SHA capital expenditures for industrial pollution prevention BMPs since 2005. Projected expenditures for FY20 are also included.

Table 13: Capital Expenditures for Pollution Prevention BMPs

Fiscal Year	Expenditure
2005	$ 613,210 - actual
2006	$ 592,873 - actual
2007	$ 450,608 - actual
2008	$ 590,704 - actual
2009	$ 478,889 – actual
2010	$ 613,766 - actual
2011	$ 595,984 - actual
2012	$ 664,577 - actual
2013	$ 917,902 - actual
2014	$641,512 - actual
2015	$2,339,971 - actual
2016	$1,858,544 - actual
2017	$2,006,170 - actual
2018	$5,465,375 - Actual
2019	$787,583 - Actual
2020	$200,000 - Projected

D.5.b Maintenance Activity Pollution Reduction Program

MDOT SHA continues to implement programs and activities aimed at reducing pollutants associated with maintenance activities along MDOT SHA owned roadways and MDOT SHA owned facilities. These activities, including street sweeping, inlet cleaning, and storm drain vacuuming, are discussed in the following sections. In addition, MDOT SHA is implementing methods to minimize the use of winter weather deicing materials and the use of pesticides, herbicides, and fertilizers associated with vegetation management.

Chemical application information (i.e., data for deicing materials, herbicides, and fertilizers) is provided in the Chemical Application table (CAP) in the MS4 geodatabase submitted with this FY19 MS4 annual report.

i. Street Sweeping

The current MDOT SHA street sweeping program is predicated upon operational and safety needs for maintaining drainage from roadways, keeping roadsides free of lose debris thrown by turning wheels, and keeping roadsides visually attractive. Sweeping of the roadway results in the collection and disposal of loose material including dirt, sand, trash, and other debris. By removing this material from the roadway surface before it can be washed away in runoff, street sweeping also reduces pollutants in the storm drain network.

MDOT SHA sweeps a selected number of roadways regularly during the spring, summer, and fall months of April through November. The collected material is then disposed of in an approved landfill.

ii. Inlet Cleaning & Storm Drain Vacuuming

Inlet cleaning and storm drain vacuuming are two additional operational practices that MDOT SHA has identified as beneficial in improving water quality. Inlet cleaning and storm drain vacuuming removes accumulated material from inlets and connecting storm drain pipes. This maintains clear drainage systems for roadway runoff, deters flooding, minimizes ice development during winter storms, and prevents damage to underground inlets and pipes. Sediment and trash make up most of the material that is removed. See **Figure 10** for before and after results for an inlet cleaning operation.

Figure 10: Inlet Before and After Cleaning

MDOT SHA owns and operates vacuum pump trucks (see **Figure 11**) and tow-behind vacuum trailers (see **Figure 12**) for routine inlet and storm drain vacuuming. MDOT SHA personnel operate this equipment in central Maryland in the following counties: Anne Arundel, Baltimore, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Prince George’s, and St. Mary’s.

Figure 11: MDOT SHA Vacuum Pump Truck

Figure 12: MDOT SHA Tow-Behind Vacuum Trailers

In late FY19 and early FY20, MDOT SHA activated four contracts with private contractors to perform inlet cleaning services. One of these contracts also includes storm drain cleaning/vacuuming. These contractors use similar or better vacuum trucks than the MDOT SHA owned equipment to provide these services.

Table 14 presents the number of inlets and tons of material collected from inlet cleaning and storm drain vacuuming operations by the MDOT SHA Office of Maintenance staff and contractors and as a component of HHD (Fund 77) repaving contracts in FY19.

Table 14: Number of Inlets Cleaned, Storm Drain Vacuuming Totals and Estimated Tons Collected in FY19

County	MDOT SHA Shop	Total Number of Inlets Cleaned	Tons[1] Collected	Tons Collected from Storm Drain Vacuuming
Anne Arundel	Annapolis	34	4	9
	Glen Burnie	118	12	12
Baltimore	Golden Ring	284	30	47
	Hereford	211	22	5
	Owings Mills	211	22	22
Carrol	Westminster	0	0	9
Cecil	Elkton	2	0	0
Charles	La Plata	2	0	6
Frederick	Frederick	5	1	3
Harford	Churchville	115	12	31
Howard	Dayton			5
Montgomery	Fairland	113	12	22
	Gaithersburg	211	22	11
Prince George's	Laurel	82	9	2
	Upper Marlboro	392	41	5
Wicomico County	Salisbury	8	1	0
	Subtotal	**1788**	**188**	**189**
Fund 77 Repaving Projects		371	39	0
	Grand Total	**2159**	**227**	**189**

[1]Assumed 210 lbs. (dry weight) cleaned from each inlet and converted to tons (rounded to the nearest whole number).

iii. Minimize Use of Pesticides, Herbicides, Fertilizers and Other Pollutants

Landscape management by MDOT SHA is directed towards efficient use of resources with the least environmental impacts. To promote best practices, MDOT SHA develops guidance documents, provides training, invests in cooperative research programs, and develops specifications such as Nutrient Management Plans.

Landscape Management Guide

During the previous reporting period, work continued on the *MDOT SHA Landscape Management Guide* (LMG) to fully revise and replace the *MDOT SHA Integrated Vegetation Management Manual for Maryland Highways* (IVMM, 2003), the *SHA Turfgrass Management Guidelines*, and the *SHA Mowing Policy*.

This new document presents a performance-based guide for managing green assets along Maryland highways, and a major step forward to minimizing pesticide and fertilizer use on MDOT SHA ROW. Key concepts and draft chapters of the LMG were discussed at all pesticide applicator training sessions presented by OED to MDOT SHA pesticide applicators in FY19. A test draft of the LMG was released for use in October 2018, and the final draft is nearing completion.

Chemical Application

MDOT SHA has provided the chemical application program information in the Chemical Application table (CAP) as specified in the MDE 2017 Geodatabase Guideline format.

OED offers the following four pesticide applicator training classes each year:

- ENV 100 allows participants to become a Registered Pesticide Applicator with the Maryland Department of Agriculture
- ENV 200 provides recertification credits for MDOT employees, consultants, and contractors
- ENV 210 is a Pesticide Core and ROW Certification preparation class
- ENV 220 is an aquatic pesticide training to qualify MDOT personnel to take the Pesticide Category 5 Aquatic test (ENV 221 was discontinued and the contents were incorporated into ENV 220)

Table 15 shows classes and participation during the FY19 reporting period.

Table 15: Pesticide Applicator Training

Date	Training Sessions			
	ENV 100	ENV 200	ENV 210	ENV 220
8/9/2018	15		12	
8/10/2018			7	
8/24/2018	17			
10/18/2018			5	
3/28/2019	27			
4/2/2019			7	
4/11/2019		17		
4/18/2019		11		
4/25/2019		31		
5/1/2019		31		
5/7/2019	30			
5/21/2019			6	
Subtotals	**89**	**90**	**37**	**0**
Total	**216**			

Integrated Pest Management – Use of Biocontrol Insects to Suppress Invasive Plant Species along MDOT SHA ROW

MDOT SHA continued to work with the Maryland Department of Agriculture (MDA) in cooperative research programs to control invasive plants using insect biocontrols. MDA released Mile-a-Minute Vine Weevil, *Rhinoncomimus latipes*, at 15 locations within MDOT SHA ROW during the previous year. Additionally, MDOT SHA and MDA are researching an insect biocontrol, *Aphalara itadori*, that would assist in suppressing Japanese Knotweed. Japanese Knotweed is a highly invasive, hardy, herbaceous perennial that was introduced from escaped ornamental plantings. It is a recent invader of channels, streams, wetlands, and riparian areas, although it can also be found in upland areas. It spreads by durable rhizomes, but also is a viable seed producer. These biocontrol insects consistently reduce the growth and seed production of the target plants and reduce the need for herbicide control.

Herbicide Application

Most vegetation management on MDOT SHA property is performed mechanically by mowers and similar machinery. Management objectives are defined in the LMG, and herbicides are applied when not practical or feasible to meet objectives by mechanical methods alone. Vegetation controlled by MDOT SHA includes noxious weeds, invasive weeds, and plant material that reduces highway safety and operability.

All MDOT SHA employees and contractors who apply herbicide on MDOT SHA ROW must be registered with MDA and operate under the supervision of an MDA certified pesticide applicator. Herbicide/Pesticide application records must be kept by all MDA certified pesticide applicators and must be presented to MDA inspectors upon request. MDOT SHA does not have enforcement authority with respect to, or rights to access, these records like MDA. This creates limitations with respect to accounting and reporting the amounts of pesticide/herbicide chemicals applied by MDOT SHA contractors.

To obtain a reasonable estimate of herbicide applied to MDOT SHA ROW by MDOT SHA staff and contractors, MDOT SHA applies a modeling approach that estimates contractor application from pertinent contract documents and supplements those estimated amounts with more empirical usage data from MDOT SHA's consumable inventory management system that captures actual chemical products and amounts withdrawn from MDOT SHA Maintenance Shop storage rooms.

Table 16 displays the results of the MDOT SHA modeling, showing herbicide constituents from chemical products withdrawn from MDOT SHA supply and reasonable estimates of actual amounts of each applied statewide to MDOT SHA property during the FY19 reporting period. A significant decrease can be observed in quantities of herbicide applied relative to the FY18 reporting period. This decrease is not exclusively the result of programmatic improvements but instead are a result of a change in reporting methodology.

Previous modeling methodology applied assumptions for chemical mixture composition to extrapolate gallons of chemical solution applied to the ROW. Through internal reviews of this approach, it was determined that chemicals are diluted and mixed with notable variability by MDOT SHA staff and contractors and no current mechanism exists to capture this variance. For this reporting period, MDOT SHA reports actual concentrated chemical amounts, removing the extrapolation/assumption previously applied to get the amount of diluted/mixed chemical solution, to produce more accurate and trackable application amounts.

Table 16: Herbicides Applied to MDOT SHA Property

Chemical	Unit Applied	Quantity Applied
2,4-D	Gal.	937
Bromacil	Gal.	2
Chlosulfuron	Lbs.	127
Clopyralid	Gal.	269
Diglycoamine	Gal.	3
Dithiopyr	Gal.	0
Diuron	Lbs.	140
Fosamine	Gal.	713
Glyphosate	Gal.	2,017
Halosulfuron-methyl	Gal.	0
Imazethapyr	Gal.	1
Isoxaben	Gal.	0
Mefluidide	Gal.	113
Metsulfuron	Lbs.	8
Oryzalin	Gal.	115
Prodiamine	Gal.	0
Triclopyr	Gal.	794
Trinexapac-ethyl	Gal.	658
Total	**Gal.**	**5,622**
Total	**Lbs.**	**275**

Nutrient Management Plans

The Maryland Lawn Fertilizer Law limits the total amount and timing of fertilizer applications. MDOT SHA uses slow-release nitrogen and low or no phosphorus fertilizers when establishing and maintaining turfgrass, meadows, and other vegetation. Topsoil, both salvaged and furnished, is sampled and tested for major and minor plant nutrients, pH, organic matter, and soluble salts. The test results are used to develop Nutrient Management Plans (NMP) to ensure optimal nutrient levels and growing conditions, and to avoid excess fertilizer application.

Topsoil producer stockpiles are tested every three months, and test results are used to develop NMPs.

Fertilizer use during the reporting period includes:

- 103,863 lbs. 20-16-12 fertilizer; ureaform, monoammonium phosphate, potassium sulfate
- 36,419 lbs. 37-0-0 fertilizer; sulfur coated urea,
- 14,687 lbs. 14-14-14 fertilizer; polymer-coated fertilizer with minor nutrients, and
- 890 lbs. 20-20-20 fertilizer; water soluble fertilizer with micronutrients.

Mowing Reduction & Native Vegetation Establishment

A major initiative at MDOT SHA is to reduce the extent of frequently mowed areas within the ROW, and to limit mowing in other areas to no more than once per year in the dormant season.

The MDOT SHA standard specifications and guidance of the MDOT SHA Landscape Design Guide (LDG) specify locations where native meadow can be installed for mowing reduction. Most new construction includes one or more of the following types of meadow: upland, lowland, wet, and bioretention meadow. Forested and native meadow areas require infrequent mowing, enhance and preserve native vegetation, and provide stormwater benefits such as increased nutrient uptake.

iv. Minimize Use of Winter Weather Deicing Materials

MDOT SHA continues to test and evaluate new winter materials, equipment, and strategies in an on-going effort to improve the level of service provided to motorists during winter storms while at the same time minimizing the impact of its operations on the environment.

Table 17: MDOT SHA Deicing Materials

Material	Characteristics	FY19 Quantity Applied Statewide
Sodium Chloride (Rock and Solar Salt)	The principal winter material used by SHA. Effective down to 20° F and is relatively inexpensive.	206,162 tons (does not include the salt used to make the liquid brine)
Abrasives	These include sand and crushed stone and are used to increase traction for motorists during storms. Abrasives have no snow melting capability.	18,214 tons
Calcium Chloride	A solid (flake) winter material used during extremely cold winter storms. SHA uses limited amounts of calcium chloride.	0 gallons
Salt Brine	Liquid sodium chloride or liquefied salt is a solution that can be used as an anti-icer on highways prior to the onset of storms, or as a deicer on highways during a storm. Used extensively by SHA. Freeze point of -6° F.	3,019,832 gallons
Magnesium Chloride (Mag)	A liquid winter material used by SHA for deicing operations in its northern and western counties. It has a freeze point of -26° F and has proven cost effective in colder regions.	9,565 gallons

In FY19, MDOT SHA continued minimization practices described in the FY18 MS4 annual report, including "anti-icing" before storm events, expanding the number of direct liquid application (DLA) snow routes, and continuation of its 'sensible salting' training for State and hired equipment operators, in an on-going effort to decrease the use of deicing materials without jeopardizing the safety and mobility of motorists during and after winter storms. **Table 17** lists the types of materials and quantities applied by MDOT SHA in winter deicing operations.

New Road Salt Management

On May 20, 2010, the Governor approved Senate Bill 775, requiring MDOT SHA, in consultation with the MDE, to develop a best practices road salt management guidance document by October 2011. MDOT SHA posted the consequent Salt Management Plan (SMP) on its website in October 2011. The SMP was subsequently updated in October of 2012, 2015, and 2016. The current, October 2016 SMP can be accessed via the MDOT SHA website at the following address:

http://www.roads.maryland.gov/OOM/Statewide_Salt_Management_Plan.pdf

Table 18: Recent Salt Usage Statewide

Winter	Storms	Inches	Salt Used (Tons)
2013 to 2014	17.3	66.5	551,443
2014 to 2015	16.0	47.4	340,083
2015 to 2016	7.6	40.0	137,358
2016 to 2017	7.8	27.2	91,494
2017 to 2018	13	31.5	190,294
2018 to 2019	10.5	41.6	210,193

Roadside Deicer Application

Table 18 displays application data, starting from the adoption date of the SMP, including the yearly average number of storms fought by MDOT SHA and the average amount of precipitation in inches. The salt usage in tons, shown in **Table 18**, is a statewide seasonal total and includes areas outside of the MS4 Permit areas. Within the areas covered under the MS4 Permit, MDOT SHA applied a total of 149,432 tons of salt.

It is important to understand how MDOT SHA makes comparisons of road salt usage. MDOT SHA uses a metric of pounds of road salt per

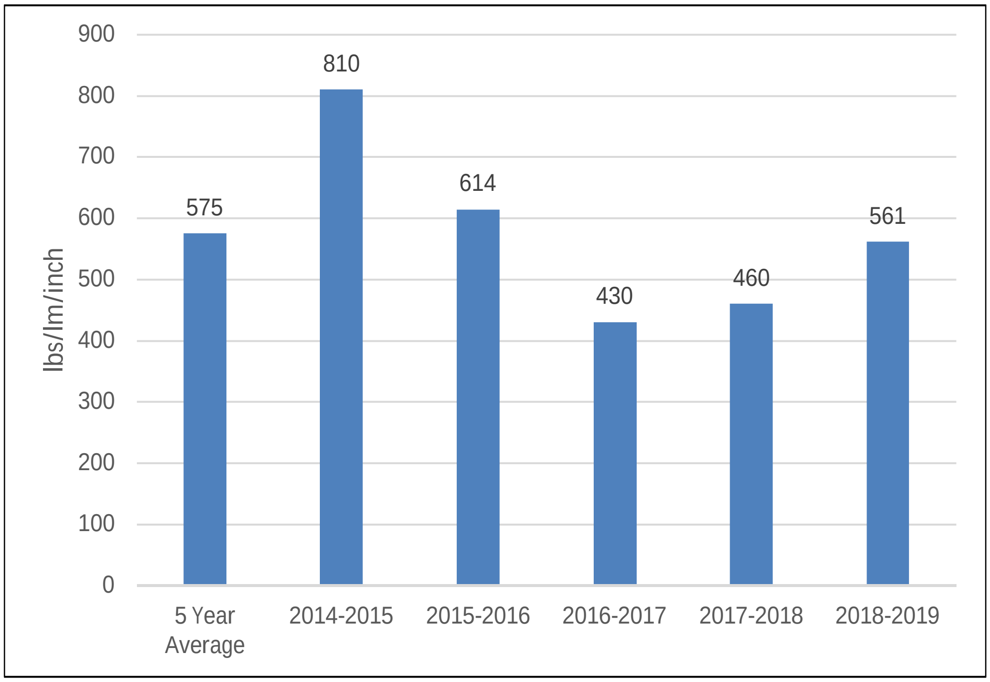


Figure 13: Comparison of Salt Usage Normalized by Snow Depth Statewide

total lane miles per inch of snow (lbs/lm/inch). This allows an equal comparison across the state in the measurement of road salt usage. The amount of salt applied during FY19 across the state is 561 lbs/lm/inch. This reflects an increase in MDOT SHA salt usage by 100 lbs/lm/inch (see **Figure 13**). This increase is attributed to increased winter storm frequency and accumulation, as well as periods of sustained freezing temperatures. MDOT SHA is still actively working on salt reduction and will continue this work into the future. Prior to the 2014-2015 winter season, a challenge was issued by MDOT SHA management to reduce road salt usage by five percent. The MDOT SHA surpassed that goal and salt usage numbers over the last four years have been consistently greater than 25 percent below the 2014-2015 season total.

MDOT SHA Annual Snow College

The Annual Snow College training presentations are included in Appendices II and III of the SMP. This training is offered annually at each of the seven MDOT SHA districts for new maintenance shop hires as well as 20 percent of veteran shop forces. Snow College was canceled in Districts 1 and 2 in FY19, due to unanticipated circumstances, and will be scheduled to include greater than average participation in FY20. The goal is to train all maintenance personnel over a five-year period and then repeat the process. This ensures that all maintenance personnel are exposed to current trends and technologies. **Table 19** summarizes the Snow College training events during the FY19 reporting period and the number of attendees for each.

Table 19: MDOT SHA Snow College Training

SHA District Shops	Dates	Attendees
1 DO, WI, WO, SO	N/A	0
2 CE, KE, QA, CO, TA	N/A	0
3 MG, MF, PL, PM	11/26/18 – 11/27/18	26
4 BG, BH, BO, HA	11/19/18 – 11/20/18	17
5 AA, AG, CV, CA, CH, SM	1/7/19 –1/8/19	19
6 GA, AL, WA	11/28/18 – 11/29/18	13
7 FR, CL, HO	12/19/18 – 12/20/18	16
	Total	**91**

Annual Maintenance Shop Winter Meetings

In 2015, MDOT SHA developed training on Best Practices for Salt Management and Environmental Stewardship during Winter Operations. Training is based on the practices outlined in the SMP and is targeted specifically at the facility maintenance employees who manage or perform winter emergency operations. During the reporting period, 28 sessions were held and approximately 1,000 employees were trained.

Hired Equipment Operator Training

Prior to the start of each winter season, MDOT SHA provides training to hired equipment contractors and operators. The training presentations are included in the SMP. During the reporting period, more than 28 sessions were held and approximately 2,100 hired equipment operators were trained.

v. Pollution Prevention and Good Housekeeping Training

SWPPP Training

MDOT SHA continues to provide annual Stormwater Pollution Prevention Plan (SWPPP) training to its maintenance personnel. Environmental compliance training covers a variety of media areas including stormwater management, spill prevention and response, pollution prevention requirements, and training for pollution prevention team members performing stormwater inspections and quarterly visual monitoring assessments.

Training and instruction regarding the SWPPP is given to employees when appropriate. Initial training occurs within six months of hiring. At a minimum, personnel training will be conducted annually, on a calendar year basis, to provide consistent understanding of pollution prevention and to notify employees of SWPPP changes.

Training documentation is maintained on the MDOT SHA Online Learning Center. **Table 20** includes information related to SWPPP training during this reporting period.

Table 20: SWPPP Training by Shop

Maintenance Facility	Training Date	Total Trained
Cambridge	Oct-18	22
Princess Anne	Oct-18	21
Salisbury	Sept-18	24
Snow Hill	Sept-18	30
Centreville	Oct-18	36
Chestertown	Oct-18	25
Denton	Oct-18	25
Easton	Oct-18	23
Elkton	Sept-18	34
Fairland	Oct-18	30
Gaithersburg	May-19	32
Laurel	Oct-18	29

Table 20: SWPPP Training by Shop

Maintenance Facility	Training Date	Total Trained
Upper Marlboro	Oct-18	34
Churchville	Apr-19	46
Hereford	May-19	29
Golden Ring	May-19	34
Owings Mills	May-19	37
Annapolis	Oct-18	41
Glen Burnie	Sept-18	38
La Plata	Nov-18	22
Leonardtown	Nov-18	44
Prince Frederick	Sept-18	23
Dayton	Dec-18	48
Frederick	Oct-18	59
Westminster	Oct-18	5
	Total:	**791**

D.5.c Changes in Maintenance Practices and Overall Pollutant Reductions

The MS4 permit also requires MDOT SHA to report annually on the changes in any maintenance practices and the overall pollutant reductions resulting from the maintenance program. MDOT SHA has reviewed its current maintenance program and determined that the program is adequately meeting the requirements.

Concerning overall pollutant reductions resulting from the MDOT SHA maintenance program, we are assuming that data relative to this condition is for deicing, fertilizer, and herbicide. The Chemical Application (CAP) has been provided along with this report in the associated MS4 geodatabase.

Section E.4, TMDL Compliance, contains details regarding the pollutant reductions associated with MDOT SHA's street sweeping and inlet cleaning programs. Additionally, these two restoration strategies are detailed within the MS4 geodatabase under the AltBMP elements.

D.6 Public Education

Requirements under this condition include:

a) *Maintain a compliance hotline or similar mechanism for public reporting of water quality complaints, including suspected illicit discharges, illegal dumping and spills;*

b) *Provide information to the transportation community about the benefits of:*

   i) *Stormwater management implementation and facility maintenance;*

   ii) *Proper erosion and sediment control practices;*

   iii) *Increasing proper disposal of vehicle fluids such as brake fluid or motor oil (not in inlets or catch basins);*

   iv) *Refraining from and reporting roadside dumping;*

   v) *Proper litter and trash disposal;*

   vi) *Decreasing vehicle idling;*

   vii) *Utilizing alternative modes of transportation (bus, train, walking, biking, carpooling);*

   viii) *Car care and washing; and*

   ix) *Proper pet waste management at rest areas and welcome centers.*

c) *Provide information regarding the following water quality issues to the regulated community when requested:*

   i) *NPDES permitting requirements;*

   ii) *Pollution prevention plan development;*

   iii) *Proper housekeeping; and*

   iv) *Spill prevention and response.*

D.6.a Mechanism for Public Reporting

MDOT SHA continues to use the Customer Care Management System (CCMS) as its centralized customer service reporting and tracking system and its operations are the same as was described in the FY18 MS4 annual report. Customers can submit their concerns or requests directly into CCMS from the MDOT SHA webpage at the following address:

http://marylandsha.force.com/customercare/request_for_service

CCMS can be used to report a variety of service requests including water quality complaints such as suspected illicit discharges, illegal dumping, spills, and trash and litter problems along MDOT SHA roadways and facilities. During the FY19 reporting period, CCMS received approximately 28,000 service requests (also known as "tickets"). There were approximately 3,000 service requests regarding littering and illegal dumping related issues of which 2,800 are closed. Tickets reporting debris, litter, and graffiti account for 11 percent of all CCMS tickets. Such tickets peak in late February, March, and April following the winter season.

An email reporting mechanism has also been implemented via wpd@sha.state.md.us

D.6.b Provide Information to the Transportation Community

MDOT SHA provides resources to members of the transportation community interested in learning about ways to reduce stormwater pollution in local waterways and the Chesapeake Bay. As discussed in **Section D.4.b**, MDOT SHA hosts an educational outreach webpage, developed for this purpose, that can be accessed at:

https://www.roads.maryland.gov/Index.aspx?pageid=48.

The webpage includes information related to the following topics:

i. Stormwater Management Implementation and Facility Maintenance

The Bay Restoration Strategies webpage provides extensive information on the use of BMPs to reduce nitrogen, phosphorus, and sediment from reaching the Chesapeake Bay including information on structural SW controls, nonstructural SW controls, land use change strategies, as well as source control strategies. This webpage can be found at the following address:

http://www.roads.maryland.gov/Index.aspx?pageid=37

MDOT SHA also hosts several interactive maps on their webpage, including the Chesapeake Bay Restoration Viewer. The public can enter an address into the interactive mapping tool to find restoration BMPs MDOT SHA has implemented in their own neighborhood. The viewer can be accessed here:

http://www.roads.maryland.gov/Index.aspx?PageId=714

ii. Proper Erosion and Sediment Control Practices

MDOT SHA has a well-established erosion and sediment control training program which serves to educate and bring awareness to MDOT SHA designers, construction employees, design consultants, and contractors. See **Section D.2** above for information on training provided throughout the reporting period.

Since 2004, the MDOT SHA Erosion and Sediment Control Certification (Yellow Card) has served to provide up to date awareness and education, and this certification is a requirement to conduct construction business with MDOT SHA. This training now serves a greater number of participants since it is available on-line. This training is discussed in **Section D.2**.

In addition to these training courses MDOT SHA has created a variety of other media to provide education and awareness of the regulatory requirements on MDOT SHA projects. For instance, MDOT SHA has published *Environmental Guidelines for Construction* along with an erosion and sediment control field guide to support the 2011 MDE ESC specifications and standards and illustrate increased requirements. A reference library (on-line/CD) was also created for project personnel use and is available on the MDOT SHA OED QA Toolkit. This program also uses in-field education and working partnerships throughout MDOT SHA to help end users understand and meet environmental requirements.

To increase public awareness regarding proper erosion and sediment control practices, the MDOT SHA educational outreach webpage includes links to the MDE erosion and sediment control page for community members interested in learning more about the program.

iii. Increasing Proper Disposal of Vehicle Fluids (Not in Inlets or Catch Basins)

The MDOT SHA educational outreach webpage includes information about the importance of and methods for proper vehicle fluid disposal, along with links to the MDE Maryland Used Motor Oil Recycling Program webpage.

iv. Refraining from and Reporting Roadside Dumping

As part of MDOT SHA's public education initiative to discourage and report problems associated with illegal roadside dumping, MDOT SHA created a flyer titled *Keep Our State Waterways Clean*. This flyer provides information related to the definition of illegal dumping, the problems associated with illegal dumping, common items associated with illegal dumping, and steps to report illegal dumping if encountered along MDOT SHA roadways. The flyer can be found via the MDOT SHA educational outreach webpage along with links to CCMS for reporting roadside dumping. Additionally, MDOT SHA has strategically placed "No Dumping" signs throughout the state.

v. Proper Litter and Trash Disposal

As discussed in **Section D.4** above, MDOT SHA has an existing, multi-faceted public education program in effect with goals to educate the public on environmental stewardship to reduce littering.

The MDOT SHA educational outreach webpage includes information and links about proper litter and trash disposal and how members of the transportation community can help reduce the volume of trash entering local waterways.

vi. Decreasing Vehicle Idling

MDOT SHA is saving money and reducing emissions through its vehicle equipment idling policy, in effect since September 22, 2009. The policy restricts operation of a motor vehicle engine for more than five consecutive minutes when the vehicle is not in motion. The two exceptions to this policy are when a unit is deployed along a state route in preparation for winter operations or when a unit is functioning under an emergency, or maintaining traffic, using emergency lighting. The policy applies to all operators of MDOT SHA vehicles and equipment, as well as drivers of consultant support vehicles.

To increase public awareness regarding the benefits of reducing vehicle idling, educational information has been provided on the MDOT SHA educational outreach webpage.

vii. Utilizing Alternative Transportation

MDOT SHA offers several incentives to reduce the number of drivers and/or number of commuter days/miles per week by Administration employees. Fewer commuter days and miles mean less vehicle pollutants entering the watershed.

Alternate Work Schedules for Employees

Alternate work schedules include flexible work hours allowing employees to work compressed workweeks reducing the total number of commuting days and miles.

Teleworking for Employees

Teleworking allows employees to work from a remote location (presumably at or close to home) and reduces the number of commuting days and miles per week. Each office has or is developing a teleworking policy.

Carpooling

Carpooling reduces the number of commuters on the road and has been encouraged at MDOT SHA for both its employees and the traveling public for many years. MDOT SHA carpooling incentives for employees include prioritizing parking space allocation to those in a designated carpool and administrative assistance in locating a carpool within the employee's residential area for those that wish to carpool to work.

MDOT SHA promotes carpooling for the traveling public by constructing and maintaining park and ride facilities throughout the entire state. All MDOT SHA park and ride facilities are free and can accommodate carpools and van pools. Overnight parking is also permitted. MDOT SHA currently has more than 100 park and ride locations throughout Maryland that provide more than 12,000 free parking spaces for commuters.

There is an interactive map on the MDOT SHA web page to help the traveling public locate and get directions to all the MDOT SHA park and ride facilities. It can be accessed online at the following address:

http://roads.maryland.gov/pages/parkandridemaps.aspx?PageId=248&d=57

HOV Lanes

In addition to park and ride facilities, MDOT SHA has also constructed High Occupancy Vehicle (HOV) lanes on some of its interstates to promote carpooling. HOV lanes are reserved for carpools, vanpools, buses, and motorcycles during designated time periods. HOV lanes are intended to save commute time for carpool users and bus riders by enabling them to bypass areas of heavy traffic congestion. By giving carpool users and bus riders a faster and more reliable ride during peak traffic periods, HOV lanes serve as a strong incentive for ridesharing, which in turn helps to manage congestion and contributes to improved air quality. HOV lanes are generally designated via white diamonds on signage and pavements markings. MDOT SHA currently has two HOV facilities, along I-270 in Montgomery County and along US-50 in Prince George's County.

MDOT SHA hosts an HOV page on its website that can be accessed at the link below. The page includes information about regulations concerning HOV lane usage, maps of HOV lane locations in Maryland, and contact information.

http://www.roads.maryland.gov/index.aspx?PageId=249

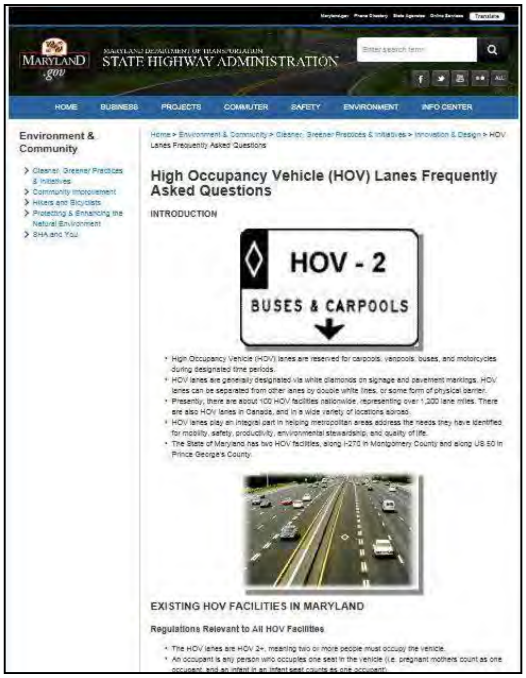


Figure 14: MDOT SHA HOV Lane

Figure 15: MDOT SHA Bike Safety Social Media Post

Bicycle Safety Awareness

MDOT SHA has continued its bicycle safety campaign, 'Look Out For Each Other', which stresses the role of the vehicle driver in bicycle safety. Featuring Maryland professionals who commute with bicycles, the campaign reminds drivers 'A Cyclist Might Be Someone You Know.' With special emphasis during the spring and summer months when bicycle crashes increase, the year-long campaign also advises bicyclists to obey the rules of the road, ride predictably, and stay visible when riding at night.

Artscape 2018

At the Annual Artscape event in Baltimore City (July 20-22, 2018), MDOT SHA sponsored a booth along West Mount Royal Avenue to enhance awareness of bicycle safety. The booth was titled 'Look Out for Each Other: A Cyclist May be Someone You Know'. At the booth, Artscape attendees learned valuable bike safety tips, and were able to make bike spin art.

Figure 16: MDOT SHA Artscape Bike Safety Booth

National Bike to Work Day

In support of Bicycle Safety Month and National Bike to Work Day, MDOT SHA hosted the Baltimore City – Mt. Vernon pit stop for Bike to Work Day on Friday, May 17, 2019. Located at the corner of Guilford Avenue and East Monument Street between 7 a.m. and 9 a.m. The MDOT SHA grassroots event reminded drivers and bicyclists to "Drive Smart, Bike Smart."

The pit stop included bike tune ups, snacks, bike accessories, and demonstrations with MTA's bus bike rack, all to promote biking as an alternative method of transportation.

Figure 17: Bus Bike Rack Demonstration at MDOT SHA Bike to Work Day Pit Stop

Mass Transit

The MDOT SHA educational outreach webpage includes information regarding the benefits of using alternative transportation as well as links to learn more about the above-mentioned programs.

viii. Proper Car Care and Washing

Improper car care and car washing can readily contribute pollutants into the adjacent storm drain system. Simply following a few simple steps when maintaining or washing your vehicle can help to conserve water and protect the quality of nearby water bodies.

To increase public awareness regarding proper car care and washing, educational information has been provided on the MDOT SHA educational outreach webpage.

ix. Proper Pet Waste Management

MDOT SHA currently owns and maintains seven welcome centers and rest areas within the MS4 jurisdictions of Charles, Frederick, Howard, and Washington Counties. MDOT SHA welcome centers and rest areas are provided as a service to the traveling public. Not only do these facilities allow humans to rest from long journeys, but they also provide areas to walk pets.

The risk of water pollution increases when pet waste is left on rest area sidewalks, parking lots, and grassy areas as stormwater runoff can carry pet waste left on the ground into storm drains and nearby waterways. MDOT SHA has addressed proper pet waste management at some of its rest areas and welcome centers.

Figure 18: Pet Waste Disposal Station at the I-70 Eastbound Rest Area

For instance, at the MDOT SHA newer welcome centers, such as the I-70 eastbound and westbound rest area and welcome center situated on South Mountain between Fredrick and Hagerstown in Frederick County, MDOT SHA has incorporated designated pet walking areas. These areas contain pet waste disposal stations which feature pet waste bag dispensers, educational signs, and trash bins specifically for the collection and proper disposal of pet waste. The disposal stations aim to educate the public on the importance of proper pet waste management and to encourage pet owners to pick up and properly dispose of their pet's waste, thereby keeping pet waste out of our waterways.

x. Other MDOT SHA Water Quality Awareness Training & Events

Chesapeake Bay Field Trips

Annual Chesapeake Bay field trips are led by the Chesapeake Bay Foundation. The trips demonstrate the link between highway runoff and its impacts on streams, rivers, and the health of the Chesapeake Bay. It is a great opportunity for MDOT SHA employees to learn about one another's careers as well as habits and actions in our daily work and home environment that may affect the health of the Chesapeake Bay.

This field trip is offered through the MDOT SHA On-line Learning Center, College of Engineering, environmental design training (ENV400). It is a class that requires no pre-requisite training and is offered to all employees seeking to improve their environmental awareness. Therefore, this class has a mixture of employees from all over the state with varied levels of experience and educational background.

The training includes visits to important environmental sites including wetlands, streams, forests, and a boat trip on the Bay. Four trips were held during this reporting period on October 18, 2018, November 1, 2018, April 10, 2019, and April 16, 2019 with 75 MDOT SHA employees attending in all. See Figure 2-17 for a photo from the April 16, 2019 training.

Figure 19: April 2019 MDOT SHA Chesapeake Bay Field Trip

OHD University

The Office of Highway Development University (OHDU) is an in-house training program initially established to provide new OHD employees with the technical and project management skills that have been identified as essential for success in OHD. The program currently includes eighteen first year classes and eight second year classes that cover a variety of topics. When first developed, the OHDU program course content was specifically developed for new OHD entry-level engineers. Since that time, this program has expanded to include all new OHD employees and other newly hired professionals within all MDOT SHA design offices.

'Basic Hydrology' is a 1st year OHDU class that provides a basic overview of the hydrologic cycle and how it is relevant to roadway projects. This class was held on January 30, 2019 and included 17 participants.

'Basic Hydraulics' is a 1st year OHDU class that provides a basic overview of managing drainage systems with an emphasis on inlets, pipes, and ditches. Students learn about the adverse impacts of uncontrolled storm water runoff and why it is important to provide stable conveyance. Students learn about the methodologies for determining inlet spacing and sizing, pipe and ditch sizing, culvert sizing, and pipe material selection. This class was held on May 1, 2019 and included 17 participants.

'SWM & Erosion and Sediment Control' is a 2nd year OHDU class that provides an overview of SWM and ESC and how both are relevant to MDOT SHA projects. Topics include current regulations, design criteria, types of facilities, and common design issues. Discussion also includes these important key aspects: the difference between SW quality and quantity management, right-of-way allocation, requesting SWM borings, aesthetics associated with SWM facilities, safety, and maintenance access. This class was held on March 20, 2019 and included 14 participants.

'Environmental Permits and Regulations' is a 2nd year OHDU class that provides information on the types of environmental permits that are typically required for projects, including SWM, ESC, JPA, wetlands and waterways, dam safety, NEPA, roadside tree, and reforestation. The class includes discussion of what is needed for each permit submittal and the regulations with which MDOT SHA must comply as it relates to the project development process. This class was held on April 3, 2019 and included 12 participants.

D.6.c Information for the Regulated Community

i. NPDES Permitting Requirements

Information relating to NPDES Construction Activity Permits is available on the MDE website, and MDOT SHA directs requests for information to that site.

ii. Pollution Prevention Plan Development

SWPPPs are required by NPDES General Permit No. 12-SW for each MDOT SHA industrial facility. The SWPPPs are available for review upon request.

iii. Proper Housekeeping

Proper housekeeping measures are identified in the MDOT SHA SWPPPs for industrial facilities. These documents are available upon request.

Proper housekeeping measures include sweeping areas in front of salt and material storage structures, pick-up and proper disposal of garbage and floatable debris, routine inspections of drums, tanks, and other containers, and conducting vehicle and equipment repairs indoors or under cover.

iv. Spill Prevention and Response

MDOT SHA maintains SOPs related to spill prevention and response that are available upon request. These documents are updated on a routine basis per MDOT SHA Environmental Management System.

E. Restoration Plans and Total Maximum Daily Loads (TMDL)

In compliance with §402(p)(3)(B)(iii) of the CWA, MS4 permits require stormwater controls to reduce the discharge of pollutants to the MEP. By regulation at 40 CFR §122.44, BMPs and programs *implemented pursuant to this permit must be consistent with applicable wasteload applications (WLAs) developed under EPA approved TMDLs.*

In pursuit of these goals, SHA shall coordinate watershed assessments with surrounding jurisdictions and annually report on restoration plans, opportunities for public participation, and TMDL compliance status to MDE. As required below, watershed assessments and restoration plans shall include a thorough discussion of water quality analysis findings based on coordination with surrounding jurisdictions, TMDL documents and other resources when available, identification of water quality improvement opportunities, and a schedule for BMP and programmatic implementation to meet stormwater WLAs included in EPA approved TMDLs. SHA shall address both specific WLAs and target loads when SHA is part of larger aggregate loads. A list of EPA approved TMDLs for SHA in the permit area is included in Attachment B of the permit.

E.1 Watershed Assessments

Requirements under this condition include:

a) *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:*

   i) *Determine current water quality conditions;*

   ii) *Include the results of visual inspections targeting SHA rights-of-way and facilities conducted in areas identified as priority for restoration;*

   iii) *Identify and rank water quality problems for restoration associated with SHA rights-of-way and facilities;*

   iv) *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*

   v) *Specify pollutant load reduction benchmarks and deadlines that demonstrate progress toward meeting all applicable stormwater WLAs.*

E.1.a Watershed Assessment

MDOT SHA references county watershed assessments to identify specific watershed issues and restoration project opportunities. This methodology is presented in MDOT SHA TMDL implementation plans and in the following subsections i. through v.

In some cases when it is mutually beneficial to both parties MDOT SHA may establish a partnership agreement with other MS4 jurisdictions or landowners to coordinate pollution reduction strategies related to specific projects. This coordination can facilitate data exchange and integration and encourage targeted project implementation to meet pollutant reduction goals.

i. Current Water Quality Conditions

MDOT SHA reviews county watershed assessments to determine current water quality conditions, problem areas, and suggested methods to remediate water quality issues. These reviews are included in Part IV of the MDOT SHA *Impervious Restoration and Coordinated TMDL Implementation plan* (referred to hereafter as the "Implementation Plan") under respective subsections dedicated to each individual watershed and in Section F. of the subsequently submitted individual TMDL implementation plans.

ii. Visual Inspections Targeting MDOT SHA ROW

Part III.C. of the Implementation Plan describes the MDOT SHA process for visual inspections targeting MDOT SHA right-of-way and inspection evaluations for each watershed are provided in the respective subsections of Part IV. The inspection evaluation is located in Section F. of subsequently submitted individual watershed TMDL implementation plans.

iii. Water Quality Problems for Restoration

MDOT SHA utilizes multiple approaches to identify and rank water quality problems. County watershed assessments are reviewed to identify and rank water quality problems for restoration within the local watersheds. These reviews are incorporated into MDOT SHA TMDL implementation plans as described previously in Section E.1.a.i. The visual assessment process, previously described in Section E.1.a.ii., helps evaluate field conditions. The outfall inspection protocol, developed by MDOT SHA and incorporated into Part Two of the FY18 annual report, describes a process for field inspection, assessment, and ranking based on the severity of stabilization issues. From these inspections MDOT SHA can identify outfall stabilization projects that have potential to reduce pollutant loads and support attainment of impervious restoration goals.

iv. Water Quality Improvement Projects

County watershed assessments prioritize and rank structural and non-structural improvement projects to be implemented. Watershed assessment reviews are included in MDOT SHA TMDL implementation plans as described previously in Section E.1.a.i.

v. Pollutant Load Reduction Benchmarks and Deadlines

Interim benchmarks have been established for 2020 and 2025 for all the local TMDLs and incorporated into the revised Implementation Plan and into the addendum to Table 3-2, included with this annual report as **Appendix C**. Progress in meeting these benchmarks is discussed in this annual report under **Sections E.2.b and E.4.b**.

E.2 Restoration Plans

Requirements under this condition include:

a) Within one year of permit issuance, SHA shall submit an impervious surface area assessment consistent with the methods described in the MDE document "Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, Guidance for National Pollutant Discharge Elimination System Stormwater Permits" (MDE, August 2014 or subsequent versions). Upon approval by MDE, this impervious surface area assessment shall serve as the baseline for the restoration efforts required in this permit.

By the end of this permit term, SHA shall commence and complete the implementation of restoration efforts for twenty percent of SHA's impervious surface area consistent with the methodology described in the MDE document cited in PART IV.E.2.a. that has not already been restored to the MEP. Equivalent acres restored of impervious surfaces, through new retrofits or the retrofit of pre-2002 structural BMPs, shall be based upon the treatment of the WQv criteria and associated list of practices defined in the 2000 Maryland Stormwater Design Manual. For alternate BMPs, the basis for calculation of equivalent impervious acres restored is based upon the pollutant loads from forested cover.

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:

i) 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;

ii) Provide detailed cost estimates for individual projects, programs, controls, and plan implementation;

iii) 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

iv) 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.

MDOT SHA Implementation

MDOT SHA developed and submitted its Implementation Plan on October 8, 2016. This plan integrates both Parts IV.E.2.a (Impervious Assessment and Restoration) and IV.E.2.b (Coordinated TMDL Implementation Plans) of the MS4 permit into a single document. Impervious assessment and restoration are addressed in Part II of the Implementation Plan and the coordinated TMDL implementation plans are addressed in Parts III and IV.

TMDL documents are issued by MDE frequently, and to keep pace with the E.2.b requirement to develop and issue an implementation plan within one year of issuance of a TMDL, MDOT SHA develops and submits individual implementation plans for subsequent TMDLs to MDE. Periodically, MDOT SHA will update the Implementation Plan to incorporate these individual TMDL implementation plans. A revised *Interim Review Draft* version of the Implementation Plan that integrated the latest MDOT SHA TMDL implementation plans was attached to the MDOT SHA 2018 MS4 annual report but did not include Part II because the MDOT SHA impervious baseline assessment was still under consideration by MDE.

An updated version of Part II of the Implementation Plan that integrates the MDE approved impervious restoration goal of 4,621 acres is included as **Appendix B** to this report. The Implementation Plan has also been updated on our website to include the revised Part II.

During the FY19 reporting period, MDOT SHA developed and submitted to MDE individual TMDL implementation plans in accordance with the requirement described in Part IV.E.2.b. These implementation plans are described further in Sections E.2.b. and E.3 and are made publicly accessible on the MDOT SHA website at the following web address:

https://www.roads.maryland.gov/Index.aspx?pageid=336

Sections E.2.a, E.2.b, and E.3 discuss FY19 progress relative to the Implementation Plan. Rather than reiterate content from the Implementation Plan, this reporting will reference pertinent sections as appropriate.

E.2.a Impervious Baseline Assessment and Restoration Plan

In the MDOT SHA 2016 Impervious Area Assessment, submitted to MDE on October 9, 2016, MDOT SHA proposed an impervious area restoration amount of 4,719.2 acres and MDE subsequently requested additional information prior to issuing its approval. Since then, MDE continued analysis and dialogue with MDOT SHA regarding the impervious acre baseline and MDOT SHA has submitted updated baseline calculations to MDE for review on July 31, 2017, October 9, 2017, and June 29, 2018. In its review of the latest MDOT SHA submission, MDE concluded that the impervious area restoration requirement for MDOT SHA, to satisfy Part IV.E.2.a. of the NPDES MS4 permit, is 4,620.9 acres. MDE determined this goal based on an approved baseline 23,104.8 acres of untreated impervious area owned by MDOT SHA. MDOT SHA reporting and accounting in this FY19 MS4 annual report reflects this communication from MDE and applies 4,621 acres as the official MDOT SHA restoration goal for the current permit term.

MDOT SHA may submit a revised baseline assessment in its fifth permit year (2020) with the corresponding MS4 annual report.

Impervious Restoration Plan

The MDOT SHA impervious restoration plan, incorporated into Part II of the Implementation Plan, includes a combination of built practices, annual operations activities, and redevelopment credit. The plan has been revised and submitted as **Appendix B** of this FY19 MS4 annual report and includes revisions to Table 2-2 that provides a comprehensive list of annual operations practices as well as completed, under design, and planned built practices broken down by fiscal year with location information and estimated impervious treatment acres provided for each.

In order to track progress and adaptively manage its NPDES program to meet the 20 percent impervious restoration requirement by October 8, 2020, MDOT SHA established benchmarks in Table 2-1 of the Implementation Plan. Actual restoration achieved and relative progress toward the permit goal can be referenced in **Table 21** and is illustrated further in **Figure 20** and **Figure 21** of this FY19 MS4 annual report.

Also, the MDOT SHA MS4 permit is currently being modified to allow for nutrient credit trading for this permit term. The tentative determination was issued by MDE on June 21, 2019 with a 90-day public comment period. The comment period ended on September 19 and the final determination is anticipated October 2019. Although MDOT SHA does not anticipate using this option to meet the 20 percent restoration goal, this is an option sought during the reporting period.

Table 22 details total credit claimed by MDOT SHA at the end of its fourth permit year (FY19) with complimentary summaries by fiscal year and BMP type. The relative implementation of various BMP types in the portfolio is shown in **Figure 22**.

Year-to-year implementation levels for annual BMPs, specifically inlet cleaning and street sweeping operations, are reported in **Table 22a**. MDOT SHA has also implemented storm drain vacuuming, as described in Section **D.5.b** and summarized in **Table 14** of this report, which it has included in MDOT SHA inlet cleaning reporting. In dealing with these annual practices, MDOT SHA understands that it must ensure a consistent level of treatment be maintained annually as indicated by the annual operational goals achieved at the end of this permit term and moving forward.

In the MS4 geodatabase submitted with this FY19 MS4 annual report, MDOT SHA has provided restoration BMP information in the following:

- Restoration BMP feature class (RST)
- Alternate BMP Polygon feature class (APY)
- Alternate BMP Line feature class (ALN)
- Stream Restoration Protocols table (SRP)

Table 21: Percentage of Impervious Treatment (Benchmark versus Achieved)

	Benchmarks					Actual Achieved	
	Original (2016)	Original (2016)	Revised (2018)	Revised (2018)	Revised (2019)		
Fiscal Year	% Impervious Restoration	% Progress Toward Restoration Goal	% Impervious Restoration	% Progress Toward Restoration Goal	Projected Acres	Actual Restoration Achieved (Acres)	% Progress Toward Restoration Goal
October 21, 2010 to 2015	4%	20%	--	--	924	1,824	39%
2016	6%	30%	--	--	1,386	2,438	53%
2017	8%	40%	--	--	1,848	2,963	64%
2018	9%	45%	--	--	2,079	3,206	69%
2019	13%	65%	*10%	*50%	2,311	3,472	75%
2020	19%	95%	19%	95%	4,390		
2021	20%	100%	20%	100%	4,621		

*In FY18 annual report, the MDOT SHA restoration goal for FY19 was reduced from 13% and 65% to 10% and 50% respectively.

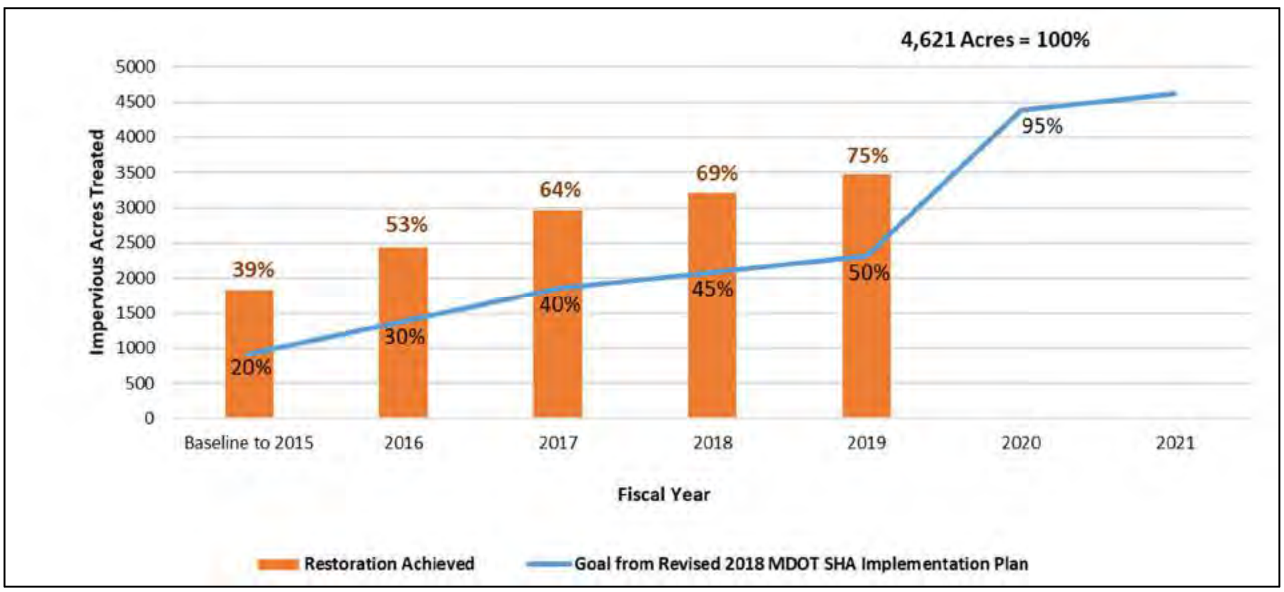


Figure 20: MDOT SHA FY Impervious Restoration Achieved Compared to Benchmark

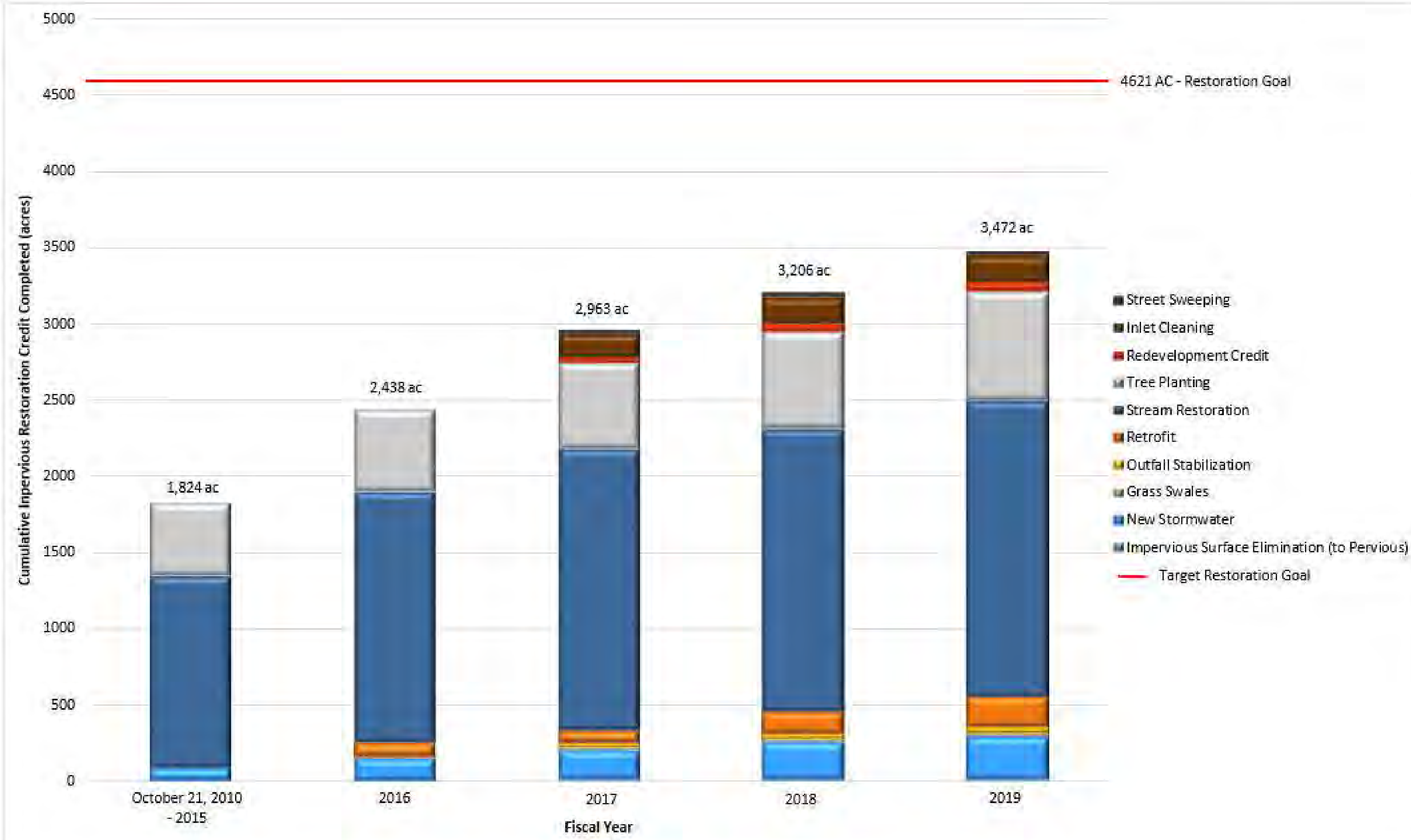


Figure 21: Cumulative Impervious Restoration Progress with BMP Types

Table 22: Impervious Restoration Credit by BMP Type through FY19

BMP Type	Oct 21, 2010 - 2015 (acres)	2016 (acres)	2017 (acres)	2018 (acres)	2019 (acres)	Total (acres)
Impervious Surface Elimination (to Pervious)	0.48	0.00	1.85	0.03	0.11	2.47
New Stormwater Control Structures	87.38	53.89	55.17	51.41	35.57	283.42
Grass Swales	0.00	9.07	11.60	0.00	0.00	20.67
Outfall Stabilization	0.00	7.50	10.89	9.40	7.88	35.67
Retrofit Existing Stormwater Control Structures	0.00	89.71	3.43	62.69	51.88	207.71
Stream Restoration	1,251.99	392.17	196.83	7.14	91.89	1,940.02
Tree Planting	483.70	62.59	20.22	77.70	70.08	714.28
Redevelopment Credit	0.00	0.00	41.85	9.71	7.82	59.38
Inlet Cleaning	0.00	0.00	150.00	25.00	0.00	175.00
Street Sweeping	0.00	0.00	33.00	0.00	0.00	33.00
Totals	**1,824**	**615**	**525**	**243**	**265**	**3,472**
20% Restoration Target						**4,621**
% Impervious Restoration						**15%**
% Progress Towards Restoration Goal						**75%**

Table 22a: Impervious Restoration Credit by Operational BMP Type Achieved Each FY

BMP Type	Oct 21, 2010 - 2015	2016	2017	2018	2019	Annual Operational Goals
	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)
Inlet Cleaning	N/A	N/A	150.00	175.20	166.60	175
Street Sweeping	N/A	N/A	33.00	33	25.96	33
Totals	**N/A**	**N/A**	**183**	**208.20**	**192.56**	**208**

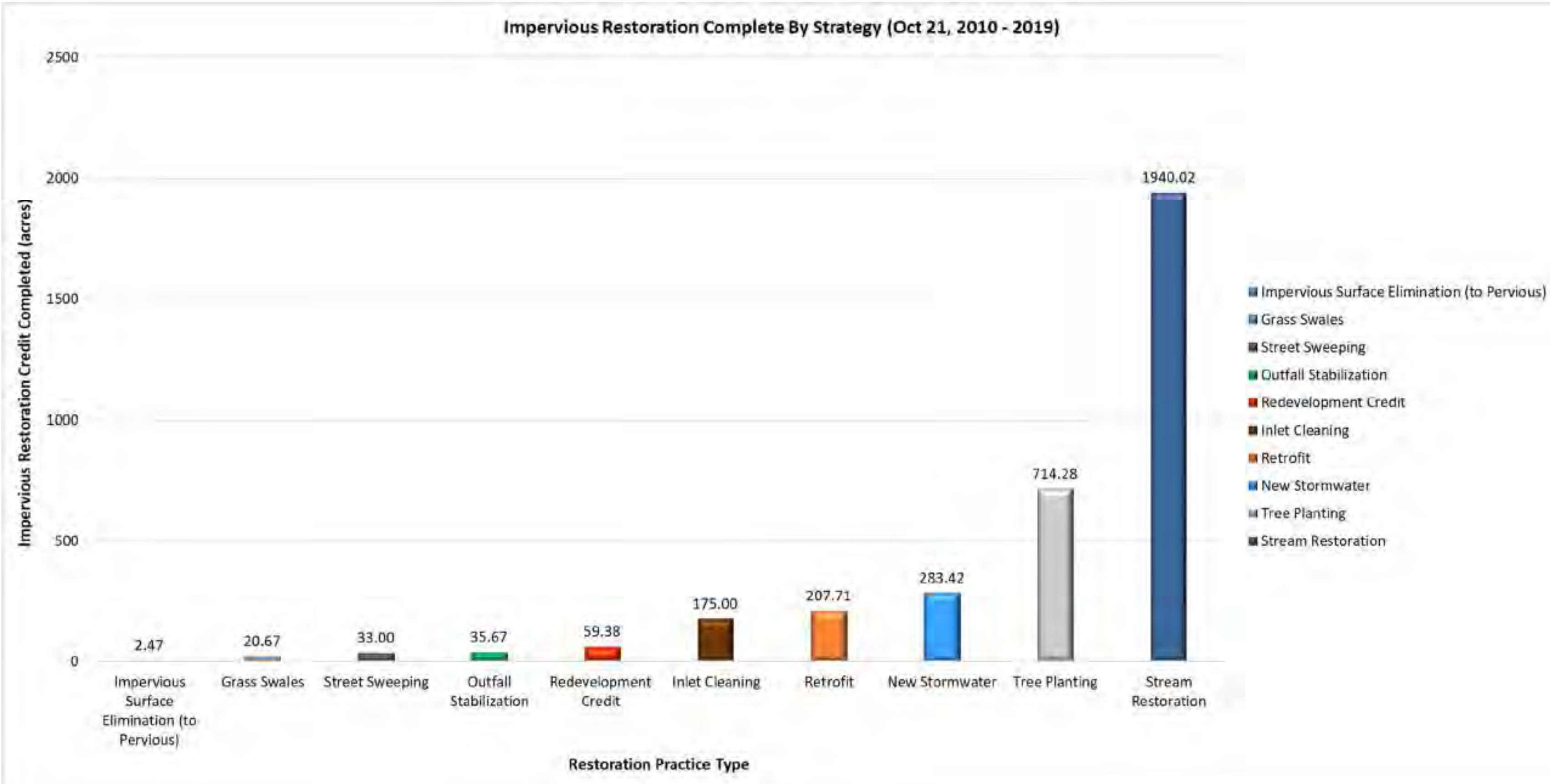


Figure 22: Impervious Restoration Completed by BMP Type (Oct 21, 2010 – June 30, 2019)

Updated Equivalent Impervious Acre Credit for Stream Restoration

On October 17, 2018, MDE distributed a memorandum to Maryland's MS4 community concerning "Stream Restoration Crediting for MS4 Permitting Purposes" that reiterated its support for the Chesapeake Bay Program's use of site specific stream restoration monitoring data for calculating nutrient credits and confirmed that MDE does allow the NPDES Phase I MS4 regulated community to, by extension, calculate individual project impervious acre equivalencies using that same site specific data with the condition that credit will be capped at the actual impervious area draining to the most downstream point of the stream restoration project.

On April 30, 2019, MDE distributed a follow up memorandum concerning "Stream Restoration Crediting Clarification for MS4 Permitting Purposes" that outlined updated guidance on stream restoration crediting. Per this updated guidance, the impervious acre credit per linear foot for stream restoration, defined as 0.01 acres in the 2014 MDE Accounting Guidance, has increased to 0.02 or 0.03 acres for respective implementation in the Piedmont or Coastal Plain physiographic regions. These revised credits are uncapped in relation to the actual impervious acres in a given project's watershed and are applicable to all projects; past, present, and future; that meet the requirements set forth in the Chesapeake Bay Program's 2014 expert panel report, "*Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects*".

MDOT SHA has verified that all stream restoration projects, for which it is claiming restoration credit for in this permit term, meet or exceed the *Basic Qualifying Conditions* described in the expert panel report. **Table 23** demonstrates how MDOT SHA is accounting for stream restoration credit; as presented by **Table 22** and **Figure 22** in this FY19 MS4 annual report, and **Table 2-2** of **Appendix D**. In accordance with MDE recommendations, for all future stream restoration projects MDOT SHA is evaluating opportunities to apply site specific monitoring data to calculation of nutrient credits and individual project impervious acre equivalencies.

Table 23: Summary of Adjustments to Stream Restoration Equivalent Impervious Acre Restoration Credit Resulting from MDE 4/30/2019 Memorandum

Unique BMP #	Project Name	Geography	Crediting Method Applied for Adjustment	Initial Credit Claimed (Acres)	Adjusted Credit (Acres)
Projects Reported from October 21, 2010 through FY15					
SH12ALN000003	Paint Branch	Non-Coastal Plain	Planning Rate	20.26	60.78
SH15ALN000004	Unnamed Tributary to Paint Branch	Non-Coastal Plain	Planning Rate	7.12	21.36
SH13ALN000005	Paint Branch	Non-Coastal Plain	Planning Rate	5.46	16.38
SH15ALN000006	Unnamed Tributary to Paint Branch	Non-Coastal Plain	Planning Rate	20.14	60.42
SH13ALN000007	Unnamed Tributary to Paint Branch	Non-Coastal Plain	Planning Rate	27.89	83.67
SH14ALN000008	Paint Branch	Coastal Plain	Planning Rate	64.50	129.00
SH15ALN000009	Indian Creek	Coastal Plain	Planning Rate	12.09	24.18
SH12ALN000013	Northwest Branch Anacostia River	Non-Coastal Plain	Planning Rate	60.11	180.33
SH13ALN000014	Mill Creek	Non-Coastal Plain	Planning Rate	48.54	145.62
SH15ALN000015	Plumtree Run	Non-Coastal Plain	Planning Rate	21.00	63.00
SH13ALN000017	Magness Run - Tributary of Deer Creek	Non-Coastal Plain	Planning Rate	11.60	34.80
SH12ALN000018	Dorsey Run	Non-Coastal Plain	Planning Rate	19.73	59.19

Table 23: Summary of Adjustments to Stream Restoration Equivalent Impervious Acre Restoration Credit Resulting from MDE 4/30/2019 Memorandum

Unique BMP #	Project Name	Geography	Crediting Method Applied for Adjustment	Initial Credit Claimed (Acres)	Adjusted Credit (Acres)
SH12ALN000029	Unnamed Tributary to Red Hill Branch	Non-Coastal Plain	Planning Rate	10.44	31.32
SH13ALN000032	Goshan Branch	Non-Coastal Plain	Planning Rate	39.91	119.73
SH14ALN000010	Unnamed Tributary to North Branch Rock Creek	Non-Coastal Plain	Planning Rate	29.07	87.21
SH15ALN000016	Upper Little Patuxent River Stream Restoration	Non-Coastal Plain	Planning Rate	45.00	135.00
			Subtotal	**442.9**	**1,251.99**
Projects Reported in FY16					
SH16ALN000031	Broad Creek	Coastal Plain	Planning Rate	24.14	48.28
SH15ALN000002	I-97 at E-W-Blvd Outfall	Coastal Plain	Planning Rate	0	0
SH16ALN000011	Manor Run	Non-Coastal Plain	Planning Rate	62.92	188.76
SH16ALN000012	Unnamed Tributary to Northwest Branch Anacostia River	Non-Coastal Plain	Planning Rate	51.71	155.13
			Subtotal	**138.77**	**392.17**
Projects Reported in FY17					
SH17ALN000046	ICC - PB-12B at Hollywood Branch	Non-Coastal Plain	Planning Rate	30.55	91.65
SH17ALN000045	ICC - PB-12A at Hollywood Branch	Non-Coastal Plain	Planning Rate	33.06	99.18
SH16ALN000044	Furnace Ave	Coastal Plain	Planning Rate	3	6
			Subtotal	**66.61**	**196.83**
Projects Reported in FY18					
SH18ALN000047	Patapsco Valley State Park - Avalon Area	Non-Coastal Plain	Planning Rate	2.38	7.14
Subtotal				**2.38**	**7.14**
Projects Reported in FY19					
SH19ALN000050	Little Catoctin Creek at US 340	Non-Coastal Plain	Planning Rate	30.63	91.89
			Subtotal	**30.63**	**91.89**
			Grand Total	**681.25**	**1,940.02**

Management of Excess Impervious Acre Credits

MDOT SHA confirmed with MDE that, as the 2020 permit deadline approaches, if the restoration requirement for this permit term is exceeded, excess impervious restoration credit can be applied to the next permit term restoration requirement.

E.2.b Coordinated TMDL Implementation Plan

Delivery of this FY19 MS4 annual report, specifically **Appendices B and C**, completes the MDOT SHA submittal, of its coordinated TMDL implementation plan to MDE for approval. MDOT SHA understands that upon approval by MDE, the Implementation Plan will be enforceable under this permit. The following subsections i. through iv. demonstrate completeness of the MDOT SHA submittal.

In accordance with commitments made during an interagency meeting between MDE and MDOT SHA on April 10, 2017, as documented in Attachment III of the letter to MDOT SHA from MDE dated April 26, 2017 regarding its review of the MDOT SHA FY16 MS4 annual report, **Appendix C** is provided with this FY19 MS4 annual report and contains an addendum to Table 3-2, originally submitted with Part III of the revised Implementation Plan on October 9, 2018. This addendum to Table 3-2 represents the analysis of reductions required and timeframes for meeting additional TMDLs not otherwise listed in Attachment B of the NPDES MS4 permit. **Table 25** has been updated to include the additional TMDLs and demonstrates progress toward 2020 reduction targets.

Additional timeframes, specifically a 2025 interim reduction target and the target year for meeting the TMDL, are currently omitted from the addendum to Table 3-2 in **Appendix C** because these are currently under development for inclusion in their respective individual TMDL implementation plans to be submitted to MDE with the fifth year (FY20) annual report in accordance with the MDOT SHA commitment. MDOT SHA will provide an updated Table 3-2, complete with all timeframes, once all individual watershed TMDL implementation plans have been developed by MDOT SHA.

Supplemental Implementation plans for Individual TMDLs

During the FY19 reporting period, the EPA approved the following six, new TMDLs for which MDOT SHA was included in aggregated WLAs:

- TMDL of Sediment in the Non-Tidal Patuxent River Lower Watershed, EPA approval date July 2, 2018.
- TMDL of Sediment in the Non-Tidal Patuxent River Middle Watershed, EPA approval date July 2, 2018.
- TMDL of Polychlorinated Biphenyls (PCBs) in the Piscataway Creek and Mattawoman Creek Tidal Fresh Chesapeake Bay Segments, EPA approval date February 19, 2019.
- TMDL of Sediment in the Non-Tidal Upper Chester River Watershed, EPA approval date April 8, 2019.
- TMDL of Sediment in the Non-Tidal West River Watershed, EPA approval date April 24, 2019.
- TMDL of Fecal Coliform in the Restricted Shellfish Harvesting Areas of Battle Creek, Buzzard Island Creek and Hog Neck Creek in the Lower Patuxent River, EPA approval date May 21, 2019.

As of the submittal date for this FY19 MS4 annual report, individual implementation plans for the two Patuxent River sediment TMDLs listed above as approved by EPA on July 2, 2018 have been finalized, submitted to MDE, and are available on the MDOT SHA website. The submittal dates for these plans falls within FY20 so are not reported as FY19 submittals in **Table 24** below. Plans for the other four TMDLs listed are in development. This is discussed further in **Section E.3** of this report.

Table 24 summarizes MDOT SHA FY19 submittals to MDE of four individual TMDL implementation plans required in response to TMDLs with EPA approval dates in FY18.

Table 24: Individual TMDL Implementation Plans Submitted to MDE in FY19

TMDL	EPA Approval Date	Date Plan Submitted to MDE
TMDL of PCBs in the Patuxent River Mesohaline, Oligohaline and Tidal Fresh Chesapeake Bay Segments	9/19/2017 (FY18)	9/18/2018 (FY19)
TMDL of Sediment in the Non-Tidal South River Watershed	9/28/2017 (FY18)	9/28/2018 (FY19)
TMDL of Sediment in the Other West Chesapeake Watershed	2/9/2018 (FY18)	2/9/2019 (FY19)
TMDL of sediment in the Non-Tidal Back River Watershed	3/5/2018 (FY18)	3/6/2019 (FY19)

i. Schedule

The final dates, or "Target Years", for meeting WLAs applicable to MDOT SHA are listed in Table 3-2 of the Implementation Plan, and the "Addendum to Table 3-2", provided in **Appendix C** of this FY19 MS4 annual report. Practices proposed to support meeting the WLAs during the current permit term are listed in Table 2-2 provided in **Appendix B** of this FY19 MS4 annual report and practices proposed for implementation beyond the 2020 impervious restoration deadline are included in Part IV of the Implementation Plan and individual TMDL implementation plans developed by MDOT SHA to date. Progress meeting the WLAs is addressed in **Section E.4.a** below.

ii. Cost Estimates

MDOT SHA advertises construction projects on eMaryland Marketplace. Detailed cost estimates for projects that are under design cannot be published due to the bidding process. Once project bids have been opened, the three lowest bids are posted on the MDOT SHA website linked below and can be found by searching for Bid Tabulations at the bottom of the page:

http://www.roads.maryland.gov/pages/cic.aspx?PageId=857

Total expenditures including design, ROW, and construction for each restoration contract advertised for this permit term are included in **Section E.4.d**, **Table 27**. Future allocations to be used for MS4 compliance and restoration are listed in **Table 26**.

Lists of proposed practices and estimated costs by FY to achieve the required reductions are included in Part IV of the Implementation Plan and individual TMDL implementation plans submitted after the 2018 plan revision.

iii. Documenting Progress

MDOT SHA models all TMDLs up to 100% attainment to determine how much restoration work must be implemented to meet interim and final targets. The MDOT SHA Restoration Modeling Protocol has been revised and provided in **Appendix D** of this FY19 MS4 annual report. **Table 25** summarizes pollutant load reduction progress achieved relative to the benchmarks and WLA provided in the Implementation Plan and individual TMDL implementation plans submitted after the 2018 plan revision. A similar summary table has been provided in all preceding annual reports submitted by MDOT SHA to MDE during the current permit term.

iv. Adaptive Management

If benchmarks are not being met, both the Bay TMDL and the MDE MS4 permit allow for adjustments in the plan to ensure the plan goals are met. This 'adaptive management' concept is discussed in Part II, Section C of the Implementation Plan (see **Appendix B**).

E.3 Public Participation

Requirements under this condition include:

SHA shall provide opportunity to the public regarding the development of its coordinated TMDL implementation plan by allowing for public participation, soliciting input, and incorporating any relevant ideas and program improvements that can aid in achieving TMDLs and water quality standards according to the actions below. SHA is required to provide:

a) Notice in a regional newspaper and SHA's website outlining how the public may obtain information on the development of the coordinated TMDL implementation plan and opportunities for comment;
b) Procedures for providing copies of the coordinated TMDL implementation plan to interested parties upon request;
c) A minimum 30 day comment period before finalizing the coordinated TMDL implementation plan; and
d) A summary in each annual report of how SHA addressed or will address any material comment received from the public.

As previously discussed in **Section E.2.b,** MDOT SHA developed and submitted to MDE four individual TMDL implementation plans during FY19. Each plan was posted for 30 days on the MDOT SHA website for public review with instructions for downloading the plan and submitting comments. The following list summarizes notices issued during the FY19 reporting period soliciting public comments for draft implementation plans:

- **Patuxent River Mesohaline, Oligohaline and Tidal Fresh Chesapeake Bay Segments PCBs TMDL Implementation Plan**
  - Notices were posted in the classified section of the Baltimore Sun and the Washington Post on August 10, 2018.
  - The public comment period was held from August 10, 2018 to September 10, 2018. No comments were received during the public comment period.
- **Non-Tidal South River Watershed Sediment TMDL Implementation Plan**
  - Notices were posted in the classified section of the Baltimore Sun and the Washington Post on August 24, 2019.
  - The public comment period was held from August 24, 2018 to September 24, 2018. No comments were received during the public comment period.
- **Other West Chesapeake Watershed Sediment TMDL Implementation Plan**
  - Notices were posted in the classified section of the Baltimore Sun and the Washington Post on January 4, 2019.
  - The public comment period was held from January 4, 2019 to February 4, 2019. No comments were received during the public comment period.
- **Non-Tidal Back River Watershed Sediment TMDL Implementation Plan**
  - Notices were posted in the classified section of the Baltimore Sun and the Washington Post on February 4, 2019.
  - The public comment period was held from February 4, 2019 to March 5,

2019. No comments were received during the public comment period.

- **Non-Tidal Patuxent River Lower Watershed Sediment TMDL Implementation Plan**
    - Notices were posted in the classified section of the Baltimore Sun and the Washington Post on May 24, 2019.
    - The public comment period was held from May 24, 2019 to June 24, 2019. No comments were received during the public comment period.
- **Non-Tidal Patuxent River Middle Watershed Sediment TMDL Implementation Plan**
    - Notices were posted in the classified section of the Baltimore Sun and the Washington Post on May 24, 2019.
    - The public comment period was held from May 24, 2019 to June 24, 2019. No comments were received during the public comment period.

E.4 TMDL Compliance

Requirements under this condition include:

SHA shall evaluate and document its progress toward meeting all applicable stormwater WLAs included in EPA approved TMDLs. An annual TMDL assessment report with tables will be submitted to MDE. This assessment shall include complete descriptions of the analytical methodology used to evaluate the effectiveness of SHA's restoration plans and how these plans are working toward achieving compliance with EPA approved TMDLs. SHA shall further provide:

a) Estimated net change in pollutant load reductions from all completed structural and nonstructural water quality improvement projects, enhanced stormwater management programs, and alternative stormwater control initiatives;

b) A comparison of the net change in pollutant load reductions detailed above with the established benchmarks, deadlines, and applicable stormwater WLAs;

c) Itemized costs for completed projects, programs, and initiatives to meet established pollutant reduction benchmarks and deadlines;

d) Cost estimates for completing all projects, programs, and alternatives necessary for meeting applicable stormwater WLAs; and

e) A description of a plan for implementing additional watershed restoration actions that can be enforced when benchmarks, deadlines, and applicable stormwater WLAs are not being met or when projected funding is inadequate.

E.4.a Progress Achieved and Practices Implemented

Practices used to meet the impervious restoration goal were also used to model TMDL reduction strategies for both the Chesapeake Bay TMDL and local TMDLs.

Table 25 shows FY19 progress regarding reductions for each pollutant and watershed and compares this progress to 2020 interim targets and final reduction targets. Figures are also included that depict target reductions, FY19 progress, and BMPs implemented by watershed for sediment (**Figure 23**), phosphorus (**Figure 24**), nitrogen (**Figure 25**), and trash (**Figure 26**). Graphics depicting reductions for PCBs and bacteria are not provided.

Table 25: Local TMDL Pollutant Reduction Progress Through June 30, 2019

Watershed Name	County	Pollutant	Unit	MDOT SHA Reduction Target	2020 Interim Reduction Target	Reduction Achieved as of 6/30/2019	% Reduction Achieved Relative to Total Reduction Target	% Reduction Achieved Relative to 2020 Target
Nutrient and Sediment TMDLs								
Anacostia River Nontidal	MO	Nitrogen	EOS-lbs/yr	21,632.9	3,342.1	3,225.1	14.9%	96.5%
		Phosphorus	EOS-lbs/yr	1,793.4	1,793.4	2,338.1	130.4%	130.4%
		Sediment	EOS-lbs/yr	462,742.0	462,742.0	1,292,622.0	279.3%	279.3%
Anacostia River Tidal	MO, PG	Nitrogen	EOS-lbs/yr	4,909.9	41.8	1.4	0.0%	3.4%
		Phosphorus	EOS-lbs/yr	574.6	16.5	0.4	0.1%	2.3%
		Sediment	EOS-lbs/yr	157,499.8	5,010.9	159.9	0.1%	3.2%
Antietam Creek	WA	Phosphorus	EOS-lbs/yr	277.1	102.0	65.4	23.6%	64.2%
		Sediment	EOS-lbs/yr	1,007,480.3	108,098.0	93,146.2	9.2%	86.2%
Bynum Run	HA	Sediment	EOS-lbs/yr	24,315.6	16,469.4	7,431.6	30.6%	45.1%
Cabin John Creek	MO	Sediment	EOS-lbs/yr	231,907.0	79,327.4	98,506.1	42.5%	124.2%
Catoctin Creek	FR	Phosphorus	EOS-lbs/yr	153.4	153.4	31.8	20.7%	20.7%
		Sediment	EOS-lbs/yr	594,338.1	280,378.7	49,806.7	8.4%	17.8%
Conococheague Creek	WA	Sediment	EOS-lbs/yr	522,112.3	43,821.1	39,708.0	7.6%	90.6%
Double Pipe Creek	FR, CL	Phosphorus	EOS-lbs/yr	1,039.8	585.4	33.8	3.3%	5.8%
	FR, CL	Sediment	EOS-lbs/yr	455,050.1	371,012.7	13,384.9	2.9%	3.6%
Gwynns Falls	BA	Sediment	EOS-lbs/yr	498,013.6	37,415.0	22,246.5	4.5%	59.5%
Jones Falls	BA	Sediment	EOS-lbs/yr	94,768.1	64,214.0	66,389.5	70.1%	103.4%
Liberty Reservoir	BA, CL	Phosphorus	EOS-lbs/yr	562.8	81.7	76.4	13.6%	93.5%
		Sediment	EOS-lbs/yr	506,848.5	68,649.3	62,473.1	12.3%	91.0%
Little Patuxent River	AA, HO	Sediment	EOS-lbs/yr	524,969.0	524,969.0	386,659.8	73.7%	73.7%

Table 25: Local TMDL Pollutant Reduction Progress Through June 30, 2019

Watershed Name	County	Pollutant	Unit	MDOT SHA Reduction Target	2020 Interim Reduction Target	Reduction Achieved as of 6/30/2019	% Reduction Achieved Relative to Total Reduction Target	% Reduction Achieved Relative to 2020 Target
Loch Raven Reservoir	BA, CL, HA	Phosphorus	EOS-lbs/yr	185.5	185.5	92.6	49.9%	49.9%
Lower Gunpowder Falls	BA	Sediment	EOS-lbs/yr	170,420.2	170,420.2	24,953.1	14.6%	14.6%
Lower Monocacy River	CL, FR, MO	Phosphorus	EOS-lbs/yr	1,118.6	1,107.8	134.0	12.0%	12.1%
	FR, MO	Sediment	EOS-lbs/yr	1,002,040.0	384,523.2	58,163.2	5.8%	15.1%
Mattawoman Creek	CH, PG	Nitrogen	EOS-lbs/yr	2,871.2	545.0	229.8	8.0%	42.2%
		Phosphorus	EOS-lbs/yr	325.7	73.1	27.7	8.5%	38.0%
Non-Tidal Back River	BA	Nitrogen	EOS-lbs/yr	1,306.1	552.4	460.5	35.3%	83.4%
		Phosphorus	EOS-lbs/yr	127.7	127.7	113.5	88.9%	88.9%
		Sediment	EOS-lbs/yr	242,233.7	50,294.1	59,265.8	24.5%	117.8%
Other West Chespeake	AA, CV	Sediment	EOS-lbs/yr	18,231.5	829.1	317.5	1.7%	38.3%
Patapsco LN Branch	AA, BA, HO	Sediment	EOS-lbs/yr	473,754.1	309,836.2	90,185.9	19.0%	29.1%
Patuxent River Lower	AA, CV, CH, PG, SM	Sediment	EOS-lbs/yr	25,689.8	1,705.8	2,577.3	10.0%	151.1%
Patuxent River Middle	AA, CV, PG	Sediment	EOS-lbs/yr	58,862.8	5,128.7	4,817.1	8.2%	93.9%
Patuxent River Upper	AA, HO, PG	Sediment	EOS-lbs/yr	39,183.4	39,183.4	7,284.9	18.6%	18.6%
Potomac River MO County	MO	Sediment	EOS-lbs/yr	320,707.6	48,320.4	18,113.8	5.6%	37.5%
Potomac River WA County	WA	Sediment	EOS-lbs/yr	201,344.8	55,562.0	55,562.0	27.6%	100.0%
Prettyboy Reservoir	BA, CL	Phosphorus	EOS-lbs/yr	18.1	18.1	0.7	3.9%	3.9%
Rock Creek	MO	Phosphorus	EOS-lbs/yr	353.9	353.9	983.6	277.9%	277.9%
		Sediment	EOS-lbs/yr	666,193.5	661,381.4	660,221.4	99.1%	99.8%

Table 25: Local TMDL Pollutant Reduction Progress Through June 30, 2019

Watershed Name	County	Pollutant	Unit	MDOT SHA Reduction Target	2020 Interim Reduction Target	Reduction Achieved as of 6/30/2019	% Reduction Achieved Relative to Total Reduction Target	% Reduction Achieved Relative to 2020 Target
Rocky Gorge Reservoir	HO, MO, PG	Phosphorus	EOS-lbs/yr	49.0	15.5	5.2	10.7%	33.7%
Seneca Creek	MO	Sediment	EOS-lbs/yr	596,436.2	363,663.1	200,252.1	33.6%	55.1%
South River	AA	Sediment	EOS-lbs/yr	64,205.5	64,205.5	53,439.6	83.2%	83.2%
Swan Creek	HA	Sediment	EOS-lbs/yr	7,674.9	5,400.0	2,137.8	27.9%	39.6%
Triadelphia Reservoir	HO, MO	Phosphorus	EOS-lbs/yr	49.1	2.8	1.3	2.7%	47.3%
Upper Monocacy River	CL, FR	Phosphorus	EOS-lbs/yr	54.2	54.2	99.9	184.2%	184.2%
	CL, FR	Sediment	EOS-lbs/yr	412,830.6	65,776.2	57,847.3	14.0%	87.9%
PCB TMDLs								
Anacostia River - NE Branch	MO, PG	PCBs	g/yr	7.8	0.2	0.1	1.2%	39.8%
Anacostia River - NW Branch	MO, PG	PCBs	g/yr	7.6	0.4	0.2	2.8%	59.7%
Anacostia River Tidal	PG	PCBs	g/yr	16.1	1.0	0.6	3.5%	57.7%
Back River Oligohaline Tidal	BA	PCBs	g/yr	10.3	0.4	1.3	12.3%	352.8%
Baltimore Harbor	AA, BA	PCBs	g/yr	5.7	1.4	0.1	2.6%	10.8%
Bear Creek	AA, BA	PCBs	g/yr	5.8	0.6	0.4	6.5%	58.6%
Bird River	HA	PCBs	g/yr	0.9	0.1	0.1	9.2%	100.0%
Bush River Oligohaline	HA	PCBs	g/yr	6.9	0.3	0.4	5.9%	119.2%
Curtis Creek/Bay	AA, BA	PCBs	g/yr	29.3	1.4	2.4	8.3%	174.4%
Lake Roland	BA	PCBs	g/yr	4.7	0.2	0.3	5.9%	126.6%
Patuxent River Tidal Fresh	AA, CV, HO, MO, PG	PCBs	g/yr	5.1	0.1	0.1	2.4%	88.4%
Potomac River Upper Tidal	CH, PG	PCBs	g/yr	1.1	0.1	0.0	1.6%	29.7%
Trash TMDLs								

Table 25: Local TMDL Pollutant Reduction Progress Through June 30, 2019

Watershed Name	County	Pollutant	Unit	MDOT SHA Reduction Target	2020 Interim Reduction Target	Reduction Achieved as of 6/30/2019	% Reduction Achieved Relative to Total Reduction Target	% Reduction Achieved Relative to 2020 Target
Anacostia River - MO County	MO	Trash	lbs/yr	6,044.0	3,273.0	674.0	11.2%	20.6%
Anacostia River - PG County	PG	Trash	lbs/yr	14,134.0	5,604.0	2,809.0	19.9%	50.1%
Patapsco - Gwynns Falls	BA	Trash & Debris	lbs/yr	2,415.0	2,415.0	2,007.0	83.1%	83.1%
Patapsco - Jones Falls	BA	Trash & Debris	lbs/yr	1,490.0	1,490.0	2,060.0	138.3%	138.3%
Note: For the Trash WLA MDOT SHA is required to continue practicing trash removal activities that are captured in the baseline and remove 100% of the WLA set in the TMDL documents.								
Bacteria TMDLs								
Anacostia River, Downstream of NEB/NWB Confluence	PG	enterococci	Billion MPN/day	88,818.9	1,022.0	1,022.0	1.2%	100.0%
Anacostia River, Upstream of NEB/NWB Confluence	MO, PG	enterococci	Billion MPN/day	262,217.1	2,367.0	1,695.0	0.6%	71.6%
Antietam Creek	WA	E.coli	Billion MPN/yr	167,003.8	3,587.0	3,587.0	2.1%	100.0%
Baltimore Harbor-Furnace Creek	AA	enterococci	billion counts/day	26,525.0	1,300.0	1,027.5	3.9%	79.0%
Baltimore Harbor-Marley Creek	AA	enterococci	billion counts/day	15,678.0	3,050.0	3,960.0	25.3%	129.8%
Cabin John Creek	MO	E.coli	Billion MPN/day	28,202.7	512.0	512.0	1.8%	100.0%
Conococheague Creek	WA	E.coli	Billion MPN/yr	104,802.4	830.0	830.0	0.8%	100.0%
Double Pipe Creek	CL,FR	E.coli	Billion MPN/yr	71,325.6	0.0	0.0	0.0%	0.0%
Gwynns Falls	BA, BC	E.coli	Billion MPN/day	156,079.1	0.0	0.0	0.0%	0.0%
Herring Run	BA, BC	E.coli	Billion MPN/yr	28,318.3	0.0	0.0	0.0%	0.0%

Table 25: Local TMDL Pollutant Reduction Progress Through June 30, 2019

Watershed Name	County	Pollutant	Unit	MDOT SHA Reduction Target	2020 Interim Reduction Target	Reduction Achieved as of 6/30/2019	% Reduction Achieved Relative to Total Reduction Target	% Reduction Achieved Relative to 2020 Target
Jones Falls	BA, BC	E.coli	Billion MPN/day	84,191.2	0.0	0.0	0.0%	0.0%
Liberty Reservoir	BA, CL	E.coli	Billion MPN/yr	113,824.4	6,811.0	6,811.0	6.0%	100.0%
Loch Raven Reservoir	BA,CL, HO	E.coli	BN MPN/yr	99,289.0	1,818.0	861.4	0.9%	47.4%
Lower Monocacy River	CL,FR, MO	E.coli	Billion MPN/yr	217,951.8	2,788.9	2,788.9	1.3%	100.0%
Lower Patuxent River - Indian Creek	CH, SM	fecal coliform	billion counts/day	2,427.0	151.0	151.0	6.2%	100.0%
Magothy River - Forked Creek	AA	fecal coliform	billion counts/day	0.0	0.0	0.0	0.0%	0.0%
Magothy River - subsegment	AA	fecal coliform	billion counts/day	3,929.3	86.0	86.0	2.2%	100.0%
Other West Chesapeake - Tracy and Rockhold Creeks	AA	fecal coliform	billion counts/day	5,936.4	0.0	0.0	0.0%	0.0%
Patapsco River LN Branch	AA,BA, CL,HO	E.coli	BN MPN/yr	34,276.0	1,829.0	1,136.0	3.3%	62.1%
Patuxent River Upper	AA,PG	E.coli	BN MPN/yr	11,869.0	45.0	45.0	0.4%	100.0%
Piscataway Creek	PG	E.coli	Billion MPN/day	13,653.7	682.0	682.0	5.0%	100.0%
Rock Creek - Non-Tidal	MO	enterococci	Billion MPN/day	116,713.4	856.0	856.0	0.7%	100.0%
Severn River - Mill Creek	AA	fecal coliform	billion counts/day	8,559.6	220.0	220.0	2.6%	100.0%
Severn River - subsegment	AA	fecal coliform	billion counts/day	16,808.7	2,078.0	2,091.0	12.4%	100.6%
Severn River - Whitehall & Meredith Creeks	AA	fecal coliform	billion counts/day	6,844.1	558.0	498.0	7.3%	89.2%

Table 25: Local TMDL Pollutant Reduction Progress Through June 30, 2019

Watershed Name	County	Pollutant	Unit	MDOT SHA Reduction Target	2020 Interim Reduction Target	Reduction Achieved as of 6/30/2019	% Reduction Achieved Relative to Total Reduction Target	% Reduction Achieved Relative to 2020 Target
South River - Duval Creek	AA	fecal coliform	billion counts/day	0.0	0.0	0.0	0.0%	0.0%
South River - Ramsey Lake	AA	fecal coliform	billion counts/day	188.5	0.0	0.0	0.0%	0.0%
South River - Selby Bay	AA	fecal coliform	billion counts/day	1.8	0.0	0.0	0.0%	0.0%
South River - subsegment	AA	fecal coliform	billion counts/day	31,283.1	4,946.0	1,859.0	5.9%	37.6%
Upper Monocacy River	CL, FR	E.coli	Billion MPN/yr	76,636.4	1,398.0	1,398.0	1.8%	100.0%
West River - Bear Neck Creek	AA	fecal coliform	billion counts/day	1,025.6	0.0	0.0	0.0%	0.0%
West River - Cadle Creek	AA	fecal coliform	billion counts/day	690.6	0.0	0.0	0.0%	0.0%
West River - Parish Creek	AA	fecal coliform	billion counts/day	0.0	0.0	0.0	0.0%	0.0%
West River - subsegment	AA	fecal coliform	billion counts/day	1,257.8	0.0	0.0	0.0%	0.0%
Chesapeake Bay TMDLs								
MS4 Area Wide	NA	Nitrogen	DEL-lbs/yr	88,281.0	37,538.3	21,776.2	25%	58%
MS4 Area Wide	NA	Phosphorus	DEL-lbs/yr	25,994.0	18,957.8	6,311.8	24%	33%
MS4 Area Wide	NA	Sediment	DEL-lbs/yr	14,910,510.0	10,714,87.68	3,713,220.2	25%	35%
Note: The modeling was conducted for the entire permitted area. MDOT SHA assumed a baseline year of 2011.								

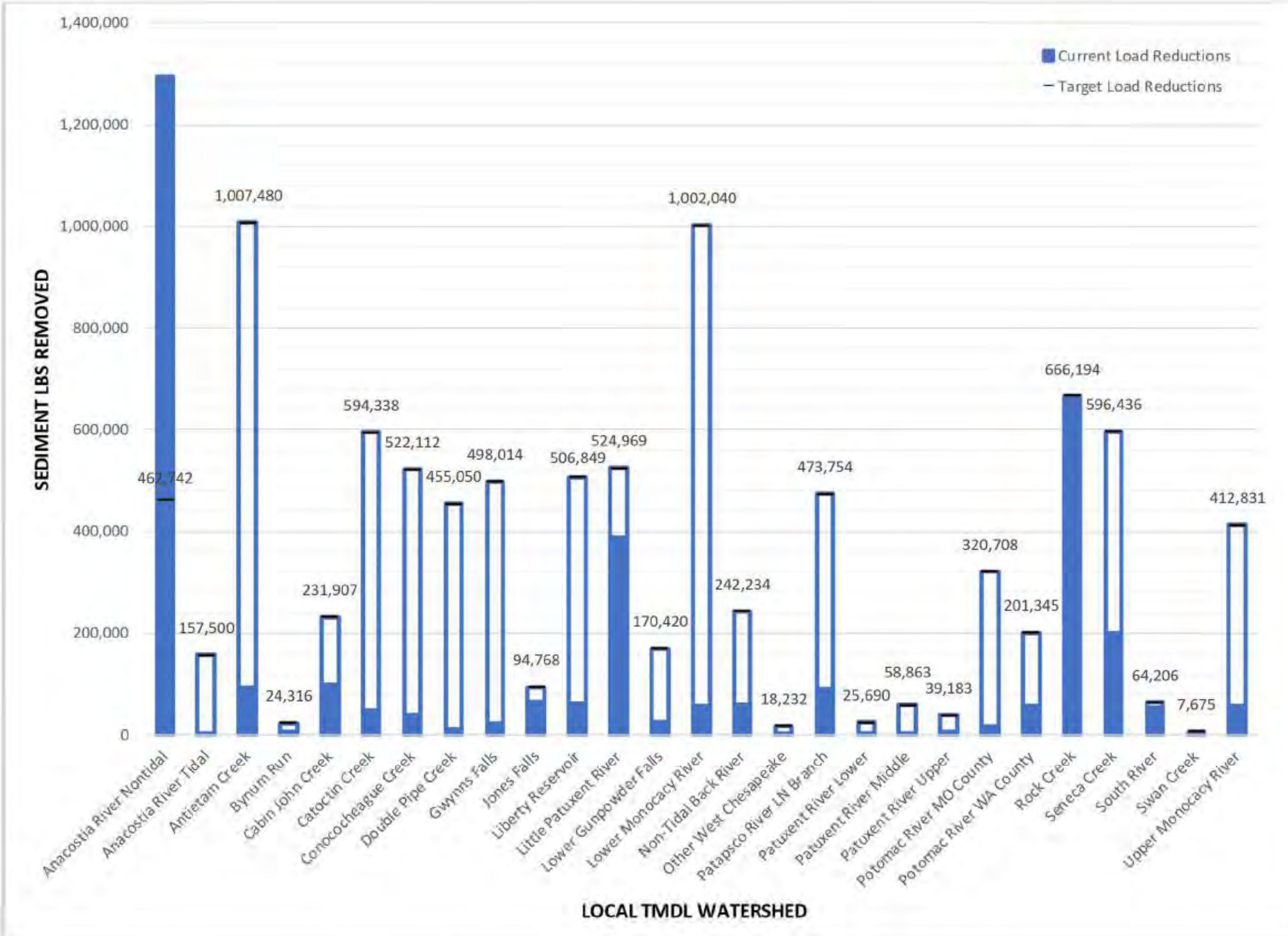


Figure 23: Sediment Reductions Achieved to Date

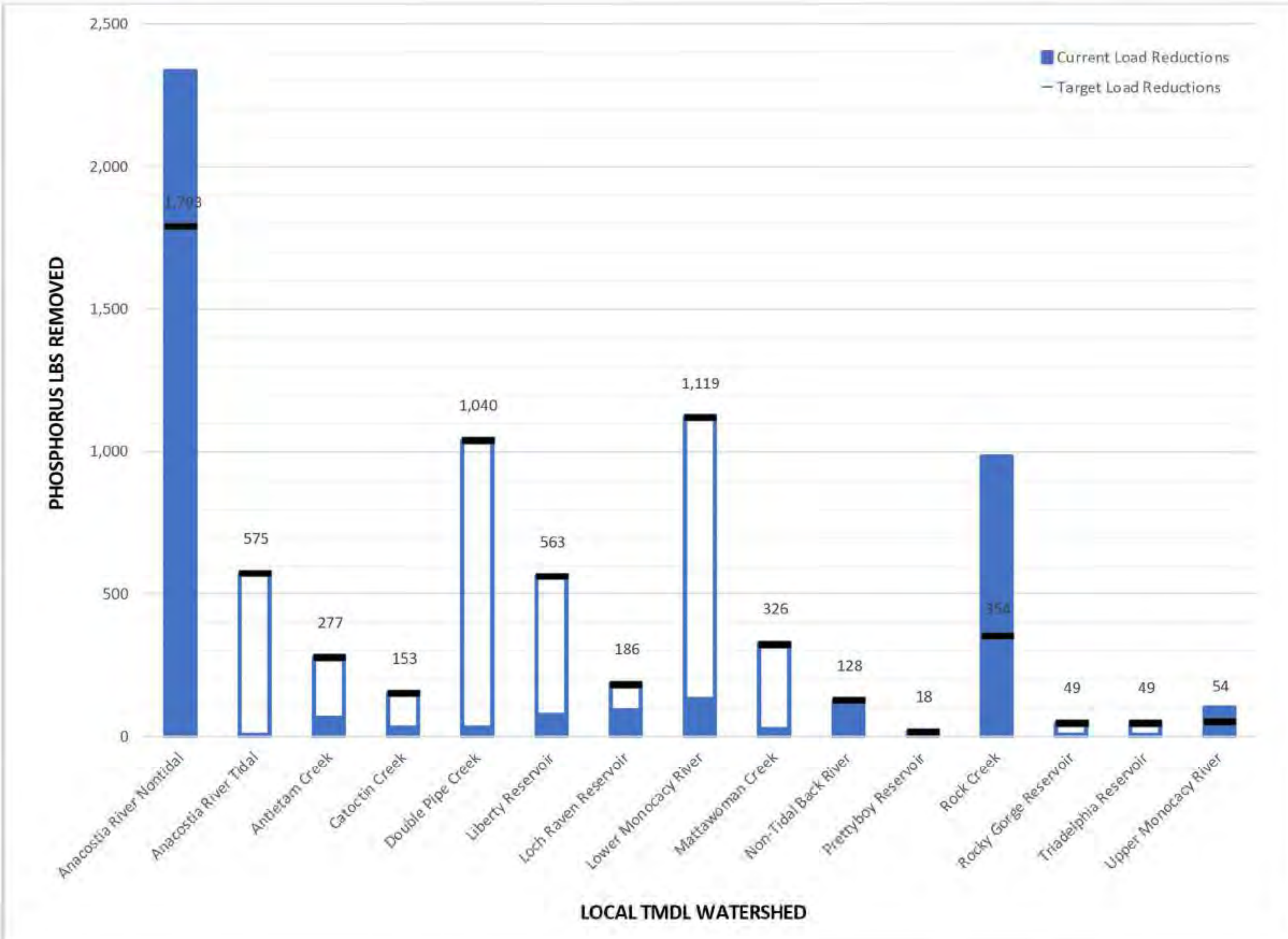


Figure 24: Phosphorus Reductions Achieved to Date

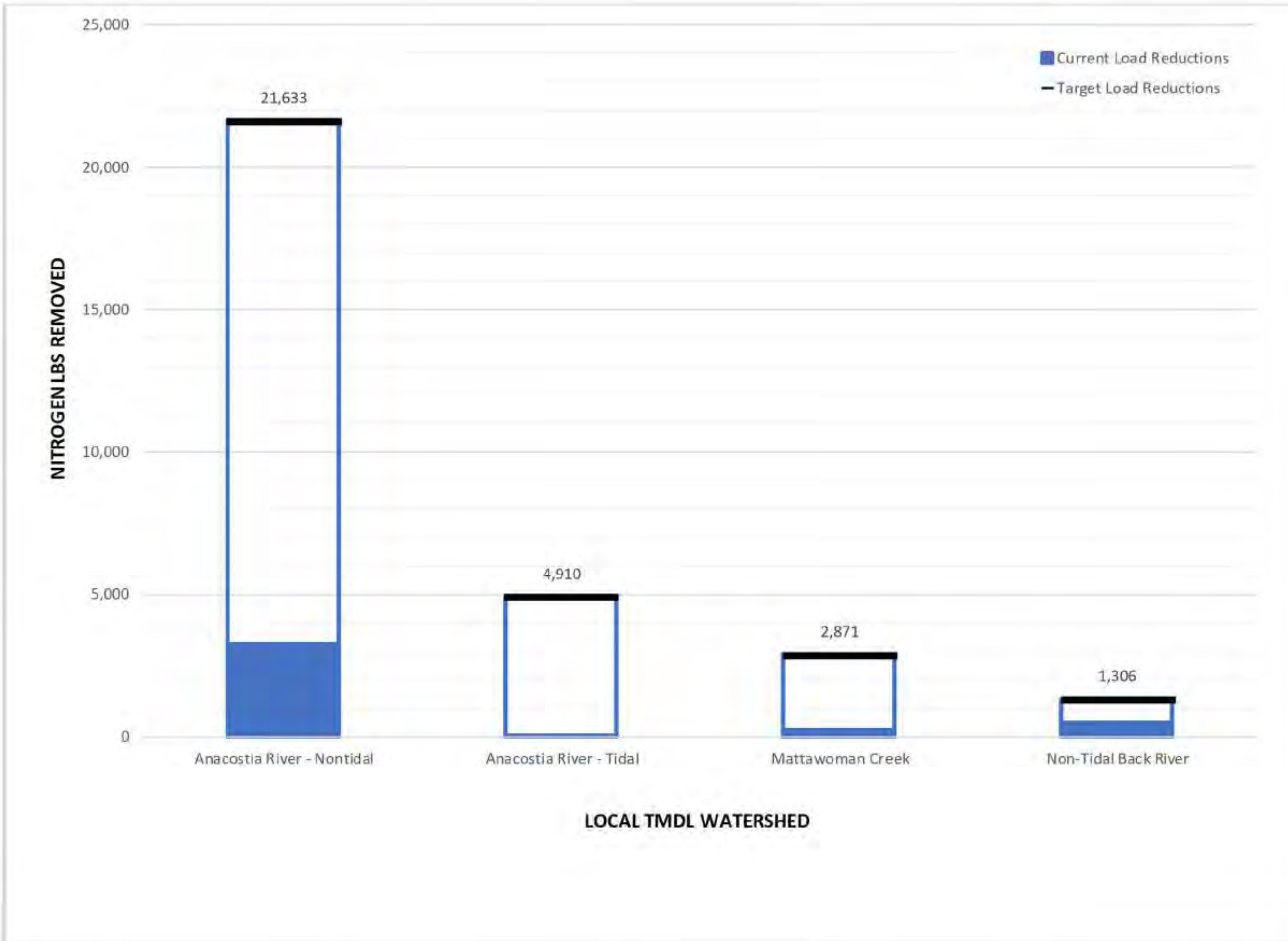


Figure 25: Nitrogen Reductions Achieved to Date

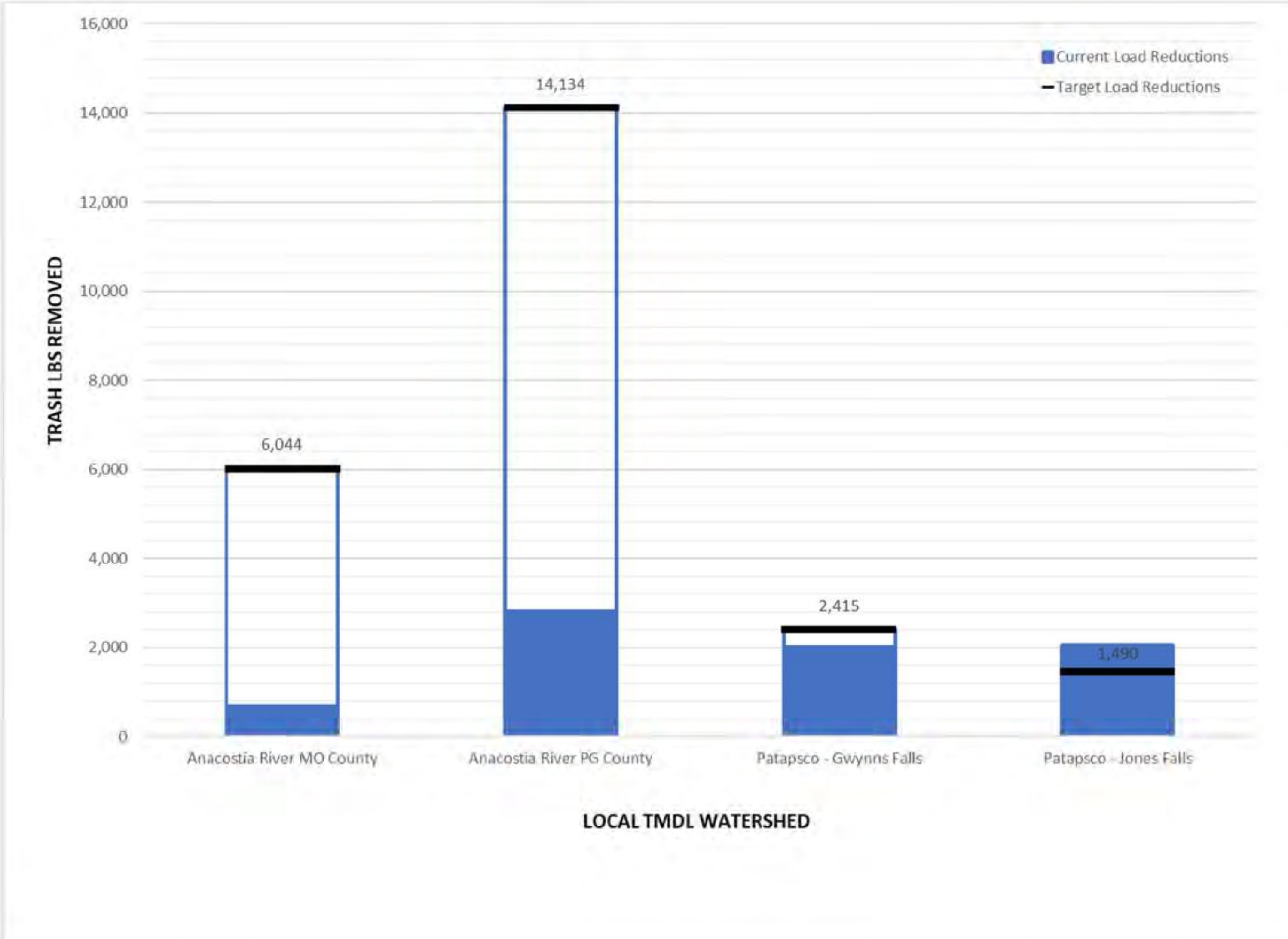


Figure 26: Trash Reductions Achieved to Date

E.4.b Benchmark Comparisons

Benchmarks and comparative reductions for TMDL pollutants are discussed previously, in Section E.4.a. of this report, and are summarized in **Table 25**.

E.4.c Itemized Costs

Expenditures are itemized for each restoration project that has advertised, is under construction, or has completed construction in **Table 27**. These expenditures are not always final because each project listed may be at different levels of completion. These costs include everything specific to implementing each BMP type and can include engineering design, ROW or easement acquisitions, and construction.

Restoration projects commonly consist of numerous BMPs and providing exact expenditures for each individual BMP is not possible. Estimated expenditures for individual BMPs have been derived by dividing the overall project cost by the impervious restoration credit provided by each project. Tables are included in the CD submitted with this FY19 MS4 annual report that list BMPs built for each project (ordered by MDOT SHA project or FMIS number) and the impervious restoration acres provided by each. The expenditures per credit acre for each project can be multiplied by the credit each BMP is providing to derive an estimated per BMP cost. This cost data is not included in **Table 27**, but is added to the "IMPL_COST" data field of the RestBMP (RST) feature class in the MS4 geodatabase submitted with this FY19 MS4 annual report. This calculation is only performed for projects that have completed construction and are showing all the associated BMPs as built.

In the MS4 geodatabase submitted with this FY19 MS4 annual report, MDOT SHA has provided BMP cost information for completed projects through FY19 (restoration BMPs):

- Restoration BMP feature class (RST)
- Alternate BMP Polygon feature class (APY)
- Alternate BMP Line feature class (ALN)

Additionally, a comprehensive list of restoration practices completed from 2011 to June 30, 2019, broken down by FMIS contract, is included on the CD with this FY19 MS4 annual report. Each entry includes location information and estimated impervious runoff treatment acreages.

Lists of proposed BMPs and estimated costs are included in Part IV of the Implementation Plan and the individual TMDL implementation plans subsequently developed and submitted to MDE.

E.4.d Cost Estimates for Completing Restoration

MDOT SHA has programmed capital funding through the Fund 82 TMDL Restoration Fund to meet the impervious restoration target and fund the MS4 program in the amounts indicated in **Table 26** below.

Table 26: Fund 82 Allocations (Capital Funds)

Fiscal Year	Allocations (Millions)
2020	$90.0
2021	$69.1
2022	$15.0
2023	$15.0
2024	$24.1
2025	$23.1
Total 2020 - 2025	**$236.3**

Table 27: FY11 to FY19 Itemized Costs for Advertised Projects

FMIS	BMP Type	Project Name	Planning and Design	ROW	Construction	Total Expenditures	No. of BMPs in Project	No. of BMPs Constructed to Date	Impervious Treatment for Project (AC)	Impervious Treated to Date (AC)
AA0825182	Streams	STREAM RESTORATION TARNANS BRANCH	$0	$0	$97,991	$97,991	1	0	88.38	0
AA0825282	Streams	STREAM RESTORATION BACON RIDGE	$0	$0	$1,767,521	$1,767,521	1	0	359.4	0
AA1665182	Streams	I-97 SB WEST OF EAST-WEST BOULEVARD	$227,446	$1,781,399	$584,893	$2,593,738	2	2	7.5	7.5
AA7955282	SWM	AT VARIOUS LOCATSION - GROUP 1	$859,762	$0	$1,752,146	$2,611,908	9	9	4.83	4.83
AA8675182	Impervious Removal	SANDY PT PK-MDOT/SHA RESTOR CREDIT PARTN	$0	$0	$200,000	$200,000	1	0	1	0
AA8955182	Streams	SRI - BROAD CREEK STREAM RESTORATION	$314,269	$0	$1,902,841	$2,217,110	1	1	48.28	48.28
AT0415182	Trees	SRI-TREE PLANT-VAR LOC IN DISTRICT 3	$953,766	$0	$1,685,609	$2,639,375	89	89	18.87	18.87
AT0425182	Trees	TREE PLANTING IN WASHINGTON COUNTY	$178,807	$0	$1,456,439	$1,635,246	82	82	19.41	19.41
AT0445182	Swales	GRASS SWALE, ATTENUATION SWALE OR DRY SWALE	$199,503	$0	$5,390,192	$5,589,695	37	37	20.67	20.67
AT0445282	Trees	AT VARIOUS LOCATIONS IN CHARLES COUNTY	$150,466	$340	$15,393	$166,199	1	0	24.16	0
AT0685282	Trees	SRI-TREE PLANTING-VAR LOC BALTIMORE CO	Separate PP/PE Task	$0	$1,618,230	$1,618,230	125	125	28.43	28.43
AT0685382	Trees	SRI-AT VARIOUS LOCATION - D4	Separate PP/PE Task	$0	$1,964,073	$1,964,073	100	100	29.55	29.55

Table 27: FY11 to FY19 Itemized Costs for Advertised Projects

FMIS	BMP Type	Project Name	Planning and Design	ROW	Construction	Total Expenditures	No. of BMPs in Project	No. of BMPs Constructed to Date	Impervious Treatment for Project (AC)	Impervious Treated to Date (AC)
AT0685482	Trees	TREE PLANTING-VAR LOC IN AA AND CH	Separate PP/PE Task	$0	$1,498,964	$1,498,964	77	77	17.48	17.48
AT0685582	Trees	SRI-TREE PLANTING-VAR LOC IN CECIL CO	Separate PP/PE Task	$0	$687,263	$687,263	34	34	8.55	8.55
AT0865182	Retrofits	DRAINAGE IMPROVEMENTS AT VARIOUS LOCATIONS IN DISTRICT 3	$30,000	$10,265	$5,521,108	$5,561,373	14	14	54.67	54.67
AT0875182	Retrofits	TMDL STORMWATER FACILITY ENHANCEMENT IN DISTRICT 5 - DESIGN BUILD	$0	$424,269	$4,753,055	$5,177,323	10	10	60.34	60.34
AT0875282	Retrofits	AT VARIOUS LOCATIONS IN AA COUNTY	$12,572	$0	$987,420	$999,992	2	2	6.9	6.9
AT0885182	SWM	TC56-TMDL AT VARIOUS LOCATIONS IN DIST 7	$1,048,097	$0	$5,397,187	$6,445,284	70	70	33.28	33.28
AT0895182	SWM	TC56-AT VARIOUS LOCATIONS IN DIST 5	$500,038	$0	$1,741,662	$2,241,700	24	24	12.91	12.91
AT4285282	Impervious Removal	AT VARIOUS LOCATIONS-DISTRICT 7-GROUP 1	$686,641	$0	$2,135,272	$2,821,913	8	8	1.85	1.85
AT5025182	Trees	TC70-CHESAPEAKE BAY WATERSHED PROGRAM-D4	Separate PP/PE Task	$0	$1,568,585	$1,568,585	108	108	37.37	37.37
AT5025282	Trees	TC70-CHESAPEAKE BAY WATERSHED PROGRAM D7	Separate PP/PE Task	$0	$2,912,940	$2,912,940	138	138	70.82	70.82

Table 27: FY11 to FY19 Itemized Costs for Advertised Projects

FMIS	BMP Type	Project Name	Planning and Design	ROW	Construction	Total Expenditures	No. of BMPs in Project	No. of BMPs Constructed to Date	Impervious Treatment for Project (AC)	Impervious Treated to Date (AC)
AT5025382	Trees	TC70-CHESAPEAKE BAY WATERSHED PROG D-3,5	Separate PP/PE Task	$0	$729,320	$729,320	47	47	23.59	23.59
AT5025482	Trees	TC70-CHESAPEAKE BAY WATERSHED PROGRAM-D6	Separate PP/PE Task	$0	$1,212,257	$1,212,257	55	55	30.47	30.47
AT7995382	SWM	TC70-SWM AT VARIOUS LOCATIONS IN DIST 5	$166,191	$0	$3,332,757	$3,498,948	47	47	18.86	18.86
AW0432182	Trees	TREE PLANTING AT VARIOUS LOC - DIST 4	$531	$0	$966,678	$967,209	0	0	0	0
AW0435382	Trees	TREE PLANTING ON DNR IN DISTRICT 4	$0	$0	$778,652	$778,652	0	0	0	0
AW0445182	Trees	TREE PLANTING AT VARIOUS LOC - DIST 7	$836,125	$0	$1,446,043	$2,282,168	75	75	29.86	29.86
AW0445282	Trees	AT VARIOUS LOCATIONS IN DISTRICT 7-CL CO	$165,598	$0	$1,125,864	$1,291,462	50	50	30.86	30.86
AW0445482	Trees	TREE PLANTING ON DNR PROP IN DISTRICT 7	$0	$0	$1,732,410	$1,732,410	0	0	0	0
AW045182	Trees	TREE PLANTING AT VARIOUS LOC - DIST 4	$817,782	$0	$106,886	$924,668	0	0	0	0
AW0465182	Trees	TREE PLANTING AT VARIOUS LOC - DIST 3	$244,171	$0	$487,428	$731,599	12	12	2.94	2.94
AW0475182	Trees	AT VARIOUS LOCATIONS IN ANNE ARUNDEL CO	$923,781	$0	$1,287,250	$2,211,031	91	91	23.07	23.07
AW0825282	Trees	SRI-TREE PLANTING AT VAR LOC IN D-7	Separate PP/PE Task	$0	$2,679,952	$2,679,952	192	192	53.13	53.13

Table 27: FY11 to FY19 Itemized Costs for Advertised Projects

FMIS	BMP Type	Project Name	Planning and Design	ROW	Construction	Total Expenditures	No. of BMPs in Project	No. of BMPs Constructed to Date	Impervious Treatment for Project (AC)	Impervious Treated to Date (AC)
AX0335182	Streams	PATAPSCO VALLEY ST PK-STREAM RESTORATION	$415,006	$0	$700,041	$1,115,046	1	1	7.14	7.14
AX2645182	SWM	TC11-LEGACY PAVEMENT IMP-DIST 2/DIST 4	$1,245,680	$0	$4,995,307	$6,240,987	60	60	30.43	30.43
AX2645282	SWM	TC11-LEGACY PAVEMENT IMP-DISTRICT 3	$419,335	$0	$2,771,928	$3,191,263	17	17	6.02	6.02
AX2645382	SWM	TC11-LEGACY PAVEMENT IMP-DISTRICT 5	Separate PP/PE Task	$0	$1,263,859	$1,263,859	13	13	5.11	5.11
AX2645482	SWM	LEGACY PAVEMENT IMP-DIST 7/SOME DIST 6	$327,282	$0	$3,283,794	$3,611,076	55	55	23.4	23.4
AX3765360	Streams	RESTORATION OF NW-170	Breakdown Unknown, Cost Estimated - Part of Larger Effort	$0	$0	$0	1	1	180.33	180.33
AX3765560	Streams	RESTORATION OF NB-1	Breakdown Unknown, Cost Estimated - Part of Larger Effort	$0	$0	$0	2	2	275.97	275.97
AX3765D60	Streams	RESTORATION OF PB-85	Breakdown Unknown	$0	$0	$0	1	1	129	129

Table 27: FY11 to FY19 Itemized Costs for Advertised Projects

FMIS	BMP Type	Project Name	Planning and Design	ROW	Construction	Total Expenditures	No. of BMPs in Project	No. of BMPs Constructed to Date	Impervious Treatment for Project (AC)	Impervious Treated to Date (AC)
AX3765E60	Streams	RESTORATION OF PB-37, PB-108, PB-8	Breakdown Unknown, Cost Estimated - Part of Larger Effort	$0	$0	$0	3	3	160.83	160.83
AX3765F60	Streams	RESTORATION OF PB-119, PB-109	Breakdown Unknown, Cost Estimated - Part of Larger Effort	$0	$0	$0	2	2	81.78	81.78
AX3765K60	Streams	RESTORATION OF IC-62	Breakdown Unknown	$0	$0	$0	1	1	24.18	24.18
AX3765L60	Streams	STREAM RESTORATION OF CRICKET LAND TRIBUTARY (NW-4)	Breakdown Unknown	$0	$0	$0	1	1	155.13	155.13
AX3765N60	Streams	RESTORATION OF SC-2 - GOSHAN BRANCH	Breakdown Unknown	$0	$0	$0	1	1	119.73	119.73
AX3765U60	Streams	RESTORATION OF RC-2	Breakdown Unknown	$0	$0	$0	1	1	145.62	145.62
AX3785R60	Streams	STREAM RESTORATION OF PB-12A, PB-12B AT HOLLYWOOD BRANCH	Breakdown Unknown	$0	$3,753,209	$3,753,209	2	2	190.83	190.83

Table 27: FY11 to FY19 Itemized Costs for Advertised Projects

FMIS	BMP Type	Project Name	Planning and Design	ROW	Construction	Total Expenditures	No. of BMPs in Project	No. of BMPs Constructed to Date	Impervious Treatment for Project (AC)	Impervious Treated to Date (AC)
AX7665182	Retrofits	SRI-AT VARIOUS LOCATIONS IN DISTRICT 4	$1,494,480	$0	$4,865,018	$6,359,498	12	12	16.91	16.91
AX7665282	Retrofits	TC94-SWM AT VARIOUS LOCATIONS - GROUP 1	$2,726,516	$0	$327,231	$3,053,747	11	0	28.3	0
AX7665482	Retrofit	AT VARIOUS LOC IN AA COUNTY-GROUP 1	$2,320,673	$26,558	$2,897,056	$5,244,287	5	5	21.39	21.39
AX7665582	Retrofits	AT VARIOUS LOCATIONS IN WA CO - GROUP 1	$754,373	$0	$2,078,286	$2,832,658	5	5	18.1	18.1
AX7665B82	Retrofits	AT VAR LOCATIONS IN AA COUNTY-GROUP 1A	$0	$24,723	$10,809	$35,532	4	0	19.42	0
AX7665C82	Retrofit	AT VARIOUS LOCATIONS IN D-7, GROUP 2	$0	$0	$2,360,017	$2,360,017	5	5	19.13	19.13
AX7665D82	Retrofit	TOTAL MAXIMUM DAILY LOAD-DESIGN BUILD	$718,950	$0	$8,769,164	$9,488,114	TBD	0	631.5	0
AX7665E82	Retrofit	SWM RETROFITS - D3 - GROUP 1A	$0	$0	$529,548	$529,548	2	1	11.43	5.75
AX766A56	Retrofit	SWM RETROFITS - D3 - GROUP 1	$1,801,466	$0	$2,103,128	$3,904,594	6	2	16.93	6.41
AX9295182	SWM	TC70-SWM AT VARIOUS LOCATION IN DIST 3	$161,555	$0	$2,474,194	$2,635,749	17	17	11.26	11.26
BA2015382	SWM	SWM-AT VARIOUS LOCATIONS - GROUP 1	$675,745	$0	$2,775,853	$3,451,598	14	14	12.5	12.5
BA2015482	Outfalls	WHITE MARSH TRIBUTARY AT MD 43	$329,122	$0	$755,958	$1,085,080	1	1	7.875	7.875
BA2015582	Retrofit	AT VARIOUS LOCATIONS - SWM GROUP 1B	$1,218,497	$0	$2,857,441	$4,075,939	13	13	11.3	11.3

Table 27: FY11 to FY19 Itemized Costs for Advertised Projects

FMIS	BMP Type	Project Name	Planning and Design	ROW	Construction	Total Expenditures	No. of BMPs in Project	No. of BMPs Constructed to Date	Impervious Treatment for Project (AC)	Impervious Treated to Date (AC)
BA2015782	Streams	LITTLE GUNPOWDERS FALLS TRIB AT MD145 & MD 165	$95,983	$191,717	$542,022	$829,722	1	0	125.25	0
BA2705182	Outfalls	AT VAR LOC IN BALTIMORE COUNTY, GROUP 1	$283,380	$49,499	$9,204	$342,084	1	0	21.05	0
BA4415182	Streams	STREAM RESTORATION MARDELLA BRANCH	$0	$0	$63,088	$63,088	1	0	86.43	0
BA4415282	Streams	STREAM RESTORATION MCGILL RUN/TRIBUTARY	$0	$0	$168,024	$168,024	1	0	181.89	0
BA4415382	Streams	STREAM RESTORATION FOURTH MINE	$0	$0	$28,932	$28,932	1	0	59.76	0
BA4415482	Streams	STREAM RESTORATION LONG GREEN CREEK	$0	$0	$1,140,843	$1,140,843	1	0	279.39	0
BA4415582	Streams	STREAM RESTORATION UT PATAPSCO CREEK	$0	$0	$54,720	$54,720	1	0	53.4	0
BA4415682	Streams	STREAM RESTORATION ROLLING RIDGE	$0	$0	$550,386	$550,386	1	0	104.01	0
CE2175182	Streams	STREAM RESTORATION NE CREEK	$0	$0	$1,581,039	$1,581,039	1	0	421.35	0
CE2175282	Streams	STREAM RESTORATION LITTLE CREEK	$0	$0	$4,283,732	$4,283,732	1	0	1095.03	0
CE2705182	Trees	TREE PLANTING AT VARIOUS LOCATIONS	$400,369	$0	$931,537	$1,331,906	30	30	11.78	11.78
CE2725282	SWM	AT VARIOUS LOCATIONS - GROUP 1	$1,026,042	$52,745	$2,015,743	$3,094,530	10	10	4.99	4.99

Table 27: FY11 to FY19 Itemized Costs for Advertised Projects

FMIS	BMP Type	Project Name	Planning and Design	ROW	Construction	Total Expenditures	No. of BMPs in Project	No. of BMPs Constructed to Date	Impervious Treatment for Project (AC)	Impervious Treated to Date (AC)
CE2865182	Streams	GRAMIES RUN	$1,613,124	$43,740	$3,648,583	$5,305,447	1	0	164.19	0
CH2985182	SWM	SMALLWOOD STATE PARK	$527,933	$0	$742,859	$1,270,792	5	5	6.3	6.3
CL2535182	Streams	PINEY RUN AT MD 32	$599,778	$0	$2,211,236	$2,811,014	1	0	508.5	0
CL4185282	Streams	STREAM RESTORATION MUDDY CREEK	$0	$0	$1,365,205	$1,365,205	1	0	239.16	0
DNR - Million Tree	Trees	TREE PLANTINGS FOR MILLION TREE INITIATIVE (PARTNERSHIP WITH DNR)	PE Unknown	$0	$1,389,650	$1,389,650	94	94	148.21	148.21
FR5975182	Streams	LITTLE CATOCTIN CREEK	$564,250	$149,430	$3,148,763	$3,862,443	1	1	91.89	91.89
FR6635382	SWM	AT VARIOUS LOCATIONS - GROUP 1A	$725,782	$0	$1,580,650	$2,306,432	9	9	6.31	6.31
FR6715182	Streams	ISRAEL CREEK- STREAM RESTORATION	$399,167	$156	$5,201	$404,524	1	0	112.86	0
FR6835182	Streams	ISRAEL CREEK AT STAUFFERS ROAD	$371,679	$602,605	$4,927	$979,211	1	0	104.09	0
FR6985182	Streams	STREAM RESTORATION BENS BRANCH	$0	$0	$338,952	$338,952	1	0	141.24	0
FR6985282	Streams	STREAM RESTORATION UT BROAD RUN	$0	$0	$263,671	$263,671	1	0	179.58	0
FR6985382	Streams	STREAM RESTORATION UT TALBOT BRANCH	$0	$0	$94,618	$94,618	1	0	90.93	0
FR6985482	Streams	STREAM RESTORATION BUSH CREEK	$0	$0	$89,613	$89,613	1	0	101.55	0
HA1925282	Retrofit	AT VARIOUS LOCATIONS - GROUP 1A	$1,219,624	$20,518	$1,884,427	$3,124,569	8	8	6.85	6.85

Table 27: FY11 to FY19 Itemized Costs for Advertised Projects

FMIS	BMP Type	Project Name	Planning and Design	ROW	Construction	Total Expenditures	No. of BMPs in Project	No. of BMPs Constructed to Date	Impervious Treatment for Project (AC)	Impervious Treated to Date (AC)
HA4075182	Streams	PLUMTREE RUN STREAM RESTORATION	$127,012	$0	$1,404,460	$1,531,472	1	1	63	63
HA4095182SB R	Streams	MD 23 MAGNESS FARM STREAM RESTORATION AT TRIBUTARY OF DEER CREEK	$107,549	$0	$97,408	$204,957	1	1	34.8	34.8
HA6025182	Streams	STREAM RESTORATION MARYLEA FARM	$0	$0	$196,390	$196,390	1	0	296.55	0
HO1045182	Streams	STREAM RESTORATION AT BRAMPTON HILLS	$0	$0	$4,076	$4,076	0	0	0	0
HO1095182	Streams	STREAM RESTORATION SOUTH BRANCH PATAPSCO	$0	$0	$65,368	$65,368	1	0	164.91	0
HO1095282	Streams	STREAM RESTORATION LITTLE PATUXENT	$0	$0	$111,024	$111,024	1	0	219.06	0
HO1695182	Streams	FURNACE AVENUE TRIBUTARY	$179,360	$0	$543,395	$722,756	1	1	6	6
HO2065182	Streams	UPPER LITTLE PATUXENT - TC 12	$239,689	$0	$2,072,751	$2,312,440	1	1	135	135
HO3255124	Streams	DORSEY RUN	$766,658	$0	$303,050	$1,069,708	1	1	59.19	59.19
HO3985182	Outfalls	AT VARIOUS LOCATIONS - GROUP 1	$45,304	$0	$431,435	$476,739	1	0	3.25	0
HO4085174	Streams	MD 100 RED HILL BRANCH BRAMPTON HILLS	Breakdown Unknown	$0	$0	$0	1	1	31.32	31.32

Table 27: FY11 to FY19 Itemized Costs for Advertised Projects

FMIS	BMP Type	Project Name	Planning and Design	ROW	Construction	Total Expenditures	No. of BMPs in Project	No. of BMPs Constructed to Date	Impervious Treatment for Project (AC)	Impervious Treated to Date (AC)
MO0325182	Streams	STREAM RESTORATION WATTS BRANCH TRIBUTAR	$75,514	$0	$1,058	$76,572	0	0	0	0
MO0375182	Streams	STREAM RESTORATION NORTH CREEK	$0	$0	$36,922	$36,922	1	0	91.95	0
MO2965182	Streams	TRIBUTARY TO CABIN JOHN CRK (TOWER OAKS)	$39,242	$0	$717,861	$757,103	1	0	9.98	0
PG0075182	Streams	STREAM RESTORATION AT PATUXENT REFUGE	$0	$0	$262,504	$262,504	1	0	40	0
PG0585182	SWM	ROSARYVILLE STATE PARK	$448,499	$0	$688,090	$1,136,589	3	3	3.36	3.36
PG0735182	Outfalls	SRI-ALONG MD 210	$882,753	$61,868	$2,418,164	$3,362,784	6	6	10.89	10.89
PG1085182	SWM	WATER QUALITY SITES ON MD 4 AND MD 214	$133,304	$0	$2,085,440	$2,218,744	2	2	9.91	9.91
PG8325182	Outfalls	AT VARIOUS LOCATIONS-GROUP 2	$1,607,370	$66,196	$1,445,646	$3,119,212	1	0	15.15	0
PG9535182	Streams	CHARLES BRANCH TRIBUTARIES	$173,697	$64,264	$600,773	$838,734	1	0	234.8	0
Various	Trees	TREE PLANTINGS ASSOCIATED WITH VARIOUS LANDSCAPE/SUSTAINABILITY PROJECTS	Exact Cost Unknown, Part of Larger Planting Contracts	$0	$0	$0	227	227	79.71	79.71
WA2445182	SWM	SRI-PA STATE LINE TO FREDERICK COUNTY LI	$107,190	$0	$4,903,456	$5,010,646	70	70	31.98	31.98

Table 27: FY11 to FY19 Itemized Costs for Advertised Projects

FMIS	BMP Type	Project Name	Planning and Design	ROW	Construction	Total Expenditures	No. of BMPs in Project	No. of BMPs Constructed to Date	Impervious Treatment for Project (AC)	Impervious Treated to Date (AC)
WA2655382	Retrofit	AT VARIOUS LOCATIONS WA COUNTY-GROUP 1A	$1,147,565	$0	$2,919,614	$4,067,179	8	8	13.23	13.23
WA2655482	SWM	AT VARIOUS LOCATIONS - GROUP 1B	$1,420,415	$8,106	$3,041,756	$4,470,277	10	10	6.08	6.08
WA2655682	Streams	LITTLE TONOLOWAY CREEK AT KIRKWOOD PARK	$404,766	$0	$1,337,892	$1,742,658	1	0	59.37	0
WA2775182	Trees	TREE PLANTING AT VARIOUS LOCATIONS	$458,542	$0	$2,698,368	$3,156,910	11	11	41.86	41.86
					Totals:	**$210,314,808**	**2288**	**2,235**	**9536**	**3,163**
									Credit with no contract/funding information:	42
									Redevelopment credit:	59
									Inlet cleaning credit:	175
									Street sweeping credit:	33
									Grand total (impervious treated to date):	**3,472**

E.4.e Gap-Filling Watershed Action Plan

The MDOT SHA OED staff and funding resources are functioning at capacity to develop and implement the 20 percent restoration plan. An excess of potential projects has been identified and evaluated for implementation. Many of these projects are currently under design or shelved at strategic milestones that will enable them to be reactivated if needed to fill gaps.

F. Assessment of Controls

MDOT SHA and ten other municipalities in Maryland have been conducting discharge characterization monitoring since the early 1990s. From this expansive monitoring, a statewide database has been developed that includes hundreds of storms across numerous land uses. Analyses of this dataset and other research performed nationally effectively characterize stormwater runoff in Maryland for NPDES municipal stormwater purposes. To build on the existing information and to better track progress toward meeting TMDLs, better data are needed on ESD performance and BMP efficiencies and effectiveness.

Assessment of controls is critical for determining the effectiveness of the NPDES stormwater management program and progress toward improving water quality. SHA shall use chemical, biological, and physical monitoring to assess watershed restoration efforts, document BMP effectiveness, or calibrate water quality models for showing progress toward meeting any applicable WLAs developed under EPA approved TMDLs identified above. Additionally, SHA shall propose a stream monitoring site to assess the implementation of the latest version of the 2000 Maryland Stormwater Design Manual.

F.1 Watershed Restoration Assessment

MDOT SHA is required to continue monitoring in the Montgomery County Seneca Creek watershed, or, select and submit for MDE's approval a new watershed restoration project for monitoring. Monitoring activities shall occur where the cumulative effects of watershed restoration activities can be assessed. One outfall and an associated in-stream station, or other locations based on a study design approved by MDE, shall be monitored. The minimum criteria for chemical, biological, and physical monitoring are as follows:

a) Chemical Monitoring:

i) Twelve (12) storm events shall be monitored per year at each monitoring location with at least three occurring per quarter. Quarters shall be based on the calendar year. If extended dry weather periods occur, baseflow samples shall be taken at least once per month at the monitoring stations if flow is observed;

ii) Discrete samples of stormwater flow shall be collected at the monitoring stations using automated or manual sampling methods. Measurements of pH and water temperature shall be taken;

iii) At least three (3) samples determined to be representative of each storm event shall be submitted to a laboratory for analysis according to methods listed under 40 CFR Part 136 and event mean concentrations (EMC) shall be calculated for:

1. *Biochemical Oxygen Demand*
2. *Total Kjeldahl Nitrogen (TKN)*
3. *Nitrate plus Nitrite*
4. *Total Suspended Solids*
5. *Petroleum Hydrocarbons (TPH)*
6. *E. coli or enterococcus*
7. *Total Lead*
8. *Total Copper*
9. *Total Zinc*
10. *Total Phosphorus*
11. *Hardness*

iv) Continuous flow measurements shall be recorded at the in-stream monitoring station or other practical locations based on the approved study design. Data collected shall be used to estimate annual and seasonal pollutant loads and reductions, and for the calibration of watershed assessment models. Pollutant load estimates shall be reported according to any EPA approved TMDLs with stormwater WLAs.

b) *Biological Monitoring:*

   i) *Benthic macroinvertebrate samples shall be gathered each Spring between the outfall and in-stream stations or other practical locations based on an MDE approved study design; and*

   ii) *SHA shall use the EPA Rapid Bioassessment Protocols (RBP), Maryland Biological Stream Survey (MBSS), or other similar method approved by MDE.*

c) *Physical Monitoring:*

   i) *A geomorphologic stream assessment shall be conducted between the outfall and in-stream monitoring locations or in a reasonable area based on the approved study design. This assessment shall include an annual comparison of permanently monumented stream channel cross-sections and the stream profile;*

   ii) *A stream habitat assessment shall be conducted using techniques defined by the EPA's RBP, MBSS, or other similar method approved by MDE; and*

   iii) *A hydrologic and/or hydraulic model shall be used (e.g., TR-20, HEC-2, HEC-RAS, HSPF, SWMM, etc.) in the fourth year of the permit to analyze the effects of rainfall; discharge rates; stage; and, if necessary, continuous flow on channel geometry.*

d) *Annual Data Submittal:*

   i) *EMCs submitted on MDE's long-term monitoring database as specified in PART V below;*

   ii) *Chemical, biological, and physical monitoring results and a combined analysis for the approved monitoring locations; and*

   iii) *Any requests and accompanying justifications for proposed modifications to the monitoring program*

Stream Restoration at Little Catoctin Creek Watershed

Notice to proceed on the Stream Restoration of Little Catoctin Creek at MD 340 – Frederick County Project (MDOT SHA contract number FR5975182) was issued on January 2, 2018. Construction activities were initiated in February 2018 and the project was substantially completed by April 15, 2019.

Over the past year MDOT SHA implemented the monitoring plan by continuing to monitor chemical, biological, and physical conditions. Monitoring efforts during the first year through December 2017 represent baseline pre-restoration conditions; while monitoring efforts from January 2018 through March 2019 represent construction phase conditions. Monitoring efforts conducted after April 15, 2019 represent post-construction conditions.

This reporting period includes results from both construction and post-construction monitoring phases, which are discussed in detail within **Appendix F** of this annual report. Pre-construction monitoring, which falls under phases CHEM 1, BIO 1, and PHYS 1, was completed and reported previously in the FY18 MS4 annual report. The construction phase monitoring began in January 2018 and falls under phase CHEM 2. As noted in the MDE approved monitoring plan, biological monitoring (BIO 2) and physical monitoring (PHYS 2) were not to be performed during the construction phase. Post-construction monitoring, which falls under phases CHEM 3, BIO 3, and PHYS 3, began April 15, 2019.

CHEM 2 includes data for stage, discharge, velocity, continuous water quality measurements, and discrete water quality measurements. BIO 3 includes post-construction monitoring of benthic invertebrates exclusively because fish and stream habitat assessments were performed in July of 2019 (FY20 reporting period) and will consequently be included in the FY20 MS4 annual report. PHYS 3 includes geomorphic assessments to establish a baseline for the post-restoration project area. This assessment was performed at six cross sections throughout the study area, including reaches upstream and downstream of the project limits. The cross-sections were monumented for future reference and comparison. Longitudinal profiles were also established upstream and downstream of each cross-section from riffle crest to riffle crest at a minimum of 60 feet.

Record Setting Rainfall

Precipitation across the region has been at historic levels during this reporting year, making site access and storm sampling difficult, not only due to the de-commissioning of the upstream gage (see section below) but due to lacking adequate dry periods between subsequent sampleable storms. Too frequent precipitation events restrict which storm events can qualify for permit sampling and can also fundamentally alter dynamics and transport in the river system. For example, increased river flows due to atypical climatic factors can cause a greater export of in-stream constituents in the stream load, but also lead to greater concentrations of constituents mobilized by greater runoff and stream energy.

According to the National Weather Service Climate Survey provided for Martinsburg West Virginia (the closest location with a Climate Summary available), annual precipitation from January 1st to July 29th, 2019 totaled 28.84 inches, nearly a 6-inch greater departure than the long-term (1981-2010) normal and 5.9 inches greater than last year at this time (NWS 2019).

Historic runoff and streamflow averages and deviation are calculated by the United States Geologic Survey for both hydrologic regions and individual long-term gages across the United States. Regional analyses of the 2018 Water Year (Oct 1, 2017 – Sept 31, 2018), the most recently computed, indicate that Central Maryland, where Little Catoctin Creek is located, had runoff in the >90th percentile of long-term data (see **Figure 27**). This data indicates WY2018 was greater than 90% of historical conditions, since calculations began in 1901, and show how atypical the observed high stream flows in the region have been.

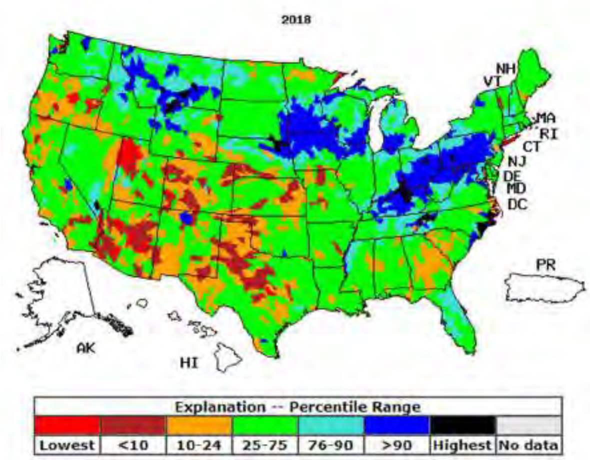


Figure 27: Annual computed runoff long-term percentiles for Water Year 2018 (Oct 2017-Sept 2018), the most recently computed, for the United States of America (USGS 2019).

The nearby USGS gage at Catoctin Creek (USGS 01637500 near Middletown, Maryland), which has been in operation since 1947, provides additional detailed context to the atypical precipitation and flow conditions for this reporting year. In the history of the Catoctin Creek gage, mean annual flows ranged from a minimum of 13.5 cfs to a maximum of 163.5, with a median of 71.5 cfs. For the Water Year 2018, mean annual flow was 128.1 cfs, nearly 80% larger than the long-term median. To date for the 2019 water year, the mean annual flow is currently at 208 cfs, on pace to be the greatest in the 62-year record and nearly triple the long-term median (USGS 2016).

Current and historic observations for Catoctin Creek 01637500 near Middletown, Maryland can be found here:

https://nwis.waterdata.usgs.gov/md/nwis/uv/?site_no=01637500

Gage De-commission During Construction

It is important to note that construction activities within the active floodplain at the upstream portions of Little Catoctin Creek necessitated the removal of the upstream USGS gage 01636845 on January 18, 2019. Gage data collection was offline until May 23, 2019, until all construction-related activities in the vicinity had ceased and stream conditions allowed for the gage and data collection sensors to be reestablished. **Figure 28** shows the newly installed U.S. Geological Survey Site 01636845 following completion of construction.

During the period that the upstream gage was removed from Little Catoctin Creek, discharge data from the downstream gage 01636846 was used to estimate upstream, per the original site design. This gage was located outside of the zone of disturbance during the construction period and did not have to be moved. Since May 23, 2019, the upstream gage 01636845 has been collecting continuous stage, and the stage-discharge rating for calculating real-time discharge is still under development. Once the rating has been completed, a calculated continuous discharge will be back-filled to May 23, 2019 and released onward. At this time, the acoustic doppler velocity meter (ADVM) will be reinstalled at optimal position in the channel based on recurrence to capture storm flow velocities.

F.1.a Chemical Monitoring

In September 2016, the U.S. Geological Survey Site 01636845 (Little Catoctin Creek Near Rosemont, MD; upstream) was established, which included a radar stage sensor and acoustic doppler velocity meter (ADVM) for continuous flow measurements. In December 2016, sondes were installed at both locations to continuously measure water quality data; Temperature, Specific Conductivity, pH, and Turbidity on a 5-minute interval. Both the gage and sensors were de-commissioned during construction from January 18, 2019 through May 23, 2019 (see section above).

Current and historic observations can be found here:

https://nwis.waterdata.usgs.gov/md/nwis/uv/?site_no=01636845

Since the beginning of the record, a total of 82 discharge measurements have been recorded with a range of 0.49 cfs to 307 cfs. Thirty-six discharge measurements have been collected within the 2018-2019 reporting period from July 1, 2018 through June 30, 2019, inclusive of the time when gage instrumentation was decommissioned (see section above), with a range of 2.61 cfs to 307 cfs.

Summary of Upstream Continuous Data

Observed Maximum and Minimum values, with associated dates, obtained from continuous monitoring equipment at station 01636845 for the reporting period July 1, 2018 – June 30, 2019 are below. Summary tables of continuous data for monitoring periods CHEM1, CHEM2, and CHEM 3 are contained in **Appendix F**:

- SPECIFIC CONDUCTANCE: Maximum, 637 µS/cm, November 15, 2018; minimum, 64 µS/cm, August 22, 2018.
- WATER TEMPERATURE: Maximum, 88.2°F, July 03, 2018; minimum, 32.4°F, on January 11, 2019.
- pH: Maximum 9.2* standard units, April 09, 2019; minimum, 6.9* standard units, May 05, 2019
- TURBIDITY: Maximum, 2140 FNU, May 24, 2019; minimum, 0.8 FNU, October 7, 2018

- MEAN VELOCITY: Maximum, 2.95 feet per second, August 12, 2018*; minimum, ICE -0.64 feet per second, on August 09, 2018*.

** Provisional data*
ICE = Flow at Station affected by ice

Figure 28: Newly installed U.S. Geological Survey Site 01636845 (Little Catoctin Creek Near Rosemont, MD; Upstream)

Downstream Monitoring; USGS Gage 01636846

In December 2016, U.S. Geological Survey Site 01636846 (Little Catoctin Creek at Rosemont, MD; downstream) was established and instrumented with an ADVM to measure stream velocity. In September 2017, continuous monitoring at USGS site 01636846 was expanded to include continuous measures of stage for the computation of discharge by way of a bubbler-style unit. Current and historic observations can be found here:

https://nwis.waterdata.usgs.gov/md/nwis/uv/?site_no=01636846

Since the installation of monitoring equipment at this location, 52 direct discharge measurements have been recorded with a range of 0.45 cfs to 108 cfs. An indirect peak discharge measurement for May 15, 2019 indicated a peak flow of 9630 cfs. Twenty-six discharge measurements have been collected within the 2018-2019 reporting period from July 1, 2018 – June 30, 2019 with a range of 1.97 cfs to 40.1 cfs.

Summary of Downstream 2018-19 Continuous Data

Observed Maximum and Minimum values, with associated dates, obtained from continuous monitoring equipment at station 01636846 for the reporting period July 1, 2018 – June 30, 2019 are below. Summary tables of continuous data for monitoring periods CHEM1, CHEM2, and CHEM 3 are contained in **Appendix F**:

- SPECIFIC CONDUCTANCE: Maximum, 869 µS/cm, February 21, 2019; minimum, 74 µS/cm, August 22, 2018.
- WATER TEMPERATURE: Maximum, 89.4°F, June 27, 2019; minimum, ICE -32.4°F, on January 21, 2019*.
- pH: Maximum, 9.2* standard units, May 09, 2019; minimum, 6.9* standard units, May 05, 2019
- TURBIDITY: Maximum, 2170 FNU, May 10, 2019; minimum, 2.3 FNU, August 19, 2018
- MEAN VELOCITY: Maximum, 7.13 feet per second, October 23, 2018*; minimum, -1 feet per second, on October 13, 2018*.

** Provisional data*
ICE = Flow at Station affected by ice

Summary of Discrete Water Quality Sampling

From the period of June 2, 2018 through June 29, 2019, a total of 15 storm sample sets and 5 low-flow samples were collected upstream at 01636845 and 17 storm sample sets and 5 low-flow samples were collected downstream at

01636846. Samples have been analyzed for nutrients, metals, VOC's, bacteria, and 5-day biological oxygen demand. Upon completion of analyses, results are loaded into the U.S. Geological Survey's National Water Information Service (NWIS) and are available online here:

https://www.waterqualitydata.us/

For site 01636845, data are also available online here:

https://waterdata.usgs.gov/nwis/uv?format=gif_default&site_no=01636845

For site 01636846, data are also available online here:

https://waterdata.usgs.gov/nwis/uv?format=gif_default&site_no=01636846

Chemical monitoring methods, monitoring plan site map, and monitoring results can be found in **Appendix F**, **Section 3**.

F.1.b Biological Monitoring

Three stream reaches were identified for biological monitoring and are located within the restoration project area, upstream of the project area (control reach), and downstream of the project reach. Two sites were allocated at each reach and, when possible, coincide with the physical and chemical monitoring locations. A supplemental site (PRFR-107) was included in the control reach to capture a small tributary, although only for benthic macroinvertebrate sampling.

All the biological sampling and associated physical habitat monitoring was performed by Maryland Department of Natural Resources using the Maryland Biological Stream Survey (MBSS) sampling protocols. As specified in the MDE approved monitoring plan, no biological data were collected during the construction phase (BIO 2).

Post-construction biological monitoring (BIO 3) was performed shortly after construction was completed. Benthic macroinvertebrate samples were collected from all seven biological sampling locations on April 24th and 25th of 2019. Biological monitoring of fish assemblages and physical habitat conditions was not performed until July of 2019; therefore, results of those assessments will be reported in FY20.

Biological monitoring methods, monitoring plan site map, monitoring results, photo log of sampling locations, and a discussion of next steps can be found in **Appendix F**, **Section 4**.

F.1.c Physical Monitoring

Physical monitoring began by setting a baseline for observing geomorphic changes in channel cross section and profile to determine energy/friction slope through the observed cross section (both in water surface elevations and riffle-to-riffle), and bed material. Monumented cross sections were established and surveyed along with longitudinal profiles. Wolman pebble counts were also performed at each site. Photo documentation and field notes are kept along with the recorded data.

Post-construction phase cross-section and profile surveys were conducted in June 2019 to establish baseline conditions at three new locations within the reconstructed floodplain at Little Catoctin. Additionally, surveys were performed at three monumented cross-sections established in 2017. The monumented cross-sections established in 2017 are all located outside of the reconstructed floodplain.

The post-construction channel most closely resembles a Rosgen 'DA' channel with very low banks and access to the floodplain at a less than bankfull discharge. The evolution of the restored channel will be evaluated as post-construction monitoring continues in the coming years (see **Figure 29**). Further discussion can be found in **Appendix F**, **Section 5**.

Figure 29: Post-construction channel at Section P-2 of the Physical Monitoring Locations

Preliminary findings of the physical monitoring, including comparisons of the cross-section data collected in 2019 with the topographical surveys performed in 2015, 2017, and 2018 can be found in **Appendix F**, **Section F**.

F.1.d Annual Data Submittal

Pre-restoration chemical, biological, and physical monitoring was completed at Little Catoctin Creek in FY18. Chemical monitoring during construction, as well as post-restoration monitoring was performed in FY19. MDOT SHA has prepared an implementation document, included with this annual report as **Appendix F**. This appendix describes in detail these monitoring activities. In the MS4 geodatabase submitted with this FY19 MS4 annual report, MDOT SHA has provided the monitoring program information in the following feature classes and tables.

- Monitoring Site feature class (MSI)
- Monitoring Drainage Area feature class (MDA)
- Chemical Monitoring table (CHE)
- Biological Monitoring (BIO)

F.2 Stormwater Management Assessment

MDOT SHA is required to select a site to monitor, develop a monitoring plan, and submit for MDE's approval within 1 year of permit issuance for determining the effectiveness of stormwater management practices for stream channel protection as implemented under the latest stormwater regulations. Physical stream monitoring protocols shall include:

a) An annual stream profile and survey of permanently monumented cross-sections at the approved monitoring site to evaluate channel stability in conjunction with surrounding and on-going development;
b) A comparison of the annual stream profile and survey of the permanently monumented cross-sections with baseline conditions for assessing areas of aggradation and degradation; and
c) A hydrologic and/or hydraulic model shall be used (e.g., TR-20, HEC-2, HEC- RAS, HSPF, SWMM, etc.) in the fourth year of the permit to analyze the effects of rainfall; discharge rates; stage; and, if necessary, continuous flow on channel geometry.

I-70 at Marriottsville Road in Little Patuxent River Watershed

On August 30, 2017, MDE granted MDOT SHA conditional approval to conduct ESD monitoring at this site contingent upon MDOT SHA submitting a revised monitoring plan to MDE that includes the combined plan with Howard County and TR-20 results for the existing and proposed conditions with and without proposed BMPs at the I-70/ Marriottsville Interchange as well as with and without all BMPs in the watershed. In response, MDOT SHA included an updated assessment of controls monitoring plan in the FY17 MS4 annual report fulfilling these requirements. MDE provided approval of the revised monitoring plan on September 19, 2018.

In order to meet this permit condition, MDOT SHA has initiated monitoring along I-70 at the Marriottsville Road bridge in Howard County.

MDOT SHA has proposed stormwater controls along I-70 within the Marriottsville Road interchange and include: two grass swales, three bioswales, and one bioretention. Additionally, Howard County has proposed additional stormwater controls on a bridge replacement and road widening project on Marriottsville Road crossing over I-70 and include: two bioswales, and a micro-bioretention. All facilities are located within the Little Patuxent River (LPR) watershed (see **Figure 30**).

MDOT SHA has been coordinating with Howard County to include the design and construction of the MDOT SHA proposed BMPs into the County's bridge replacement project. Including the proposed MDOT SHA BMPs into the County project has several benefits, including lower overall design and construction costs and physical impacts to the BMPs by the bridge construction are avoided.

MDOT SHA has executed a Project Task Agreement (PTA) with the County, which details the responsibilities of both parties (including design, permitting, construction of the BMPs, maintenance, funding, credit, and data sharing). The construction schedule of the MDOT SHA BMPs is dependent on the County's bridge replacement project schedule as follows:

- Design and permitting of the MDOT SHA BMPs and bridge replacement project: Completed in 2021, and
- Construction: Start in summer 2021 and End in fall 2023 (2-year duration).

As a result of the longer than anticipated County schedule, no post-construction monitoring will occur within this permit term.

MDOT SHA has been implementing the monitoring plan by establishing baseline physical stream conditions to evaluate channel stability in conjunction with surrounding and on-going development. MDOT SHA has prepared an implementation document, included with this annual report as **Appendix G**. This appendix describes in detail these monitoring activities.

This reporting period includes results of Year 1 and 2 pre-construction monitoring, and baseline monitoring results are discussed in detail within **Appendix G** of this annual report. Physical stream monitoring includes a geomorphic assessment to establish a baseline for channel stability downstream of the project area. This assessment was performed at two permanently monumented cross sections located below the MDOT SHA ROW outfall. The cross-sections were monumented for future reference and comparison.

A longitudinal profile reach is also downstream of the outfall, which contains both cross section locations. Wolman pebble counts were performed at both cross-section locations and were used in the sediment mobility assessment.

F.2.a Annual Physical Monitoring

Physical monitoring began by setting a baseline for observing geomorphic changes in the channel cross-section and profile site to evaluate channel stability in conjunction with surrounding and on-going development. Two monumented cross-sections were established and surveyed along with a longitudinal profile reach and Wolman pebble counts at each cross-section location. Photo documentation and field notes are kept along with the recorded data. The cross-sections and profile reach were initially established and surveyed on June 13, 2018. In FY19, the cross-sections and profiles were re-surveyed on July 26, 2018 and September 11, 2019 following significant rain events (i.e., greater than 1.5 inches of rain in a 24-hour period) and again on June 20, 2019 to measure changes on an annual timescale.

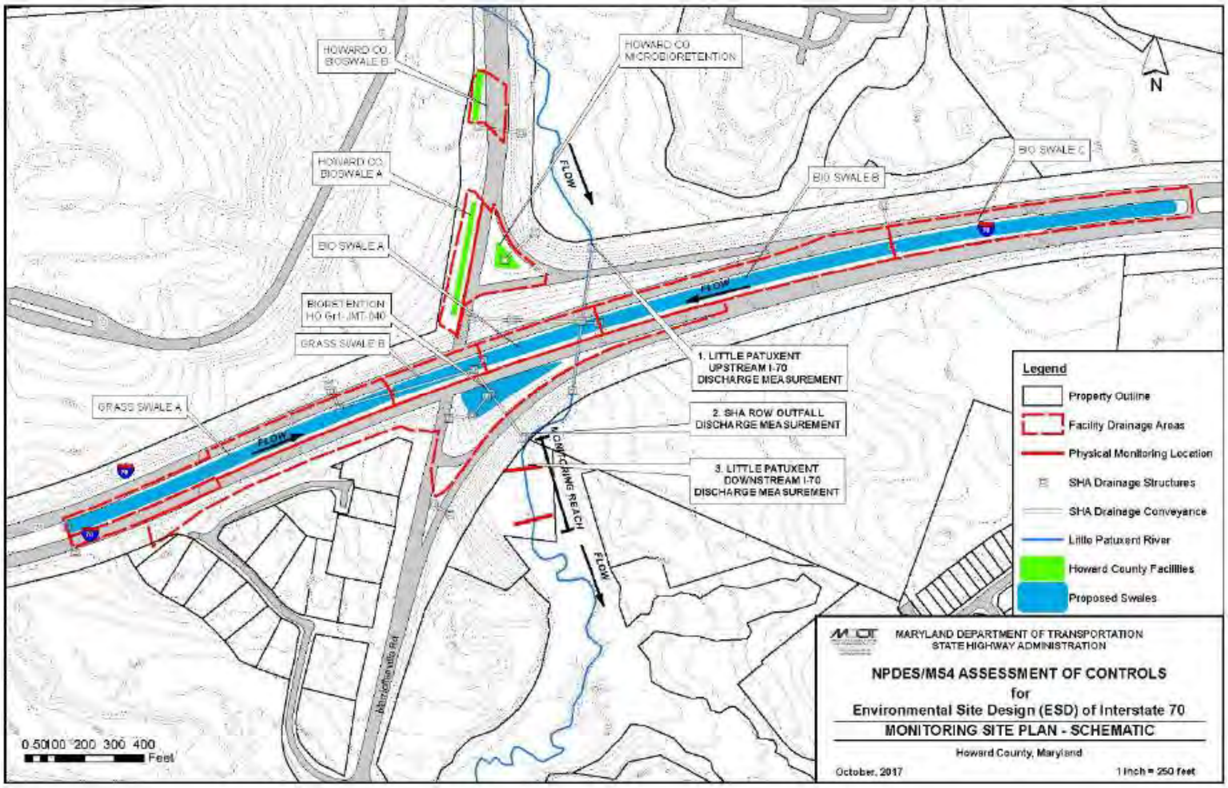


Figure 30: MDOT SHA and HO County ESD Facilities and Monitoring Sites

F.2.b Monitoring Comparisons and Reporting

The monitoring efforts during the first two years represent baseline conditions. A more thorough analysis of baseline, pre-construction conditions can be found in **Appendix G**. A comparison of the annual stream profile and survey of the permanently monumented cross-sections with baseline conditions for assessing areas of aggradation and degradation will occur after construction has been completed.

F.2.c Discharge Monitoring

MDOT SHA has opted to conduct additional continuous flow monitoring at three locations, as well as rainfall gauging on site to analyze the effects of rainfall, discharge rates, stage, and continuous flow on channel geometry given that the hydrologic and/or hydraulic modeling will not be performed until the final year of post-construction monitoring. Flow Station 1 is the northern-most monitoring location and is located upstream of the other continuous flow monitoring sites and I-70 at a double box culvert. Flow Station 2 is located at the outfall of the proposed infiltration facilities (includes discharge from the median bioswales). Flow Station 3 is located at the receiving Little Patuxent River stream channel (assessment reach) downstream of I-70. Flow gauging devices and data loggers were installed in early June 2018; thus, discharge data presented in the FY18 report was limited. Year 2 discharge has been ongoing since July 1, 2018 and is being used to further develop the baseline conditions. A more thorough analysis of baseline discharge conditions can be found in **Appendix G**.

G. Program Funding

The MS4 permit requires a fiscal analysis of capital and operations expenditure and budgets as well as watershed protection and restoration funds generated through stormwater fees or other means. MDOT SHA does not impose stormwater fees or generate funding for watershed protection and restoration outside of the State Transportation Trust Fund. This permit condition also requires that adequate program funding be made available to ensure compliance for the next fiscal year. Funding needs to meet all the permit requirements are split between capital and operations funding as described below.

Capital Funding

Capital funds are programmed to meet the needs of the MS4 program. MDOT SHA currently maintains adequate capacity in architectural/engineering consultant contracts to support these activities.

Operations and Maintenance Funding

Operations and maintenance funds are budgeted for routine maintenance of structural stormwater control structures, street sweeping, inlet cleaning, chemical application and winter deicing training, and other activities to foster minimization, litter removal, and education. As restoration practices increase, enhancements to the operations budget are sought through the legislature.

Delivered Data

In the MS4 geodatabase submitted with this FY19 MS4 annual report, MDOT SHA has provided the fiscal program information in the Fiscal Analyses table (FIS). These values are also summarized in **Table 28** below. The FIS table includes a mandatory field for watershed protection and restoration funds generated for the current fiscal year. Since MDOT SHA does not generate these funds, this field is not applicable.

Table 28: MS4 Funding Budget and Expenditures

Fund	FY19 Expenditures (Millions)	FY20 Budget (Millions)*
Fund 82 – TMDL/MS4	$81.3	$90.0
Fund 74 – Drainage	$20.3	$9.1
Fund 49 – Industrial	$0.8	$0.2
Operations/ Maintenance	$11.4	$14.0
Totals	$113.8	$113.3
*Note Funding numbers are rounded to nearest $0.1 Million		

Appendix A

Non-Functioning BMP Accounting Protocol - 2019 Revision

Appendix A

Non-Functioning BMP Accounting Protocol – 2019 Revision

MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

Non-Functioning BMP Accounting Protocol

Revised - October 2019

MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

TABLE OF CONTENTS

1 Introduction

This document describes the Maryland Department of Transportation State Highway Administration (MDOT SHA) procedure for handling best management practice (BMP) inspection, maintenance, and repair timeframes relative to Municipal Separate Storm Sewer System (MS4) permit requirements. The MDE (2014) guidance document for wasteload and impervious accounting for the MS4 permit stipulates 3-year inspection and maintenance be provided for all BMPs used for impervious baseline treatment, impervious restoration credit, and TMDL pollutant load reductions. Field inspections provide assessment of the BMP functionality that apply an industry standardized grading system to indicate whether the BMP has passed or failed, but determination of how to proceed with addressing need for maintenance or repairs is not clear. Differing levels of maintenance or repair and timelines associated will vary widely based on the type of failure. A second level of assessments is necessary to make the determination as to the exact type of repairs or maintenance needed, scheduling, work order development and assignments, contracting mechanisms, permitting, and priority. This protocol does not deal with this maintenance and repair assessment process.

The question this protocol answers concerns timelines related to BMPs that are determined to be non-functioning or failing and managing retention or removal of the MS4 restoration or pollutant load credits associated with that facility. It is recognized that different timelines are necessary depending upon the type of failure. If MDOT SHA can demonstrate they are adhering to the necessary timeframe for the type of failure; the baseline treatment, restoration credit, or pollutant load reductions will be retained. This protocol focuses on timeframes in the inspection cycle when a facility is determined to be failed, leeway for performing maintenance or repair assessments, and timeframes for completing maintenance or repairs before the MS4 credit will be temporarily or permanently lost.

2 Inspect and Maintain

The MDE MS4 Accounting Guidance (MDE, 2014) addresses urban BMP inspections and maintenance in several areas:

> *<u>Reporting and Maintenance</u>: NPDES stormwater permits require that a database be maintained of all stormwater BMPs implemented for new development, redevelopment, and restoration. The urban BMP database structure is outlined in Appendix B. Data for TMDL and impervious acre credits will be noted for each BMP. The database also contains information regarding inspection and maintenance. Regular maintenance shall occur for all BMPs once every 3 years and each jurisdiction shall implement appropriate actions to document that any deficiencies are rectified. Otherwise the credits will be removed until proper performance is verified. Therefore, proper reporting and ongoing BMP inspection and maintenance are essential for compliance with NPDES permit requirements.* (MDE, 2014, page 3 and 18)
>
> *BMPs where plans, design specifications and complete maintenance records are not available are not considered to provide acceptable water quality treatment. Impervious areas draining to these structures must count toward the baseline.* (MDE, 2014, page 7)

> *A comprehensive BMP inventory is required of all local stormwater programs and shall include updated information on inspection and maintenance activities.* (MDE, 2014, page 7)

> *BMP Maintenance and Verification: All BMPs must be verified, inspected, and maintained according to State stormwater management regulations and CBP reporting and verification procedures. According to Code of Maryland Regulations (COMAR) for stormwater management, preventative maintenance of all ESD and structural stormwater management measures is required to ensure proper function. Regular inspections shall occur once every 3 years and each jurisdiction shall implement appropriate actions and document that any deficiencies are rectified. The BMP database (see Appendix B) will need to specify the last inspection date and whether the facilities have been properly maintained. A 'failed' designation assigned to any BMP indicates that the facility is not functioning as designed. This is described in the BMP Implementation and Restoration Credit section of this document.* (MDE. 2014, pages 7-8)

> *In the 2014 memo to the CBP's Urban Stormwater Workgroup, "Final Recommended Guidance for Verification of Urban Stormwater BMPs," Schueler and Goulet emphasize the need for regular inspection and maintenance. This will ensure that BMPs perform as designed. In order for BMPs to qualify for pollutant removal rates and to take credit toward the Chesapeake Bay TMDL, the information in the BMP Implementation and Restoration Credit section of this document must be provided.* (MDE, 2014, page 8)

> *Successful restoration requires that BMPs function properly to ensure that the expected water quality improvements are achieved. Therefore, BMP inspection and routine maintenance need to be conducted in order for MS4 jurisdictions to claim credit. Further, to receive proper credit toward the Chesapeake Bay TMDL, MDE will need to report BMP data using CBP approved rates, reporting procedures, and BMP verification requirements (Schueler and Goulet, 2014a). Otherwise, the credits will be removed until proper performance is verified. Therefore, BMP inspection, maintenance, and verification are essential for compliance with NPDES permit requirements. MDE will evaluate permit compliance based on the success of implementation and ongoing maintenance and whether these activities are performed to MEP.* (MDE, 2014, page 25)

3 PROCEDURE FOR NON-FUNCTIONING BMPS

MDOT SHA uses many practices to manage stormwater for new development, redevelopment, and restoration needs. Practices can include both operational activities such as inlet cleaning or street sweeping as well as built practices referenced in the MDE (2014) guidance such as:

- SW Control Structures
- SW Control Structure Retrofits
- Urban Tree Planting (Reforestation on Pervious Urban)
- Stream Restoration
- Outfall Stabilization

- Pavement Removal (Impervious Urban to Pervious)
- Shoreline Management.

All BMPs used for MS4 credit are subject to the 3-year inspection and maintenance requirement. MDOT-SHA has undertaken a robust BMP inspection program using qualified stormwater professionals to inspect and document the BMP condition. Grades are assigned by the inspector defining the functional level provided by the BMP and whether it is providing water quality (WQ) treatment. Because there is a maintenance, repair, or remediation timeframe that needs to be factored in when handling BMPs with failed inspection grades, MS4 credit will not be removed from MS4 compliance accounting immediately after a failed grade is determined. BMPs may fail to varying degrees. Some may require major maintenance activities to bring it to functionality, some may require minor repairs or reconstruction, and some may require complete, structural overhaul. Because the timeframes associated with these degrees also vary, MDOT SHA uses different approaches to determine how the documented WQ treatment is handled. It may be kept in the dataset or it may need to be temporarily or permanently removed from the dataset and MS4 credit accounting.

Table 1 documents the timeframes and inspection and maintenance assessment scenarios MDOT SHA applies when managing MS4 credit accounting relative to non-functioning (FAIL) inspection grades and scheduled maintenance or repairs performed to return a given facility back to acceptable function (PASS). There are five different scenarios identified and documented.

*Table 1: MDE PASS/FAIL** Reporting and Credit Accounting Based on Field Inspection Grades and Follow Up Maintenance Activity*

Inspection Scenario	Year 1	Year 3	Year 6	Scheduled Remediation Completion Date	Actual Remediation Completion Date
1	**PASS**– WQ treatment kept in reported data.	**FAIL –** Initial field inspection yields failed grade; WQ treatment kept in reported data. Maintenance assessment performed before next inspection cycle.	**PASS** – Minor remediation or major maintenance needed and performed within 3-year timeframe. WQ treatment kept in reported data.		
2	**PASS**– WQ treatment kept in reported data.	**FAIL --** Initial field inspection yields failed grade; WQ treatment kept in reported data. Maintenance assessment performed before next inspection cycle.	**FAIL --** Major remediation needed. Maintenance/remediation schedule provided to MDE; WQ treatment kept in reported data.	**PASS** – Remediation/maintenance completed on schedule; WQ treatment kept in reported data.	
3	**PASS**– WQ treatment kept in reported data.	**FAIL --** Initial field inspection yields failed grade; WQ treatment kept in reported data. Maintenance assessment performed before next inspection cycle.	**FAIL --** Major remediation needed. Maintenance/remediation schedule provided to MDE; WQ treatment kept in reported data.	**FAIL** – Remediation/maintenance *not* completed on schedule; WQ treatment temporarily removed from reported MS4 credit.	**PASS** – Remediation/maintenance completed; WQ treatment added back into reported data/reported MS4 credit.
4	**PASS**– WQ treatment kept in reported data.	**PASS**– Initial field inspection yields passing grade but subsequent maintenance assessment determines that the facility is not providing WQ functions and should be considered failed.	**FAIL –** Grade changed during Maintenance assessment. Maintenance/remediation schedule provided to MDE; WQ treatment kept in reported data.	**PASS** – Remediation/maintenance completed on schedule; WQ treatment kept in reported data.	
5	**PASS**– WQ treatment kept in reported data.	**FAIL --** Initial field inspection yields failing grade; WQ treatment kept in reported data. Maintenance assessment performed before next inspection cycle.	**FAIL** – Due to various considerations, facility determined to be abandoned. WQ treatment permanently removed from reported data and reported MS4 credit.		

*** **PASS** or **FAIL** designation (capitalized, emboldened text above) corresponds to the associated rating provided in MDOT SHA MS4 annual reports under Section D.1.d.*

4 REFERENCES

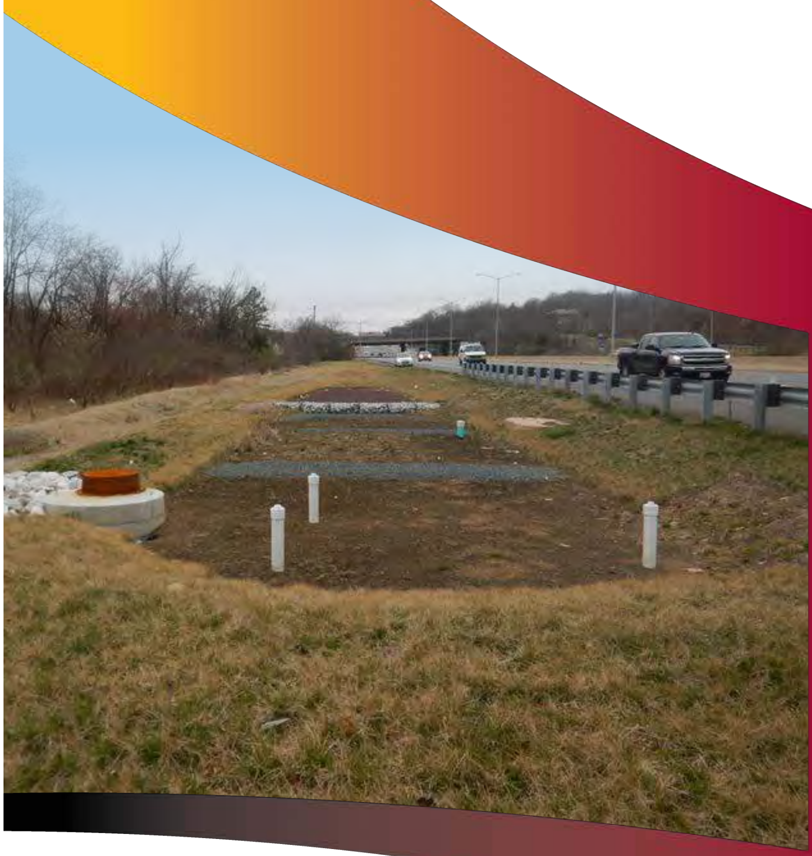
Maryland Department of the Environment (MDE, 2009). Maryland Stormwater Design Manual, Volumes I & II. MDE, Baltimore MD, 2000, Updated 2009. https://mde.maryland.gov/programs/water/stormwatermanagementprogram/pages/stormwater_design.aspx

Maryland Department of the Environment (MDE, 2014). *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, Guidance for National Pollutant Discharge Elimination System Stormwater Permits*. MDE, Baltimore, MD, August 2014. Retrieved from http://www.mde.state.md.us/programs/Water/StormwaterManagementProgram/Documents/NPDES%20MS4%20Guidance%20August%2018%202014.pdf

Maryland Department of the Environment (MDE, 2015). *NPDES MS4 Phase I Permit for Maryland State Highway Administration*. MDE, Baltimore, MD, October 9, 2015. Retrieved from http://www.mde.state.md.us/programs/Water/StormwaterManagementProgram/SedimentandStormwaterHome/Documents/SHA%20Final%20Permit%20complete%2010_9_2015.pdf

Appendix B

Appendix B



MDOT SHA Impervious Restoration and Coordinated TMDL Implementation Plan, Part II - 2019 Revision

Appendix B

MDOT SHA Impervious Restoration and Coordinated TMDL Implementation Plan, Part II – 2019 Revision

MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

II. IMPERVIOUS RESTORATION PLAN AND CHESAPEAKE BAY TMDL COMPLIANCE

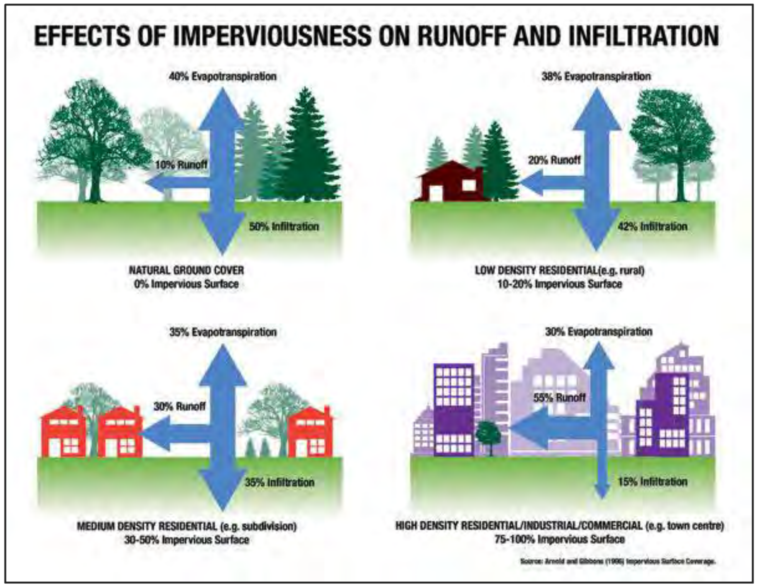


Figure 2-1: Effects of Imperviousness on Runoff and Infiltration
(Source: EPA, 2016)

A. URBANIZATION AND IMPERVIOUS SURFACE RESTORATION

Urbanization increases paved surfaces and decreases areas where rainfall can seep into the ground. This results in increased volumes and frequency of stormwater runoff because more water flows from impervious surfaces that had previously infiltrated into the ground (see **Figure 2-1**). Along with this runoff come pollutants including trash, organic debris, and sediments that are picked up along the way. Often, urban runoff flows directly to waterways without being detained and treated to minimize pollutant discharges or to allow infiltration. By requiring MS4 jurisdictions to treat a portion of their existing impervious surfaces, EPA and MDE are seeking to offset increases in runoff and pollutant loading from past development. This will improve conditions in the waterways where these areas drain.

Park and Rides

Urban Interstates

Rural Interstates

Collector Roads

Rest Areas

Maintenance Shops/Offices

Figure 2-2: MDOT SHA Typical Impervious Surfaces

SHA owns and operates impervious surfaces in the form of interstate highways, arterial and collector roads, park and rides, rest areas, maintenance shops, material storage facilities, and offices. Examples of MDOT SHA impervious surfaces are shown in **Figure 2-2**.

MDOT SHA MS4 Permit Requirements

This part of the plan details MDOT SHA compliance for impervious restoration. Wording detailing this requirement taken from **Part III.E.2.a** of the MDOT SHA MS4 permit is copied below. Full wording from the permit for **Part III.E. Restoration Plans and TMDLs**, is included in **Part I, Program Introduction**.

Restoration Plans (Permit Part III.E.2.a)

Within one year of permit issuance, SHA shall submit an impervious surface area assessment consistent with the methods described in the MDE document "Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, Guidance for National Pollutant Discharge Elimination System Stormwater Permits" (MDE, August 2014 or subsequent versions). Upon approval by MDE, this impervious surface area assessment shall serve as the baseline for the restoration efforts required in this permit.

By the end of this permit term, SHA shall commence and complete the implementation of restoration efforts for twenty percent of SHA's impervious surface area consistent with the methodology described in the MDE document cited in PART III.E.2.a. that has not already been restored to the MEP. Equivalent acres restored of impervious surfaces, through new retrofits or the retrofit of pre-2002 structural BMPs, shall be based upon the treatment of the WQv criteria and associated list of practices defined in the 2000 Maryland Stormwater Design Manual. For alternate BMPs, the basis for calculation of equivalent impervious acres restored is based upon the pollutant loads from forested cover.

By complying with the 20 percent impervious restoration requirement, MDOT SHA will also be accomplishing its part in restoring the Chesapeake Bay (Bay). The Bay TMDL was issued in December 2010 and Maryland issued its WIP I that same month (see **Part I, Program Introduction** for additional discussion). Wording from the MDOT SHA MS4 permit relating the 20 percent restoration requirement to Chesapeake Bay restoration is copied below.

Chesapeake Bay Restoration by 2025 (Permit Part VI.A)

A Chesapeake Bay TMDL has been developed by the EPA for the six Bay States (Delaware, Maryland, New York, Pennsylvania, Virginia, and West Virginia) and the District of Columbia. The TMDL describes the level of effort that will be necessary for meeting water quality criteria and restoring the Chesapeake Bay. This permit is requiring compliance with the Chesapeake Bay TMDL through the use of a strategy that calls for the restoration of twenty percent of previously developed impervious land with little or no controls within this five year permit term as described in Maryland's Watershed Implementation Plan. The TMDL is an aggregate of nonpoint sources or the load allocations (LA), and point sources or WLAs, and a margin of safety. The State is required to issue NPDES permits to point source discharges that are consistent with the assumptions of any applicable TMDL, including those approved subsequent to permit issuance.

Urban stormwater is defined in the CWA as a point source discharge and will subsequently be a part of Maryland's Chesapeake Bay WLA. The NPDES stormwater permits can play a significant role in regulating pollutants from Maryland's urban sector and in the development of Chesapeake Bay

Watershed Implementation Plans. Therefore, Maryland's NPDES stormwater permits issued to SHA and other municipalities will require coordination with MDE's Watershed Implementation Plan and be used as the regulatory backbone for controlling urban pollutants toward meeting the Chesapeake Bay TMDL by 2025.

B. IMPERVIOUS AREA ASSESSMENT

An inventory of impervious surfaces (in acres) currently owned by MDOT SHA within the MS4 areas and an assessment to quantify those impervious surfaces that receive runoff treatment was performed. This inventory and assessment was used to compute the untreated impervious baseline acreage against which the 20 percent impervious restoration requirement was computed. This restoration must be completed by the permit expiration date of October 8, 2020.

MDOT SHA and MDE have coordinated to arrive at the MDE-approved baseline impervious area assessment that is applied to the current MS4 permit compliance as follows:

- MDOT SHA owns 25,663.5 acres of impervious surfaces within the MS4 areas.
- Treated impervious surfaces total 2,558.7 acres.
- Untreated impervious surfaces total 23,104.8 acres (25,663.5 minus 2,558.7). This is the untreated surface baseline.
- 4,621 acres of impervious surfaces (23,104.8 multiplied by 0.2) is the 20 percent impervious restoration requirement.

Procedures and methods used by MDOT SHA to derive key elements of this assessment are discussed in the following sections.

B.1. Impervious Surface Inventory

An inventory of MDOT SHA-owned impervious surfaces was conducted by producing a planning-level ROW GIS layer demarcating MDOT SHA-owned property and an impervious surface layer. The ROW layer was produced by extracting data from the MDP Property View GIS product and refining it with property boundary data from other sources such as recorded plats and ROW GIS data from other agencies. The ROW layer was then edited to contain only those surfaces within the MS4 areas.

The impervious surface layer was produced using high-resolution aerial imagery consistent with the baseline dates listed in **Table 2-1a**. The layer was generated using the Feature Analyst toolset within GIS, along with desktop review and calibration, to produce polygons from the aerial imagery. This layer was then intersected with the ROW layer to create a GIS layer representing MDOT SHA impervious surfaces within MS4 areas.

Table 2-1a: Impervious Baseline Dates by County

County	Basline Date
Anne Arundel	12/31/2005
Baltimore	12/31/2005
Carroll	12/31/2005
Cecil	12/31/2005
Charles	12/31/2004
Fredrick	12/31/2005
Harford	12/31/2004
Howard	12/31/2002
Montgomery	12/31/2004
Prince George's	12/31/2005
Washington	12/31/2005
City of Salisbury (Wicomico)	12/31/2006

B.2.Baseline Runoff Treatment Assessment

According to MDE direction, stormwater control structures and alternative BMPs that were built (and are currently in functioning condition) prior to the previous MDOT SHA MS4 permit term expiration date of October 21, 2010 can be applied to the baseline treatment. A database of existing MDOT SHA-owned stormwater control structures, conveyances, and drainage areas was developed by MDOT SHA under the previous MS4 permit database development, tracking and reporting requirement and was used to identify BMPs to be used in this accounting.

BMP Verification and Functionality

MDE requires that all BMPs be verified, inspected, and maintained per State stormwater management regulations to ensure proper function for WQ treatment. Before being included in the MDOT SHA baseline assessment of facilities providing runoff treatment, data associated with these practices were evaluated to ensure they meet requirements for inspection, maintenance and functionality. MDOT SHA has undertaken a robust stormwater control structure (SW BMP) inspection program using qualified stormwater professionals to inspect and document the SW BMP condition. Ratings are used to determine the functional level provided by the SW BMP which indicates whether the SW BMP is providing WQ treatment. A failed rating indicates that the SW BMP is not providing WQ treatment.

SW BMPs may fail to varying degrees. Some may require major maintenance activities to bring it to functionality, some may require minor reconstruction, and some may require complete, structural overhaul. Because the timeframes associated with these degrees also vary, MDOT SHA developed a Non-Functioning BMP Protocol to document procedures for handling BMPs that fail to varying degrees. This protocol can be found in the MDOT SHA FY19 MS4 annual report as Appendix A.

Documenting WQv

MDE also requires documentation including plans, design specifications, and complete maintenance records in order to claim baseline or restoration credit. For baseline facilities, MDOT SHA has evaluated its records for existing stormwater control structures to determine if adequate documentation exists to demonstrate water quality treatment levels provided. In cases where records were not located, an analysis was performed using field surveys and accepted engineering computational standards to determine water quality treatment levels used in the baseline assessment. Documentation was produced to accompany these analyses and support runoff treatment assigned to these facilities. All documentation supporting treatment assessment are filed and associated with database records.

Impervious Disconnection

MDE allows removing impervious surfaces from the treatment requirement for areas that are considered to be “disconnected” from storm drain systems because they drain to open areas or channels. One method to employ this concept is the use of open section roads with swales that meet the grass swale criteria provided by MDE (2009a) (MDE, 2014a). An open section road is one where stormwater is not conveyed by closed storm drain systems but instead drains to open channels. MDOT SHA developed the *Existing Water Quality Grass Swale Identification Protocol* to document criteria used to evaluate existing open channels or ditches that meet these criteria. This protocol was initially approved by MDE on April 16, 2013 and was recently revised and approved by MDE on May 18, 2016. It is available on the MDOT SHA website.

An extensive inventory was undertaken within the MS4 areas along MDOT SHA ROW and open section roadways to identify, document, field verify, and place open channels that qualify for this treatment credit into the MDOT SHA database. These open channels are considered to be structural stormwater controls and will be inspected according to the three-year requirement for other practices.

Redevelopment Treatment

Redevelopment credit and pavement removal associated with new roadway improvement projects can be counted towards the MDOT SHA baseline assessment and restoration treatment provided (discussed in the following **Section C**). Redevelopment is a requirement of past and present stormwater regulations that currently requires 50 percent of existing impervious surfaces within a site development area to be included in the water quality volume calculations used in determining the stormwater management needs of the project. The existing impervious areas that receive runoff treatment or are removed as a result of new roadway improvement projects are credited towards restoration at the rate allowable based on the *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* guidelines.

Cross-Jurisdictional Treatment

This analysis looks at overlaps in baseline treatment or restoration credit with adjacent Phase I MS4 entities and resolves them for the MDOT SHA data and impervious baseline accounting. MDE has directed the MS4 community that the MS4 entity directly treating SW runoff can claim the impervious area against their baseline or restoration accounting and the MS4 that owns the impervious area can remove the area from their baseline untreated accounting.

Cross-jurisdictional treatment is defined as areas of MDOT SHA owned impervious surfaces that are treated by another jurisdiction's restoration or baseline SW BMP. The MDOT SHA impervious surfaces were evaluated, classified, and determined to be treated for baseline accounting if the other jurisdiction's BMPs meet the following criteria:

- Provides water quality treatment,
- Implementation status is 'Complete' or 'Under Construction',
- Passing inspection record,
- Treats MDOT SHA impervious surfaces, and
- Rainfall treated (Pe) value is greater than zero.

Figure 2-3: GIS Analysis of Impervious Accounting Categories

Figure 2-3 illustrates a GIS analysis of MDOT SHA roadways and stormwater control structures to determine impervious runoff treatment. The blue lines designate drainage areas associated with stormwater control structures. The yellow areas are MDOT SHA impervious surfaces draining to control structures and considered treated. The red areas are MDOT SHA impervious surfaces that are not draining to control structures or qualifying open channels and are considered untreated. The green areas are impervious surfaces outside of MDOT SHA ROW and not owned by MDOT SHA. Although these off-site areas fall within the drainage areas of MDOT SHA structural stormwater controls, it was the practice in the past for MDOT SHA to treat only water quality volumes associated with MDOT SHA roadways and allow the volumes associated with these offsite areas to bypass the water quality treatment components of structural stormwater controls. Therefore, for the baseline development, these off-site areas are not included as MDOT SHA runoff treatment provided.

C. IMPERVIOUS RESTORATION PLAN

MDOT SHA and MDE determined 4,621 acres of existing impervious surfaces must be retrofitted for runoff treatment or offset by alternative practices by October 8, 2020.

C.1. MEP Treatment Standard

In compliance with the CWA, the MS4 permit requires the use of structural stormwater controls or alternate practices to reduce the discharge of pollutants from MDOT SHA storm sewer systems to the MEP. The MEP standard for impervious restoration projects is treatment of the WQv. The WQv is defined as the storage needed to capture and treat runoff from 90% of the average annual rainfall and is equal to 1 inch in the Eastern Rainfall Zone (east of Frederick County) and 0.9 inch in the Western Rainfall Zone (west of and including Frederick County) in Maryland (MDE, 2009a).

MDE allows for pro-rating of the treatment credit for practices that cannot meet the WQv. This means that if a facility treats less than the WQv, the credit will be reduced and if the facility treats more, the credit will be increased. For MDE-provided rates for reduction and increase, see MDE (2014a), *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, Section III - BMP Implementation and Restoration Credits*.

MDE recognizes that not all restoration can be accomplished through the use to structural stormwater controls. Therefore, MDE has developed a list of alternative practices that are acceptable to offset the impacts of impervious surfaces in the areas they are constructed. These alternative practices are assigned impervious treatment equivalencies that can be used to determine the amount of impervious surfaces that are considered treated by these practices (see Table 7 in *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated*, MDE, 2014a, and MDE *Stream Restoration Crediting Clarification for MS4 Permitting Purposes* dated 4/30/2019).

C.2. Restoration Treatment Strategy

MDOT SHA is implementing a combination of built practices, maintenance activities, and redevelopment credit which are included in **Tables 2-2a-g** located at the end of this part starting on page 2-11. Each entry includes location information and impervious acres treated. **Figure 2-5** illustrates the mix of practices proposed and the amount of impervious restoration to be accomplished by each practice type. For BMP sites identified in FY20 and FY21 the locations are known however the impervous acreage treatment of the BMP are estimated according to the construction plans. The majority of the BMPs that are scheduled to be completed in FY20 and FY21 are currently under construction and the estimated credit associated with the projects are highly accurate. Descriptions of the built and annual activity practices are included in **Part I.F. Restoration Practices**.

On April 30, 2019 MDE issued a memorandum “Stream Restoration Crediting Clarification for MS4 Permitting Purposes” which increased the planning rates for stream restoration and impervious acre equivalents. After implementing this memorandum to current and future projects, MDOT SHA now anticipates to exceed the restoration goal of 4,621 acres and now estimates impervious restoration credit to be approximately 9,960 acres.

Figure 2-4 illustrates the current MDOT SHA impervious restoration plan by State fiscal year (FY). The State FY is from July 1 to June 30. For each FY over the permit duration, a certain number of practices have been or will be built including tree planting, pavement removal, new stormwater control structures, retrofit stormwater control structures, stream restoration and outfall stabilization. Although it appears from the graph that restoration efforts will continue beyond the 2020 deadline into FY 2021, the deadline of October 8, 2020 falls within the first quarter of FY 2021.

Figure 2-4 also includes maintenance activities such as inlet cleaning, storm drain cleaning, and street sweeping, which will be increased during the permit term to meet its ultimate impervious credit acreage goal as shown in **Table 2-2a**. Moving forward, redevelopment credit will be assessed for restoration credit as new roadway projects are built.

Progress Reporting and Adaptive Management

Annual reports will be submitted to MDE that will document progress in meeting proposed restoration credit benchmarks. Each report will include a database and written description of compliance measures. If benchmarks are not being met, both the Bay TMDL and the MDE MS4 permit allow for adjustments in the plan to ensure restoration goals are met. MDE (2014a) explains this adaptive management concept as follows:

> *With respect to permit compliance, MS4 jurisdictions are required to continuously re-evaluate, fine tune and adjust restoration efforts when established benchmarks cannot be met. Remaining on schedule to accomplish all permit conditions while continuously looking for opportunities to improve these efforts becomes a delicate balance. MS4 jurisdictions should carefully identify any delays in implementation schedules and provide a remedial action plan for current and future projects in order to facilitate restoration and improve program implementation. MDE will consider the level of restoration achieved and compare to implementation schedules and required benchmarks to determine compliance with permit requirements.* (p. 25)

MDOT SHA has made adjustments to this plan as needed and will continue to provide an update on the total acres of impervious restoration credit achieved in each MS4 annual report.

Urban BMP Placement

As stated in **Part I.E.2. Urban Sector Focus,** a focus on urban areas is required with a minimum of half of the 20 percent restoration requirement accomplished with practices on MDOT SHA ROW or with practices that are located within urban land uses if placed off MDOT SHA ROW. MDOT SHA has prepared a best management practice (BMP) placement protocol to outline this approach to locating BMPs for impervious treatment credit. Baseline practices do not have to comply with these criteria.

C.3. Restoration Viewer

MDOT SHA developed a website with an interactive map that the public can use to follow implementation progress and to explore projects in their area and throughout the eleven MS4 counties. The MDOT SHA Bay Restoration Viewer can be found at the link:

www.roads.maryland.gov/index.aspx?PageId=714

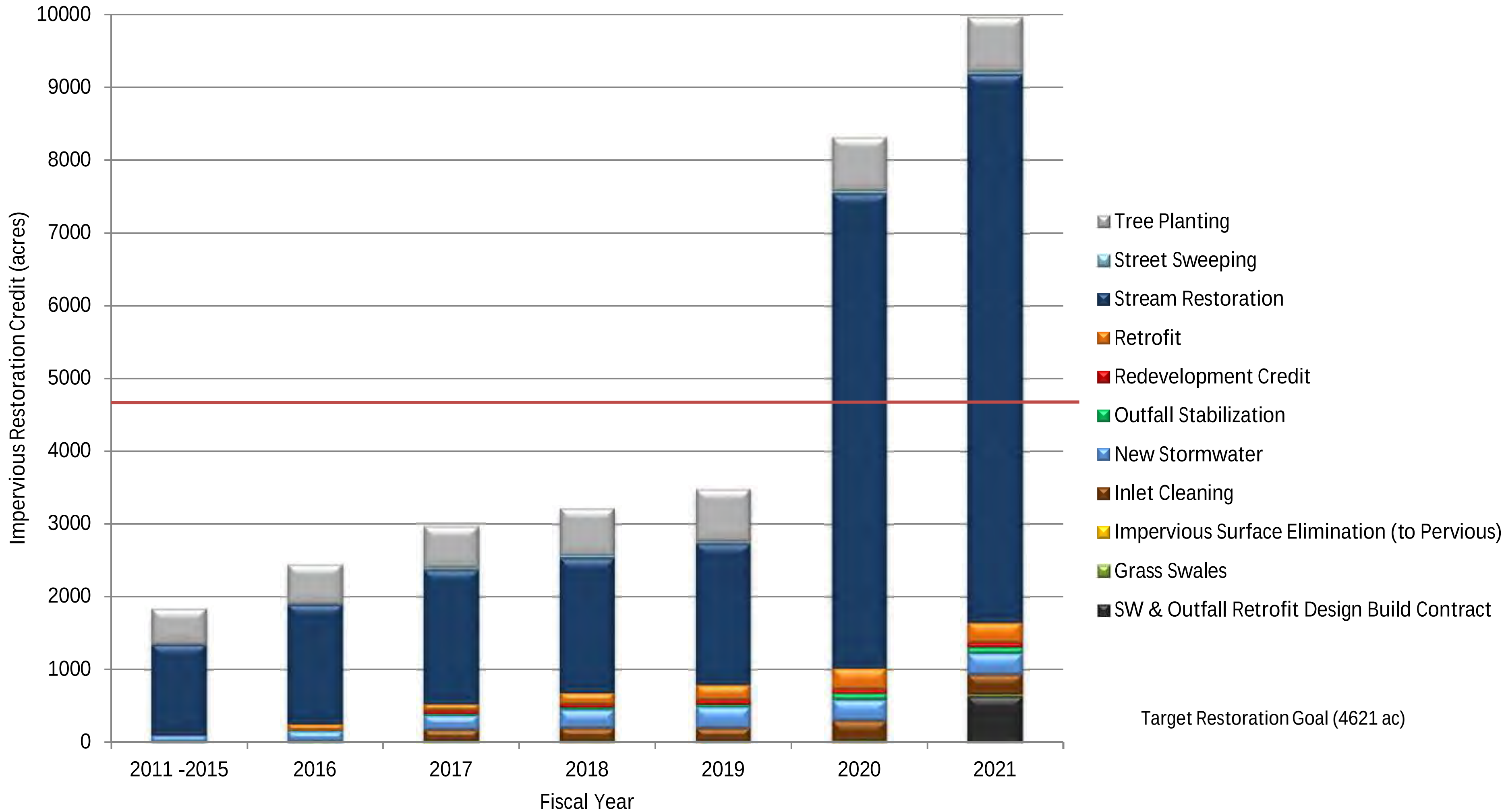


Figure 2-4: Cumulative Restoration Plan by Fiscal Year with Practice Menu

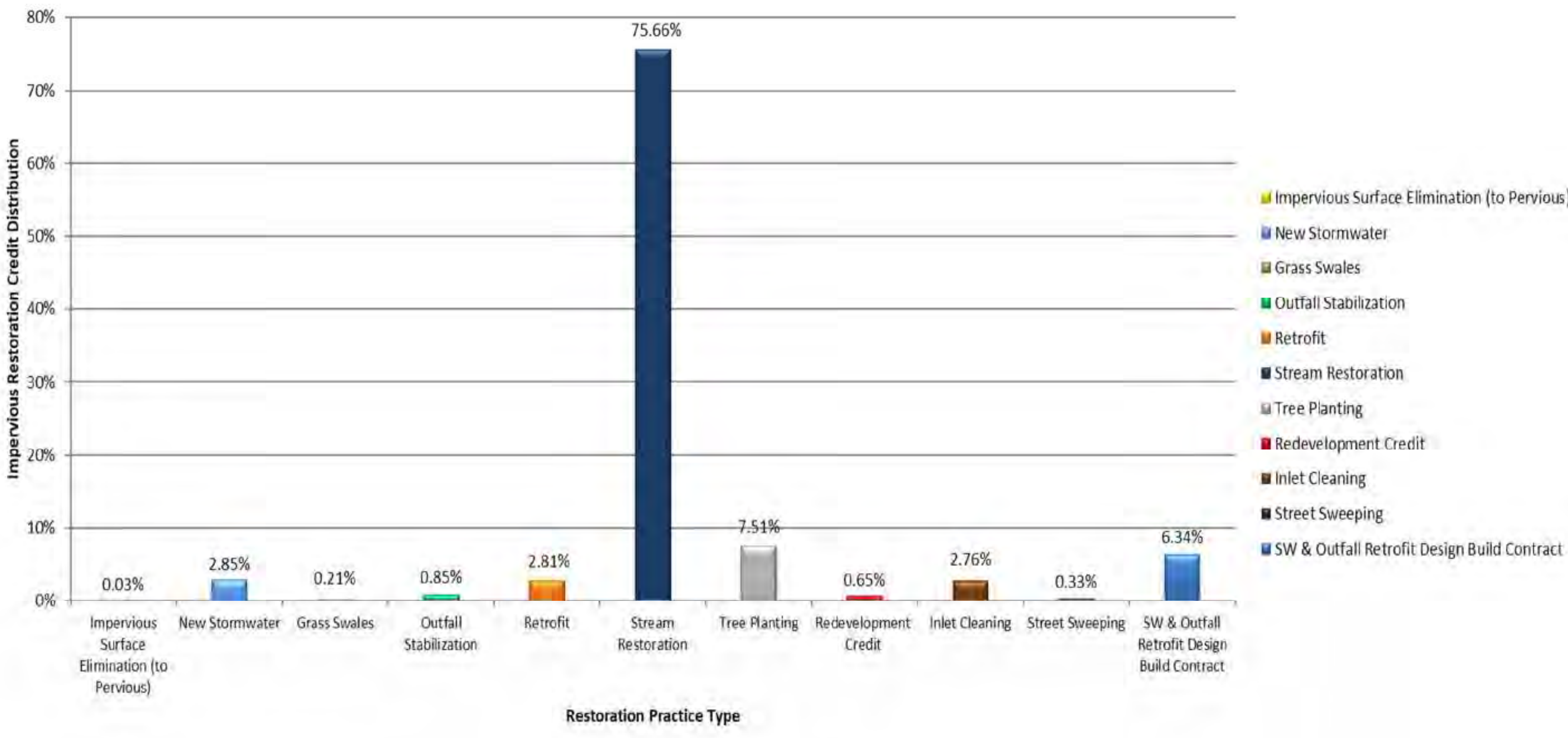


Figure 2-5: Percent of Restoration Treatment Accomplished by Practice Type

D. SCHEDULE AND FUNDING

In order to meet the 20 percent impervious restoration requirement by October 8, 2020, a specific number of acres has been planned for treatment each year. **Table 2-1** shows the projected percentages of impervious treatment, projected percent progress towards the 20% restoration goal, and actual funding for FY11 to FY19 and the projected funding for FY20 and FY21. The impervious treatment acres by fiscal year were determined based on the 20 percent restoration goal for 2020 and based on completed projects and preliminary planning efforts that assessed the feasibility of implementing various restoration strategies, along with the associated project design and construction schedules. Projected funding was determined based on the estimated costs to implement each strategy specific project over the permit term.

These funding projections are consistent with the Maryland Department of Transportation (MDOT) Consolidated Transportation Program (CTP) for FY 2016 to FY 2021, which is Maryland's six-year capital budget for transportation projects. In addition, the projected funding also accounts for operational activities.

Table 2-1: Percentage of Impervious Treatment by Fiscal Year & Funding Allocations 2011-2021

Year (Fiscal)	Projected Percentage of Impervious Treatment Acres	Projected Percent Progress Toward Restoration Goal	Funding Projection/Expenditures by Fiscal Year* (Millions)
2011-15	4%	20%	$96
2016	6%	30%	$53
2017	8%	40%	$64
2018	9%	45%	$79
2019	10%	50%	$113
2020	19%	95%	$113
2021	20%	100%	$69

** Funding Projections for FY 2011 –-2019 are based on actual expenditures.*

E. COMPREHENSIVE LIST OF RESTORATION PRACTICES

Tables 2-2a through **2-2g** below provide a comprehensive list of annual operations practices, and completed, programmed and planned built impervious restoration practices broken down by year. Each table entry includes location information and estimated impervious runoff treatment acreage. This list is based on preliminary baseline impervious estimates. Projects and information listed are subject to change and may be modified due to unforeseen circumstances.

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH12ALN000003	Stream Restoration	Anacostia River	02140205	159559.85	402146.09	60.78
SH12ALN000013	Stream Restoration	Anacostia River	02140205	159559.47	397321.50	180.33
SH12ALN000018	Stream Restoration	Little Patuxent River	02131105	164274.84	418585.79	59.19
SH12ALN000029	Stream Restoration	Little Patuxent River	02131105	174235.63	416127.26	31.32
SH13ALN000005	Stream Restoration	Anacostia River	02140205	160042.82	401413.54	16.38
SH13ALN000007	Stream Restoration	Anacostia River	02140205	158520.42	401822.08	83.67
SH13ALN000014	Stream Restoration	Rock Creek	02140206	163439.62	386982.29	145.62
SH13ALN000017	Stream Restoration	Deer Creek	02120202	221430.99	441003.14	34.80
SH13ALN000032	Stream Restoration	Seneca Creek	02140208	170966.32	383824.12	119.73
SH14ALN000008	Stream Restoration	Anacostia River	02140205	148865.47	405647.43	129.00
SH14ALN000010	Stream Restoration	Rock Creek	02140206	162449.00	391909.38	87.21
SH15ALN000002	Stream Restoration	Severn River	02131002	159493.48	431938.55	0.00
SH15ALN000004	Stream Restoration	Anacostia River	02140205	158745.99	400685.31	21.36
SH15ALN000006	Stream Restoration	Anacostia River	02140205	158471.35	400379.90	60.42
SH15ALN000009	Stream Restoration	Anacostia River	02140205	151553.44	408448.77	24.18
SH15ALN000015	Stream Restoration	Atkisson Reservoir	02130703	204740.72	456761.66	63.00
SH15ALN000016	Stream Restoration	Little Patuxent River	02131105	177825.43	412849.52	135.00
SH16ALN000011	Stream Restoration	Rock Creek	02140206	160195.12	391644.34	188.76
SH16ALN000012	Stream Restoration	Anacostia River	02140205	157814.56	398261.67	155.13

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16ALN000031	Stream Restoration	South River	02131003	145891.51	438563.02	48.28
SH16ALN000044	Stream Restoration	Patapsco River L N Br	02130906	171819.50	425505.56	6.00
SH17ALN000045	Stream Restoration	Anacostia River	02140205	155213.31	401010.05	99.18
SH17ALN000046	Stream Restoration	Anacostia River	02140205	154518.98	401632.13	91.65
SH18ALN000047	Stream Restoration	Patapsco River L N Br	02130906	173446.15	423202.32	7.14
SH19ALN000050	Stream Restoration	Potomac River FR Cnty	02140301	185918.26	345651.52	91.89
SH15ALN000035	Outfall Stabilization	Severn River	02131002	159509.01	431999.29	7.50
SH17ALN000036	Outfall Stabilization	Piscataway Creek	02140203	112612.86	399955.14	3.55
SH17ALN000037	Outfall Stabilization	Piscataway Creek	02140203	115659.99	400855.96	2.14
SH17ALN000038	Outfall Stabilization	Piscataway Creek	02140203	115358.50	400979.82	1.40
SH17ALN000039	Outfall Stabilization	Piscataway Creek	02140203	111718.18	399211.40	1.93
SH17ALN000041	Outfall Stabilization	Potomac River U tidal	02140201	119836.63	400705.06	1.19
SH17ALN000043	Outfall Stabilization	Potomac River U tidal	02140201	120063.30	400694.64	0.68
SH18ALN000048	Outfall Stabilization	Cabin John Creek	02140207	153942.03	386610.65	9.40
SH19ALN000049	Outfall Stabilization	Bird River	02130803	190518.24	444582.33	7.88
SH16RST130531	FY16 restoration new stormwater BMP project.	Little Patuxent River	02131105	180175.30	409550.06	0.27
SH16RST210197	FY16 restoration new stormwater BMP project.	Conococheague Creek	02140504	220795.58	335320.73	0.32
SH16RST210198	FY16 restoration new stormwater BMP project.	Conococheague Creek	02140504	220795.67	335289.23	0.13
SH16RST210210	FY16 restoration new stormwater BMP project.	Antietam Creek	02140502	220644.66	336627.96	0.07
SH16RST080772	FY16 restoration new stormwater BMP project.	Port Tobacco River	02140109	89210.79	400886.39	0.50
SH16RST130624	FY16 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	171226.26	417921.02	0.30

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16RST130627	FY16 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	170286.93	419819.05	0.49
SH16RST130620	FY16 restoration new stormwater BMP project.	Little Patuxent River	02131105	173822.69	416132.87	0.31
SH16RST100320	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	192635.00	367756.54	0.32
SH16RST100325	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	192128.38	369623.76	0.36
SH16RST100334	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	191731.04	371583.78	0.46
SH16RST100321	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	192534.48	367991.41	0.27
SH16RST100303	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	201009.51	365757.46	0.49
SH16RST100304	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	201176.71	365812.34	0.80
SH16RST100305	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	201659.54	365858.88	1.71
SH16RST100306	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	202272.79	365772.85	0.92
SH16RST100312	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	204428.46	365220.57	0.44
SH16RST100311	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	204140.12	365407.05	0.40
SH16RST100314	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	204760.24	365001.66	0.42
SH16RST130622	FY16 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	172624.90	417183.46	0.29

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16RST100327	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	192114.67	369951.18	0.41
SH16RST100329	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	192053.42	370383.61	0.58
SH16RST100331	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	191941.07	370916.99	0.65
SH16RST100310	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	203719.34	365631.06	1.54
SH16RST100461	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	205217.68	364704.16	0.19
SH16RST100462	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	205705.10	364385.59	0.44
SH16RST100463	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	205947.50	364226.94	0.09
SH16RST100464	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	206436.65	363907.25	0.60
SH16RST100465	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	206582.21	363814.54	0.39
SH16RST100466	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	206957.81	363653.77	0.56
SH16RST100467	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	207162.47	363606.27	0.75
SH16RST100468	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	207707.89	363522.97	0.33
SH16RST100469	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	207999.21	363477.44	1.20
SH16RST100470	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	208846.96	363283.17	0.77

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16RST100471	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	208981.10	363234.59	0.48
SH16RST100472	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	209348.67	363101.05	0.18
SH16RST100473	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	209615.13	363034.12	0.94
SH16RST100474	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	209864.42	363008.48	0.67
SH16RST100475	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	210171.28	363001.52	0.71
SH16RST100476	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	210586.06	362971.93	0.80
SH16RST100477	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	210851.01	362926.60	0.96
SH16RST100299	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	200206.76	365434.87	0.72
SH16RST130621	FY16 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	172649.02	417090.61	0.47
SH16RST130628	FY16 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	170120.36	419969.29	0.31
SH16RST130630	FY16 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	169488.10	420545.38	0.49
SH16RST130625	FY16 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	171105.17	418896.81	0.16
SH16RST100302	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	200988.73	365750.17	0.33
SH16RST100322	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	192158.44	368728.81	0.31

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16RST100324	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	192126.25	369458.11	0.33
SH16RST100333	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	191797.61	371369.28	0.71
SH16RST130619	FY16 restoration new stormwater BMP project.	Little Patuxent River	02131105	174653.91	415973.60	0.57
SH16RST130629	FY16 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	169716.09	420338.72	0.47
SH16RST130631	FY16 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	168362.08	421893.95	0.11
SH16RST130632	FY16 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	168284.53	422009.43	0.29
SH16RST100309	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	203105.06	365745.77	0.32
SH16RST100316	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	205089.04	364787.11	0.45
SH16RST130623	FY16 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	172541.40	417473.10	0.39
SH16RST100313	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	204591.86	365111.42	0.40
SH16RST210194	FY16 restoration new stormwater BMP project.	Conococheague Creek	02140504	220794.46	335950.74	0.30
SH16RST210207	FY16 restoration new stormwater BMP project.	Conococheague Creek	02140504	220710.34	333551.18	0.19
SH16RST210193	FY16 restoration new stormwater BMP project.	Conococheague Creek	02140504	220794.76	335875.16	0.17
SH16RST210195	FY16 restoration new stormwater BMP project.	Conococheague Creek	02140504	220794.95	335856.15	0.07

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16RST210196	FY16 restoration new stormwater BMP project.	Conococheague Creek	02140504	220794.83	335823.63	0.17
SH16RST210206	FY16 restoration new stormwater BMP project.	Conococheague Creek	02140504	220721.33	333577.16	0.19
SH16RST210211	FY16 restoration new stormwater BMP project.	Antietam Creek	02140502	220670.18	336574.38	0.19
SH16RST080760	FY16 restoration new stormwater BMP project.	Zekiah Swamp	02140108	86689.14	401055.08	1.14
SH16RST100301	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	200793.40	365655.99	0.87
SH16RST100300	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	200543.32	365535.83	0.73
SH16RST080777	FY16 restoration new stormwater BMP project.	Port Tobacco River	02140109	89988.54	400961.02	0.82
SH16RST100335	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	191658.07	371808.73	0.81
SH16RST100323	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	192122.92	369225.82	0.62
SH16RST100326	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	192129.66	369734.24	0.68
SH16RST100330	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	192009.34	370656.26	0.68
SH16RST100315	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	204930.84	364890.60	0.33
SH16RST100319	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	192800.98	367365.83	0.24
SH16RST100332	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	191863.47	371166.22	0.53

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16RST100328	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	192090.87	370129.39	0.59
SH16RST080796	FY16 restoration new stormwater BMP project.	Port Tobacco River	02140109	93816.90	401482.79	0.25
SH16RST080767	FY16 restoration new stormwater BMP project.	Port Tobacco River	02140109	88653.78	400832.48	0.26
SH16RST080785	FY16 restoration new stormwater BMP project.	Port Tobacco River	02140109	91280.50	401082.23	0.37
SH16RST080786	FY16 restoration new stormwater BMP project.	Port Tobacco River	02140109	91426.59	401095.18	0.32
SH16RST080788	FY16 restoration new stormwater BMP project.	Port Tobacco River	02140109	91784.39	401130.09	0.37
SH16RST080797	FY16 restoration new stormwater BMP project.	Port Tobacco River	02140109	93982.79	401516.93	0.44
SH16RST080750	FY16 restoration new stormwater BMP project.	Potomac River L tidal	02140101	85092.62	402219.12	0.83
SH16RST080764	FY16 restoration new stormwater BMP project.	Potomac River L tidal	02140101	84679.97	402521.97	0.48
SH16RST080756	FY16 restoration new stormwater BMP project.	Zekiah Swamp	02140108	86048.08	401514.01	0.67
SH16RST080758	FY16 restoration new stormwater BMP project.	Zekiah Swamp	02140108	86385.84	401264.63	0.43
SH16RST100479	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	211082.66	362884.93	0.26
SH16RST100480	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	211245.18	362854.70	0.74
SH16RST100481	FY16 restoration new stormwater BMP project.	Upper Monocacy River	02140303	211565.96	362798.05	0.48

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16RST080500	FY16 restoration new stormwater BMP project.	Potomac River L tidal	02140101	77731.85	403032.12	0.46
SH16RST080510	FY16 restoration new stormwater BMP project.	Wicomico River	02140106	80100.65	403908.93	0.35
SH16RST080780	FY16 restoration new stormwater BMP project.	Port Tobacco River	02140109	90626.90	401018.91	0.96
SH16RST161120	FY16 restoration new stormwater BMP project.	Western Branch	02131103	127811.41	413931.71	1.63
SH16RST161121	FY16 restoration new stormwater BMP project.	Western Branch	02131103	127745.79	414149.29	0.51
SH16RST021225	FY16 restoration new stormwater BMP project.	Severn River	02131002	151842.98	442635.18	0.56
SH16RST021223	FY16 restoration new stormwater BMP project.	Severn River	02131002	151951.44	442565.41	0.58
SH16RST021222	FY16 restoration new stormwater BMP project.	Magothy River	02131001	154321.36	440996.88	0.79
SH16RST021241	FY16 restoration new stormwater BMP project.	Severn River	02131002	150506.45	443494.55	0.65
SH16RST021238	FY16 restoration new stormwater BMP project.	Severn River	02131002	151492.57	442860.99	0.67
SH16RST021239	FY16 restoration new stormwater BMP project.	Severn River	02131002	151179.48	443062.63	0.46
SH16RST021240	FY16 restoration new stormwater BMP project.	Severn River	02131002	150944.66	443213.16	0.46
SH16RST021232	FY16 restoration new stormwater BMP project.	Magothy River	02131001	152368.51	442296.81	0.28
SH16RST021244	FY16 restoration new stormwater BMP project.	Severn River	02131002	150219.44	443679.98	0.33

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16RST021237	FY16 restoration new stormwater BMP project.	Severn River	02131002	151655.89	442755.63	0.29
SH16RST100336	FY16 restoration new stormwater BMP project.	Lower Monocacy River	02140302	191705.24	371775.97	0.35
SH16RST210524	FY17 restoration new stormwater BMP project.	Little Tonoloway Creek	02140509	228593.23	298273.80	0.21
SH16RST210525	FY17 restoration new stormwater BMP project.	Little Tonoloway Creek	02140509	228446.77	298199.85	0.43
SH16RST210526	FY17 restoration new stormwater BMP project.	Little Tonoloway Creek	02140509	228376.61	298169.70	0.14
SH16RST210529	FY17 restoration new stormwater BMP project.	Little Tonoloway Creek	02140509	227999.78	298155.90	0.40
SH16RST210530	FY17 restoration new stormwater BMP project.	Little Tonoloway Creek	02140509	227401.87	298402.23	0.39
SH16RST210533	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	227166.98	298624.00	0.22
SH16RST210545	FY17 restoration new stormwater BMP project.	Tonoloway Creek	02140507	226504.22	300727.85	0.29
SH16RST210548	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	225716.43	301669.13	0.56
SH16RST210549	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	225665.92	301789.80	0.20
SH16RST210550	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	225577.53	302027.27	0.51
SH16RST210551	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	225556.58	302094.94	0.21
SH16RST210552	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	225490.18	302312.56	0.26

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16RST210553	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	225446.49	302483.96	0.23
SH16RST210554	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	225194.40	303222.68	0.25
SH16RST210555	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	225127.58	303358.53	0.25
SH16RST210556	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	225065.86	303557.57	0.22
SH16RST210558	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	224993.29	303940.07	0.25
SH16RST210559	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	224983.49	303928.40	0.34
SH16RST210571	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	219845.64	311222.11	0.05
SH16RST210572	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	219531.17	311616.92	0.83
SH16RST210573	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	218919.06	312099.36	1.23
SH16RST210574	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	218643.32	312305.72	0.09
SH16RST210575	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	219201.85	311903.49	0.86
SH16RST210576	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	224891.36	304340.66	0.77
SH16RST210577	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	224741.74	305001.91	0.67
SH16RST210578	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	224545.74	305569.56	0.58

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16RST210579	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	224452.41	305709.64	0.57
SH16RST210580	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	224132.77	306077.22	0.79
SH16RST210581	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	224071.59	306146.89	0.80
SH16RST210582	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	223936.77	306302.34	0.39
SH16RST210584	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	221907.35	309018.75	0.38
SH16RST210585	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	221791.67	309132.70	0.36
SH16RST210586	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	221762.03	309162.09	0.17
SH16RST210587	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	221681.67	309252.45	0.17
SH16RST210588	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	221660.80	309274.76	0.63
SH16RST210589	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	221466.14	309530.65	0.63
SH17RST030737	FY17 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	200330.36	429190.56	0.44
SH16RST060286	FY17 restoration new stormwater BMP project.	Liberty Reservoir	02130907	213698.54	400413.22	22.76
SH16RST210523	FY17 restoration new stormwater BMP project.	Little Tonoloway Creek	02140509	228765.94	298360.22	0.87
SH16RST210560	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	218259.33	312680.67	0.34

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16RST210562	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	219478.42	311672.02	0.29
SH16RST210565	FY17 restoration new stormwater BMP project.	Licking Creek	02140506	221041.70	310048.77	0.48
SH16RST210566	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	220457.55	310546.17	0.13
SH16RST210567	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	220427.25	310571.21	0.13
SH16RST210568	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	220281.50	310689.12	0.37
SH16RST210569	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	220228.86	310741.82	0.09
SH16RST210590	FY17 restoration new stormwater BMP project.	Potomac River WA Cnty	02140501	221427.42	309586.59	0.43
SH16RST210591	FY17 restoration new stormwater BMP project.	Little Conococheague	02140505	220576.37	320883.86	0.32
SH16RST210592	FY17 restoration new stormwater BMP project.	Little Conococheague	02140505	220567.58	320927.81	0.43
SH16RST210593	FY17 restoration new stormwater BMP project.	Little Conococheague	02140505	220652.12	320528.58	1.48
SH16RST210594	FY17 restoration new stormwater BMP project.	Little Conococheague	02140505	220672.99	320580.07	0.25
SH16RST210595	FY17 restoration new stormwater BMP project.	Conococheague Creek	02140504	217718.04	331505.99	0.52
SH16RST210596	FY17 restoration new stormwater BMP project.	Conococheague Creek	02140504	217590.55	331743.19	0.70
SH16RST210598	FY17 restoration new stormwater BMP project.	Marsh Run	02140503	215600.90	334578.11	0.45

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16RST210599	FY17 restoration new stormwater BMP project.	Marsh Run	02140503	215604.28	334737.50	0.38
SH16RST210600	FY17 restoration new stormwater BMP project.	Marsh Run	02140503	215610.22	335103.04	0.29
SH16RST210601	FY17 restoration new stormwater BMP project.	Marsh Run	02140503	215613.77	335314.43	0.56
SH16RST210602	FY17 restoration new stormwater BMP project.	Marsh Run	02140503	215594.84	335564.54	0.50
SH16RST210603	FY17 restoration new stormwater BMP project.	Marsh Run	02140503	215554.20	335828.13	0.17
SH16RST210604	FY17 restoration new stormwater BMP project.	Marsh Run	02140503	215547.53	335866.99	0.62
SH16RST210605	FY17 restoration new stormwater BMP project.	Marsh Run	02140503	215487.03	336263.77	0.48
SH16RST210606	FY17 restoration new stormwater BMP project.	Antietam Creek	02140502	215466.39	336442.79	0.37
SH16RST210609	FY17 restoration new stormwater BMP project.	Antietam Creek	02140502	214799.22	341473.98	0.36
SH16RST210610	FY17 restoration new stormwater BMP project.	Antietam Creek	02140502	214766.33	341516.53	0.30
SH16RST210612	FY17 restoration new stormwater BMP project.	Antietam Creek	02140502	214882.94	342012.44	1.17
SH16RST210613	FY17 restoration new stormwater BMP project.	Antietam Creek	02140502	214899.05	342259.45	0.27
SH16RST210614	FY17 restoration new stormwater BMP project.	Antietam Creek	02140502	214898.81	342295.07	0.45
SH16RST210615	FY17 restoration new stormwater BMP project.	Antietam Creek	02140502	214877.33	342556.57	0.57

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16RST210616	FY17 restoration new stormwater BMP project.	Antietam Creek	02140502	214347.07	343583.30	0.46
SH16RST210617	FY17 restoration new stormwater BMP project.	Antietam Creek	02140502	213951.60	344067.53	1.07
SH16RST210618	FY17 restoration new stormwater BMP project.	Antietam Creek	02140502	212391.03	345990.28	0.50
SH16RST210619	FY17 restoration new stormwater BMP project.	Antietam Creek	02140502	212212.79	346123.45	0.85
SH17RST161088	FY18 restoration new stormwater BMP project.	Patuxent River upper	02131104	136781.75	424123.71	5.46
SH17RST161089	FY18 restoration new stormwater BMP project.	Western Branch	02131103	127470.59	422687.46	4.45
SH18RST021556	FY18 restoration new stormwater BMP project.	Baltimore Harbor	02130903	170966.30	434819.08	0.35
SH18RST021562	FY18 restoration new stormwater BMP project.	Baltimore Harbor	02130903	169572.03	433859.78	0.26
SH18RST021563	FY18 restoration new stormwater BMP project.	Baltimore Harbor	02130903	169506.53	434086.89	0.13
SH18RST021566	FY18 restoration new stormwater BMP project.	Baltimore Harbor	02130903	171073.71	433993.71	0.57
SH18RST021569	FY18 restoration new stormwater BMP project.	Baltimore Harbor	02130903	170993.96	433645.09	0.86
SH17RST030744	FY18 restoration new stormwater BMP project.	Back River	02130901	185115.81	444184.74	1.16
SH18RST161269	FY18 restoration new stormwater BMP project.	Western Branch	02131103	123802.51	416342.00	0.99
SH18RST161270	FY18 restoration new stormwater BMP project.	Western Branch	02131103	124029.17	416504.44	1.32

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH18RST161271	FY18 restoration new stormwater BMP project.	Western Branch	02131103	123851.12	416987.60	1.05
SH18RST082828	FY18 restoration new stormwater BMP project.	Mattawoman Creek	02140111	99002.84	383696.58	0.59
SH18RST082829	FY18 restoration new stormwater BMP project.	Mattawoman Creek	02140111	98897.90	383855.55	5.08
SH18RST082831	FY18 restoration new stormwater BMP project.	Mattawoman Creek	02140111	98305.52	383839.61	0.13
SH18RST082832	FY18 restoration new stormwater BMP project.	Mattawoman Creek	02140111	98246.30	383642.40	0.25
SH18RST082833	FY18 restoration new stormwater BMP project.	Mattawoman Creek	02140111	98035.42	383850.12	0.25
SH18RST031878	FY18 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	174397.29	425257.06	0.58
SH18RST031877	FY18 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	174468.19	425352.29	1.24
SH18RST031876	FY18 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	174315.05	430278.58	2.47
SH18RST122047	FY18 restoration new stormwater BMP project.	Lower Winters Run	02130702	198446.10	459731.49	0.30
SH18RST070489	FY18 restoration new stormwater BMP project.	Northeast River	02130608	219502.78	489444.19	0.79
SH18RST070484	FY18 restoration new stormwater BMP project.	Northeast River	02130608	224549.80	488241.10	0.36
SH18RST070485	FY18 restoration new stormwater BMP project.	Northeast River	02130608	224608.09	488215.82	0.84
SH18RST070487	FY18 restoration new stormwater BMP project.	Northeast River	02130608	222677.83	489445.31	0.31

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH18RST070490	FY18 restoration new stormwater BMP project.	Little Elk Creek	02130605	216711.43	498926.15	0.39
SH18RST070491	FY18 restoration new stormwater BMP project.	Little Elk Creek	02130605	216767.09	498953.59	0.32
SH18RST070492	FY18 restoration new stormwater BMP project.	Little Elk Creek	02130605	221354.32	498522.18	1.00
SH18RST070493	FY18 restoration new stormwater BMP project.	Northeast River	02130608	223070.11	489221.09	0.12
SH18RST070494	FY18 restoration new stormwater BMP project.	Northeast River	02130608	224329.79	488382.52	0.19
SH18RST070495	FY18 restoration new stormwater BMP project.	Northeast River	02130608	223398.49	489006.90	0.67
SH18RST122227	FY18 restoration new stormwater BMP project.	Bush River	02130701	200968.67	465603.23	0.52
SH18RST122228	FY18 restoration new stormwater BMP project.	Bush River	02130701	200797.73	465719.58	1.03
SH18RST122232	FY18 restoration new stormwater BMP project.	Gunpowder River	02130702	194506.76	459709.12	2.66
SH18RST210961	FY18 restoration new stormwater BMP project.	Little Conococheague	02140505	220799.24	321136.44	0.93
SH18RST210978	FY18 restoration new stormwater BMP project.	Conococheague Creek	02140504	220765.07	335341.72	0.50
SH18RST210979	FY18 restoration new stormwater BMP project.	Conococheague Creek	02140504	220824.56	335469.85	0.43
SH18RST210980	FY18 restoration new stormwater BMP project.	Conococheague Creek	02140504	220692.26	335510.34	0.74
SH18RST210981	FY18 restoration new stormwater BMP project.	Conococheague Creek	02140504	220736.08	335549.31	0.98

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH18RST210982	FY18 restoration new stormwater BMP project.	Conococheague Creek	02140504	220637.99	335565.51	0.41
SH18RST210983	FY18 restoration new stormwater BMP project.	Conococheague Creek	02140504	220578.37	335439.79	0.59
SH18RST031889	FY18 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	173688.35	425585.61	0.45
SH18RST031890	FY18 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	173519.14	425698.07	0.30
SH18RST031891	FY18 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	173321.26	425757.11	0.66
SH18RST031892	FY18 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	173168.50	425761.83	0.37
SH18RST031893	FY18 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	173580.10	425636.41	0.22
SH18RST031901	FY18 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	175324.60	424238.73	0.36
SH18RST031902	FY18 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	175168.44	424603.16	0.48
SH18RST101299	FY18 restoration new stormwater BMP project.	Lower Monocacy River	02140302	190620.48	377584.69	0.53
SH18RST101302	FY18 restoration new stormwater BMP project.	Lower Monocacy River	02140302	190213.92	377573.92	0.43
SH18RST101303	FY18 restoration new stormwater BMP project.	Lower Monocacy River	02140302	190367.67	377882.77	0.36
SH18RST101306	FY18 restoration new stormwater BMP project.	Lower Monocacy River	02140302	186691.36	366411.21	1.35
SH18RST101307	FY18 restoration new stormwater BMP project.	Lower Monocacy River	02140302	195534.30	357955.66	0.90

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH18RST101309	FY18 restoration new stormwater BMP project.	Lower Monocacy River	02140302	186731.92	366403.65	0.68
SH18RST101312	FY18 restoration new stormwater BMP project.	Lower Monocacy River	02140302	195712.46	357824.20	1.25
SH18RST101313	FY18 restoration new stormwater BMP project.	Lower Monocacy River	02140302	190406.67	377309.80	0.75
SH18RST021935	FY18 restoration new stormwater BMP project.	Baltimore Harbor	02130903	169563.85	433959.88	0.27
SH18RST031899	FY18 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	172824.63	425791.14	0.72
SH18RST101701	FY18 restoration new stormwater BMP project.	Lower Monocacy River	02140302	190378.52	377841.65	0.06
SH19RST021568	FY19 restoration new stormwater BMP project.	Baltimore Harbor	02130903	165513.38	434363.58	0.69
SH19RST122226	FY19 restoration new stormwater BMP project.	Bush River	02130701	201412.67	464663.73	0.30
SH19RST122231	FY19 restoration new stormwater BMP project.	Lower Winters Run	02130702	195253.35	459423.16	1.48
SH19RST031897	FY19 restoration new stormwater BMP project.	Lower Gunpowder Falls	02130802	192746.76	437242.65	4.24
SH19RST021564	FY19 restoration new stormwater BMP project.	Baltimore Harbor	02130903	169677.02	434347.16	1.06
SH19RST031866	FY19 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	173800.90	424780.70	0.48
SH19RST031871	FY19 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	174468.19	425352.29	0.62
SH19RST210950	FY19 restoration new stormwater BMP project.	Antietam Creek	02140502	213289.49	345107.00	1.06

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH19RST210969	FY19 restoration new stormwater BMP project.	Conococheague Creek	02140504	221035.31	335891.84	0.55
SH19RST210970	FY19 restoration new stormwater BMP project.	Conococheague Creek	02140504	220929.32	335712.10	0.62
SH19RST031896	FY19 restoration new stormwater BMP project.	Lower Gunpowder Falls	02130802	192662.33	438088.48	1.92
SH19RST031864	FY19 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	175232.74	426857.67	1.13
SH19RST031867	FY19 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	173481.14	424615.92	0.67
SH19RST122230	FY19 restoration new stormwater BMP project.	Lower Winters Run	02130702	195408.68	459399.42	0.19
SH19RST210951	FY19 restoration new stormwater BMP project.	Antietam Creek	02140502	214850.69	341075.15	0.59
SH19RST031895	FY19 restoration new stormwater BMP project.	Lower Gunpowder Falls	02130802	192700.49	437933.63	0.49
SH19RST031868	FY19 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	173260.95	424502.62	0.55
SH19RST031869	FY19 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	174286.59	425130.98	0.43
SH19RST031874	FY19 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	174952.49	426534.81	0.53
SH19RST122225	FY19 restoration new stormwater BMP project.	Bush River	02130701	201737.02	464732.89	0.41
SH19RST210973	FY19 restoration new stormwater BMP project.	Antietam Creek	02140502	220856.42	351605.54	0.60
SH19RST031873	FY19 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	174642.21	425896.03	1.68

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH19RST031875	FY19 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	174761.68	426281.16	0.71
SH19RST031898	FY19 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	193676.58	436111.64	0.36
SH19RST031870	FY19 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	174397.29	425257.06	0.36
SH19RST210955	FY19 restoration new stormwater BMP project.	Antietam Creek	02140502	214907.61	341560.21	2.34
SH19RST210959	FY19 restoration new stormwater BMP project.	Antietam Creek	02140502	215032.45	339130.30	1.19
SH19RST021565	FY19 restoration new stormwater BMP project.	Baltimore Harbor	02130903	165742.05	434213.26	0.64
SH19RST122224	FY19 restoration new stormwater BMP project.	Bush River	02130701	201731.13	464583.96	0.26
SH19RST210972	FY19 restoration new stormwater BMP project.	Antietam Creek	02140502	219621.70	350628.08	0.66
SH19RST031894	FY19 restoration new stormwater BMP project.	Lower Gunpowder Falls	02130802	193351.04	436390.69	0.73
SH19RST031865	FY19 restoration new stormwater BMP project.	Patapsco River L N Br	02130906	174019.42	424907.11	0.91
SH19RST210947	FY19 restoration new stormwater BMP project.	Antietam Creek	02140502	208538.71	347791.37	0.60
SH19RST210948	FY19 restoration new stormwater BMP project.	Antietam Creek	02140502	211669.36	344406.91	1.74
SH19RST210956	FY19 restoration new stormwater BMP project.	Antietam Creek	02140502	214647.08	341516.69	4.78
SH13RST130532	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	179796.16	410173.78	0.46

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH14RST080518	VBY-FY15 restoration new stormwater BMP project.	Zekiah Swamp	02140108	82783.79	403869.60	0.19
SH12RST130536	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	179470.39	410687.90	0.37
SH14RST080515	VBY-FY15 restoration new stormwater BMP project.	Wicomico River	02140106	81433.75	404109.40	0.29
SH13RST150460	VBY-FY15 restoration new stormwater BMP project.	Potomac River MO Cnty	02140202	161618.92	380198.04	0.22
SH13RST130534	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	179574.70	410535.11	0.94
SH13RST080523	VBY-FY15 restoration new stormwater BMP project.	Zekiah Swamp	02140108	84321.53	402786.15	0.21
SH13RST130522	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	181047.34	408211.24	0.73
SH13RST130524	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	180727.51	408640.04	0.48
SH13RST130525	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	180642.51	408781.31	0.41
SH14RST080517	VBY-FY15 restoration new stormwater BMP project.	Wicomico River	02140106	81627.78	404121.22	0.44
SH13RST130520	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	181474.37	407730.20	0.27
SH13RST150444	VBY-FY15 restoration new stormwater BMP project.	Seneca Creek	02140208	163698.25	376625.14	0.16
SH13RST150449	VBY-FY15 restoration new stormwater BMP project.	Potomac River MO Cnty	02140202	161903.11	379810.63	0.23
SH13RST150450	VBY-FY15 restoration new stormwater BMP project.	Potomac River MO Cnty	02140202	161666.04	380112.07	0.22

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13RST150451	VBY-FY15 restoration new stormwater BMP project.	Potomac River MO Cnty	02140202	161227.52	380656.01	0.29
SH13RST130539	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	180760.51	408588.74	0.42
SH13RST070052	VBY-FY15 restoration new stormwater BMP project.	L Susquehanna River	02120201	212093.88	480629.15	0.45
SH13RST070053	VBY-FY15 restoration new stormwater BMP project.	L Susquehanna River	02120201	212245.72	480906.69	1.23
SH13RST150459	VBY-FY15 restoration new stormwater BMP project.	Potomac River MO Cnty	02140202	161976.14	379742.80	0.40
SH13RST080520	VBY-FY15 restoration new stormwater BMP project.	Zekiah Swamp	02140108	83427.72	403444.68	0.26
SH15RST160319	VBY-FY15 restoration new stormwater BMP project.	Western Branch	02131103	138735.97	413043.61	0.74
SH13RST150456	VBY-FY15 restoration new stormwater BMP project.	Seneca Creek	02140208	163305.99	377729.32	0.21
SH14RST160398	VBY-FY15 restoration new stormwater BMP project.	Western Branch	02131103	137028.79	422977.42	0.27
SH13RST030576	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	223730.41	430483.50	0.23
SH13RST030578	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	223195.56	430500.15	1.08
SH13RST150457	VBY-FY15 restoration new stormwater BMP project.	Seneca Creek	02140208	162751.02	378981.42	0.58
SH15RST130576	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	167401.76	412619.98	0.36
SH13RST070087	VBY-FY15 restoration new stormwater BMP project.	Furnace Bay	02130609	213432.35	485011.52	0.27

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13RST030571	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	225350.28	430731.03	0.23
SH14RST160410	VBY-FY15 restoration new stormwater BMP project.	Western Branch	02131103	136964.80	423548.88	0.46
SH14RST160418	VBY-FY15 restoration new stormwater BMP project.	Patuxent River upper	02131104	136697.73	424755.73	0.75
SH14RST030567	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	226214.21	430694.22	0.97
SH15RST021283	VBY-FY15 restoration new stormwater BMP project.	South River	02131003	143800.62	430319.36	0.31
SH14RST160391	VBY-FY15 restoration new stormwater BMP project.	Western Branch	02131103	137279.79	421977.57	0.50
SH14RST160396	VBY-FY15 restoration new stormwater BMP project.	Western Branch	02131103	137104.54	422635.62	0.48
SH14RST160397	VBY-FY15 restoration new stormwater BMP project.	Western Branch	02131103	137044.39	422844.01	0.58
SH14RST160399	VBY-FY15 restoration new stormwater BMP project.	Western Branch	02131103	137019.81	423058.74	0.60
SH14RST160412	VBY-FY15 restoration new stormwater BMP project.	Patuxent River upper	02131104	136869.30	424063.35	0.73
SH14RST160416	VBY-FY15 restoration new stormwater BMP project.	Patuxent River upper	02131104	136724.08	424649.83	0.63
SH14RST082133	VBY-FY15 restoration new stormwater BMP project.	Zekiah Swamp	02140108	98143.97	415819.46	0.65
SH14RST082134	VBY-FY15 restoration new stormwater BMP project.	Zekiah Swamp	02140108	98151.79	415703.28	0.62
SH13RST070072	VBY-FY15 restoration new stormwater BMP project.	L Susquehanna River	02120201	212416.18	481330.73	1.45

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13RST070081	VBY-FY15 restoration new stormwater BMP project.	Furnace Bay	02130609	212933.59	483263.15	0.55
SH13RST070083	VBY-FY15 restoration new stormwater BMP project.	Furnace Bay	02130609	213056.30	483727.66	0.37
SH13RST070086	VBY-FY15 restoration new stormwater BMP project.	Furnace Bay	02130609	213376.86	484875.50	0.69
SH13RST070088	VBY-FY15 restoration new stormwater BMP project.	Furnace Bay	02130609	213487.40	485133.76	0.67
SH13RST082138	VBY-FY15 restoration new stormwater BMP project.	Zekiah Swamp	02140108	99919.44	412104.98	0.25
SH13RST030575	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	224211.38	430463.57	1.04
SH13RST030570	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	225538.47	430780.96	0.12
SH14RST030569	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	225573.27	430790.35	0.25
SH15RST021282	VBY-FY15 restoration new stormwater BMP project.	South River	02131003	144035.62	431432.35	0.67
SH13RST070071	VBY-FY15 restoration new stormwater BMP project.	L Susquehanna River	02120201	212340.69	481127.38	0.21
SH13RST070074	VBY-FY15 restoration new stormwater BMP project.	Furnace Bay	02130609	212672.98	482273.60	0.46
SH15RST021302	VBY-FY15 restoration new stormwater BMP project.	South River	02131003	145267.18	433113.96	0.35
SH13RST030581	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	222214.19	430227.60	0.20
SH13RST070073	VBY-FY15 restoration new stormwater BMP project.	Furnace Bay	02130609	212626.83	482097.77	0.53

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13RST070075	VBY-FY15 restoration new stormwater BMP project.	Furnace Bay	02130609	212717.42	482450.68	0.64
SH13RST070076	VBY-FY15 restoration new stormwater BMP project.	Furnace Bay	02130609	212765.51	482625.19	0.56
SH15RST130568	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	167127.02	413088.88	0.12
SH15RST130570	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	166686.68	413769.28	0.30
SH13RST030573	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	224548.31	430517.05	0.07
SH13RST030574	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	224501.56	430506.45	0.39
SH15RST160827	VBY-FY15 restoration new stormwater BMP project.	Anacostia River	02140205	141967.89	411909.99	0.71
SH15RST160830	VBY-FY15 restoration new stormwater BMP project.	Anacostia River	02140205	143688.99	411674.13	0.73
SH15RST160831	VBY-FY15 restoration new stormwater BMP project.	Anacostia River	02140205	143736.86	411600.62	0.63
SH14RST021338	VBY-FY15 restoration new stormwater BMP project.	Patuxent River middle	02131102	122255.33	429745.51	0.29
SH12RST120320	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	204396.12	456924.06	0.94
SH12RST120310	VBY-FY15 restoration new stormwater BMP project.	Lower Winters Run	02130702	201433.00	458560.49	0.55
SH13RST120335	VBY-FY15 restoration new stormwater BMP project.	Lower Winters Run	02130702	201909.27	458370.75	0.30
SH13RST120341	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	204760.77	456679.18	0.85

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13RST120345	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	206188.96	456114.19	0.73
SH12RST120328	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	205939.62	456348.44	0.41
SH12RST120311	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	202840.89	457925.31	0.28
SH13RST070077	VBY-FY15 restoration new stormwater BMP project.	Furnace Bay	02130609	212876.15	483047.56	1.15
SH15RST021298	VBY-FY15 restoration new stormwater BMP project.	Patuxent River upper	02131104	143168.35	427703.23	0.32
SH15RST021299	VBY-FY15 restoration new stormwater BMP project.	Patuxent River upper	02131104	143219.13	428153.30	0.41
SH15RST021295	VBY-FY15 restoration new stormwater BMP project.	South River	02131003	143927.62	430950.88	0.33
SH14RST082135	VBY-FY15 restoration new stormwater BMP project.	Zekiah Swamp	02140108	98183.96	415303.22	0.43
SH14RST080519	VBY-FY15 restoration new stormwater BMP project.	Zekiah Swamp	02140108	82814.00	403854.66	0.80
SH14RST210203	VBY-FY15 restoration new stormwater BMP project.	Conococheague Creek	02140504	220797.63	334842.39	0.69
SH13RST150452	VBY-FY15 restoration new stormwater BMP project.	Potomac River MO Cnty	02140202	160055.83	381691.03	0.16
SH13RST150446	VBY-FY15 restoration new stormwater BMP project.	Seneca Creek	02140208	163368.38	376963.36	0.23
SH13RST150447	VBY-FY15 restoration new stormwater BMP project.	Seneca Creek	02140208	162646.04	379136.06	0.20
SH13RST150448	VBY-FY15 restoration new stormwater BMP project.	Seneca Creek	02140208	162602.66	379181.23	0.17

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13RST030582	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	221910.75	430129.14	0.19
SH13RST030585	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	221124.45	429854.48	1.24
SH13RST030583	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	221576.82	430020.70	0.22
SH14RST160400	VBY-FY15 restoration new stormwater BMP project.	Western Branch	02131103	136989.61	423327.34	0.91
SH14RST160411	VBY-FY15 restoration new stormwater BMP project.	Western Branch	02131103	136940.73	423730.78	0.73
SH14RST030568	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	225892.52	430805.64	1.30
SH14RST210209	VBY-FY15 restoration new stormwater BMP project.	Antietam Creek	02140502	220624.82	336567.11	0.30
SH13RST150445	VBY-FY15 restoration new stormwater BMP project.	Seneca Creek	02140208	163351.29	377015.54	0.14
SH13RST080522	VBY-FY15 restoration new stormwater BMP project.	Zekiah Swamp	02140108	84190.80	402883.73	0.31
SH12RST130533	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	179755.34	410241.30	0.54
SH14RST210204	VBY-FY15 restoration new stormwater BMP project.	Conococheague Creek	02140504	220802.96	334991.47	0.17
SH13RST080521	VBY-FY15 restoration new stormwater BMP project.	Zekiah Swamp	02140108	83536.72	403365.17	0.45
SH13RST130526	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	180511.31	408996.92	0.35
SH14RST210199	VBY-FY15 restoration new stormwater BMP project.	Conococheague Creek	02140504	220795.84	335444.71	0.29

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH14RST210216	VBY-FY15 restoration new stormwater BMP project.	Conococheague Creek	02140504	220769.23	336282.72	0.28
SH14RST080516	VBY-FY15 restoration new stormwater BMP project.	Wicomico River	02140106	81599.90	404121.02	0.28
SH14RST210201	VBY-FY15 restoration new stormwater BMP project.	Conococheague Creek	02140504	220798.55	335139.91	0.43
SH14RST210202	VBY-FY15 restoration new stormwater BMP project.	Conococheague Creek	02140504	220796.41	335088.75	0.19
SH14RST210208	VBY-FY15 restoration new stormwater BMP project.	Antietam Creek	02140502	220599.55	336612.63	0.04
SH13RST080524	VBY-FY15 restoration new stormwater BMP project.	Zekiah Swamp	02140108	84347.39	402766.66	0.23
SH13RST080525	VBY-FY15 restoration new stormwater BMP project.	Zekiah Swamp	02140108	84458.25	402687.07	0.43
SH13RST070046	VBY-FY15 restoration new stormwater BMP project.	L Susquehanna River	02120201	211893.55	480295.47	0.44
SH14RST210205	VBY-FY15 restoration new stormwater BMP project.	Conococheague Creek	02140504	220789.53	334981.76	0.09
SH15RST130552	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	162955.29	416847.12	0.20
SH15RST130563	VBY-FY15 restoration new stormwater BMP project.	Middle Patuxent River	02131106	169533.07	407176.15	0.12
SH15RST130549	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	163739.21	415817.36	0.95
SH13RST130521	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	181293.82	407932.93	0.42
SH13RST130527	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	180408.84	409166.00	0.51

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13RST130528	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	180294.02	409354.25	0.54
SH13RST130529	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	180258.98	409413.00	0.45
SH13RST130530	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	179885.12	410034.63	0.42
SH14RST160394	VBY-FY15 restoration new stormwater BMP project.	Western Branch	02131103	137232.19	422379.55	0.65
SH13RST030580	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	222504.44	430322.42	0.16
SH13RST070082	VBY-FY15 restoration new stormwater BMP project.	Furnace Bay	02130609	212976.08	483423.79	0.82
SH13RST070084	VBY-FY15 restoration new stormwater BMP project.	Furnace Bay	02130609	213106.90	483915.19	0.74
SH13RST070085	VBY-FY15 restoration new stormwater BMP project.	Furnace Bay	02130609	213225.53	484363.81	0.92
SH13RST082136	VBY-FY15 restoration new stormwater BMP project.	Zekiah Swamp	02140108	98445.53	414223.58	0.52
SH13RST082139	VBY-FY15 restoration new stormwater BMP project.	Zekiah Swamp	02140108	100226.58	412083.09	0.43
SH13RST030587	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	222777.37	430413.60	0.70
SH13RST030572	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	224681.02	430549.92	0.25
SH13RST030577	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	223525.31	430497.28	0.77
SH13RST030584	VBY-FY15 restoration new stormwater BMP project.	Loch Raven Reservoir	02130805	221350.87	429947.27	0.21

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13RST070051	VBY-FY15 restoration new stormwater BMP project.	L Susquehanna River	02120201	211978.26	480432.58	0.44
SH15RST130566	VBY-FY15 restoration new stormwater BMP project.	Middle Patuxent River	02131106	168800.72	408490.03	0.19
SH15RST130569	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	167167.63	413131.81	0.37
SH15RST130571	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	167717.85	411903.93	0.39
SH14RST160390	VBY-FY15 restoration new stormwater BMP project.	Western Branch	02131103	137238.72	421739.59	0.46
SH15RST130572	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	167356.96	412589.27	0.44
SH15RST130574	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	167257.06	412802.04	0.20
SH15RST130564	VBY-FY15 restoration new stormwater BMP project.	Middle Patuxent River	02131106	169201.33	407949.92	0.70
SH15RST130562	VBY-FY15 restoration new stormwater BMP project.	Middle Patuxent River	02131106	169540.01	407156.21	0.05
SH15RST130544	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	166058.41	414372.10	0.31
SH15RST130573	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	167300.11	412709.56	0.20
SH15RST130577	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	167534.16	412331.54	0.31
SH15RST130546	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	164436.07	415332.70	0.49
SH15RST130555	VBY-FY15 restoration new stormwater BMP project.	Middle Patuxent River	02131106	168280.54	410582.88	0.64

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH15RST130557	VBY-FY15 restoration new stormwater BMP project.	Middle Patuxent River	02131106	170929.03	405252.66	0.29
SH15RST130559	VBY-FY15 restoration new stormwater BMP project.	Middle Patuxent River	02131106	170802.94	405443.37	1.11
SH15RST130575	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	167194.37	412940.30	0.20
SH15RST130551	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	163577.72	416022.22	0.38
SH15RST130561	VBY-FY15 restoration new stormwater BMP project.	Middle Patuxent River	02131106	169577.03	407049.58	0.54
SH14RST160415	VBY-FY15 restoration new stormwater BMP project.	Patuxent River upper	02131104	136811.42	424297.42	0.38
SH14RST021341	VBY-FY15 restoration new stormwater BMP project.	Patuxent River middle	02131102	124601.82	429001.45	0.64
SH14RST021343	VBY-FY15 restoration new stormwater BMP project.	Patuxent River middle	02131102	124736.65	428930.95	0.42
SH14RST021348	VBY-FY15 restoration new stormwater BMP project.	Patuxent River middle	02131102	125767.03	427614.49	0.49
SH14RST021349	VBY-FY15 restoration new stormwater BMP project.	Patuxent River middle	02131102	125801.64	427563.54	0.06
SH14RST021351	VBY-FY15 restoration new stormwater BMP project.	Patuxent River middle	02131102	125825.18	427531.64	0.05
SH14RST021354	VBY-FY15 restoration new stormwater BMP project.	Patuxent River middle	02131102	125851.05	427494.22	0.31
SH14RST021359	VBY-FY15 restoration new stormwater BMP project.	Patuxent River middle	02131102	125931.60	427378.91	0.18
SH14RST021364	VBY-FY15 restoration new stormwater BMP project.	Patuxent River middle	02131102	126013.75	427265.55	0.35

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH14RST021369	VBY-FY15 restoration new stormwater BMP project.	Patuxent River middle	02131102	126378.42	426788.56	0.32
SH14RST021370	VBY-FY15 restoration new stormwater BMP project.	Patuxent River middle	02131102	126761.80	426249.77	0.34
SH14RST021371	VBY-FY15 restoration new stormwater BMP project.	Patuxent River middle	02131102	126926.70	425889.86	0.50
SH14RST021374	VBY-FY15 restoration new stormwater BMP project.	Patuxent River middle	02131102	127034.54	425465.89	0.68
SH15RST160886	VBY-FY15 restoration new stormwater BMP project.	Western Branch	02131103	136222.67	414858.53	0.99
SH15RST021449	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	147545.67	425848.76	1.00
SH15RST021450	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	147765.71	425893.44	0.37
SH15RST021451	VBY-FY15 restoration new stormwater BMP project.	Little Patuxent River	02131105	147882.71	425916.81	0.23
SH14RST082128	VBY-FY15 restoration new stormwater BMP project.	Patuxent River lower	02131101	94214.15	419652.50	0.75
SH14RST082122	VBY-FY15 restoration new stormwater BMP project.	Patuxent River lower	02131101	93477.34	419641.81	0.45
SH14RST082123	VBY-FY15 restoration new stormwater BMP project.	Patuxent River lower	02131101	93554.81	419643.08	0.27
SH14RST082124	VBY-FY15 restoration new stormwater BMP project.	Patuxent River lower	02131101	93663.90	419644.78	0.17
SH14RST082125	VBY-FY15 restoration new stormwater BMP project.	Patuxent River lower	02131101	93835.60	419647.98	0.26
SH14RST082126	VBY-FY15 restoration new stormwater BMP project.	Patuxent River lower	02131101	93943.54	419649.48	0.26

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH14RST082127	VBY-FY15 restoration new stormwater BMP project.	Patuxent River lower	02131101	94096.86	419651.30	0.44
SH13RST082140	VBY-FY15 restoration new stormwater BMP project.	Zekiah Swamp	02140108	103676.55	411143.98	0.16
SH13RST082141	VBY-FY15 restoration new stormwater BMP project.	Zekiah Swamp	02140108	103784.39	411107.38	0.98
SH14RST080513	VBY-FY15 restoration new stormwater BMP project.	Wicomico River	02140106	80733.08	404005.84	0.44
SH12RST080506	VBY-FY15 restoration new stormwater BMP project.	Wicomico River	02140106	78496.15	403637.13	0.62
SH14RST080507	VBY-FY15 restoration new stormwater BMP project.	Wicomico River	02140106	79522.68	403820.53	0.48
SH14RST080508	VBY-FY15 restoration new stormwater BMP project.	Wicomico River	02140106	79817.08	403865.76	0.50
SH14RST080512	VBY-FY15 restoration new stormwater BMP project.	Wicomico River	02140106	80556.53	403977.70	0.36
SH12RST080501	VBY-FY15 restoration new stormwater BMP project.	Potomac River L tidal	02140101	77797.42	403127.66	0.25
SH12RST080502	VBY-FY15 restoration new stormwater BMP project.	Potomac River L tidal	02140101	77881.55	403228.15	0.28
SH12RST080503	VBY-FY15 restoration new stormwater BMP project.	Potomac River L tidal	02140101	78016.19	403360.71	0.31
SH12RST080504	VBY-FY15 restoration new stormwater BMP project.	Wicomico River	02140106	78143.66	403459.97	0.44
SH12RST080505	VBY-FY15 restoration new stormwater BMP project.	Wicomico River	02140106	78314.87	403559.08	0.33
SH13RST120347	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	206309.52	455943.64	0.62

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13RST120349	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	207070.10	454996.18	0.35
SH13RST120343	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	205285.84	456547.86	0.23
SH13RST120337	VBY-FY15 restoration new stormwater BMP project.	Lower Winters Run	02130702	202263.61	458201.68	0.24
SH13RST120333	VBY-FY15 restoration new stormwater BMP project.	Lower Winters Run	02130702	201323.68	458590.40	0.31
SH12RST120315	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	203772.38	457454.22	0.47
SH12RST120314	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	203298.50	457707.55	0.24
SH12RST120321	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	205083.09	456598.28	0.29
SH12RST120313	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	203041.47	457832.11	0.37
SH12RST120312	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	202916.41	457893.27	0.15
SH12RST120318	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	204183.55	457117.17	0.11
SH12RST120319	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	204374.02	456943.95	0.15
SH12RST120324	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	207292.54	454748.82	0.21
SH12RST120317	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	203866.56	457392.36	0.28
SH12RST120323	VBY-FY15 restoration new stormwater BMP project.	Atkisson Reservoir	02130703	206873.42	455220.11	0.14
SH16RST021617	Stormwater - Grass Swale	Severn River	02131002	155985.29	431579.77	0.55

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16RST021571	Stormwater - Grass Swale	Baltimore Harbor	02130903	169617.20	431745.51	0.30
SH16RST021576	Stormwater - Grass Swale	Baltimore Harbor	02130903	165757.49	430672.37	0.97
SH16RST021577	Stormwater - Grass Swale	Baltimore Harbor	02130903	165499.54	430632.39	0.40
SH16RST021583	Stormwater - Grass Swale	Baltimore Harbor	02130903	161490.07	431286.72	0.76
SH16RST021584	Stormwater - Grass Swale	Baltimore Harbor	02130903	161300.63	431357.03	0.55
SH16RST021585	Stormwater - Grass Swale	Baltimore Harbor	02130903	161098.56	431439.00	1.06
SH16RST021586	Stormwater - Grass Swale	Baltimore Harbor	02130903	160573.14	431676.27	0.35
SH16RST021587	Stormwater - Grass Swale	Baltimore Harbor	02130903	160459.64	431727.11	0.42
SH16RST021588	Stormwater - Grass Swale	Severn River	02131002	155848.66	431399.00	0.53
SH16RST021591	Stormwater - Grass Swale	Severn River	02131002	155200.08	431095.53	0.60
SH16RST021592	Stormwater - Grass Swale	Severn River	02131002	154236.04	431991.02	0.40
SH16RST021593	Stormwater - Grass Swale	Severn River	02131002	154103.77	432089.95	0.23
SH16RST021575	Stormwater - Grass Swale	Baltimore Harbor	02130903	168421.04	431739.57	0.25
SH16RST021579	Stormwater - Grass Swale	Baltimore Harbor	02130903	163399.09	430765.39	1.14
SH16RST021580	Stormwater - Grass Swale	Baltimore Harbor	02130903	163191.05	430787.97	0.56
SH17RST021600	Stormwater - Grass Swale	South River	02131003	151192.26	433358.87	0.34
SH17RST021615	Stormwater - Grass Swale	South River	02131003	147853.75	435442.04	0.41
SH17RST021616	Stormwater - Grass Swale	Baltimore Harbor	02130903	160792.95	431577.67	1.30
SH17RST021610	Stormwater - Grass Swale	South River	02131003	148618.00	434601.51	0.39
SH17RST021611	Stormwater - Grass Swale	South River	02131003	148475.16	434749.70	0.79
SH17RST021612	Stormwater - Grass Swale	South River	02131003	148326.82	434876.18	0.28
SH17RST021614	Stormwater - Grass Swale	South River	02131003	147954.13	435241.47	0.83
SH17RST021594	Stormwater - Grass Swale	Severn River	02131002	153813.29	432308.23	0.29
SH17RST021595	Stormwater - Grass Swale	South River	02131003	152591.33	433420.69	0.25
SH17RST021596	Stormwater - Grass Swale	South River	02131003	152084.61	433550.56	0.53

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH17RST021598	Stormwater - Grass Swale	South River	02131003	151620.22	433514.54	0.51
SH17RST021599	Stormwater - Grass Swale	South River	02131003	151394.78	433441.33	0.66
SH17RST021601	Stormwater - Grass Swale	South River	02131003	150992.47	433296.17	0.80
SH17RST021602	Stormwater - Grass Swale	South River	02131003	150769.45	433299.31	0.22
SH17RST021603	Stormwater - Grass Swale	South River	02131003	150577.49	433336.85	0.71
SH17RST021604	Stormwater - Grass Swale	South River	02131003	150348.41	433383.66	0.42
SH17RST021605	Stormwater - Grass Swale	South River	02131003	149745.86	433507.27	0.48
SH17RST021606	Stormwater - Grass Swale	South River	02131003	149213.27	433635.59	0.64
SH17RST021607	Stormwater - Grass Swale	South River	02131003	149055.14	433743.91	0.52
SH17RST021608	Stormwater - Grass Swale	South River	02131003	148836.62	434143.98	0.47
SH17RST021597	Stormwater - Grass Swale	South River	02131003	151799.46	433546.26	0.76
SH19RST020044	Retrofit	Severn River	02131002	157244.12	427497.72	1.71
SH16RST020090	Retrofit	Severn River	02131002	155529.16	430566.81	2.78
SH16RST020163	Retrofit	South River	02131003	149355.98	433629.39	1.52
SH16RST020221	Retrofit	Severn River	02131002	153637.30	432492.82	0.73
SH18RST020232	Retrofit	Baltimore Harbor	02130903	166889.23	430950.77	6.03
SH19RST020235	Retrofit	Baltimore Harbor	02130903	162605.56	430836.18	7.24
SH16RST020252	Retrofit	South River	02131003	146510.08	438730.38	3.37
SH19RST020253	Retrofit	Severn River	02131002	150989.63	448602.34	2.79
SH19RST020254	Retrofit	Severn River	02131002	150997.36	448486.77	4.75
SH16RST020262	Retrofit	South River	02131003	146277.05	439107.18	1.98
SH16RST020266	Retrofit	South River	02131003	146243.11	438968.32	1.10
SH16RST020269	Retrofit	South River	02131003	146311.34	438355.84	19.84
SH16RST020337	Retrofit	Patuxent River middle	02131102	126163.71	427008.74	1.20
SH16RST020438	Retrofit	Severn River	02131002	154974.35	431285.78	11.02

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH18RST020525	Retrofit	South River	02131003	145235.28	439310.86	0.87
SH16RST020547	Retrofit	Baltimore Harbor	02130903	162247.60	430927.95	16.80
SH19RST020566	Retrofit	Baltimore Harbor	02130903	170917.92	431097.15	4.90
SH17RST030181	Retrofit	Bird River	02130803	189787.86	448217.96	1.84
SH17RST030186	Retrofit	Bird River	02130803	190008.66	448423.09	0.88
SH17RST030230	Retrofit	Back River	02130901	185031.25	444228.81	2.90
SH17RST030267	Retrofit	Loch Raven Reservoir	02130805	193908.13	434579.05	1.90
SH19RST060149	Retrofit	S Branch Patapsco	02130908	195513.69	399334.55	1.19
SH19RST100035	Retrofit	Lower Monocacy River	02140302	207300.38	373258.62	2.33
SH18RST100037	Retrofit	Lower Monocacy River	02140302	206029.91	372864.27	0.80
SH19RST100038	Retrofit	Upper Monocacy River	02140303	201812.52	370337.48	4.78
SH19RST100171	Retrofit	Lower Monocacy River	02140302	188759.24	383492.25	10.03
SH17RST120055	Retrofit	Deer Creek	02120202	210389.84	464481.73	0.83
SH17RST120094	Retrofit	Lower Winters Run	02130702	196802.07	456546.22	2.60
SH18RST120103	Retrofit	Bynum Run	02130704	208360.73	457544.83	1.38
SH18RST120104	Retrofit	Bynum Run	02130704	208480.04	457742.18	1.00
SH18RST120136	Retrofit	Deer Creek	02120202	210045.21	465575.40	1.69
SH16RST150021	Retrofit	Rock Creek	02140206	160507.76	393500.69	0.61
SH16RST150023	Retrofit	Anacostia River	02140205	161792.04	393727.25	9.43
SH16RST150026	Retrofit	Cabin John Creek	02140207	154321.19	386751.45	2.29
SH16RST150029	Retrofit	Cabin John Creek	02140207	154172.08	386587.08	0.88
SH19RST150204	Retrofit	Seneca Creek	02140208	168762.16	377879.20	5.75
SH16RST150342	Retrofit	Rock Creek	02140206	160128.28	393188.53	2.66
SH16RST150343	Retrofit	Rock Creek	02140206	160328.59	393480.09	2.40
SH16RST160101	Retrofit	Anacostia River	02140205	132813.54	408582.64	5.98

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH19RST160160	Retrofit	Western Branch	02131103	132351.77	408428.92	1.25
SH16RST160170	Retrofit	Patuxent River upper	02131104	158886.89	413133.26	0.07
SH16RST160171	Retrofit	Patuxent River upper	02131104	158942.58	413179.94	0.14
SH19RST160177	Retrofit	Anacostia River	02140205	150402.24	405410.15	1.76
SH16RST160189	Retrofit	Piscataway Creek	02140203	121223.53	410451.60	0.50
SH16RST160190	Retrofit	Piscataway Creek	02140203	119758.58	410493.58	0.20
SH16RST160210	Retrofit	Western Branch	02131103	142074.86	413805.95	1.81
SH19RST160453	Retrofit	Mattawoman Creek	02140111	110366.61	398685.69	1.58
SH19RST160656	Retrofit	Anacostia River	02140205	150472.98	404990.58	1.82
SH16RST160702	Retrofit	Anacostia River	02140205	147483.15	408515.21	2.40
SH18RST160737	Retrofit	Piscataway Creek	02140203	122199.49	410123.85	25.30
SH18RST210001	Retrofit	Conococheague Creek	02140504	220473.79	331330.69	3.55
SH18RST210015	Retrofit	Marsh Run	02140503	216020.27	335708.08	2.55
SH18RST210017	Retrofit	Antietam Creek	02140502	222826.28	340058.25	9.03
SH18RST210200	Retrofit	Little Tonoloway Creek	02140509	226240.49	293338.11	1.61
SH18RST210213	Retrofit	Conococheague Creek	02140504	217893.25	333541.11	1.36
SH11APY000231	Tree Planting	Loch Raven Reservoir	02130805	200724.15	429549.85	0.20
SH11APY000232	Tree Planting	Lower Monocacy River	02140302	192317.80	362994.70	2.22
SH11APY000233	Tree Planting	Lower Monocacy River	02140302	192485.66	363106.76	1.92
SH11APY000234	Tree Planting	Lower Monocacy River	02140302	192631.87	363075.76	0.62
SH11APY000235	Tree Planting	Lower Monocacy River	02140302	192443.15	363236.12	0.23
SH11APY000236	Tree Planting	Lower Monocacy River	02140302	192410.85	363412.09	0.60
SH11APY000237	Tree Planting	Lower Monocacy River	02140302	192084.53	363675.83	2.11
SH11APY000238	Tree Planting	Lower Monocacy River	02140302	192121.29	363829.13	0.44
SH11APY000239	Tree Planting	Lower Monocacy River	02140302	192192.70	363756.37	1.16

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH11APY000240	Tree Planting	Lower Monocacy River	02140302	192293.47	363635.28	0.22
SH11APY000241	Tree Planting	Lower Monocacy River	02140302	192218.35	363427.57	0.52
SH11APY000242	Tree Planting	Lower Monocacy River	02140302	192307.07	363489.40	0.42
SH11APY000243	Tree Planting	Lower Monocacy River	02140302	192304.36	363330.37	0.12
SH11APY000244	Tree Planting	Lower Monocacy River	02140302	192368.15	363293.65	0.13
SH11APY000245	Tree Planting	Lower Monocacy River	02140302	192422.21	362984.90	0.43
SH11APY000248	Tree Planting	Lower Susquehanna River	02120201	214768.58	474368.11	1.23
SH11APY000249	Tree Planting	Lower Susquehanna River	02120201	214691.28	474353.39	1.19
SH11APY000250	Tree Planting	Lower Susquehanna River	02120201	214758.43	474573.15	1.16
SH11APY000251	Tree Planting	Lower Susquehanna River	02120201	214401.89	474134.89	1.81
SH11APY000252	Tree Planting	Lower Susquehanna River	02120201	214220.61	473984.00	3.65
SH11APY000253	Tree Planting	Lower Susquehanna River	02120201	214928.58	473306.29	2.80
SH11APY000254	Tree Planting	Lower Susquehanna River	02120201	214806.95	473224.56	2.84
SH11APY000255	Tree Planting	Lower Susquehanna River	02120201	214820.93	473449.24	1.91
SH11APY000256	Tree Planting	Lower Susquehanna River	02120201	214701.41	473520.95	5.74
SH11APY000257	Tree Planting	Lower Susquehanna River	02120201	214680.07	473189.64	2.88
SH11APY000258	Tree Planting	Little Gunpowder Falls	02130804	194117.84	454474.84	1.13
SH11APY000259	Tree Planting	Little Gunpowder Falls	02130804	193984.91	454490.44	1.01
SH11APY000260	Tree Planting	Lower Susquehanna River	02120201	214716.11	474110.66	2.81
SH11APY000261	Tree Planting	Little Patuxent River	02131105	167675.63	411942.82	1.66
SH11APY000262	Tree Planting	Little Patuxent River	02131105	167160.12	412706.88	0.11
SH11APY000263	Tree Planting	Middle Patuxent River	02131106	168398.17	409330.96	0.26
SH11APY000264	Tree Planting	Middle Patuxent River	02131106	184554.87	397941.21	0.07
SH11APY000265	Tree Planting	Middle Patuxent River	02131106	183078.46	402136.04	0.09
SH11APY000266	Tree Planting	Middle Patuxent River	02131106	182783.62	402684.90	0.26

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH11APY000267	Tree Planting	Little Patuxent River	02131105	181966.16	409351.65	0.14
SH11APY000268	Tree Planting	S Branch Patapsco	02130908	183775.20	400141.22	0.14
SH11APY000269	Tree Planting	Little Patuxent River	02131105	175888.69	415272.42	1.69
SH11APY000270	Tree Planting	Little Patuxent River	02131105	173965.44	416099.12	0.43
SH11APY000271	Tree Planting	Rocky Gorge Dam	02131107	164096.24	408452.56	0.34
SH11APY000272	Tree Planting	Rocky Gorge Dam	02131107	163902.34	408326.51	0.12
SH11APY000273	Tree Planting	Rocky Gorge Dam	02131107	164191.41	408182.23	0.24
SH11APY000274	Tree Planting	Little Patuxent River	02131105	174683.57	415913.90	0.32
SH11APY000275	Tree Planting	Little Patuxent River	02131105	164328.55	408807.27	0.64
SH11APY000276	Tree Planting	Patuxent River upper	02131104	162349.98	411706.93	0.94
SH11APY000277	Tree Planting	Patuxent River upper	02131104	162117.31	412140.60	0.10
SH11APY000278	Tree Planting	Patapsco River L N Br	02130906	169121.58	419442.62	0.44
SH11APY000279	Tree Planting	Little Patuxent River	02131105	164035.41	409136.42	0.12
SH11APY000280	Tree Planting	Little Patuxent River	02131105	164110.39	409582.20	0.03
SH11APY000281	Tree Planting	Little Patuxent River	02131105	164093.32	409662.83	0.02
SH11APY000282	Tree Planting	Little Patuxent River	02131105	163981.61	409870.81	0.05
SH11APY000283	Tree Planting	Little Patuxent River	02131105	164013.57	409901.25	0.06
SH11APY000284	Tree Planting	Little Patuxent River	02131105	163884.85	410097.06	0.09
SH11APY000285	Tree Planting	Little Patuxent River	02131105	163715.32	410432.10	0.15
SH11APY000286	Tree Planting	Little Patuxent River	02131105	163499.23	410845.55	0.09
SH11APY000287	Tree Planting	Patapsco River L N Br	02130906	170643.98	419454.07	0.48
SH11APY000288	Tree Planting	Little Patuxent River	02131105	175299.36	415853.00	0.25
SH11APY000289	Tree Planting	Little Patuxent River	02131105	167327.38	412712.19	1.98
SH11APY000290	Tree Planting	Little Patuxent River	02131105	164203.91	408733.21	1.16
SH11APY000291	Tree Planting	Rocky Gorge Dam	02131107	164083.55	408820.29	0.08

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH11APY000292	Tree Planting	Little Patuxent River	02131105	164150.92	408668.38	0.05
SH11APY000293	Tree Planting	Little Patuxent River	02131105	165523.33	409673.13	0.44
SH11APY000294	Tree Planting	Little Patuxent River	02131105	167162.06	413076.03	2.00
SH11APY000295	Tree Planting	Middle Patuxent River	02131106	168379.45	409618.58	0.10
SH11APY000296	Tree Planting	Middle Patuxent River	02131106	182987.19	402307.99	0.07
SH11APY000297	Tree Planting	Little Patuxent River	02131105	167537.54	412247.89	1.54
SH11APY000298	Tree Planting	Little Patuxent River	02131105	174346.51	416028.72	0.28
SH11APY000299	Tree Planting	Patapsco River L N Br	02130906	172605.88	422227.57	2.82
SH11APY000300	Tree Planting	Little Patuxent River	02131105	174768.59	415917.83	0.21
SH11APY000301	Tree Planting	Middle Patuxent River	02131106	182698.81	402848.79	0.03
SH11APY000302	Tree Planting	Cabin John Creek	02140207	153900.95	389952.44	0.19
SH11APY000303	Tree Planting	Rock Creek	02140206	153826.36	389987.07	0.14
SH11APY000305	Tree Planting	Rock Creek	02140206	153858.54	390053.53	0.13
SH11APY000306	Tree Planting	Cabin John Creek	02140206	153798.59	389858.82	0.07
SH11APY000308	Tree Planting	Rock Creek	02140206	153928.15	389989.48	0.26
SH11APY000309	Tree Planting	Cabin John Creek	02140207	154020.71	389796.96	0.08
SH11APY000310	Tree Planting	Cabin John Creek	02140207	153965.57	389827.62	0.04
SH11APY000311	Tree Planting	Anacostia River	02140205	142555.13	412106.94	0.47
SH11APY000312	Tree Planting	Anacostia River	02140205	142469.56	412133.65	0.68
SH11APY000313	Tree Planting	Anacostia River	02140205	142668.38	411924.47	0.41
SH11APY000314	Tree Planting	Anacostia River	02140205	142495.23	411993.24	0.30
SH11APY000315	Tree Planting	Anacostia River	02140205	142138.14	412108.84	0.02
SH11APY000316	Tree Planting	Anacostia River	02140205	142231.93	412273.58	0.80
SH11APY000317	Tree Planting	Anacostia River	02140205	142250.69	412301.37	0.02
SH11APY000318	Tree Planting	Anacostia River	02140205	142157.29	412153.42	0.29

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH11APY000319	Tree Planting	Anacostia River	02140205	142029.73	412090.62	0.34
SH11APY000320	Tree Planting	Anacostia River	02140205	142044.85	412178.89	0.33
SH11APY000321	Tree Planting	Anacostia River	02140205	142005.44	412127.83	0.30
SH11APY000322	Tree Planting	Anacostia River	02140205	142056.78	412347.05	0.82
SH11APY000323	Tree Planting	Anacostia River	02140205	142143.14	412297.16	0.40
SH11APY000324	Tree Planting	Anacostia River	02140205	142055.53	412459.62	0.58
SH11APY000325	Tree Planting	Anacostia River	02140205	142100.13	412514.31	0.16
SH11APY000326	Tree Planting	Anacostia River	02140205	142218.93	412405.63	0.02
SH11APY000327	Tree Planting	Anacostia River	02140205	142027.44	412533.87	0.11
SH11APY000328	Tree Planting	Anacostia River	02140205	141882.48	412194.87	0.50
SH11APY000329	Tree Planting	Anacostia River	02140205	141918.04	412252.18	0.09
SH11APY000330	Tree Planting	Anacostia River	02140205	141797.37	412283.79	0.47
SH11APY000332	Tree Planting	Anacostia River	02140205	141829.31	412165.37	0.03
SH11APY000333	Tree Planting	Anacostia River	02140205	141574.62	412338.18	0.87
SH11APY000334	Tree Planting	Anacostia River	02140205	141812.39	412415.83	0.75
SH11APY000335	Tree Planting	Anacostia River	02140205	141885.20	412404.10	0.25
SH11APY000336	Tree Planting	Anacostia River	02140205	141929.31	412382.78	0.40
SH11APY000337	Tree Planting	Anacostia River	02140205	141636.43	412486.17	1.10
SH11APY000338	Tree Planting	Anacostia River	02140205	141869.57	412009.46	0.32
SH11APY000339	Tree Planting	Anacostia River	02140205	141902.43	412072.00	0.09
SH11APY000340	Tree Planting	Anacostia River	02140205	141957.59	411861.87	0.15
SH11APY000341	Tree Planting	Anacostia River	02140205	142054.16	412054.96	0.14
SH11APY003001	Tree Planting	Liberty Reservoir	02130907	199462.92	399784.47	4.42
SH11APY003002	Tree Planting	Liberty Reservoir	02130907	201572.62	400936.00	1.45
SH11APY003007	Tree Planting	Potomac River L tidal	02140101	85464.64	393785.62	0.08

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH11APY003008	Tree Planting	Potomac River L tidal	02140101	85392.49	393958.55	0.04
SH11APY003009	Tree Planting	Nanjemoy Creek	02140110	86502.22	393184.79	0.30
SH11APY003010	Tree Planting	Lower Susquehanna River	02120201	214111.92	474130.79	1.10
SH11APY003011	Tree Planting	Lower Susquehanna River	02120201	214067.53	473943.57	3.36
SH11APY003012	Tree Planting	Lower Susquehanna River	02120201	214400.45	473891.20	2.24
SH11APY003013	Tree Planting	Lower Susquehanna River	02120201	214258.58	473826.48	1.29
SH11APY003014	Tree Planting	Deer Creek	02120202	217092.45	461948.62	5.20
SH11APY003019	Tree Planting	Liberty Reservoir	02130907	201218.09	400562.09	4.30
SH11APY003020	Tree Planting	Liberty Reservoir	02130907	201380.35	400683.05	0.91
SH11APY003021	Tree Planting	Liberty Reservoir	02130907	201406.96	400611.99	1.18
SH11APY003022	Tree Planting	Liberty Reservoir	02130907	201468.09	400551.99	1.66
SH12APY000342	Tree Planting	Patapsco River L N Br	02130906	172520.64	429528.43	0.37
SH12APY000343	Tree Planting	Patapsco River L N Br	02130906	172370.32	429583.42	0.47
SH12APY000344	Tree Planting	Patapsco River L N Br	02130906	172318.20	429454.14	0.52
SH12APY000345	Tree Planting	Baltimore Harbor	02130903	170843.48	431010.34	0.21
SH12APY000346	Tree Planting	Baltimore Harbor	02130903	170421.22	431746.74	0.28
SH12APY000347	Tree Planting	Baltimore Harbor	02130903	167183.80	431237.98	0.20
SH12APY000348	Tree Planting	Baltimore Harbor	02130903	164421.12	430650.33	0.05
SH12APY000349	Tree Planting	Baltimore Harbor	02130903	164320.34	430650.40	0.06
SH12APY000350	Tree Planting	Baltimore Harbor	02130903	164014.62	430615.84	0.76
SH12APY000352	Tree Planting	Baltimore Harbor	02130903	165743.45	434257.99	0.71
SH12APY000353	Tree Planting	Baltimore Harbor	02130903	163076.56	435556.55	0.10
SH12APY000354	Tree Planting	Baltimore Harbor	02130903	163032.69	434645.40	0.30
SH12APY000355	Tree Planting	Patapsco River L N Br	02130906	166552.24	423974.85	0.04
SH12APY000356	Tree Planting	Patapsco River L N Br	02130906	166686.03	424029.64	0.01

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH12APY000357	Tree Planting	Severn River	02131002	155935.35	434341.69	0.63
SH12APY000358	Tree Planting	Lower Gunpowder Falls	02130802	194981.67	449431.84	17.15
SH12APY000359	Tree Planting	Gunpowder River	02130801	188222.81	455121.35	7.64
SH12APY000360	Tree Planting	Jones Falls	02130904	194017.79	429095.06	0.24
SH12APY000361	Tree Planting	Jones Falls	02130904	193990.72	428877.51	0.01
SH12APY000362	Tree Planting	Jones Falls	02130904	194114.48	428794.09	0.12
SH12APY000363	Tree Planting	Jones Falls	02130904	193968.68	428804.27	0.30
SH12APY000364	Tree Planting	Jones Falls	02130904	193420.26	429011.14	0.67
SH12APY000365	Tree Planting	Jones Falls	02130904	193604.85	429070.22	0.55
SH12APY000366	Tree Planting	Jones Falls	02130904	193638.74	429122.26	0.03
SH12APY000367	Tree Planting	Jones Falls	02130904	193363.87	429199.60	0.07
SH12APY000368	Tree Planting	Jones Falls	02130904	193061.35	429072.08	0.26
SH12APY000369	Tree Planting	Jones Falls	02130904	192514.29	428937.05	0.50
SH12APY000370	Tree Planting	Jones Falls	02130904	192500.92	429049.71	0.15
SH12APY000371	Tree Planting	Jones Falls	02130904	192390.47	428887.46	0.12
SH12APY000372	Tree Planting	Jones Falls	02130904	191153.18	428935.06	0.22
SH12APY000373	Tree Planting	Jones Falls	02130904	190921.91	429010.88	0.08
SH12APY000374	Tree Planting	Jones Falls	02130904	190249.76	429211.53	0.45
SH12APY000376	Tree Planting	Jones Falls	02130904	189685.35	429839.17	0.21
SH12APY000377	Tree Planting	Gwynns Falls	02130905	189738.21	421512.25	0.20
SH12APY000378	Tree Planting	Gwynns Falls	02130905	191070.34	420577.17	2.95
SH12APY000379	Tree Planting	Gwynns Falls	02130905	190715.84	420913.60	1.26
SH12APY000380	Tree Planting	Deer Creek	02120202	227905.82	429580.40	0.43
SH12APY000381	Tree Planting	Loch Raven Reservoir	02130805	226299.14	430322.22	0.35
SH12APY000382	Tree Planting	Loch Raven Reservoir	02130805	202825.56	428690.11	0.22

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH12APY000383	Tree Planting	Jones Falls	02130904	196726.77	431437.60	0.11
SH12APY000384	Tree Planting	Loch Raven Reservoir	02130805	209005.39	428581.27	0.55
SH12APY000385	Tree Planting	Loch Raven Reservoir	02130805	215127.54	429303.11	0.24
SH12APY000386	Tree Planting	Loch Raven Reservoir	02130805	216353.56	428932.89	0.12
SH12APY000387	Tree Planting	Loch Raven Reservoir	02130805	217669.73	428414.01	0.62
SH12APY000388	Tree Planting	Loch Raven Reservoir	02130805	220512.55	429100.80	0.17
SH12APY000389	Tree Planting	Loch Raven Reservoir	02130805	221701.01	430098.04	0.13
SH12APY000390	Tree Planting	Loch Raven Reservoir	02130805	222563.16	430377.63	0.47
SH12APY000391	Tree Planting	Loch Raven Reservoir	02130805	222753.76	430441.40	0.10
SH12APY000392	Tree Planting	Loch Raven Reservoir	02130805	223069.90	430525.42	0.10
SH12APY000393	Tree Planting	Loch Raven Reservoir	02130805	223810.00	430441.81	0.32
SH12APY000394	Tree Planting	Deer Creek	02120202	226922.79	430252.09	0.49
SH12APY000395	Tree Planting	Loch Raven Reservoir	02130805	226249.92	430541.02	0.93
SH12APY000396	Tree Planting	Deer Creek	02120202	227930.95	429809.39	0.19
SH12APY000397	Tree Planting	Loch Raven Reservoir	02130805	206566.06	429166.80	0.31
SH12APY000399	Tree Planting	Gwynns Falls	02130905	189702.79	421850.94	0.38
SH12APY000401	Tree Planting	Jones Falls	02130904	192005.35	426657.76	0.14
SH12APY000402	Tree Planting	Gwynns Falls	02130905	190668.81	422807.55	0.28
SH12APY000403	Tree Planting	Gwynns Falls	02130905	190608.81	422860.33	0.28
SH12APY000404	Tree Planting	Loch Raven Reservoir	02130805	198582.85	430288.22	0.15
SH12APY000405	Tree Planting	Loch Raven Reservoir	02130805	200658.88	429561.64	0.10
SH12APY000406	Tree Planting	Loch Raven Reservoir	02130805	200722.54	429537.39	0.04
SH12APY000407	Tree Planting	Loch Raven Reservoir	02130805	199749.76	429215.12	0.34
SH12APY000408	Tree Planting	Loch Raven Reservoir	02130805	200319.83	429185.48	0.05
SH12APY000409	Tree Planting	Loch Raven Reservoir	02130805	200180.58	429128.13	0.03

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH12APY000410	Tree Planting	Jones Falls	02130904	193503.51	429137.79	0.23
SH12APY000414	Tree Planting	Big Elk Creek	02130606	228089.70	499406.13	1.13
SH12APY000415	Tree Planting	Big Elk Creek	02130606	227154.76	498505.75	1.32
SH12APY000416	Tree Planting	Potomac River M tidal	02140102	87967.77	376896.14	1.34
SH12APY000417	Tree Planting	Mattawoman Creek	02140111	101043.88	386444.64	8.78
SH12APY000418	Tree Planting	Potomac River M tidal	02140102	105901.93	389922.94	2.16
SH12APY000419	Tree Planting	Mattawoman Creek	02140111	100085.72	392563.00	0.35
SH12APY000420	Tree Planting	Patuxent River lower	02131101	97196.39	418470.03	0.41
SH12APY000421	Tree Planting	Patuxent River lower	02131101	96386.52	419180.15	0.32
SH12APY000422	Tree Planting	Patuxent River lower	02131101	96202.17	419319.07	0.08
SH12APY000423	Tree Planting	Patuxent River lower	02131101	96217.10	419370.30	0.27
SH12APY000424	Tree Planting	Zekiah Swamp	02140108	104953.97	410594.96	0.16
SH12APY000425	Tree Planting	Zekiah Swamp	02140108	104787.14	410717.70	0.50
SH12APY000426	Tree Planting	Potomac River L tidal	02140101	85555.77	395166.74	1.66
SH12APY000427	Tree Planting	Nanjemoy Creek	02140110	86728.51	393283.90	1.23
SH12APY000428	Tree Planting	Port Tobacco River	02140109	86853.42	395685.70	0.04
SH12APY000429	Tree Planting	Port Tobacco River	02140109	86284.02	395759.65	1.67
SH12APY000430	Tree Planting	Port Tobacco River	02140109	86622.41	396201.83	0.32
SH12APY000431	Tree Planting	Potomac River M tidal	02140102	105680.12	389578.05	2.71
SH12APY000432	Tree Planting	Mattawoman Creek	02140111	99440.44	392742.41	0.25
SH12APY000433	Tree Planting	Mattawoman Creek	02140111	99372.77	392839.41	0.15
SH12APY000434	Tree Planting	Mattawoman Creek	02140111	99271.23	392772.98	0.05
SH12APY000435	Tree Planting	Mattawoman Creek	02140111	98930.47	392777.92	0.46
SH12APY000436	Tree Planting	Mattawoman Creek	02140111	98300.38	392771.45	0.32
SH12APY000437	Tree Planting	Mattawoman Creek	02140111	97997.68	392685.24	0.08

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH12APY000439	Tree Planting	Potomac River L tidal	02140101	85259.70	394032.14	2.72
SH12APY000440	Tree Planting	Potomac River L tidal	02140101	85928.25	395682.10	0.95
SH12APY000441	Tree Planting	Potomac River L tidal	02140101	84757.44	393672.35	0.81
SH12APY000442	Tree Planting	Potomac River L tidal	02140101	84759.88	394296.96	0.84
SH12APY000443	Tree Planting	Potomac River L tidal	02140101	85140.84	394677.24	1.03
SH12APY000444	Tree Planting	Potomac River L tidal	02140101	84820.72	393943.85	0.48
SH12APY000445	Tree Planting	Potomac River L tidal	02140101	86145.61	396007.76	0.64
SH12APY000446	Tree Planting	Potomac River L tidal	02140101	85082.88	394275.27	0.39
SH12APY000447	Tree Planting	Potomac River L tidal	02140101	84410.77	393974.29	0.32
SH12APY000448	Tree Planting	Potomac River L tidal	02140101	84715.15	393793.31	0.37
SH12APY000449	Tree Planting	Potomac River L tidal	02140101	85095.38	393899.33	0.24
SH12APY000450	Tree Planting	Potomac River L tidal	02140101	85185.60	394269.42	0.10
SH12APY000451	Tree Planting	Potomac River L tidal	02140101	85281.65	394151.15	0.19
SH12APY000452	Tree Planting	Potomac River L tidal	02140101	85749.45	395472.48	0.13
SH12APY000453	Tree Planting	Potomac River L tidal	02140101	84591.54	393617.08	0.04
SH12APY000454	Tree Planting	Potomac River L tidal	02140101	85648.48	395358.85	0.09
SH12APY000455	Tree Planting	Nanjemoy Creek	02140110	86341.05	392856.56	1.01
SH12APY000456	Tree Planting	Nanjemoy Creek	02140110	86362.34	393040.60	0.56
SH12APY000457	Tree Planting	Nanjemoy Creek	02140110	86460.38	392754.41	0.21
SH12APY000458	Tree Planting	Nanjemoy Creek	02140110	86495.72	392987.25	0.12
SH12APY000462	Tree Planting	Mattawoman Creek	02140111	98664.89	392792.85	0.24
SH12APY000463	Tree Planting	Deer Creek	02120202	217380.81	462598.97	2.81
SH12APY000464	Tree Planting	Deer Creek	02120202	217535.16	462327.35	4.94
SH12APY000465	Tree Planting	Little Patuxent River	02131105	165602.11	409520.79	0.11
SH12APY000466	Tree Planting	Little Patuxent River	02131105	167948.98	410774.72	0.21

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH12APY000467	Tree Planting	Little Patuxent River	02131105	170170.46	412016.09	0.23
SH12APY000468	Tree Planting	Little Patuxent River	02131105	176028.09	415380.72	0.72
SH12APY000469	Tree Planting	Little Patuxent River	02131105	175846.24	415486.13	0.40
SH12APY000470	Tree Planting	Little Patuxent River	02131105	176049.25	415248.21	0.75
SH12APY000471	Tree Planting	Middle Patuxent River	02131106	165634.83	409538.23	0.14
SH12APY000472	Tree Planting	Little Patuxent River	02131105	167881.39	410737.95	0.08
SH12APY000473	Tree Planting	Little Patuxent River	02131105	165481.48	409471.69	0.00
SH12APY000474	Tree Planting	Little Patuxent River	02131105	165508.03	409495.14	0.01
SH12APY000475	Tree Planting	Anacostia River	02140205	152719.17	400656.84	0.27
SH12APY000476	Tree Planting	Anacostia River	02140205	160299.04	406113.03	0.14
SH12APY000477	Tree Planting	Rocky Gorge Dam	02131107	160514.26	406184.69	0.14
SH12APY000478	Tree Planting	Rocky Gorge Dam	02131107	160849.67	406276.65	0.12
SH12APY000479	Tree Planting	Rocky Gorge Dam	02131107	161532.48	406438.22	0.08
SH12APY000480	Tree Planting	Rocky Gorge Dam	02131107	161570.90	406366.00	0.08
SH12APY000481	Tree Planting	Rocky Gorge Dam	02131107	161666.50	406409.05	0.31
SH12APY000482	Tree Planting	Rocky Gorge Dam	02131107	161668.60	406358.64	0.14
SH12APY000483	Tree Planting	Rocky Gorge Dam	02131107	161645.88	406470.48	0.11
SH12APY000484	Tree Planting	Rocky Gorge Dam	02131107	161787.02	406555.91	0.56
SH12APY000485	Tree Planting	Rocky Gorge Dam	02131107	162089.32	406733.80	0.33
SH12APY000486	Tree Planting	Potomac River MO Cnty	02140202	157163.31	367884.50	0.81
SH12APY000487	Tree Planting	Potomac River MO Cnty	02140202	156960.88	367789.76	2.15
SH12APY000488	Tree Planting	Potomac River MO Cnty	02140202	156758.30	367628.62	1.16
SH12APY000489	Tree Planting	Potomac River MO Cnty	02140202	156935.52	367297.90	0.39
SH12APY000490	Tree Planting	Potomac River MO Cnty	02140202	156378.83	366992.96	2.09
SH12APY000491	Tree Planting	Potomac River MO Cnty	02140202	155888.32	366276.43	1.28

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH12APY000492	Tree Planting	Potomac River MO Cnty	02140202	156037.77	366322.23	1.68
SH12APY000493	Tree Planting	Potomac River MO Cnty	02140202	156317.27	366382.50	2.38
SH12APY000494	Tree Planting	Potomac River MO Cnty	02140202	156612.24	365933.92	1.63
SH12APY000495	Tree Planting	Potomac River MO Cnty	02140202	156717.13	366324.28	1.35
SH12APY000496	Tree Planting	Potomac River MO Cnty	02140202	156467.25	365292.26	0.33
SH12APY000497	Tree Planting	Potomac River MO Cnty	02140202	156413.98	365216.21	0.22
SH12APY000501	Tree Planting	Potomac River MO Cnty	02140202	156488.79	363859.41	0.73
SH12APY000502	Tree Planting	Potomac River MO Cnty	02140202	156430.86	363796.46	0.57
SH12APY000503	Tree Planting	Potomac River MO Cnty	02140202	156106.17	366404.87	0.37
SH12APY000504	Tree Planting	Patuxent River middle	02131102	119203.16	425497.69	0.49
SH12APY000505	Tree Planting	Patuxent River lower	02131101	107526.84	426532.97	1.41
SH12APY000506	Tree Planting	Patuxent River lower	02131101	107282.65	426731.24	0.73
SH12APY000507	Tree Planting	Patuxent River lower	02131101	106768.02	426524.06	1.08
SH12APY000508	Tree Planting	Patuxent River lower	02131101	106995.51	426110.40	0.51
SH12APY000509	Tree Planting	Patuxent River middle	02131102	119233.37	425246.61	0.27
SH12APY000510	Tree Planting	Patuxent River middle	02131102	118342.29	425004.66	1.00
SH12APY000511	Tree Planting	Patuxent River middle	02131102	117960.86	424601.96	2.64
SH12APY000513	Tree Planting	Sideling Hill Creek	02140510	222317.60	284794.46	1.18
SH12APY003000	Tree Planting	Back River	02130901	178888.95	445651.99	0.12
SH12APY003001	Tree Planting	Lower Gunpowder Falls	02130802	192832.93	436943.24	0.23
SH12APY003002	Tree Planting	Back River	02130901	175184.12	446943.49	0.33
SH12APY003004	Tree Planting	Lower Monocacy River	02140302	192945.85	367162.37	0.23
SH12APY003005	Tree Planting	Potomac River U tidal	02140201	125885.17	400145.82	0.17
SH13APY000515	Tree Planting	Severn River	02131002	159187.04	426369.74	0.37
SH13APY000516	Tree Planting	Patapsco River L N Br	02130906	166974.91	423412.34	1.07

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13APY000517	Tree Planting	Baltimore Harbor	02130903	164769.63	427509.05	0.19
SH13APY000518	Tree Planting	Baltimore Harbor	02130903	165319.77	430536.46	0.82
SH13APY000519	Tree Planting	Baltimore Harbor	02130903	165132.42	430536.19	1.68
SH13APY000520	Tree Planting	Baltimore Harbor	02130903	165098.73	430730.48	0.65
SH13APY000521	Tree Planting	Baltimore Harbor	02130903	164870.67	430771.49	1.03
SH13APY000522	Tree Planting	Baltimore Harbor	02130903	164731.53	430738.72	0.90
SH13APY000523	Tree Planting	Severn River	02131002	158258.05	432242.19	1.47
SH13APY000524	Tree Planting	Severn River	02131002	158712.16	432307.99	0.37
SH13APY000525	Tree Planting	Baltimore Harbor	02130903	166860.88	431000.60	0.59
SH13APY000526	Tree Planting	Baltimore Harbor	02130903	167851.44	431507.00	0.08
SH13APY000527	Tree Planting	Baltimore Harbor	02130903	167762.40	431446.51	0.32
SH13APY000528	Tree Planting	Baltimore Harbor	02130903	165091.17	428941.69	0.39
SH13APY000529	Tree Planting	Baltimore Harbor	02130903	165178.92	429080.15	3.01
SH13APY000530	Tree Planting	Patapsco River L N Br	02130906	164821.84	426463.85	1.23
SH13APY000531	Tree Planting	Jones Falls	02130904	194280.35	431933.71	0.05
SH13APY000532	Tree Planting	Gwynns Falls	02130905	196205.37	415847.02	0.14
SH13APY000533	Tree Planting	Gwynns Falls	02130905	189858.30	421467.09	0.33
SH13APY000534	Tree Planting	Gwynns Falls	02130905	190046.13	421401.51	1.41
SH13APY000535	Tree Planting	Gwynns Falls	02130905	191235.99	420607.18	0.59
SH13APY000536	Tree Planting	Gwynns Falls	02130905	192931.64	419969.16	0.26
SH13APY000538	Tree Planting	Gwynns Falls	02130905	193519.65	418592.96	0.13
SH13APY000539	Tree Planting	Gwynns Falls	02130905	193759.59	418149.25	0.50
SH13APY000540	Tree Planting	Gwynns Falls	02130905	193981.80	417819.58	0.18
SH13APY000541	Tree Planting	Gwynns Falls	02130905	196861.02	415416.22	0.19
SH13APY000542	Tree Planting	Gwynns Falls	02130905	196929.96	415354.54	0.09

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13APY000543	Tree Planting	Gwynns Falls	02130905	197866.33	414739.14	0.27
SH13APY000544	Tree Planting	Gwynns Falls	02130905	193590.69	417957.14	0.64
SH13APY000545	Tree Planting	Loch Raven Reservoir	02130805	203231.80	428539.09	0.29
SH13APY000546	Tree Planting	Back River	02130901	183757.97	444282.68	0.19
SH13APY000547	Tree Planting	Back River	02130901	180895.66	442752.37	0.27
SH13APY000548	Tree Planting	Back River	02130901	180804.53	442865.56	0.12
SH13APY000549	Tree Planting	Back River	02130901	180320.41	442934.48	0.15
SH13APY000550	Tree Planting	Back River	02130901	180230.42	442915.35	0.27
SH13APY000551	Tree Planting	Back River	02130901	179913.83	443411.01	0.28
SH13APY000552	Tree Planting	Back River	02130901	180009.93	443427.23	0.18
SH13APY000553	Tree Planting	Back River	02130901	179840.68	443670.94	0.80
SH13APY000554	Tree Planting	Back River	02130901	179536.88	444086.02	0.16
SH13APY000555	Tree Planting	Baltimore Harbor	02130903	178816.83	445483.58	0.11
SH13APY000556	Tree Planting	Back River	02130901	179095.80	445420.70	0.22
SH13APY000557	Tree Planting	Back River	02130901	178853.01	445580.13	0.57
SH13APY000558	Tree Planting	Baltimore Harbor	02130903	178215.13	446122.06	0.11
SH13APY000559	Tree Planting	Back River	02130901	177613.96	446445.90	0.10
SH13APY000560	Tree Planting	Back River	02130901	177837.74	446441.14	0.23
SH13APY000561	Tree Planting	Back River	02130901	176477.40	446843.92	0.09
SH13APY000562	Tree Planting	Back River	02130901	176412.34	446727.14	0.17
SH13APY000563	Tree Planting	Back River	02130901	175530.46	447055.18	0.27
SH13APY000564	Tree Planting	Lower Gunpowder Falls	02130802	192587.53	437459.90	0.19
SH13APY000565	Tree Planting	Back River	02130901	192135.55	438791.08	0.72
SH13APY000566	Tree Planting	Loch Raven Reservoir	02130805	193879.48	434489.05	0.28
SH13APY000567	Tree Planting	Back River	02130901	192220.49	438728.89	0.41

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13APY000568	Tree Planting	Jones Falls	02130904	194667.51	430854.13	0.64
SH13APY000569	Tree Planting	Gwynns Falls	02130905	182884.62	422059.21	0.25
SH13APY000570	Tree Planting	Back River	02130901	192063.41	439059.71	0.09
SH13APY000571	Tree Planting	Back River	02130901	192146.75	438973.25	0.24
SH13APY000572	Tree Planting	Gwynns Falls	02130905	182687.16	421913.65	0.41
SH13APY000573	Tree Planting	Loch Raven Reservoir	02130805	194063.41	433284.93	0.19
SH13APY000575	Tree Planting	Lower Gunpowder Falls	02130802	193633.16	436226.48	0.24
SH13APY000576	Tree Planting	Back River	02130901	183561.75	446700.10	0.11
SH13APY000577	Tree Planting	Back River	02130901	183594.90	446796.49	0.14
SH13APY000578	Tree Planting	Back River	02130901	183370.65	446779.49	0.73
SH13APY000579	Tree Planting	Back River	02130901	181229.51	442831.21	0.30
SH13APY000580	Tree Planting	Back River	02130901	180690.22	441484.36	0.36
SH13APY000581	Tree Planting	Back River	02130901	180685.23	441800.96	0.26
SH13APY000582	Tree Planting	Back River	02130901	180637.67	441643.62	0.19
SH13APY000583	Tree Planting	Back River	02130901	180755.50	441655.45	0.31
SH13APY000584	Tree Planting	Back River	02130901	184952.39	444150.40	0.11
SH13APY000585	Tree Planting	Back River	02130901	185172.35	444091.51	0.16
SH13APY000586	Tree Planting	Back River	02130901	185115.34	444155.50	0.24
SH13APY000587	Tree Planting	Back River	02130901	178987.57	445563.64	0.10
SH13APY000588	Tree Planting	Back River	02130901	179005.21	445378.70	0.29
SH13APY000589	Tree Planting	Back River	02130901	178666.23	449508.98	0.83
SH13APY000590	Tree Planting	Gwynns Falls	02130905	182146.65	421897.24	1.55
SH13APY000591	Tree Planting	Back River	02130901	178873.68	445519.73	0.20
SH13APY000592	Tree Planting	Back River	02130901	179026.33	445382.99	0.06
SH13APY000594	Tree Planting	Jones Falls	02130904	194105.77	431858.18	0.07

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13APY000595	Tree Planting	Double Pipe Creek	02140304	211801.74	398716.56	0.30
SH13APY000596	Tree Planting	Double Pipe Creek	02140304	210097.18	397193.60	0.23
SH13APY000597	Tree Planting	Double Pipe Creek	02140304	209833.42	396499.61	0.27
SH13APY000598	Tree Planting	Double Pipe Creek	02140304	208486.05	391816.02	0.26
SH13APY000599	Tree Planting	Double Pipe Creek	02140304	214575.46	395950.34	0.72
SH13APY000600	Tree Planting	Double Pipe Creek	02140304	215067.52	395151.77	0.90
SH13APY000601	Tree Planting	S Branch Patapsco	02130908	190150.25	387650.95	0.06
SH13APY000602	Tree Planting	S Branch Patapsco	02130908	189194.05	387383.30	0.20
SH13APY000603	Tree Planting	S Branch Patapsco	02130908	188563.50	386660.77	0.09
SH13APY000604	Tree Planting	S Branch Patapsco	02130908	188386.60	402923.27	0.16
SH13APY000605	Tree Planting	Double Pipe Creek	02140304	212963.81	399243.66	0.38
SH13APY000606	Tree Planting	Double Pipe Creek	02140304	212198.90	399047.02	0.17
SH13APY000607	Tree Planting	Double Pipe Creek	02140304	211906.79	398829.53	0.05
SH13APY000608	Tree Planting	Double Pipe Creek	02140304	211217.51	398321.88	0.14
SH13APY000609	Tree Planting	Double Pipe Creek	02140304	211637.01	398587.79	0.18
SH13APY000610	Tree Planting	Double Pipe Creek	02140304	211424.81	398462.21	0.14
SH13APY000611	Tree Planting	Double Pipe Creek	02140304	209932.55	396773.70	0.01
SH13APY000612	Tree Planting	Double Pipe Creek	02140304	209530.83	396072.62	0.09
SH13APY000613	Tree Planting	Double Pipe Creek	02140304	209735.14	396327.86	0.11
SH13APY000614	Tree Planting	Double Pipe Creek	02140304	209618.21	396173.40	0.08
SH13APY000615	Tree Planting	Patuxent River lower	02131101	96069.71	419359.11	0.32
SH13APY000616	Tree Planting	Patuxent River lower	02131101	96081.24	419469.59	0.15
SH13APY000617	Tree Planting	Patuxent River lower	02131101	95917.65	419503.16	0.14
SH13APY000618	Tree Planting	Patuxent River lower	02131101	96214.77	419430.56	0.08
SH13APY000619	Tree Planting	Patuxent River lower	02131101	97075.48	418608.04	0.15

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13APY000620	Tree Planting	Patuxent River lower	02131101	96461.89	419269.79	0.51
SH13APY000621	Tree Planting	Patuxent River lower	02131101	96657.28	418966.66	0.17
SH13APY000622	Tree Planting	Lower Monocacy River	02140302	192354.50	364104.56	0.75
SH13APY000623	Tree Planting	Lower Monocacy River	02140302	192858.66	367189.87	2.17
SH13APY000624	Tree Planting	Lower Monocacy River	02140302	193046.40	369650.17	0.25
SH13APY000625	Tree Planting	Lower Monocacy River	02140302	206588.33	373151.01	0.28
SH13APY000626	Tree Planting	Lower Monocacy River	02140302	208064.33	373012.14	0.22
SH13APY000627	Tree Planting	Lower Monocacy River	02140302	197203.15	365217.75	0.17
SH13APY000628	Tree Planting	Lower Monocacy River	02140302	197423.07	365365.09	0.43
SH13APY000630	Tree Planting	Upper Monocacy River	02140303	215349.79	363392.78	0.20
SH13APY000631	Tree Planting	Upper Monocacy River	02140303	218700.74	364886.36	0.33
SH13APY000632	Tree Planting	Upper Monocacy River	02140303	225950.15	373393.49	0.03
SH13APY000633	Tree Planting	Upper Monocacy River	02140303	226053.04	373211.47	0.21
SH13APY000634	Tree Planting	Upper Monocacy River	02140303	218639.57	364781.50	0.11
SH13APY000635	Tree Planting	Lower Winters Run	02130702	195167.44	459431.23	0.25
SH13APY000636	Tree Planting	Gunpowder River	02130801	194958.22	459435.42	0.07
SH13APY000637	Tree Planting	Atkisson Reservoir	02130703	206094.08	454021.90	0.34
SH13APY000638	Tree Planting	Atkisson Reservoir	02130703	207954.72	454286.30	0.40
SH13APY000639	Tree Planting	Bynum Run	02130704	209509.40	454349.17	0.41
SH13APY000640	Tree Planting	Bynum Run	02130704	209701.97	454401.75	0.26
SH13APY000641	Tree Planting	Bynum Run	02130704	209795.54	454432.74	0.18
SH13APY000642	Tree Planting	Bynum Run	02130704	209883.86	454503.87	0.52
SH13APY000643	Tree Planting	Bynum Run	02130704	210015.29	454551.50	1.28
SH13APY000644	Tree Planting	Bynum Run	02130704	209952.15	454407.44	0.29
SH13APY000645	Tree Planting	Conowingo Dam	02120204	220449.35	468578.02	0.23

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13APY000647	Tree Planting	Atkisson Reservoir	02130703	208120.08	454212.64	0.39
SH13APY000648	Tree Planting	Lower Winters Run	02130702	195072.59	459408.34	0.04
SH13APY000649	Tree Planting	Patapsco River L N Br	02130906	171156.50	418484.83	0.39
SH13APY000650	Tree Planting	Patapsco River L N Br	02130906	171144.78	418684.49	0.11
SH13APY000651	Tree Planting	Patapsco River L N Br	02130906	171153.59	418811.02	0.09
SH13APY000652	Tree Planting	Patapsco River L N Br	02130906	168897.56	421215.98	0.22
SH13APY000653	Tree Planting	Patapsco River L N Br	02130906	169072.27	421035.38	0.24
SH13APY000654	Tree Planting	Little Patuxent River	02131105	169371.19	416131.71	0.25
SH13APY000655	Tree Planting	Little Patuxent River	02131105	169268.51	416168.19	0.59
SH13APY000656	Tree Planting	Little Patuxent River	02131105	169171.42	416313.19	0.14
SH13APY000657	Tree Planting	Middle Patuxent River	02131106	178443.16	401084.77	0.49
SH13APY000658	Tree Planting	Middle Patuxent River	02131106	178397.34	401161.49	0.21
SH13APY000659	Tree Planting	Little Patuxent River	02131105	163476.88	416363.26	0.71
SH13APY000660	Tree Planting	Little Patuxent River	02131105	163383.15	416096.74	0.79
SH13APY000661	Tree Planting	Little Patuxent River	02131105	163270.22	416252.59	0.61
SH13APY000662	Tree Planting	Little Patuxent River	02131105	174599.81	413917.41	0.49
SH13APY000663	Tree Planting	Little Patuxent River	02131105	173254.72	413457.08	0.05
SH13APY000664	Tree Planting	Little Patuxent River	02131105	173354.08	413495.69	0.15
SH13APY000665	Tree Planting	Little Patuxent River	02131105	173150.04	413450.37	0.08
SH13APY000667	Tree Planting	Middle Patuxent River	02131106	167966.34	410680.84	0.23
SH13APY000668	Tree Planting	Middle Patuxent River	02131106	168184.29	410624.98	0.26
SH13APY000669	Tree Planting	Little Patuxent River	02131105	168317.94	410954.19	0.07
SH13APY000670	Tree Planting	Little Patuxent River	02131105	168014.24	410897.81	0.24
SH13APY000671	Tree Planting	Little Patuxent River	02131105	181810.90	407448.52	0.24
SH13APY000672	Tree Planting	Little Patuxent River	02131105	181852.41	407282.07	0.34

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13APY000673	Tree Planting	Middle Patuxent River	02131106	182210.91	403999.49	0.79
SH13APY000674	Tree Planting	Middle Patuxent River	02131106	182386.51	403826.61	0.30
SH13APY000675	Tree Planting	Patapsco River L N Br	02130906	180975.09	414872.60	0.08
SH13APY000676	Tree Planting	Little Patuxent River	02131105	163448.65	410948.43	0.06
SH13APY000678	Tree Planting	Little Patuxent River	02131105	164075.53	409382.99	0.06
SH13APY000679	Tree Planting	Little Patuxent River	02131105	164068.33	409515.52	0.05
SH13APY000680	Tree Planting	Little Patuxent River	02131105	164051.59	409587.90	0.01
SH13APY000681	Tree Planting	Patapsco River L N Br	02130906	169008.97	423928.25	0.77
SH13APY000682	Tree Planting	Middle Patuxent River	02131106	178908.68	401463.02	0.61
SH13APY000683	Tree Planting	Middle Patuxent River	02131106	179352.72	402117.05	0.87
SH13APY000684	Tree Planting	Patapsco River L N Br	02130906	169052.39	423861.58	0.61
SH13APY000685	Tree Planting	Lower Monocacy River	02140302	179004.17	372091.22	0.47
SH13APY000686	Tree Planting	Anacostia River	02140205	149842.87	398680.84	0.21
SH13APY000687	Tree Planting	Anacostia River	02140205	149698.52	398622.36	0.14
SH13APY000688	Tree Planting	Anacostia River	02140205	149733.16	398481.05	0.07
SH13APY000689	Tree Planting	Anacostia River	02140205	149841.85	398518.90	0.18
SH13APY000690	Tree Planting	Anacostia River	02140205	149651.90	399524.73	0.11
SH13APY000691	Tree Planting	Anacostia River	02140205	149799.10	399437.33	0.13
SH13APY000692	Tree Planting	Seneca Creek	02140208	171327.01	384235.41	0.36
SH13APY000693	Tree Planting	Seneca Creek	02140208	171482.10	384335.98	0.33
SH13APY000694	Tree Planting	Seneca Creek	02140208	171632.62	384462.45	0.13
SH13APY000695	Tree Planting	Seneca Creek	02140208	171612.02	384254.98	0.29
SH13APY000696	Tree Planting	Seneca Creek	02140208	171377.62	384083.59	0.18
SH13APY000697	Tree Planting	Western Branch	02131103	139028.36	412890.99	0.51
SH13APY000698	Tree Planting	Western Branch	02131103	136211.07	413151.01	0.58

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13APY000699	Tree Planting	Western Branch	02131103	136278.18	413243.07	0.21
SH13APY000700	Tree Planting	Potomac River U tidal	02140201	128120.18	406818.11	0.21
SH13APY000701	Tree Planting	Potomac River U tidal	02140201	128089.43	406860.70	0.33
SH13APY000702	Tree Planting	Potomac River U tidal	02140201	128181.88	406971.48	0.46
SH13APY000703	Tree Planting	Potomac River U tidal	02140201	128106.84	407042.66	0.37
SH13APY000704	Tree Planting	Piscataway Creek	02140203	117818.01	402342.30	1.54
SH13APY000705	Tree Planting	Piscataway Creek	02140203	118547.96	402698.46	0.15
SH13APY000706	Tree Planting	Potomac River U tidal	02140201	125818.33	400185.65	0.70
SH13APY000707	Tree Planting	Anacostia River	02140205	139084.99	412859.78	0.09
SH13APY000708	Tree Planting	Conococheague Creek	02140504	220571.54	326901.58	1.04
SH13APY000709	Tree Planting	Conococheague Creek	02140504	220430.55	327381.54	0.55
SH13APY000710	Tree Planting	Conococheague Creek	02140504	219995.35	328235.68	0.49
SH13APY000711	Tree Planting	Conococheague Creek	02140504	216681.28	332501.51	0.58
SH13APY000712	Tree Planting	Conococheague Creek	02140504	216762.57	332663.35	0.70
SH13APY000713	Tree Planting	Conococheague Creek	02140504	216841.65	332749.57	0.35
SH13APY000714	Tree Planting	Marsh Run	02140503	215537.91	335059.01	0.53
SH13APY000715	Tree Planting	Antietam Creek	02140502	214963.57	341423.27	0.65
SH13APY000716	Tree Planting	Antietam Creek	02140502	214765.75	341501.29	0.79
SH13APY000717	Tree Planting	Antietam Creek	02140502	208618.66	347772.65	0.52
SH13APY000718	Tree Planting	Conococheague Creek	02140504	220688.13	325006.32	1.30
SH13APY000719	Tree Planting	Conococheague Creek	02140504	220604.75	325743.78	0.84
SH13APY000720	Tree Planting	Little Conococheague	02140505	220686.75	324017.39	0.43
SH13APY000721	Tree Planting	Conococheague Creek	02140504	220680.08	324336.49	0.18
SH13APY000722	Tree Planting	Little Conococheague	02140505	220883.14	321383.47	0.88
SH13APY000723	Tree Planting	Little Conococheague	02140505	220701.50	323817.58	0.44

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13APY000724	Tree Planting	Little Conococheague	02140505	220582.28	320893.16	0.27
SH13APY000725	Tree Planting	Potomac River WA Cnty	02140501	220249.29	319685.34	0.54
SH13APY000726	Tree Planting	Potomac River WA Cnty	02140501	219795.85	318844.07	1.37
SH13APY000727	Tree Planting	Little Conococheague	02140505	220618.78	320652.23	1.78
SH13APY000728	Tree Planting	Potomac River WA Cnty	02140501	219123.15	317959.95	0.33
SH13APY000729	Tree Planting	Potomac River WA Cnty	02140501	224795.59	304965.50	0.95
SH13APY000730	Tree Planting	Potomac River WA Cnty	02140501	227181.41	298574.83	0.19
SH13APY000731	Tree Planting	Potomac River WA Cnty	02140501	227139.61	298469.96	0.31
SH13APY000732	Tree Planting	Little Tonoloway Creek	02140509	227082.50	298346.07	0.54
SH13APY000733	Tree Planting	Potomac River WA Cnty	02140501	225442.71	302566.43	0.44
SH13APY000734	Tree Planting	Little Tonoloway Creek	02140509	227696.09	298202.75	0.70
SH13APY000735	Tree Planting	Little Tonoloway Creek	02140509	227888.21	297894.82	0.73
SH13APY000736	Tree Planting	Little Tonoloway Creek	02140509	227327.03	298404.41	0.37
SH13APY000737	Tree Planting	Little Tonoloway Creek	02140509	227242.15	298362.43	0.33
SH13APY000738	Tree Planting	Little Tonoloway Creek	02140509	228155.25	298137.32	0.85
SH13APY000739	Tree Planting	Little Tonoloway Creek	02140509	227995.76	298021.75	0.48
SH13APY000741	Tree Planting	Little Tonoloway Creek	02140509	226205.20	292991.29	0.27
SH13APY000742	Tree Planting	Little Tonoloway Creek	02140509	226197.67	293125.69	0.25
SH13APY000743	Tree Planting	Little Tonoloway Creek	02140509	227900.57	294517.36	0.25
SH13APY000744	Tree Planting	Little Tonoloway Creek	02140509	227915.03	294646.11	0.12
SH13APY000745	Tree Planting	Conococheague Creek	02140504	220864.68	335789.14	0.56
SH13APY000746	Tree Planting	Conococheague Creek	02140504	226074.54	336479.42	0.37
SH13APY000747	Tree Planting	Conococheague Creek	02140504	225923.70	336564.49	1.15
SH13APY000748	Tree Planting	Conococheague Creek	02140504	225995.09	336673.84	0.45
SH13APY000749	Tree Planting	Antietam Creek	02140502	215364.58	337464.39	0.80

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH13APY000750	Tree Planting	Antietam Creek	02140502	215634.08	337460.59	0.91
SH13APY000751	Tree Planting	Little Conococheague	02140505	220767.55	322330.25	0.93
SH13APY000752	Tree Planting	Marsh Run	02140503	215638.40	334821.24	0.53
SH13APY000753	Tree Planting	Conococheague Creek	02140504	220842.65	335955.64	0.19
SH13APY000754	Tree Planting	Antietam Creek	02140502	215364.41	337297.48	0.56
SH13APY000755	Tree Planting	Conococheague Creek	02140504	221220.49	331423.63	0.63
SH13APY000756	Tree Planting	Potomac River WA Cnty	02140501	227144.11	298523.93	0.16
SH13APY000757	Tree Planting	Conococheague Creek	02140504	220672.69	324299.23	0.09
SH13APY000758	Tree Planting	Little Conococheague	02140505	220323.27	319853.53	0.07
SH13APY000759	Tree Planting	Conococheague Creek	02140504	215640.31	333737.71	0.37
SH13APY000760	Tree Planting	Marsh Run	02140503	215506.74	335106.83	0.28
SH13APY000761	Tree Planting	Potomac River WA Cnty	02140501	219069.50	317857.43	0.28
SH13APY000762	Tree Planting	Antietam Creek	02140502	214939.93	341558.96	0.40
SH13APY000763	Tree Planting	Marsh Run	02140503	215627.52	334110.22	0.39
SH13APY001580	Tree Planting	Severn River	02131002	155832.60	434638.06	0.32
SH13APY001581	Tree Planting	Lower Winters Run	02130702	195309.88	459408.85	0.36
SH13APY001587	Tree Planting	S Branch Patapsco	02130908	190400.08	387703.00	0.56
SH13APY001590	Tree Planting	Jones Falls	02130904	194201.18	432061.82	0.12
SH13APY001591	Tree Planting	Jones Falls	02130904	194251.40	432025.35	0.09
SH13APY001593	Tree Planting	Jones Falls	02130904	194050.62	431819.65	0.07
SH13APY003000	Tree Planting	Gwynns Falls	02130905	191253.73	420673.06	0.72
SH14APY000764	Tree Planting	Bodkin Creek	02130902	161380.61	442393.88	0.38
SH14APY000765	Tree Planting	Bodkin Creek	02130902	161315.64	442447.40	0.59
SH14APY000766	Tree Planting	Double Pipe Creek	02140304	211300.21	385766.12	0.16
SH14APY000767	Tree Planting	Double Pipe Creek	02140304	209848.03	389066.66	0.42

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH14APY000768	Tree Planting	Double Pipe Creek	02140304	208678.93	392917.87	0.17
SH14APY000769	Tree Planting	Double Pipe Creek	02140304	208884.77	394368.92	0.66
SH14APY000770	Tree Planting	S Branch Patapsco	02130908	190649.54	387758.32	0.40
SH14APY000771	Tree Planting	Double Pipe Creek	02140304	210389.76	397587.70	0.86
SH14APY000772	Tree Planting	Double Pipe Creek	02140304	210945.31	398098.85	0.45
SH14APY000773	Tree Planting	Double Pipe Creek	02140304	211978.35	398901.84	0.07
SH14APY000774	Tree Planting	S Branch Patapsco	02130908	190813.77	387825.16	0.17
SH14APY000775	Tree Planting	S Branch Patapsco	02130908	188168.33	387145.45	0.19
SH14APY000776	Tree Planting	Upper Monocacy River	02140303	222106.95	385847.56	0.60
SH14APY000777	Tree Planting	Upper Monocacy River	02140303	222670.37	386283.64	0.62
SH14APY000778	Tree Planting	Upper Monocacy River	02140303	226847.50	389187.43	0.12
SH14APY000779	Tree Planting	Double Pipe Creek	02140304	199780.42	393311.22	0.27
SH14APY000780	Tree Planting	Upper Monocacy River	02140303	224764.81	387581.79	0.30
SH14APY000781	Tree Planting	Upper Monocacy River	02140303	227663.18	389350.51	0.33
SH14APY000782	Tree Planting	S Branch Patapsco	02130908	198405.65	393491.39	0.18
SH14APY000783	Tree Planting	S Branch Patapsco	02130908	191652.77	387849.81	0.35
SH14APY000784	Tree Planting	Lower Monocacy River	02140302	199379.76	390170.00	0.17
SH14APY000785	Tree Planting	S Branch Patapsco	02130908	197889.97	394627.03	0.16
SH14APY000786	Tree Planting	Double Pipe Creek	02140304	217975.70	390786.86	0.14
SH14APY000787	Tree Planting	Upper Monocacy River	02140303	224619.68	387501.61	0.17
SH14APY000788	Tree Planting	S Branch Patapsco	02130908	190899.86	387782.67	0.39
SH14APY000789	Tree Planting	S Branch Patapsco	02130908	191117.40	387793.97	0.47
SH14APY000790	Tree Planting	Upper Monocacy River	02140303	221815.78	385604.55	0.19
SH14APY000791	Tree Planting	Double Pipe Creek	02140304	210752.76	397912.79	0.39
SH14APY000792	Tree Planting	Lower Monocacy River	02140302	194169.69	362461.87	0.39

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH14APY000793	Tree Planting	Catoctin Creek	02140305	199806.47	355983.59	0.21
SH14APY000794	Tree Planting	Catoctin Creek	02140305	196531.61	352934.67	0.21
SH14APY000795	Tree Planting	Catoctin Creek	02140305	196343.16	352681.86	0.20
SH14APY000796	Tree Planting	Catoctin Creek	02140305	193759.52	349252.92	0.14
SH14APY000797	Tree Planting	Lower Monocacy River	02140302	190655.38	375184.06	0.04
SH14APY000799	Tree Planting	Lower Monocacy River	02140302	189132.03	382287.50	0.12
SH14APY000800	Tree Planting	Lower Monocacy River	02140302	188901.45	382693.15	0.12
SH14APY000801	Tree Planting	Lower Monocacy River	02140302	188826.40	356835.70	0.59
SH14APY000802	Tree Planting	Lower Monocacy River	02140302	189281.53	357398.89	0.28
SH14APY000803	Tree Planting	Potomac River FR Cnty	02140301	186192.86	345203.28	0.02
SH14APY000804	Tree Planting	Lower Monocacy River	02140302	190906.43	360571.53	0.13
SH14APY000807	Tree Planting	Lower Monocacy River	02140302	206825.09	373215.34	0.76
SH14APY000808	Tree Planting	Lower Monocacy River	02140302	187923.18	385267.73	0.36
SH14APY000810	Tree Planting	Potomac River FR Cnty	02140301	186273.77	345303.23	0.06
SH14APY000811	Tree Planting	Catoctin Creek	02140305	199708.94	356034.64	0.14
SH14APY000812	Tree Planting	Catoctin Creek	02140305	196668.32	353016.33	0.62
SH14APY000814	Tree Planting	Lower Monocacy River	02140302	207106.20	373248.61	0.16
SH14APY000815	Tree Planting	Deer Creek	02120202	212314.28	468158.46	0.54
SH14APY000816	Tree Planting	Swan Creek	02130706	212396.40	468356.04	0.29
SH14APY000817	Tree Planting	Lower Susquehanna River	02120201	212028.76	471827.99	0.79
SH14APY000818	Tree Planting	Broad Creek	02120205	224491.65	460228.91	0.12
SH14APY000819	Tree Planting	Broad Creek	02120205	224926.26	459734.56	0.42
SH14APY000820	Tree Planting	Broad Creek	02120205	225006.69	459608.77	0.11
SH14APY000823	Tree Planting	Lower Susquehanna River	02120201	211903.42	471529.53	0.30
SH14APY000824	Tree Planting	Broad Creek	02120205	225549.32	458309.87	0.10

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH14APY000825	Tree Planting	Broad Creek	02120205	226448.15	456692.30	0.05
SH14APY000826	Tree Planting	Lower Susquehanna River	02120201	212200.29	472474.00	0.36
SH14APY000827	Tree Planting	Broad Creek	02120205	228195.80	456316.92	0.09
SH14APY000828	Tree Planting	Lower Susquehanna River	02120201	211894.11	471287.00	0.38
SH14APY000829	Tree Planting	Broad Creek	02120205	225092.61	459424.80	0.03
SH14APY000830	Tree Planting	Broad Creek	02120205	225299.45	458938.99	0.10
SH14APY000831	Tree Planting	Broad Creek	02120205	225289.10	458923.89	0.22
SH14APY000832	Tree Planting	Broad Creek	02120205	225286.27	453800.19	0.57
SH14APY000833	Tree Planting	Broad Creek	02120205	227420.98	455941.31	0.11
SH14APY000834	Tree Planting	Broad Creek	02120205	224373.62	460420.65	0.05
SH14APY000835	Tree Planting	Broad Creek	02120205	223747.24	452571.36	0.07
SH14APY000836	Tree Planting	Lower Susquehanna River	02120201	211951.11	471711.50	0.11
SH14APY000837	Tree Planting	Broad Creek	02120205	225566.75	458318.48	0.01
SH14APY000840	Tree Planting	Broad Creek	02120205	224447.57	453602.70	0.31
SH14APY000842	Tree Planting	Broad Creek	02120205	224542.34	460144.42	0.02
SH14APY000843	Tree Planting	Broad Creek	02120205	225358.00	458753.56	0.06
SH14APY000844	Tree Planting	Broad Creek	02120205	225967.55	457519.16	0.09
SH14APY000846	Tree Planting	Broad Creek	02120205	223700.53	452470.47	0.25
SH14APY000847	Tree Planting	Broad Creek	02120205	227265.76	455787.30	0.18
SH14APY000848	Tree Planting	Lower Susquehanna River	02120201	211946.67	471523.16	0.85
SH14APY000849	Tree Planting	Broad Creek	02120205	225079.22	459416.49	0.07
SH14APY000850	Tree Planting	Lower Susquehanna River	02120201	212200.52	473199.44	0.28
SH14APY000851	Tree Planting	Broad Creek	02120205	223881.94	453116.84	1.61
SH14APY000852	Tree Planting	Broad Creek	02120205	225396.08	458680.43	0.05
SH14APY000855	Tree Planting	Broad Creek	02120205	224165.97	453520.60	0.61

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH14APY000856	Tree Planting	Broad Creek	02120205	225927.34	454086.30	0.05
SH14APY000857	Tree Planting	Middle Patuxent River	02131106	168504.77	409058.50	0.21
SH14APY000858	Tree Planting	Middle Patuxent River	02131106	165646.37	409468.53	0.26
SH14APY000859	Tree Planting	Middle Patuxent River	02131106	168410.09	410180.00	0.07
SH14APY000860	Tree Planting	Middle Patuxent River	02131106	168516.54	408827.89	0.31
SH14APY000861	Tree Planting	Patapsco River L N Br	02130906	171794.17	417684.87	0.20
SH14APY000862	Tree Planting	Little Patuxent River	02131105	163472.68	416031.13	0.43
SH14APY000863	Tree Planting	Middle Patuxent River	02131106	168607.55	408639.71	0.48
SH14APY000864	Tree Planting	Little Patuxent River	02131105	168117.22	410684.94	0.68
SH14APY000865	Tree Planting	Middle Patuxent River	02131106	169061.83	408021.90	0.57
SH14APY000866	Tree Planting	Middle Patuxent River	02131106	170376.93	405966.88	0.12
SH14APY000867	Tree Planting	Little Patuxent River	02131105	172891.53	413470.02	0.10
SH14APY000868	Tree Planting	Patapsco River L N Br	02130906	178978.00	415515.66	0.40
SH14APY000869	Tree Planting	Little Patuxent River	02131105	175352.35	415756.57	0.23
SH14APY000870	Tree Planting	Little Patuxent River	02131105	175286.91	415723.99	0.19
SH14APY000871	Tree Planting	Little Patuxent River	02131105	175456.96	415842.74	0.23
SH14APY000872	Tree Planting	Patapsco River L N Br	02130906	171401.40	417767.03	0.17
SH14APY000873	Tree Planting	Patuxent River upper	02131104	162077.71	411789.16	0.22
SH14APY000874	Tree Planting	Patapsco River L N Br	02130906	171223.53	418045.93	0.25
SH14APY000875	Tree Planting	Little Patuxent River	02131105	174882.72	415997.37	0.10
SH14APY000876	Tree Planting	Patapsco River L N Br	02130906	169767.32	420166.06	0.75
SH14APY000877	Tree Planting	Little Patuxent River	02131105	169644.65	416013.70	0.16
SH14APY000878	Tree Planting	Patapsco River L N Br	02130906	171520.39	417671.05	0.09
SH14APY000879	Tree Planting	Patapsco River L N Br	02130906	178678.25	415364.00	0.28
SH14APY000880	Tree Planting	Middle Patuxent River	02131106	170960.30	405126.82	0.31

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH14APY000881	Tree Planting	Middle Patuxent River	02131106	169494.60	407180.30	0.09
SH14APY000882	Tree Planting	Little Patuxent River	02131105	164921.69	415108.50	0.14
SH14APY000883	Tree Planting	Little Patuxent River	02131105	162331.10	417376.75	0.14
SH14APY000884	Tree Planting	Little Patuxent River	02131105	162619.57	417327.50	0.13
SH14APY000885	Tree Planting	Little Patuxent River	02131105	163363.98	416458.45	0.57
SH14APY000886	Tree Planting	Little Patuxent River	02131105	166785.92	413729.99	0.37
SH14APY000887	Tree Planting	Middle Patuxent River	02131106	169898.24	406488.22	0.15
SH14APY000888	Tree Planting	Middle Patuxent River	02131106	170742.37	405579.42	0.34
SH14APY000889	Tree Planting	Patapsco River L N Br	02130906	178999.52	415750.18	0.23
SH14APY000890	Tree Planting	Little Patuxent River	02131105	175510.48	415662.09	1.16
SH14APY000891	Tree Planting	Little Patuxent River	02131105	175611.29	415764.51	0.73
SH14APY000892	Tree Planting	Little Patuxent River	02131105	168341.87	417739.04	0.70
SH14APY000893	Tree Planting	Little Patuxent River	02131105	164207.85	408968.71	1.94
SH14APY000894	Tree Planting	Little Patuxent River	02131105	162235.98	417815.64	0.40
SH14APY000895	Tree Planting	Patapsco River L N Br	02130906	169917.11	419995.78	0.40
SH14APY000897	Tree Planting	Little Patuxent River	02131105	169835.29	415788.70	0.50
SH14APY000898	Tree Planting	Middle Patuxent River	02131106	168005.97	410689.42	0.15
SH14APY000899	Tree Planting	Patuxent River upper	02131104	162051.54	412191.55	0.07
SH14APY000900	Tree Planting	Patapsco River L N Br	02130906	171183.41	418666.29	0.19
SH14APY000901	Tree Planting	Patapsco River L N Br	02130906	169621.29	420491.49	0.15
SH14APY000902	Tree Planting	Patapsco River L N Br	02130906	170848.09	419276.40	0.24
SH14APY000903	Tree Planting	Middle Patuxent River	02131106	178498.43	401261.63	0.45
SH14APY000904	Tree Planting	Middle Patuxent River	02131106	170142.45	406122.59	0.07
SH14APY000905	Tree Planting	Little Patuxent River	02131105	165413.52	414699.82	0.15
SH14APY000906	Tree Planting	Little Patuxent River	02131105	162137.18	417787.71	0.61

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH14APY000907	Tree Planting	Little Patuxent River	02131105	162951.33	416929.67	0.31
SH14APY000908	Tree Planting	Middle Patuxent River	02131106	169818.13	406597.58	0.15
SH14APY000909	Tree Planting	Patapsco River L N Br	02130906	171639.74	417487.26	0.54
SH14APY000910	Tree Planting	Patapsco River L N Br	02130906	171461.90	417387.21	0.71
SH14APY000911	Tree Planting	Little Patuxent River	02131105	168065.90	410717.01	0.14
SH14APY000912	Tree Planting	Little Patuxent River	02131105	168158.57	410739.30	0.21
SH14APY000913	Tree Planting	Little Patuxent River	02131105	170027.10	415780.37	0.15
SH14APY000914	Tree Planting	Patapsco River L N Br	02130906	171439.68	417574.59	0.56
SH14APY000915	Tree Planting	Little Patuxent River	02131105	163297.14	416098.76	0.12
SH14APY000916	Tree Planting	Middle Patuxent River	02131106	168423.07	408852.47	0.10
SH14APY000917	Tree Planting	Middle Patuxent River	02131106	168888.26	408315.97	0.13
SH14APY000918	Tree Planting	Middle Patuxent River	02131106	168418.83	410042.58	0.09
SH14APY001554	Tree Planting	Middle Patuxent River	02131106	168215.53	410580.54	0.28
SH14APY001555	Tree Planting	Little Patuxent River	02131105	169505.78	416168.39	0.89
SH14APY001556	Tree Planting	Liberty Reservoir	02130907	216255.50	411724.43	3.81
SH14APY001557	Tree Planting	Liberty Reservoir	02130907	216643.15	411699.62	2.63
SH14APY001558	Tree Planting	Liberty Reservoir	02130907	217538.53	411273.54	0.76
SH14APY001559	Tree Planting	Liberty Reservoir	02130907	217885.50	411383.85	3.58
SH14APY001560	Tree Planting	Liberty Reservoir	02130907	218308.84	411403.56	0.91
SH14APY001561	Tree Planting	Liberty Reservoir	02130907	216178.56	411323.08	8.21
SH14APY001562	Tree Planting	Liberty Reservoir	02130907	217120.97	411308.52	10.32
SH14APY001565	Tree Planting	Potomac River FR Cnty	02140301	186837.88	346028.20	0.09
SH14APY001594	Tree Planting	Little Patuxent River	02131105	168799.99	411116.48	0.14
SH14APY001596	Tree Planting	Little Patuxent River	02131105	172861.66	413297.84	0.08
SH14APY001598	Tree Planting	Little Patuxent River	02131105	172779.87	413276.28	0.34

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH14APY001599	Tree Planting	Little Patuxent River	02131105	162436.33	417333.59	0.85
SH14APY001600	Tree Planting	Little Patuxent River	02131105	162687.56	417071.47	0.71
SH14APY001601	Tree Planting	Little Patuxent River	02131105	165534.51	414795.94	0.40
SH14APY001605	Tree Planting	Patuxent River upper	02131104	162067.00	412050.04	1.02
SH14APY001608	Tree Planting	Catoctin Creek	02140305	201434.09	354896.89	0.32
SH14APY001609	Tree Planting	Catoctin Creek	02140305	188213.36	354433.02	0.02
SH14APY001610	Tree Planting	Potomac River FR Cnty	02140301	187050.96	346433.94	0.03
SH14APY001611	Tree Planting	Potomac River FR Cnty	02140301	186949.24	346203.59	0.03
SH14APY001614	Tree Planting	Upper Monocacy River	02140303	203981.05	365550.89	0.04
SH14APY001615	Tree Planting	Upper Monocacy River	02140303	204239.21	365384.61	0.24
SH14APY001616	Tree Planting	Lower Monocacy River	02140302	184128.65	368850.17	0.07
SH14APY001621	Tree Planting	Upper Monocacy River	02140303	201706.85	370326.36	0.59
SH14APY001622	Tree Planting	Catoctin Creek	02140305	199997.55	355192.95	0.86
SH14APY001630	Tree Planting	Bird River	02130803	190452.12	441923.74	0.38
SH14APY001635	Tree Planting	Little Patuxent River	02131105	163109.23	416752.77	0.14
SH14APY001636	Tree Planting	Little Patuxent River	02131105	175800.51	415189.96	0.53
SH14APY003000	Tree Planting	Middle Patuxent River	02131106	182922.58	402563.46	0.21
SH14APY003001	Tree Planting	Anacostia River	02140205	153744.67	406485.53	0.05
SH14APY003002	Tree Planting	Anacostia River	02140205	153758.87	406314.73	0.18
SH15APY000919	Tree Planting	Patapsco River L N Br	02130906	166818.56	423292.94	1.40
SH15APY000920	Tree Planting	Baltimore Harbor	02130903	162961.97	435659.89	0.16
SH15APY000921	Tree Planting	Patapsco River L N Br	02130906	167805.35	422626.65	0.27
SH15APY000922	Tree Planting	Deer Creek	02120202	226640.80	430546.18	1.02
SH15APY000923	Tree Planting	Gwynns Falls	02130905	193833.92	418320.72	0.56
SH15APY000924	Tree Planting	Gwynns Falls	02130905	193673.03	417771.55	0.18

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH15APY000925	Tree Planting	Back River	02130901	180289.13	443063.91	0.21
SH15APY000926	Tree Planting	Gwynns Falls	02130905	193014.34	417452.27	0.18
SH15APY000927	Tree Planting	Gwynns Falls	02130905	182110.12	421757.02	0.08
SH15APY000928	Tree Planting	Lower Gunpowder Falls	02130802	192793.21	439282.71	0.15
SH15APY000929	Tree Planting	Gwynns Falls	02130905	190581.64	421003.72	0.11
SH15APY000930	Tree Planting	Jones Falls	02130904	193429.28	429003.33	0.34
SH15APY000931	Tree Planting	Bird River	02130803	188803.99	449373.25	0.15
SH15APY000932	Tree Planting	Back River	02130901	176252.56	446884.29	0.08
SH15APY000933	Tree Planting	Back River	02130901	177606.66	446548.13	1.19
SH15APY000934	Tree Planting	Bird River	02130803	190467.27	443481.20	0.27
SH15APY000935	Tree Planting	Patapsco River L N Br	02130906	172747.51	425807.30	0.12
SH15APY000936	Tree Planting	Back River	02130901	184730.90	444443.31	0.22
SH15APY000937	Tree Planting	Back River	02130901	183938.97	446220.36	0.15
SH15APY000938	Tree Planting	Patapsco River L N Br	02130906	182168.74	418409.16	0.12
SH15APY000939	Tree Planting	Gwynns Falls	02130905	182081.38	421321.02	0.14
SH15APY000940	Tree Planting	Gwynns Falls	02130905	190921.11	420902.92	0.50
SH15APY000941	Tree Planting	Patapsco River L N Br	02130906	182051.89	419697.42	0.02
SH15APY000942	Tree Planting	Gwynns Falls	02130905	192415.57	420284.22	0.09
SH15APY000944	Tree Planting	Gwynns Falls	02130905	190197.49	421173.58	0.02
SH15APY000945	Tree Planting	Bird River	02130803	190516.82	441457.64	0.26
SH15APY000946	Tree Planting	Jones Falls	02130904	193292.75	428631.01	0.06
SH15APY000947	Tree Planting	Jones Falls	02130904	193048.77	428089.24	0.54
SH15APY000948	Tree Planting	Back River	02130901	180899.79	442724.83	0.24
SH15APY000949	Tree Planting	Back River	02130901	182994.83	447026.43	0.09
SH15APY000950	Tree Planting	Back River	02130901	183216.63	446932.45	0.07

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH15APY000951	Tree Planting	Back River	02130901	183345.65	446954.82	0.13
SH15APY000952	Tree Planting	Back River	02130901	175095.65	446937.30	0.27
SH15APY000953	Tree Planting	Bird River	02130803	189561.42	448955.49	0.10
SH15APY000955	Tree Planting	Back River	02130901	185684.06	443683.79	0.08
SH15APY000956	Tree Planting	Gwynns Falls	02130905	182199.49	421952.12	0.26
SH15APY000957	Tree Planting	Back River	02130901	189184.38	441764.96	0.78
SH15APY000958	Tree Planting	Jones Falls	02130904	191505.69	424863.66	0.13
SH15APY000959	Tree Planting	Bird River	02130803	188649.14	449501.96	0.32
SH15APY000960	Tree Planting	Gwynns Falls	02130905	191501.32	420459.19	0.12
SH15APY000962	Tree Planting	Gwynns Falls	02130905	194126.88	417540.90	0.09
SH15APY000964	Tree Planting	Lower Gunpowder Falls	02130802	193739.37	436356.45	0.10
SH15APY000965	Tree Planting	Gwynns Falls	02130905	191526.63	420370.75	0.15
SH15APY000966	Tree Planting	Deer Creek	02120202	227324.17	430024.83	0.02
SH15APY000968	Tree Planting	Back River	02130901	181008.77	442753.29	0.15
SH15APY000969	Tree Planting	Back River	02130901	183098.21	446984.46	0.19
SH15APY000970	Tree Planting	Back River	02130901	182968.87	447113.69	0.11
SH15APY000971	Tree Planting	Back River	02130901	184845.46	444360.85	0.07
SH15APY000972	Tree Planting	Baltimore Harbor	02130903	178886.90	445361.36	0.09
SH15APY000973	Tree Planting	Gwynns Falls	02130905	191247.41	420624.74	0.31
SH15APY000974	Tree Planting	Back River	02130901	177912.10	446391.10	0.13
SH15APY000975	Tree Planting	Back River	02130901	185641.20	443703.07	0.06
SH15APY000976	Tree Planting	Back River	02130901	186173.92	445959.58	0.06
SH15APY000977	Tree Planting	Jones Falls	02130904	191556.41	424892.15	0.15
SH15APY000978	Tree Planting	Gwynns Falls	02130905	197092.69	415286.85	0.78
SH15APY000979	Tree Planting	Patapsco River L N Br	02130906	175469.26	427149.04	0.09

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH15APY000980	Tree Planting	Gwynns Falls	02130905	182080.47	422165.16	0.06
SH15APY000981	Tree Planting	Back River	02130901	179534.31	444375.63	0.13
SH15APY000982	Tree Planting	Gwynns Falls	02130905	182070.88	422322.77	0.59
SH15APY000983	Tree Planting	Back River	02130901	185101.82	444034.67	0.10
SH15APY000984	Tree Planting	Lower Gunpowder Falls	02130802	192867.82	437038.66	0.24
SH15APY000985	Tree Planting	Deer Creek	02120202	227921.39	429650.94	0.08
SH15APY000986	Tree Planting	Gwynns Falls	02130905	190386.15	421228.37	0.12
SH15APY000987	Tree Planting	Back River	02130901	185541.88	443833.96	0.69
SH15APY000988	Tree Planting	Gwynns Falls	02130905	191139.24	420721.39	0.28
SH15APY000990	Tree Planting	Lower Gunpowder Falls	02130802	193678.24	436358.31	0.04
SH15APY000991	Tree Planting	Jones Falls	02130904	191418.64	423921.65	0.06
SH15APY000992	Tree Planting	Loch Raven Reservoir	02130805	213945.13	428097.84	0.27
SH15APY000993	Tree Planting	Loch Raven Reservoir	02130805	218073.50	428538.93	0.23
SH15APY000994	Tree Planting	Loch Raven Reservoir	02130805	193568.46	436075.89	0.85
SH15APY000995	Tree Planting	Loch Raven Reservoir	02130805	213833.61	427970.77	0.17
SH15APY000996	Tree Planting	Loch Raven Reservoir	02130805	193986.26	434551.55	0.11
SH15APY000997	Tree Planting	Loch Raven Reservoir	02130805	217124.34	428551.27	0.19
SH15APY000998	Tree Planting	Loch Raven Reservoir	02130805	208732.70	428691.20	0.13
SH15APY001000	Tree Planting	Loch Raven Reservoir	02130805	225058.19	430690.60	0.42
SH15APY001002	Tree Planting	Loch Raven Reservoir	02130805	217652.95	428342.24	0.15
SH15APY001003	Tree Planting	Liberty Reservoir	02130907	200341.86	413986.43	0.12
SH15APY001004	Tree Planting	Loch Raven Reservoir	02130805	201986.56	425170.10	0.09
SH15APY001005	Tree Planting	Loch Raven Reservoir	02130805	223864.95	430513.11	0.16
SH15APY001006	Tree Planting	Loch Raven Reservoir	02130805	225357.97	430772.51	0.19
SH15APY001007	Tree Planting	Loch Raven Reservoir	02130805	221068.70	429728.38	0.09

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH15APY001008	Tree Planting	Patapsco River L N Br	02130906	175651.31	427403.04	0.25
SH15APY001009	Tree Planting	Gwynns Falls	02130905	182267.99	422182.85	0.10
SH15APY001010	Tree Planting	Gwynns Falls	02130905	182167.78	422229.66	0.67
SH15APY001011	Tree Planting	Patapsco River L N Br	02130906	182059.60	419754.45	0.08
SH15APY001012	Tree Planting	Deer Creek	02120202	227249.01	430061.14	0.19
SH15APY001013	Tree Planting	Gwynns Falls	02130905	192336.14	420310.52	0.14
SH15APY001014	Tree Planting	Gwynns Falls	02130905	192258.91	420332.16	0.03
SH15APY001015	Tree Planting	Gwynns Falls	02130905	190262.62	421164.16	0.16
SH15APY001016	Tree Planting	Gwynns Falls	02130905	193949.65	418326.83	0.08
SH15APY001017	Tree Planting	Double Pipe Creek	02140304	211508.75	385466.13	0.08
SH15APY001018	Tree Planting	Double Pipe Creek	02140304	211280.71	385872.26	0.18
SH15APY001019	Tree Planting	Double Pipe Creek	02140304	211341.77	385801.60	0.05
SH15APY001020	Tree Planting	Double Pipe Creek	02140304	211264.68	386429.04	0.82
SH15APY001021	Tree Planting	Double Pipe Creek	02140304	210954.26	387011.33	0.31
SH15APY001022	Tree Planting	Upper Monocacy River	02140303	223253.58	386688.55	0.15
SH15APY001023	Tree Planting	Upper Monocacy River	02140303	223467.88	386833.83	0.18
SH15APY001024	Tree Planting	Upper Monocacy River	02140303	224888.61	387641.04	0.13
SH15APY001025	Tree Planting	Upper Monocacy River	02140303	226089.47	389048.66	0.14
SH15APY001026	Tree Planting	S Branch Patapsco	02130908	187816.92	385524.73	0.45
SH15APY001027	Tree Planting	S Branch Patapsco	02130908	188036.52	385819.36	0.46
SH15APY001028	Tree Planting	S Branch Patapsco	02130908	188683.85	387001.29	0.14
SH15APY001029	Tree Planting	S Branch Patapsco	02130908	191432.70	387821.92	0.08
SH15APY001030	Tree Planting	S Branch Patapsco	02130908	197421.52	395635.31	0.18
SH15APY001031	Tree Planting	S Branch Patapsco	02130908	198456.12	393346.42	0.11
SH15APY001032	Tree Planting	Double Pipe Creek	02140304	208596.19	392525.75	0.54

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH15APY001033	Tree Planting	Double Pipe Creek	02140304	211385.38	385618.22	0.05
SH15APY001034	Tree Planting	Double Pipe Creek	02140304	211323.77	386058.64	0.11
SH15APY001035	Tree Planting	Upper Monocacy River	02140303	223155.90	386630.36	0.15
SH15APY001036	Tree Planting	S Branch Patapsco	02130908	188987.59	387334.51	0.13
SH15APY001037	Tree Planting	S Branch Patapsco	02130908	189975.90	387593.34	0.38
SH15APY001038	Tree Planting	S Branch Patapsco	02130908	191023.76	387838.95	0.23
SH15APY001039	Tree Planting	Lower Monocacy River	02140302	199049.20	391968.87	0.28
SH15APY001040	Tree Planting	S Branch Patapsco	02130908	198342.16	393673.40	0.13
SH15APY001041	Tree Planting	Double Pipe Creek	02140304	208737.57	393056.81	0.30
SH15APY001042	Tree Planting	Double Pipe Creek	02140304	208486.28	391769.18	0.08
SH15APY001043	Tree Planting	S Branch Patapsco	02130908	190143.50	402695.47	0.12
SH15APY001044	Tree Planting	S Branch Patapsco	02130908	189646.11	403016.53	0.04
SH15APY001045	Tree Planting	Upper Monocacy River	02140303	225445.24	388177.15	0.05
SH15APY001046	Tree Planting	Upper Monocacy River	02140303	225528.11	388308.76	0.28
SH15APY001048	Tree Planting	Upper Monocacy River	02140303	223554.27	386887.40	0.07
SH15APY001049	Tree Planting	Upper Monocacy River	02140303	223876.31	387075.98	0.46
SH15APY001050	Tree Planting	Upper Monocacy River	02140303	225925.38	388927.05	0.02
SH15APY001051	Tree Planting	Upper Monocacy River	02140303	227276.28	389248.85	0.25
SH15APY001052	Tree Planting	Upper Monocacy River	02140303	225070.04	387762.51	0.19
SH15APY001053	Tree Planting	Upper Monocacy River	02140303	225278.82	387968.78	0.66
SH15APY001054	Tree Planting	Upper Monocacy River	02140303	224321.35	387331.35	0.64
SH15APY001055	Tree Planting	Back Creek	02130604	206726.42	501747.58	0.14
SH15APY001056	Tree Planting	Back Creek	02130604	206734.55	501685.98	0.17
SH15APY001057	Tree Planting	Octoraro Creek	02120203	228531.03	483112.68	0.47
SH15APY001058	Tree Planting	Octoraro Creek	02120203	227725.25	481857.22	0.31

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH15APY001059	Tree Planting	Octoraro Creek	02120203	218587.09	479092.30	0.07
SH15APY001060	Tree Planting	Little Elk Creek	02130605	221892.82	498239.50	0.43
SH15APY001061	Tree Planting	Little Elk Creek	02130605	221675.72	498289.44	0.18
SH15APY001062	Tree Planting	Little Elk Creek	02130605	226538.82	495754.05	0.04
SH15APY001063	Tree Planting	Little Elk Creek	02130605	221568.57	498345.89	0.12
SH15APY001064	Tree Planting	Northeast River	02130608	218083.34	490024.49	0.03
SH15APY001065	Tree Planting	Northeast River	02130608	218058.23	490033.27	0.05
SH15APY001066	Tree Planting	Octoraro Creek	02120203	227801.41	482072.58	0.07
SH15APY001067	Tree Planting	Octoraro Creek	02120203	227760.58	482091.77	0.13
SH15APY001068	Tree Planting	Little Elk Creek	02130605	221119.42	498654.40	0.05
SH15APY001069	Tree Planting	Northeast River	02130608	222862.01	489396.60	0.17
SH15APY001070	Tree Planting	Northeast River	02130608	222930.57	489357.85	0.04
SH15APY001071	Tree Planting	Octoraro Creek	02120203	227108.34	479907.23	0.24
SH15APY001072	Tree Planting	Octoraro Creek	02120203	227641.88	481771.42	0.54
SH15APY001073	Tree Planting	Octoraro Creek	02120203	223442.31	479494.56	0.10
SH15APY001074	Tree Planting	Octoraro Creek	02120203	225579.56	477847.19	0.38
SH15APY001075	Tree Planting	Little Elk Creek	02130605	225988.09	494356.59	0.34
SH15APY001076	Tree Planting	Little Elk Creek	02130605	221485.38	498410.62	0.24
SH15APY001077	Tree Planting	Little Elk Creek	02130605	220973.59	498704.29	0.13
SH15APY001078	Tree Planting	Little Elk Creek	02130605	216615.46	498821.34	0.13
SH15APY001079	Tree Planting	Octoraro Creek	02120203	222906.97	479468.21	0.16
SH15APY001080	Tree Planting	Little Elk Creek	02130605	222082.69	498232.05	0.01
SH15APY001081	Tree Planting	Northeast River	02130608	217947.92	490058.26	0.21
SH15APY001082	Tree Planting	Octoraro Creek	02120203	218692.03	479202.28	0.04
SH15APY001083	Tree Planting	Octoraro Creek	02120203	218431.94	478936.38	0.09

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH15APY001084	Tree Planting	Octoraro Creek	02120203	227129.02	480246.58	0.30
SH15APY001085	Tree Planting	Octoraro Creek	02120203	225687.35	477971.38	0.07
SH15APY001086	Tree Planting	Octoraro Creek	02120203	228454.64	483044.24	0.34
SH15APY001087	Tree Planting	Northeast River	02130605	220083.35	495083.28	0.31
SH15APY001088	Tree Planting	Northeast River	02130608	219348.40	489941.24	2.47
SH15APY001089	Tree Planting	Catoctin Creek	02140305	187817.04	352409.14	0.26
SH15APY001090	Tree Planting	Catoctin Creek	02140305	187953.26	353899.18	0.31
SH15APY001091	Tree Planting	Lower Monocacy River	02140302	194120.56	362588.37	0.41
SH15APY001092	Tree Planting	Lower Monocacy River	02140302	194284.63	362491.57	0.13
SH15APY001093	Tree Planting	Lower Monocacy River	02140302	197681.35	365354.36	0.27
SH15APY001095	Tree Planting	Lower Monocacy River	02140302	194327.29	358931.60	0.15
SH15APY001096	Tree Planting	Lower Monocacy River	02140302	184053.24	369188.59	0.26
SH15APY001097	Tree Planting	Lower Monocacy River	02140302	192831.57	360812.05	0.06
SH15APY001098	Tree Planting	Catoctin Creek	02140305	202413.01	351999.46	0.18
SH15APY001099	Tree Planting	Catoctin Creek	02140305	203872.02	350489.44	0.33
SH15APY001100	Tree Planting	Lower Monocacy River	02140302	193066.43	359836.80	0.49
SH15APY001101	Tree Planting	Catoctin Creek	02140305	187979.46	353341.61	0.18
SH15APY001102	Tree Planting	Catoctin Creek	02140305	188304.83	354600.74	0.33
SH15APY001103	Tree Planting	Lower Monocacy River	02140302	194000.04	362536.72	0.13
SH15APY001104	Tree Planting	Lower Monocacy River	02140302	194363.69	362539.02	0.07
SH15APY001105	Tree Planting	Potomac River FR Cnty	02140301	186718.43	356401.69	0.53
SH15APY001106	Tree Planting	Catoctin Creek	02140305	201389.83	354983.17	0.08
SH15APY001107	Tree Planting	Lower Monocacy River	02140302	183899.21	369246.44	0.20
SH15APY001108	Tree Planting	Catoctin Creek	02140305	188020.14	354198.22	0.11
SH15APY001109	Tree Planting	Upper Monocacy River	02140303	216211.15	363888.81	0.14

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH15APY001110	Tree Planting	Upper Monocacy River	02140303	224444.76	371471.57	0.22
SH15APY001111	Tree Planting	Upper Monocacy River	02140303	225719.11	372986.90	0.03
SH15APY001112	Tree Planting	Lower Monocacy River	02140302	184209.42	368588.27	0.15
SH15APY001113	Tree Planting	Lower Monocacy River	02140302	191244.71	373070.19	0.11
SH15APY001114	Tree Planting	Lower Monocacy River	02140302	192713.47	365336.91	0.12
SH15APY001115	Tree Planting	Catoctin Creek	02140305	200255.63	354910.11	0.54
SH15APY001116	Tree Planting	Catoctin Creek	02140305	203896.66	350349.20	0.15
SH15APY001117	Tree Planting	Upper Monocacy River	02140303	227757.85	373631.52	0.06
SH15APY001118	Tree Planting	Upper Monocacy River	02140303	227735.42	373563.34	0.16
SH15APY001119	Tree Planting	Upper Monocacy River	02140303	226422.07	373111.21	0.12
SH15APY001120	Tree Planting	Upper Monocacy River	02140303	221375.98	367811.91	0.27
SH15APY001121	Tree Planting	Upper Monocacy River	02140303	218642.86	364909.88	0.41
SH15APY001122	Tree Planting	Upper Monocacy River	02140303	218877.39	365228.77	0.11
SH15APY001123	Tree Planting	Lower Monocacy River	02140302	194379.31	362640.22	0.17
SH15APY001124	Tree Planting	Lower Monocacy River	02140302	195714.02	363986.21	0.33
SH15APY001125	Tree Planting	Upper Monocacy River	02140303	204053.81	365500.95	0.06
SH15APY001126	Tree Planting	Upper Monocacy River	02140303	209913.51	362974.67	0.09
SH15APY001127	Tree Planting	Upper Monocacy River	02140303	199833.51	368722.62	0.23
SH15APY001128	Tree Planting	Upper Monocacy River	02140303	200727.01	369165.31	0.42
SH15APY001129	Tree Planting	Catoctin Creek	02140305	187729.59	349746.75	0.05
SH15APY001130	Tree Planting	Catoctin Creek	02140305	187575.73	348299.13	0.08
SH15APY001131	Tree Planting	Catoctin Creek	02140305	187749.89	351649.90	0.14
SH15APY001132	Tree Planting	Lower Monocacy River	02140302	189493.48	358009.89	0.29
SH15APY001133	Tree Planting	Lower Monocacy River	02140302	195774.96	364072.27	0.22
SH15APY001134	Tree Planting	Upper Monocacy River	02140303	203130.70	365781.92	0.13

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH15APY001135	Tree Planting	Upper Monocacy River	02140303	210766.92	362905.44	0.35
SH15APY001136	Tree Planting	Upper Monocacy River	02140303	201900.07	370486.84	0.15
SH15APY001137	Tree Planting	Potomac River FR Cnty	02140301	186665.12	345799.39	0.02
SH15APY001138	Tree Planting	Lower Monocacy River	02140302	190329.53	377649.53	0.22
SH15APY001139	Tree Planting	Potomac River FR Cnty	02140301	182408.59	355581.00	0.33
SH15APY001140	Tree Planting	Lower Monocacy River	02140302	186888.72	366272.09	0.27
SH15APY001141	Tree Planting	Lower Monocacy River	02140302	191598.24	372146.50	0.41
SH15APY001142	Tree Planting	Potomac River FR Cnty	02140301	187131.17	346740.54	0.05
SH15APY001143	Tree Planting	Catoctin Creek	02140305	187997.42	354115.89	0.08
SH15APY001144	Tree Planting	Upper Monocacy River	02140303	217251.13	364072.62	0.09
SH15APY001145	Tree Planting	Upper Monocacy River	02140303	216384.48	363994.44	0.08
SH15APY001146	Tree Planting	Lower Monocacy River	02140302	207653.84	373144.19	0.16
SH15APY001147	Tree Planting	Lower Monocacy River	02140302	194138.61	362671.59	0.05
SH15APY001148	Tree Planting	Lower Monocacy River	02140302	190910.39	374115.25	0.26
SH15APY001149	Tree Planting	Lower Monocacy River	02140302	192827.52	361290.44	0.42
SH15APY001150	Tree Planting	Catoctin Creek	02140305	200435.14	354591.71	0.52
SH15APY001151	Tree Planting	Upper Monocacy River	02140303	226971.55	373308.14	0.16
SH15APY001152	Tree Planting	Upper Monocacy River	02140303	216012.25	363801.89	0.31
SH15APY001153	Tree Planting	Upper Monocacy River	02140303	225960.60	373077.14	0.05
SH15APY001154	Tree Planting	Upper Monocacy River	02140303	225996.76	373171.22	0.88
SH15APY001155	Tree Planting	Upper Monocacy River	02140303	220230.91	366729.26	0.34
SH15APY001156	Tree Planting	Catoctin Creek	02140305	188074.00	354099.46	0.24
SH15APY001157	Tree Planting	Lower Monocacy River	02140302	190906.12	360439.54	0.40
SH15APY001158	Tree Planting	Catoctin Creek	02140305	188104.76	354195.30	0.06
SH15APY001159	Tree Planting	Lower Monocacy River	02140302	188985.89	356901.36	0.22

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH15APY001160	Tree Planting	Lower Monocacy River	02140302	190752.84	360192.44	0.36
SH15APY001161	Tree Planting	Lower Monocacy River	02140302	190596.45	359943.46	0.12
SH15APY001162	Tree Planting	Lower Monocacy River	02140302	192312.29	362079.66	0.62
SH15APY001163	Tree Planting	Lower Monocacy River	02140302	192638.81	361857.61	0.50
SH15APY001165	Tree Planting	Lower Monocacy River	02140302	192362.42	361916.34	0.61
SH15APY001166	Tree Planting	Lower Monocacy River	02140302	190645.47	360022.70	0.12
SH15APY001167	Tree Planting	Lower Monocacy River	02140302	192148.26	362231.56	1.49
SH15APY001168	Tree Planting	Lower Monocacy River	02140302	184770.88	367907.23	0.33
SH15APY001169	Tree Planting	Lower Monocacy River	02140302	184375.03	368279.99	0.21
SH15APY001171	Tree Planting	Upper Monocacy River	02140303	210300.79	362969.68	0.04
SH15APY001172	Tree Planting	Lower Monocacy River	02140302	192943.58	360126.92	0.28
SH15APY001173	Tree Planting	Lower Monocacy River	02140302	192879.44	360465.73	0.28
SH15APY001174	Tree Planting	Upper Monocacy River	02140303	227461.10	373445.34	0.12
SH15APY001175	Tree Planting	Upper Monocacy River	02140303	227241.95	373346.78	0.11
SH15APY001176	Tree Planting	Catoctin Creek	02140305	187626.67	349990.27	0.06
SH15APY001177	Tree Planting	Catoctin Creek	02140305	201325.93	354987.21	0.16
SH15APY001178	Tree Planting	Catoctin Creek	02140305	199889.49	355191.74	0.42
SH15APY001179	Tree Planting	Catoctin Creek	02140305	199741.55	355352.38	0.11
SH15APY001180	Tree Planting	Catoctin Creek	02140305	200178.93	354875.52	0.53
SH15APY001181	Tree Planting	Bynum Run	02130704	211060.38	453631.99	0.09
SH15APY001182	Tree Planting	Bynum Run	02130704	209909.97	454616.00	0.24
SH15APY001183	Tree Planting	Bynum Run	02130704	210926.46	455413.45	1.32
SH15APY001184	Tree Planting	Bush River	02130701	200764.63	465735.75	0.12
SH15APY001185	Tree Planting	Bynum Run	02130704	211360.62	455802.86	1.13
SH15APY001186	Tree Planting	Little Gunpowder Falls	02130804	206880.33	448201.33	0.15

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH15APY001187	Tree Planting	Little Gunpowder Falls	02130804	205939.28	450132.77	0.17
SH15APY001188	Tree Planting	Atkisson Reservoir	02130703	205784.71	450424.95	0.13
SH15APY001189	Tree Planting	Atkisson Reservoir	02130703	204450.22	451331.55	0.25
SH15APY001190	Tree Planting	Bynum Run	02130704	211636.81	455919.00	0.20
SH15APY001191	Tree Planting	Lower Winters Run	02130702	196741.69	456562.07	0.33
SH15APY001192	Tree Planting	Bush River	02130701	201212.63	465205.09	1.01
SH15APY001193	Tree Planting	Swan Creek	02130706	205445.45	472288.06	0.20
SH15APY001194	Tree Planting	Little Gunpowder Falls	02130804	207113.21	447776.19	0.35
SH15APY001195	Tree Planting	Atkisson Reservoir	02130703	208649.79	445010.93	0.48
SH15APY001196	Tree Planting	Atkisson Reservoir	02130703	210794.23	453786.43	0.06
SH15APY001197	Tree Planting	Bynum Run	02130704	210965.26	453687.49	0.05
SH15APY001198	Tree Planting	Little Gunpowder Falls	02130804	206495.49	448997.21	0.57
SH15APY001199	Tree Planting	Lower Winters Run	02130702	197602.92	460339.16	0.23
SH15APY001200	Tree Planting	Bush River	02130701	202044.20	465176.79	0.10
SH15APY001201	Tree Planting	Atkisson Reservoir	02130703	205834.53	450309.58	0.36
SH15APY001202	Tree Planting	Atkisson Reservoir	02130703	210602.02	453891.70	0.04
SH15APY001203	Tree Planting	Bynum Run	02130704	212196.59	456534.19	0.15
SH15APY001204	Tree Planting	Little Gunpowder Falls	02130804	206989.52	448003.93	0.22
SH15APY001205	Tree Planting	Little Gunpowder Falls	02130804	209074.42	444524.26	0.15
SH15APY001206	Tree Planting	Bynum Run	02130704	211214.85	453516.00	0.18
SH15APY001208	Tree Planting	Deer Creek	02120202	212434.35	456815.73	0.63
SH15APY001209	Tree Planting	Bynum Run	02130704	211541.76	455161.08	0.17
SH15APY001210	Tree Planting	Atkisson Reservoir	02130703	204588.21	456804.21	0.11
SH15APY001212	Tree Planting	Little Gunpowder Falls	02130804	208932.51	444694.58	0.02
SH15APY001213	Tree Planting	Little Gunpowder Falls	02130804	206945.83	448092.10	0.02

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH15APY001214	Tree Planting	Atkisson Reservoir	02130703	210726.07	453825.72	0.05
SH15APY001215	Tree Planting	Atkisson Reservoir	02130703	206648.68	448678.73	0.12
SH15APY001216	Tree Planting	Little Gunpowder Falls	02130804	208122.14	445997.61	0.09
SH15APY001217	Tree Planting	Little Gunpowder Falls	02130804	208434.35	445355.55	0.31
SH15APY001218	Tree Planting	Little Gunpowder Falls	02130804	207495.11	447107.34	0.05
SH15APY001219	Tree Planting	Little Gunpowder Falls	02130804	207313.08	447431.31	0.05
SH15APY001220	Tree Planting	Atkisson Reservoir	02130703	206720.77	448533.97	0.12
SH15APY001221	Tree Planting	Atkisson Reservoir	02130703	209384.20	444152.76	0.05
SH15APY001222	Tree Planting	Atkisson Reservoir	02130703	208783.60	444854.90	0.13
SH15APY001223	Tree Planting	Atkisson Reservoir	02130703	210531.34	443120.71	0.13
SH15APY001224	Tree Planting	Bynum Run	02130704	211396.01	453354.07	0.16
SH15APY001226	Tree Planting	Bush River	02130701	201972.00	465121.37	0.17
SH15APY001227	Tree Planting	Bush River	02130701	201839.38	465019.39	0.53
SH15APY001228	Tree Planting	Bush River	02130701	201752.65	464833.21	0.04
SH15APY001229	Tree Planting	Atkisson Reservoir	02130703	204472.01	456896.33	0.15
SH15APY001230	Tree Planting	Patapsco River L N Br	02130906	171518.32	417350.02	0.11
SH15APY001231	Tree Planting	Rock Creek	02140206	148540.53	393201.61	0.53
SH15APY001232	Tree Planting	Rock Creek	02140206	148455.88	393246.17	0.12
SH15APY001233	Tree Planting	Anacostia River	02140205	153710.77	406416.44	0.04
SH15APY001234	Tree Planting	Anacostia River	02140205	154433.73	406369.63	0.22
SH15APY001235	Tree Planting	Anacostia River	02140205	155422.99	407761.12	0.22
SH15APY001236	Tree Planting	Anacostia River	02140205	155297.19	407675.49	0.02
SH15APY001237	Tree Planting	Antietam Creek	02140502	210830.44	345477.33	0.25
SH15APY001238	Tree Planting	Antietam Creek	02140502	211548.21	344540.57	0.37
SH15APY001239	Tree Planting	Antietam Creek	02140502	211075.03	345143.50	0.11

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH15APY001240	Tree Planting	Antietam Creek	02140502	209399.80	347298.62	0.07
SH15APY001241	Tree Planting	Antietam Creek	02140502	211215.53	344958.64	0.14
SH15APY001242	Tree Planting	Antietam Creek	02140502	211723.50	344404.70	0.09
SH15APY001243	Tree Planting	Antietam Creek	02140502	208812.80	347576.77	0.37
SH15APY001244	Tree Planting	Antietam Creek	02140502	209432.04	347198.76	0.16
SH15APY001245	Tree Planting	Antietam Creek	02140502	210429.95	346035.54	0.16
SH15APY001246	Tree Planting	Antietam Creek	02140502	212226.96	343831.94	0.15
SH15APY001247	Tree Planting	Antietam Creek	02140502	212499.76	343521.56	0.03
SH15APY001248	Tree Planting	Antietam Creek	02140502	212940.75	343018.86	0.12
SH15APY001249	Tree Planting	Antietam Creek	02140502	213076.24	342865.00	0.11
SH15APY001250	Tree Planting	Antietam Creek	02140502	213200.09	342724.29	0.08
SH15APY001251	Tree Planting	Antietam Creek	02140502	209443.35	347249.52	0.02
SH15APY001252	Tree Planting	Antietam Creek	02140502	211128.97	345064.37	0.23
SH15APY001253	Tree Planting	Antietam Creek	02140502	214192.72	343717.97	0.13
SH15APY001254	Tree Planting	Conococheague Creek	02140504	215564.33	333779.50	0.69
SH15APY001255	Tree Planting	Antietam Creek	02140502	213291.59	345047.38	0.02
SH15APY001256	Tree Planting	Antietam Creek	02140502	213315.74	345063.24	0.02
SH15APY001547	Tree Planting	Lower Monocacy River	02140302	192197.73	361950.06	0.47
SH15APY003000	Tree Planting	Upper Monocacy River	02140303	225841.92	388836.03	0.16
SH16APY001257	Tree Planting	Patuxent River lower	02131101	118692.57	435247.97	0.14
SH16APY001258	Tree Planting	South River	02131003	142966.37	430997.04	0.15
SH16APY001259	Tree Planting	Patuxent River middle	02131102	126901.24	425864.11	0.12
SH16APY001260	Tree Planting	Patuxent River middle	02131102	123774.82	432440.80	0.09
SH16APY001261	Tree Planting	West River	02131004	136033.39	437523.02	0.06
SH16APY001262	Tree Planting	South River	02131003	137593.78	438556.93	0.23

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16APY001264	Tree Planting	Patuxent River middle	02131102	122676.43	434833.14	0.16
SH16APY001266	Tree Planting	West River	02131004	135444.74	437395.31	0.12
SH16APY001267	Tree Planting	West Chesapeake Bay	02131005	127335.07	434407.12	0.62
SH16APY001268	Tree Planting	Patuxent River middle	02131102	128052.10	434194.74	0.09
SH16APY001269	Tree Planting	Patuxent River middle	02131102	124165.92	431500.08	0.95
SH16APY001270	Tree Planting	Patuxent River middle	02131102	124511.63	430810.55	0.33
SH16APY001271	Tree Planting	Patuxent River middle	02131102	123718.01	432693.42	0.20
SH16APY001272	Tree Planting	West River	02131004	135937.70	437470.68	0.24
SH16APY001273	Tree Planting	South River	02131003	137710.78	438607.09	0.16
SH16APY001274	Tree Planting	Patuxent River middle	02131102	128123.54	434153.01	0.09
SH16APY001275	Tree Planting	Patuxent River middle	02131102	126070.70	434856.47	0.05
SH16APY001278	Tree Planting	Patuxent River lower	02131101	118264.67	435063.22	0.38
SH16APY001279	Tree Planting	South River	02131003	143536.81	430091.68	0.14
SH16APY001280	Tree Planting	Patuxent River middle	02131102	123769.73	432478.52	0.08
SH16APY001281	Tree Planting	Patuxent River middle	02131102	127985.08	434223.16	0.05
SH16APY001283	Tree Planting	Patuxent River middle	02131102	125552.05	434847.66	0.46
SH16APY001284	Tree Planting	Patuxent River middle	02131102	123819.25	433249.16	0.52
SH16APY001286	Tree Planting	Patuxent River middle	02131102	127121.33	434478.45	0.09
SH16APY001287	Tree Planting	Patuxent River middle	02131102	123701.55	432868.61	0.51
SH16APY001288	Tree Planting	West Chesapeake Bay	02131005	128631.18	433553.45	0.41
SH16APY001289	Tree Planting	Patuxent River middle	02131102	125361.64	434849.32	0.19
SH16APY001290	Tree Planting	Patuxent River middle	02131102	128474.74	433739.15	0.04
SH16APY001291	Tree Planting	Patuxent River lower	02131101	117780.58	434748.37	0.17
SH16APY001292	Tree Planting	Patuxent River middle	02131102	124367.94	431167.47	0.19
SH16APY001293	Tree Planting	Severn River	02131002	149552.19	443857.05	0.08

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16APY001294	Tree Planting	Severn River	02131002	149795.80	443913.93	0.18
SH16APY001295	Tree Planting	Severn River	02131002	149615.39	444133.95	0.42
SH16APY001296	Tree Planting	Severn River	02131002	149770.92	444100.53	0.14
SH16APY001297	Tree Planting	Severn River	02131002	149601.77	443819.70	0.15
SH16APY001298	Tree Planting	Severn River	02131002	149784.67	443849.83	0.23
SH16APY001299	Tree Planting	Severn River	02131002	150653.99	445704.64	0.22
SH16APY001300	Tree Planting	Severn River	02131002	151222.17	447625.99	0.12
SH16APY001301	Tree Planting	Severn River	02131002	150518.86	445334.11	0.16
SH16APY001302	Tree Planting	Severn River	02131002	149429.79	444224.70	0.06
SH16APY001303	Tree Planting	Severn River	02131002	146362.75	439418.46	0.13
SH16APY001305	Tree Planting	South River	02131003	145130.08	439753.57	0.11
SH16APY001306	Tree Planting	South River	02131003	145007.65	439847.41	0.15
SH16APY001308	Tree Planting	West Chesapeake Bay	02131005	128560.02	433666.34	0.30
SH16APY001310	Tree Planting	Patuxent River middle	02131102	128277.29	434022.15	0.06
SH16APY001311	Tree Planting	Patuxent River middle	02131102	128255.88	434038.93	0.03
SH16APY001312	Tree Planting	Patuxent River middle	02131102	128217.67	434070.03	0.12
SH16APY001313	Tree Planting	Patapsco River L N Br	02130906	175908.66	427692.01	0.21
SH16APY001314	Tree Planting	Gwynns Falls	02130905	181963.45	422259.94	0.20
SH16APY001315	Tree Planting	Patapsco River L N Br	02130906	172117.48	426003.08	0.12
SH16APY001316	Tree Planting	Patapsco River L N Br	02130906	175649.44	427230.22	0.25
SH16APY001317	Tree Planting	Gwynns Falls	02130905	190325.68	421249.13	0.09
SH16APY001318	Tree Planting	Gwynns Falls	02130905	181736.35	421973.73	0.37
SH16APY001319	Tree Planting	Patapsco River L N Br	02130906	175915.61	427463.85	0.30
SH16APY001320	Tree Planting	Patapsco River L N Br	02130906	176310.63	427966.16	0.29
SH16APY001321	Tree Planting	Patapsco River L N Br	02130906	176172.59	427672.65	0.14

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16APY001322	Tree Planting	Gwynns Falls	02130905	190341.63	421148.72	0.09
SH16APY001323	Tree Planting	Patapsco River L N Br	02130906	175903.92	427412.46	0.30
SH16APY001324	Tree Planting	Patapsco River L N Br	02130906	175728.17	427657.29	0.27
SH16APY001325	Tree Planting	Gwynns Falls	02130905	182056.04	421675.42	0.78
SH16APY001326	Tree Planting	Gwynns Falls	02130905	181756.93	422235.60	0.05
SH16APY001327	Tree Planting	Patapsco River L N Br	02130906	175808.09	427628.44	0.11
SH16APY001328	Tree Planting	Liberty Reservoir	02130907	200892.06	414617.32	0.20
SH16APY001329	Tree Planting	Loch Raven Reservoir	02130805	201848.10	425166.95	0.11
SH16APY001330	Tree Planting	Loch Raven Reservoir	02130805	202224.23	425167.79	0.10
SH16APY001331	Tree Planting	Loch Raven Reservoir	02130805	199975.63	429132.05	0.29
SH16APY001332	Tree Planting	Gwynns Falls	02130905	181864.92	422209.61	0.50
SH16APY001333	Tree Planting	Gwynns Falls	02130905	181860.87	422305.23	0.51
SH16APY001334	Tree Planting	Bird River	02130803	190739.85	443283.19	0.17
SH16APY001336	Tree Planting	Gwynns Falls	02130905	186730.04	421844.00	1.01
SH16APY001337	Tree Planting	Jones Falls	02130904	193931.73	429017.75	0.13
SH16APY001338	Tree Planting	Jones Falls	02130904	193841.50	428975.04	0.09
SH16APY001339	Tree Planting	Jones Falls	02130904	194005.95	428893.11	0.16
SH16APY001340	Tree Planting	Back River	02130901	180079.70	443142.54	0.09
SH16APY001341	Tree Planting	Back River	02130901	189258.86	442018.32	0.08
SH16APY001342	Tree Planting	Bird River	02130803	190678.14	443225.22	0.03
SH16APY001343	Tree Planting	Bird River	02130803	191180.24	443717.08	0.14
SH16APY001344	Tree Planting	Liberty Reservoir	02130907	200228.36	414034.74	0.25
SH16APY001347	Tree Planting	Patapsco River L N Br	02130906	175855.61	427605.39	0.04
SH16APY001348	Tree Planting	Patuxent River lower	02131101	96410.98	419243.08	0.49
SH16APY001349	Tree Planting	Mattawoman Creek	02140111	109692.17	410975.61	0.12

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16APY001350	Tree Planting	Patuxent River lower	02131101	95707.41	419452.41	0.29
SH16APY001351	Tree Planting	Patuxent River lower	02131101	97335.10	418198.51	0.19
SH16APY001352	Tree Planting	Mattawoman Creek	02140111	109882.91	410930.97	0.11
SH16APY001353	Tree Planting	Zekiah Swamp	02140108	105536.70	410907.02	0.35
SH16APY001354	Tree Planting	Atkisson Reservoir	02130703	212528.80	447517.39	0.40
SH16APY001355	Tree Planting	Bynum Run	02130704	211882.70	454046.54	0.39
SH16APY001356	Tree Planting	Little Gunpowder Falls	02130804	207910.04	446358.44	0.03
SH16APY001357	Tree Planting	Little Gunpowder Falls	02130804	207965.76	446276.69	0.10
SH16APY001359	Tree Planting	Bynum Run	02130704	212504.27	452717.08	0.06
SH16APY001360	Tree Planting	Bynum Run	02130704	212685.04	452673.46	0.04
SH16APY001361	Tree Planting	Atkisson Reservoir	02130703	212016.81	449339.86	0.28
SH16APY001362	Tree Planting	Broad Creek	02120205	224196.43	453506.63	0.46
SH16APY001363	Tree Planting	Bynum Run	02130704	212611.19	452692.20	0.04
SH16APY001364	Tree Planting	Bynum Run	02130704	212560.31	452705.77	0.06
SH16APY001365	Tree Planting	Bynum Run	02130704	212226.91	452733.46	0.19
SH16APY001366	Tree Planting	Bynum Run	02130704	212107.73	453155.91	0.55
SH16APY001367	Tree Planting	Broad Creek	02120205	223942.09	453351.44	0.43
SH16APY001368	Tree Planting	Atkisson Reservoir	02130703	212021.16	449622.42	1.78
SH16APY001369	Tree Planting	Little Gunpowder Falls	02130804	207858.88	446385.41	0.30
SH16APY001370	Tree Planting	Atkisson Reservoir	02130703	211992.49	449469.51	0.51
SH16APY001371	Tree Planting	Little Gunpowder Falls	02130804	208006.78	446199.61	0.46
SH16APY001372	Tree Planting	Atkisson Reservoir	02130703	211977.83	450691.13	0.85
SH16APY001373	Tree Planting	Atkisson Reservoir	02130703	213370.41	445370.05	1.75
SH16APY001374	Tree Planting	Atkisson Reservoir	02130703	212034.18	449193.34	0.21
SH16APY001381	Tree Planting	Anacostia River	02140205	152842.50	400622.80	0.33

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16APY001382	Tree Planting	Anacostia River	02140205	152943.45	400754.76	0.70
SH16APY001383	Tree Planting	Seneca Creek	02140208	167462.31	378735.00	0.18
SH16APY001384	Tree Planting	Cabin John Creek	02140207	147222.35	386388.87	0.11
SH16APY001385	Tree Planting	Seneca Creek	02140208	169838.88	377299.88	0.07
SH16APY001386	Tree Planting	Seneca Creek	02140208	168356.65	377884.69	0.10
SH16APY001387	Tree Planting	Seneca Creek	02140208	173617.02	375520.05	0.05
SH16APY001389	Tree Planting	Seneca Creek	02140208	161850.82	367925.13	0.20
SH16APY001390	Tree Planting	Seneca Creek	02140208	164187.65	381390.49	0.06
SH16APY001391	Tree Planting	Potomac River MO Cnty	02140202	159059.81	384107.77	0.11
SH16APY001392	Tree Planting	Seneca Creek	02140208	163463.94	381570.36	0.24
SH16APY001393	Tree Planting	Seneca Creek	02140208	173882.75	375443.82	0.10
SH16APY001394	Tree Planting	Seneca Creek	02140208	168407.79	377738.03	0.24
SH16APY001395	Tree Planting	Rocky Gorge Dam	02131107	166367.00	394793.83	0.03
SH16APY001396	Tree Planting	Rocky Gorge Dam	02131107	166446.40	394809.07	0.07
SH16APY001397	Tree Planting	Cabin John Creek	02140207	148075.50	384694.08	0.07
SH16APY001398	Tree Planting	Cabin John Creek	02140207	148012.97	384811.18	0.04
SH16APY001399	Tree Planting	Seneca Creek	02140208	170081.65	377106.83	0.16
SH16APY001400	Tree Planting	Seneca Creek	02140208	170005.46	377124.79	1.02
SH16APY001401	Tree Planting	Seneca Creek	02140208	170207.70	377165.94	0.13
SH16APY001402	Tree Planting	Seneca Creek	02140208	170295.77	377066.05	0.04
SH16APY001403	Tree Planting	Seneca Creek	02140208	170645.38	376751.94	0.18
SH16APY001404	Tree Planting	Potomac River MO Cnty	02140202	151665.64	379644.98	0.05
SH16APY001405	Tree Planting	Potomac River MO Cnty	02140202	151724.79	379549.54	0.01
SH16APY001406	Tree Planting	Potomac River MO Cnty	02140202	151745.81	379516.04	0.01
SH16APY001407	Tree Planting	Seneca Creek	02140208	166498.53	375666.94	0.04

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16APY001408	Tree Planting	Seneca Creek	02140208	169681.19	378989.43	0.44
SH16APY001409	Tree Planting	Potomac River MO Cnty	02140202	161819.56	384560.69	1.10
SH16APY001410	Tree Planting	Cabin John Creek	02140207	147175.10	386410.99	0.13
SH16APY001411	Tree Planting	Seneca Creek	02140208	169788.99	377331.48	0.07
SH16APY001412	Tree Planting	Seneca Creek	02140208	169991.87	377054.96	0.15
SH16APY001413	Tree Planting	Seneca Creek	02140208	170012.74	377028.03	0.15
SH16APY001414	Tree Planting	Seneca Creek	02140208	170048.91	377018.16	0.03
SH16APY001415	Tree Planting	Potomac River MO Cnty	02140202	151592.49	379766.47	0.03
SH16APY001416	Tree Planting	Seneca Creek	02140208	164158.22	381386.75	0.04
SH16APY001417	Tree Planting	Seneca Creek	02140208	161445.92	378256.10	0.51
SH16APY001418	Tree Planting	Anacostia River	02140205	149569.76	396258.88	0.11
SH16APY001419	Tree Planting	Seneca Creek	02140208	169889.04	376990.93	0.18
SH16APY001420	Tree Planting	Seneca Creek	02140208	161377.32	378239.53	0.06
SH16APY001421	Tree Planting	Anacostia River	02140205	156547.05	403829.81	0.31
SH16APY001422	Tree Planting	Anacostia River	02140205	149599.54	396298.36	0.03
SH16APY001423	Tree Planting	Anacostia River	02140205	161327.36	402324.11	4.43
SH16APY001424	Tree Planting	Rocky Gorge Dam	02131107	161751.20	406421.26	0.07
SH16APY001425	Tree Planting	Rocky Gorge Dam	02131107	161827.75	406465.07	0.10
SH16APY001426	Tree Planting	Rocky Gorge Dam	02131107	160531.27	406112.11	0.32
SH16APY001427	Tree Planting	Anacostia River	02140205	160116.34	406086.38	0.16
SH16APY001428	Tree Planting	Anacostia River	02140205	160230.88	406143.19	0.13
SH16APY001429	Tree Planting	Anacostia River	02140205	147207.32	409740.12	0.10
SH16APY001430	Tree Planting	Western Branch	02131103	136031.50	413089.81	0.29
SH16APY001431	Tree Planting	Mattawoman Creek	02140111	107760.53	395429.85	0.04
SH16APY001432	Tree Planting	Anacostia River	02140205	141914.96	411498.55	0.45

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16APY001433	Tree Planting	Patuxent River upper	02131104	158880.07	413194.34	0.30
SH16APY001434	Tree Planting	Potomac River U tidal	02140201	126125.49	400283.80	0.07
SH16APY001435	Tree Planting	Potomac River U tidal	02140201	125886.16	400055.94	0.06
SH16APY001436	Tree Planting	Potomac River U tidal	02140201	128848.86	410460.19	0.48
SH16APY001437	Tree Planting	Potomac River M tidal	02140102	107594.61	395197.48	0.04
SH16APY001438	Tree Planting	Piscataway Creek	02140203	111859.89	399422.71	0.19
SH16APY001439	Tree Planting	Western Branch	02131103	127165.95	422575.24	0.03
SH16APY001440	Tree Planting	Mattawoman Creek	02140111	110047.78	399178.20	0.11
SH16APY001441	Tree Planting	Patuxent River upper	02131104	159186.56	409683.19	0.24
SH16APY001442	Tree Planting	Anacostia River	02140205	139920.14	410998.43	0.06
SH16APY001443	Tree Planting	Potomac River U tidal	02140201	126103.74	400141.03	0.13
SH16APY001444	Tree Planting	Mattawoman Creek	02140111	107897.83	395562.29	0.03
SH16APY001445	Tree Planting	Potomac River U tidal	02140201	130299.36	411441.08	0.04
SH16APY001446	Tree Planting	Mattawoman Creek	02140111	107709.15	395359.89	0.02
SH16APY001447	Tree Planting	Potomac River U tidal	02140201	130236.13	411310.20	0.40
SH16APY001448	Tree Planting	Mattawoman Creek	02140111	110447.60	398611.22	0.06
SH16APY001449	Tree Planting	Anacostia River	02140205	139644.52	410846.20	0.08
SH16APY001450	Tree Planting	Anacostia River	02140205	139917.31	410764.04	0.12
SH16APY001451	Tree Planting	Potomac River U tidal	02140201	125988.74	400165.00	0.30
SH16APY001452	Tree Planting	Anacostia River	02140205	143721.85	411596.26	0.17
SH16APY001453	Tree Planting	Anacostia River	02140205	139961.13	410925.56	0.12
SH16APY001454	Tree Planting	Potomac River U tidal	02140201	125938.04	400032.74	0.10
SH16APY001455	Tree Planting	Potomac River U tidal	02140201	129661.64	405093.77	0.08
SH16APY001456	Tree Planting	Anacostia River	02140205	148687.87	409230.74	0.06
SH16APY001457	Tree Planting	Western Branch	02131103	134071.97	418766.58	0.17

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16APY001458	Tree Planting	Western Branch	02131103	135507.90	424314.68	0.16
SH16APY001459	Tree Planting	Anacostia River	02140205	148992.49	409347.64	0.06
SH16APY001460	Tree Planting	Western Branch	02131103	132936.70	413286.81	0.12
SH16APY001461	Tree Planting	Anacostia River	02140205	148701.66	409194.40	0.25
SH16APY001462	Tree Planting	Western Branch	02131103	127337.92	422523.29	0.13
SH16APY001463	Tree Planting	Western Branch	02131103	130369.49	411726.81	0.36
SH16APY001464	Tree Planting	Potomac River U tidal	02140201	125983.94	400037.12	0.09
SH16APY001465	Tree Planting	Potomac River U tidal	02140201	125959.60	400035.54	0.03
SH16APY001466	Tree Planting	Potomac River U tidal	02140201	125943.49	400199.11	0.17
SH16APY001467	Tree Planting	Western Branch	02131103	127291.66	421750.86	0.07
SH16APY001468	Tree Planting	Western Branch	02131103	127314.94	421811.01	0.08
SH16APY001469	Tree Planting	Western Branch	02131103	127130.95	422602.54	0.04
SH16APY001470	Tree Planting	Potomac River M tidal	02140102	107655.68	395284.57	0.04
SH16APY001471	Tree Planting	Antietam Creek	02140502	214925.65	342203.99	0.12
SH16APY001472	Tree Planting	Antietam Creek	02140502	214964.13	341511.28	0.05
SH16APY001473	Tree Planting	Antietam Creek	02140502	199366.72	342995.37	0.33
SH16APY001474	Tree Planting	Antietam Creek	02140502	197843.16	342718.74	0.34
SH16APY001475	Tree Planting	Antietam Creek	02140502	197672.01	342715.90	0.04
SH16APY001476	Tree Planting	Antietam Creek	02140502	197503.24	342734.42	0.23
SH16APY001477	Tree Planting	Antietam Creek	02140502	197131.03	342832.85	0.05
SH16APY001478	Tree Planting	Antietam Creek	02140502	195600.41	343070.74	1.77
SH16APY001479	Tree Planting	Antietam Creek	02140502	195185.54	342921.63	0.32
SH16APY001480	Tree Planting	Potomac River FR Cnty	02140301	192674.90	343445.65	0.54
SH16APY001481	Tree Planting	Antietam Creek	02140502	194360.52	342900.73	0.86
SH16APY001482	Tree Planting	Potomac River FR Cnty	02140301	194069.79	342989.78	0.59

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16APY001483	Tree Planting	Potomac River FR Cnty	02140301	192113.66	343674.60	0.08
SH16APY001484	Tree Planting	Potomac River FR Cnty	02140301	191849.28	343638.69	0.34
SH16APY001485	Tree Planting	Antietam Creek	02140502	202901.13	344263.93	0.05
SH16APY001486	Tree Planting	Antietam Creek	02140502	202854.22	344294.69	0.50
SH16APY001487	Tree Planting	Antietam Creek	02140502	202549.69	344202.29	1.03
SH16APY001488	Tree Planting	Antietam Creek	02140502	201552.49	343845.91	0.08
SH16APY001489	Tree Planting	Antietam Creek	02140502	201272.63	343761.13	0.08
SH16APY001490	Tree Planting	Potomac River FR Cnty	02140301	191560.23	343538.73	0.10
SH16APY001491	Tree Planting	Potomac River FR Cnty	02140301	191493.05	343512.60	0.17
SH16APY001492	Tree Planting	Potomac River FR Cnty	02140301	191403.04	343476.27	0.22
SH16APY001493	Tree Planting	Potomac River FR Cnty	02140301	191126.25	343371.97	0.21
SH16APY001494	Tree Planting	Potomac River FR Cnty	02140301	189112.87	342240.91	0.26
SH16APY001495	Tree Planting	Potomac River FR Cnty	02140301	188970.22	342189.92	0.04
SH16APY001496	Tree Planting	Potomac River FR Cnty	02140301	188934.55	342176.42	0.06
SH16APY001497	Tree Planting	Potomac River FR Cnty	02140301	188664.42	342062.70	0.13
SH16APY001498	Tree Planting	Potomac River FR Cnty	02140301	187535.21	341488.31	0.30
SH16APY001499	Tree Planting	Potomac River FR Cnty	02140301	186330.37	341187.73	0.15
SH16APY001500	Tree Planting	Potomac River FR Cnty	02140301	185850.16	341058.04	0.11
SH16APY001501	Tree Planting	Potomac River FR Cnty	02140301	185153.21	339827.42	0.24
SH16APY001502	Tree Planting	Potomac River FR Cnty	02140301	186694.87	341259.91	0.06
SH16APY001503	Tree Planting	Potomac River FR Cnty	02140301	186590.41	341234.14	0.33
SH16APY001504	Tree Planting	Potomac River FR Cnty	02140301	187716.61	341510.03	0.16
SH16APY001505	Tree Planting	Antietam Creek	02140502	197188.94	342813.74	0.07
SH16APY001506	Tree Planting	Antietam Creek	02140502	197117.11	342894.80	0.84
SH16APY001507	Tree Planting	Antietam Creek	02140502	198088.07	342726.37	0.23

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16APY001508	Tree Planting	Antietam Creek	02140502	199528.05	343160.70	0.99
SH16APY001509	Tree Planting	Antietam Creek	02140502	201451.72	343815.87	0.04
SH16APY001510	Tree Planting	Antietam Creek	02140502	199215.95	342982.75	0.13
SH16APY001511	Tree Planting	Antietam Creek	02140502	201358.48	343786.51	0.05
SH16APY001512	Tree Planting	Antietam Creek	02140502	194605.35	342827.40	0.22
SH16APY001513	Tree Planting	Potomac River FR Cnty	02140301	185885.41	341076.43	0.04
SH16APY001514	Tree Planting	Marsh Run	02140503	215471.28	336130.07	0.28
SH16APY001515	Tree Planting	Marsh Run	02140503	215498.31	335960.64	0.19
SH16APY001516	Tree Planting	Antietam Creek	02140502	213143.23	345082.50	0.19
SH16APY001517	Tree Planting	Antietam Creek	02140502	212202.12	343793.26	0.63
SH16APY001518	Tree Planting	Antietam Creek	02140502	214249.74	343759.38	0.13
SH16APY001519	Tree Planting	Antietam Creek	02140502	212910.83	345480.25	0.18
SH16APY001520	Tree Planting	Antietam Creek	02140502	214381.60	343597.75	0.11
SH16APY001521	Tree Planting	Antietam Creek	02140502	214431.38	343536.54	0.12
SH16APY001522	Tree Planting	Antietam Creek	02140502	213317.67	345014.45	0.17
SH16APY001523	Tree Planting	Antietam Creek	02140502	214868.67	342252.98	0.14
SH16APY001524	Tree Planting	Conococheague Creek	02140504	213681.26	342127.51	0.05
SH16APY001525	Tree Planting	Antietam Creek	02140502	196864.49	342981.66	0.13
SH16APY001526	Tree Planting	Potomac River FR Cnty	02140301	191209.97	343400.10	0.08
SH16APY001527	Tree Planting	Potomac River FR Cnty	02140301	191315.19	343445.39	0.17
SH16APY001528	Tree Planting	Potomac River FR Cnty	02140301	189019.43	342207.18	0.13
SH16APY001529	Tree Planting	Antietam Creek	02140502	199280.29	343022.67	0.08
SH16APY001530	Tree Planting	Conococheague Creek	02140504	220717.90	335705.19	0.56
SH16APY001531	Tree Planting	Potomac River FR Cnty	02140301	192210.68	343672.46	0.09
SH16APY001532	Tree Planting	Antietam Creek	02140502	213407.28	344845.46	0.14

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16APY001541	Tree Planting	Severn River	02131002	150973.32	447423.22	0.34
SH16APY001542	Tree Planting	Patuxent River middle	02131102	126857.89	425905.32	0.24
SH16APY001543	Tree Planting	Severn River	02131002	156841.52	428128.26	0.59
SH16APY001544	Tree Planting	Severn River	02131002	156913.57	427919.55	0.57
SH16APY001545	Tree Planting	Patuxent River middle	02131102	124077.35	433787.54	0.07
SH16APY001546	Tree Planting	South River	02131003	145911.00	438977.87	0.30
SH16APY001552	Tree Planting	Patuxent River middle	02131102	123827.34	431956.01	0.12
SH16APY001553	Tree Planting	Patuxent River middle	02131102	123840.20	431903.21	0.05
SH16APY001563	Tree Planting	West Chesapeake Bay	02131005	120527.08	435297.10	0.09
SH16APY001564	Tree Planting	Patuxent River middle	02131102	120875.12	435221.04	0.27
SH16APY001567	Tree Planting	South River	02131003	137833.51	438662.68	0.03
SH16APY001568	Tree Planting	Nanjemoy Creek	02140110	91277.79	379800.75	0.28
SH16APY001569	Tree Planting	Severn River	02131002	158260.85	427015.25	0.36
SH16APY001570	Tree Planting	Severn River	02131002	155125.64	430965.65	0.46
SH16APY001571	Tree Planting	Zekiah Swamp	02140108	105798.50	410890.40	0.19
SH16APY001572	Tree Planting	Severn River	02131002	151078.59	447386.19	0.21
SH16APY001573	Tree Planting	Patuxent River lower	02131101	97174.57	418387.34	0.35
SH16APY001575	Tree Planting	South River	02131003	137874.28	438684.42	0.02
SH16APY001576	Tree Planting	Patuxent River lower	02131101	97354.33	418273.02	0.10
SH16APY001577	Tree Planting	Severn River	02131002	159114.70	426518.67	0.33
SH16APY001578	Tree Planting	Gilbert Swamp	02140107	89554.76	416010.52	0.20
SH16APY001579	Tree Planting	Gilbert Swamp	02140107	89695.42	414793.75	0.32
SH16APY001582	Tree Planting	Patapsco River L N Br	02130906	172460.08	429384.40	0.46
SH16APY001597	Tree Planting	Back River	02130901	192035.20	438781.99	0.36
SH16APY001602	Tree Planting	Deer Creek	02120202	226863.76	430368.93	0.30

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH16APY001603	Tree Planting	Deer Creek	02120202	227751.04	429857.02	0.22
SH16APY001604	Tree Planting	Patapsco River L N Br	02130906	175753.89	427819.09	0.20
SH16APY001612	Tree Planting	Loch Raven Reservoir	02130805	218317.47	428205.40	0.35
SH16APY003000	Tree Planting	Baltimore Harbor	02130903	162943.48	435221.00	0.33
SH17APY001548	Tree Planting	Potomac River WA Cnty	02140501	202437.11	335579.99	5.33
SH17APY001549	Tree Planting	Antietam Creek	02140502	201619.55	336108.80	1.62
SH17APY001550	Tree Planting	Potomac River WA Cnty	02140501	201383.82	335401.87	0.80
SH17APY001551	Tree Planting	Antietam Creek	02140502	201950.99	336110.26	1.56
SH17APY001639	Tree Planting	Patuxent River upper	02131104	136647.13	424837.36	0.07
SH17APY001640	Tree Planting	Anacostia River	02140205	148452.06	409184.41	0.16
SH17APY001641	Tree Planting	Potomac River U tidal	02140201	127968.00	409199.56	0.09
SH17APY001642	Tree Planting	Anacostia River	02140205	148541.30	409243.38	0.16
SH17APY001643	Tree Planting	Anacostia River	02140205	146878.36	409949.92	0.27
SH17APY001644	Tree Planting	Potomac River U tidal	02140201	129530.26	405101.51	0.07
SH17APY001646	Tree Planting	Western Branch	02131103	141255.83	412621.85	1.28
SH17APY001647	Tree Planting	Anacostia River	02140205	132799.89	408854.87	0.08
SH17APY001648	Tree Planting	Western Branch	02131103	141308.91	412551.52	0.04
SH17APY001649	Tree Planting	Potomac River U tidal	02140201	126919.20	402917.37	0.19
SH17APY001650	Tree Planting	Anacostia River	02140205	146825.65	408123.49	0.28
SH17APY001651	Tree Planting	Western Branch	02131103	142226.40	413545.03	0.26
SH17APY003000	Tree Planting	S Branch Patapsco	02130908	187341.27	410210.08	0.08
SH17APY003001	Tree Planting	S Branch Patapsco	02130908	187309.00	410112.90	0.09
SH18APY001679	Tree Planting	Octoraro Creek	02120203	225899.23	478145.58	0.22
SH18APY001680	Tree Planting	Octoraro Creek	02120203	227628.16	481460.78	0.47
SH18APY001681	Tree Planting	Baltimore Harbor	02130903	164512.11	427010.12	0.17

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH18APY001682	Tree Planting	Patapsco River L N Br	02130906	164651.91	426996.11	0.08
SH18APY001683	Tree Planting	Patapsco River L N Br	02130906	165420.25	422103.48	0.35
SH18APY001684	Tree Planting	Patapsco River L N Br	02130906	165792.36	422280.85	0.60
SH18APY001685	Tree Planting	Patapsco River L N Br	02130906	165455.20	422004.35	0.15
SH18APY001686	Tree Planting	Patapsco River L N Br	02130906	164635.18	426910.51	0.15
SH18APY001687	Tree Planting	Patapsco River L N Br	02130906	166671.55	423679.40	0.26
SH18APY001688	Tree Planting	Patapsco River L N Br	02130906	165247.81	422037.30	0.31
SH18APY001689	Tree Planting	Patapsco River L N Br	02130906	165359.31	421863.11	0.27
SH18APY001690	Tree Planting	Patapsco River L N Br	02130906	165133.89	421880.48	0.20
SH18APY001691	Tree Planting	Patapsco River L N Br	02130906	170284.71	426572.34	0.20
SH18APY001692	Tree Planting	Patapsco River L N Br	02130906	164657.51	425305.36	0.08
SH18APY001693	Tree Planting	Patapsco River L N Br	02130906	167522.03	423701.09	0.26
SH18APY001694	Tree Planting	Patapsco River L N Br	02130906	171279.61	426382.73	0.04
SH18APY001695	Tree Planting	Patapsco River L N Br	02130906	165102.76	426564.33	0.11
SH18APY001696	Tree Planting	Severn River	02131002	156286.76	431834.50	0.63
SH18APY001697	Tree Planting	Severn River	02131002	155849.09	431490.22	0.32
SH18APY001698	Tree Planting	Severn River	02131002	155138.94	431067.65	0.39
SH18APY001699	Tree Planting	Severn River	02131002	155767.31	431246.65	0.10
SH18APY001700	Tree Planting	Little Patuxent River	02131105	161453.04	417572.82	0.09
SH18APY001701	Tree Planting	Little Patuxent River	02131105	158648.07	417471.72	0.08
SH18APY001702	Tree Planting	Little Patuxent River	02131105	161437.71	418743.48	0.10
SH18APY001703	Tree Planting	Severn River	02131002	159310.09	426372.48	0.45
SH18APY001704	Tree Planting	Severn River	02131002	155769.31	431358.32	0.22
SH18APY001705	Tree Planting	Severn River	02131002	146499.96	440326.96	0.13
SH18APY001706	Tree Planting	Severn River	02131002	146425.56	440250.70	0.05

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH18APY001707	Tree Planting	Severn River	02131002	150896.83	449501.00	0.15
SH18APY001708	Tree Planting	Magothy River	02131001	160766.33	436462.79	0.11
SH18APY001709	Tree Planting	West River	02131004	133219.72	437890.36	0.26
SH18APY001710	Tree Planting	Patuxent River middle	02131102	126882.68	426102.85	0.07
SH18APY001711	Tree Planting	South River	02131003	145040.30	439596.49	0.10
SH18APY001712	Tree Planting	South River	02131003	146326.47	436302.92	0.26
SH18APY001713	Tree Planting	South River	02131003	146343.79	439338.15	0.06
SH18APY001714	Tree Planting	South River	02131003	144895.45	439709.54	0.26
SH18APY001715	Tree Planting	Patuxent River middle	02131102	123251.49	429340.70	0.08
SH18APY001716	Tree Planting	Patuxent River middle	02131102	123829.47	429182.99	0.10
SH18APY001717	Tree Planting	South River	02131003	145415.34	439253.44	0.06
SH18APY001718	Tree Planting	Severn River	02131002	146520.39	440388.78	0.17
SH18APY001719	Tree Planting	Severn River	02131002	146827.65	440484.88	0.20
SH18APY001720	Tree Planting	West Chesapeake Bay	02131005	124845.94	436500.64	0.26
SH18APY001721	Tree Planting	South River	02131003	144935.91	439578.98	0.10
SH18APY001722	Tree Planting	Baltimore Harbor	02130903	169221.27	431677.52	0.12
SH18APY001723	Tree Planting	Baltimore Harbor	02130903	169559.72	434168.77	0.23
SH18APY001724	Tree Planting	Baltimore Harbor	02130903	170722.19	431994.11	0.80
SH18APY001725	Tree Planting	Baltimore Harbor	02130903	171030.74	432683.86	0.41
SH18APY001726	Tree Planting	Baltimore Harbor	02130903	171026.27	433480.41	0.05
SH18APY001727	Tree Planting	Baltimore Harbor	02130903	170500.67	431856.57	0.11
SH18APY001728	Tree Planting	Baltimore Harbor	02130903	162393.85	430915.17	0.30
SH18APY001729	Tree Planting	Baltimore Harbor	02130903	163915.34	430679.63	0.05
SH18APY001730	Tree Planting	Baltimore Harbor	02130903	163973.28	430765.83	0.20
SH18APY001731	Tree Planting	Baltimore Harbor	02130903	164601.05	427208.73	0.29

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH18APY001732	Tree Planting	Baltimore Harbor	02130903	164221.95	430658.76	0.37
SH18APY001733	Tree Planting	Baltimore Harbor	02130903	165618.77	434167.98	0.15
SH18APY001734	Tree Planting	Baltimore Harbor	02130903	166615.34	431030.68	0.15
SH18APY001735	Tree Planting	Baltimore Harbor	02130903	165417.66	429057.45	0.38
SH18APY001736	Tree Planting	Baltimore Harbor	02130903	164899.94	430496.83	0.70
SH18APY001737	Tree Planting	Baltimore Harbor	02130903	165046.41	430345.66	0.18
SH18APY001738	Tree Planting	Baltimore Harbor	02130903	163811.78	440983.00	0.22
SH18APY001739	Tree Planting	Baltimore Harbor	02130903	165056.83	427925.63	0.05
SH18APY001740	Tree Planting	Baltimore Harbor	02130903	164944.31	430827.30	0.30
SH18APY001741	Tree Planting	Baltimore Harbor	02130903	164951.41	430912.95	0.26
SH18APY001742	Tree Planting	Baltimore Harbor	02130903	165324.05	430390.23	0.15
SH18APY001743	Tree Planting	Baltimore Harbor	02130903	164485.96	430737.46	0.27
SH18APY001744	Tree Planting	Baltimore Harbor	02130903	165233.74	428206.96	0.66
SH18APY001745	Tree Planting	Baltimore Harbor	02130903	168044.19	431594.42	0.13
SH18APY001746	Tree Planting	South River	02131003	145633.13	439150.27	0.10
SH18APY001747	Tree Planting	Patuxent River middle	02131102	122142.94	429720.39	0.07
SH18APY001748	Tree Planting	Baltimore Harbor	02130903	161969.95	430770.87	0.14
SH18APY001749	Tree Planting	Baltimore Harbor	02130903	162053.61	430703.60	0.05
SH18APY001750	Tree Planting	Patapsco River L N Br	02130906	171070.44	426350.90	0.06
SH18APY001751	Tree Planting	Patapsco River L N Br	02130906	163554.55	427208.35	0.09
SH18APY001752	Tree Planting	Baltimore Harbor	02130903	163080.34	435490.25	0.15
SH18APY001753	Tree Planting	Patapsco River L N Br	02130906	162911.98	426997.82	0.05
SH18APY001754	Tree Planting	Severn River	02131002	158364.70	432120.56	0.32
SH18APY001756	Tree Planting	Severn River	02131002	159723.00	432055.06	0.20
SH18APY001757	Tree Planting	Severn River	02131002	159857.79	432011.28	0.07

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH18APY001758	Tree Planting	Baltimore Harbor	02130903	171143.21	433256.74	0.18
SH18APY001759	Tree Planting	Severn River	02131002	155536.32	430883.29	0.04
SH18APY001760	Tree Planting	Severn River	02131002	159032.63	426722.01	0.34
SH18APY001761	Tree Planting	Severn River	02131002	159228.52	426544.04	0.46
SH18APY001762	Tree Planting	Patapsco River L N Br	02130906	170153.01	426056.45	0.14
SH18APY001763	Tree Planting	Patapsco River L N Br	02130906	164730.84	425421.59	0.09
SH18APY001764	Tree Planting	Patapsco River L N Br	02130906	164768.50	425312.78	0.26
SH18APY001765	Tree Planting	South River	02131003	145978.90	438854.90	0.11
SH18APY001767	Tree Planting	Little Patuxent River	02131105	150215.19	426271.74	0.19
SH18APY001768	Tree Planting	Severn River	02131002	156950.54	427698.23	0.26
SH18APY001769	Tree Planting	Baltimore Harbor	02130903	167612.68	431498.25	0.05
SH18APY001783	Tree Planting	Potomac River L tidal	02140101	84337.00	393729.20	0.30
SH18APY001808	Tree Planting	Double Pipe Creek	02140304	214182.26	396535.78	0.37
SH18APY001809	Tree Planting	Liberty Reservoir	02130907	208942.89	401279.92	0.15
SH18APY001810	Tree Planting	Double Pipe Creek	02140304	215911.36	393417.38	0.35
SH18APY001811	Tree Planting	Double Pipe Creek	02140304	215970.54	393317.94	0.15
SH18APY001812	Tree Planting	Liberty Reservoir	02130907	198910.69	399898.59	0.45
SH18APY001813	Tree Planting	Double Pipe Creek	02140304	218216.86	390189.83	0.82
SH18APY001814	Tree Planting	Double Pipe Creek	02140304	218524.98	389706.55	3.38
SH18APY001815	Tree Planting	Upper Monocacy River	02140303	223189.68	369754.09	0.80
SH18APY001816	Tree Planting	Upper Monocacy River	02140303	223418.22	369924.71	0.23
SH18APY001817	Tree Planting	Upper Monocacy River	02140303	223974.30	370218.89	0.05
SH18APY001818	Tree Planting	Upper Monocacy River	02140303	223815.89	370348.32	0.20
SH18APY001819	Tree Planting	Upper Monocacy River	02140303	223986.30	370401.71	0.17
SH18APY001821	Tree Planting	Octoraro Creek	02120203	223799.38	479461.46	0.44

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH18APY001822	Tree Planting	Octoraro Creek	02120203	226289.23	478538.73	0.52
SH18APY001823	Tree Planting	Octoraro Creek	02120203	227223.15	480587.51	0.64
SH18APY001824	Tree Planting	Northeast River	02130608	222750.50	489456.00	0.14
SH18APY001825	Tree Planting	Northeast River	02130608	225511.21	487797.98	0.14
SH18APY001826	Tree Planting	Northeast River	02130608	224215.15	488468.74	0.24
SH18APY001827	Tree Planting	Northeast River	02130608	226027.19	487590.63	0.39
SH18APY001828	Tree Planting	Northeast River	02130608	223744.17	488829.49	0.89
SH18APY001829	Tree Planting	Lower Susquehanna River	02120201	216461.60	479750.95	0.16
SH18APY001830	Tree Planting	Octoraro Creek	02120203	223648.30	479485.30	0.12
SH18APY001831	Tree Planting	Northeast River	02130608	222206.12	489633.39	0.45
SH18APY001832	Tree Planting	Octoraro Creek	02120203	227104.89	478949.57	0.84
SH18APY001835	Tree Planting	Baltimore Harbor	02130903	170933.90	432587.53	1.64
SH18APY001838	Tree Planting	Upper Monocacy River	02140303	224273.69	370555.47	0.47
SH18APY001839	Tree Planting	Upper Monocacy River	02140303	224306.13	370699.96	0.63
SH18APY001840	Tree Planting	Upper Monocacy River	02140303	223992.65	369788.95	0.05
SH18APY001841	Tree Planting	Upper Monocacy River	02140303	224014.99	370269.51	0.09
SH18APY001844	Tree Planting	Octoraro Creek	02120203	222371.73	479346.13	0.14
SH18APY001845	Tree Planting	Octoraro Creek	02120203	222703.66	479445.85	0.34
SH18APY001846	Tree Planting	Octoraro Creek	02120203	223571.17	479491.17	0.14
SH18APY001847	Tree Planting	Lower Susquehanna River	02120201	218270.38	478773.20	0.58
SH18APY001848	Tree Planting	Octoraro Creek	02120203	218778.52	479291.27	0.18
SH18APY001849	Tree Planting	Octoraro Creek	02120203	227739.88	482100.62	0.44
SH18APY001850	Tree Planting	Octoraro Creek	02120203	225723.82	478059.30	0.51
SH18APY001851	Tree Planting	Octoraro Creek	02120203	226251.60	478614.82	0.37
SH18APY001852	Tree Planting	Northeast River	02130608	224999.73	488120.35	0.20

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH18APY001853	Tree Planting	Northeast River	02130608	223297.16	489122.80	1.81
SH18APY001854	Tree Planting	Little Elk Creek	02130605	222785.35	498179.83	0.13
SH18APY001855	Tree Planting	Lower Susquehanna River	02120201	217975.50	478481.10	0.11
SH18APY001856	Tree Planting	Northeast River	02130608	217724.60	490077.70	0.46
SH18APY001857	Tree Planting	Northeast River	02130608	221913.79	489722.67	0.29
SH18APY001858	Tree Planting	Northeast River	02130608	221787.46	489754.68	0.27
SH18APY001859	Tree Planting	Octoraro Creek	02120203	227127.21	480336.21	0.15
SH18APY001860	Tree Planting	Upper Monocacy River	02140303	223683.96	370703.73	0.14
SH18APY001861	Tree Planting	Liberty Reservoir	02130907	199013.15	399863.29	0.32
SH18APY001863	Tree Planting	Conococheague Creek	02140504	223874.02	328065.25	8.79
SH18APY001864	Tree Planting	Marsh Run	02140503	207678.52	334434.90	4.75
SH18APY001865	Tree Planting	Antietam Creek	02140502	212895.04	345255.23	9.67
SH18APY001866	Tree Planting	Antietam Creek	02140502	200454.09	337639.13	0.80
SH18APY001867	Tree Planting	Mattawoman Creek	02140111	106787.63	402094.89	2.93
SH18APY001868	Tree Planting	Mattawoman Creek	02140111	107015.21	402341.57	0.34
SH18APY001869	Tree Planting	Antietam Creek	02140502	212759.10	345156.55	4.59
SH18APY001870	Tree Planting	Conococheague Creek	02140504	224056.60	328159.31	1.13
SH18APY001871	Tree Planting	Marsh Run	02140503	207775.25	334461.49	2.83
SH18APY001873	Tree Planting	Double Pipe Creek	02140304	219085.65	389129.33	1.36
SH19APY001872	Tree Planting	Mattawoman Creek	02140111	107832.31	403358.91	0.19
SH19APY001943	Tree Planting	Atkisson Reservoir	02130703	212111.32	452633.33	0.16
SH19APY001944	Tree Planting	Atkisson Reservoir	02130703	212090.76	451306.99	0.71
SH19APY001945	Tree Planting	Atkisson Reservoir	02130703	211864.69	450131.60	0.19
SH19APY001946	Tree Planting	Atkisson Reservoir	02130703	211982.51	451100.94	0.15
SH19APY001947	Tree Planting	Atkisson Reservoir	02130703	212232.15	452628.75	1.30

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH19APY001948	Tree Planting	Atkisson Reservoir	02130703	212206.27	452388.83	2.68
SH19APY001949	Tree Planting	Bynum Run	02130704	212250.08	453024.92	0.30
SH19APY001950	Tree Planting	Bynum Run	02130704	210588.12	454978.64	0.18
SH19APY001951	Tree Planting	Bynum Run	02130704	210816.56	455327.30	0.32
SH19APY001952	Tree Planting	Double Pipe Creek	02140304	219995.55	387166.91	0.36
SH19APY001953	Tree Planting	Double Pipe Creek	02140304	219979.85	387414.14	0.84
SH19APY001954	Tree Planting	Double Pipe Creek	02140304	219846.66	388339.38	0.23
SH19APY001955	Tree Planting	Double Pipe Creek	02140304	219819.58	388283.25	0.10
SH19APY001956	Tree Planting	Double Pipe Creek	02140304	219687.46	388512.51	0.72
SH19APY001957	Tree Planting	S Branch Patapsco	02130908	195673.77	399488.94	1.03
SH19APY001958	Tree Planting	S Branch Patapsco	02130908	195839.89	399481.01	0.23
SH19APY001959	Tree Planting	Double Pipe Creek	02140304	209774.15	389396.14	1.16
SH19APY001960	Tree Planting	Double Pipe Creek	02140304	209514.36	396043.25	0.15
SH19APY001961	Tree Planting	Double Pipe Creek	02140304	209794.19	396409.39	0.61
SH19APY001962	Tree Planting	Double Pipe Creek	02140304	219548.61	407118.48	0.19
SH19APY001963	Tree Planting	Liberty Reservoir	02130907	195996.47	399214.14	1.80
SH19APY001964	Tree Planting	Double Pipe Creek	02140304	208651.33	392834.26	0.09
SH19APY001965	Tree Planting	Double Pipe Creek	02140304	208619.01	392648.13	0.42
SH19APY001966	Tree Planting	Liberty Reservoir	02130907	198591.22	399995.71	0.41
SH19APY001967	Tree Planting	Liberty Reservoir	02130907	196045.56	399646.46	2.47
SH19APY001968	Tree Planting	Liberty Reservoir	02130907	209395.98	401419.90	0.27
SH19APY001969	Tree Planting	Liberty Reservoir	02130907	209532.01	401467.02	0.51
SH19APY001970	Tree Planting	Liberty Reservoir	02130907	213873.89	402997.03	0.53
SH19APY001971	Tree Planting	Double Pipe Creek	02140304	215473.72	394518.38	0.72
SH19APY001972	Tree Planting	Liberty Reservoir	02130907	209755.27	401540.01	0.23

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH19APY001973	Tree Planting	Double Pipe Creek	02140304	208877.70	394571.25	0.16
SH19APY001974	Tree Planting	Upper Monocacy River	02140303	223019.85	386536.24	0.77
SH19APY001975	Tree Planting	Upper Monocacy River	02140303	225725.93	388651.61	0.21
SH19APY001976	Tree Planting	Upper Monocacy River	02140303	223607.78	386923.19	0.28
SH19APY001977	Tree Planting	Upper Monocacy River	02140303	223680.62	386967.24	0.14
SH19APY001978	Tree Planting	Upper Monocacy River	02140303	223748.79	387008.11	0.27
SH19APY001979	Tree Planting	Double Pipe Creek	02140304	215098.48	395210.46	0.44
SH19APY001980	Tree Planting	Liberty Reservoir	02130907	191831.07	407680.87	0.30
SH19APY001981	Tree Planting	Double Pipe Creek	02140304	219268.76	388975.82	0.50
SH19APY001982	Tree Planting	Double Pipe Creek	02140304	219145.38	389159.11	0.49
SH19APY001983	Tree Planting	Double Pipe Creek	02140304	219756.90	388525.84	0.30
SH19APY001984	Tree Planting	Double Pipe Creek	02140304	208549.83	392153.73	0.46
SH19APY001985	Tree Planting	Double Pipe Creek	02140304	211424.64	398451.60	0.22
SH19APY001986	Tree Planting	Double Pipe Creek	02140304	215789.97	393618.38	0.69
SH19APY001987	Tree Planting	Upper Monocacy River	02140303	225779.53	388742.34	0.19
SH19APY001988	Tree Planting	Catoctin Creek	02140305	187869.31	352201.11	0.26
SH19APY001989	Tree Planting	Catoctin Creek	02140305	187791.09	351304.28	0.24
SH19APY001990	Tree Planting	Lower Monocacy River	02140302	190679.55	360217.47	0.52
SH19APY001991	Tree Planting	Catoctin Creek	02140305	200360.56	355702.24	0.20
SH19APY001992	Tree Planting	Catoctin Creek	02140305	200520.25	355610.40	0.72
SH19APY001993	Tree Planting	Catoctin Creek	02140305	195573.65	352024.31	0.64
SH19APY001994	Tree Planting	Potomac River FR Cnty	02140301	182186.79	355491.81	1.23
SH19APY001995	Tree Planting	Lower Monocacy River	02140302	189010.95	357048.14	0.20
SH19APY001996	Tree Planting	Potomac River FR Cnty	02140301	187272.15	347367.90	0.31
SH19APY001997	Tree Planting	Catoctin Creek	02140305	202046.85	354402.17	0.20

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH19APY001998	Tree Planting	Catoctin Creek	02140305	202813.08	353782.17	0.69
SH19APY001999	Tree Planting	Catoctin Creek	02140305	205950.37	350435.88	0.25
SH19APY002000	Tree Planting	Catoctin Creek	02140305	207013.95	349187.82	0.42
SH19APY002001	Tree Planting	Potomac River FR Cnty	02140301	181128.99	354871.17	0.69
SH19APY002002	Tree Planting	Potomac River FR Cnty	02140301	183373.17	355773.55	0.76
SH19APY002003	Tree Planting	Potomac River FR Cnty	02140301	183644.13	355826.98	0.72
SH19APY002004	Tree Planting	Potomac River FR Cnty	02140301	184980.23	356077.46	1.40
SH19APY002005	Tree Planting	Catoctin Creek	02140305	201184.04	353941.66	0.13
SH19APY002006	Tree Planting	Upper Monocacy River	02140303	218726.89	364845.55	0.12
SH19APY002007	Tree Planting	Upper Monocacy River	02140303	222690.83	369654.38	0.70
SH19APY002008	Tree Planting	Catoctin Creek	02140305	194772.79	350640.17	0.63
SH19APY002009	Tree Planting	Catoctin Creek	02140305	200656.00	354460.80	1.31
SH19APY002010	Tree Planting	Catoctin Creek	02140305	199404.29	355729.59	0.28
SH19APY002011	Tree Planting	Lower Monocacy River	02140302	184109.77	364041.95	0.17
SH19APY002012	Tree Planting	Catoctin Creek	02140305	201342.43	353703.87	0.18
SH19APY002013	Tree Planting	Catoctin Creek	02140305	204657.60	351948.30	0.12
SH19APY002014	Tree Planting	Catoctin Creek	02140305	193783.95	349350.54	0.19
SH19APY002015	Tree Planting	Catoctin Creek	02140305	192711.10	347124.06	0.65
SH19APY002016	Tree Planting	Catoctin Creek	02140305	192831.14	347518.97	0.40
SH19APY002017	Tree Planting	Catoctin Creek	02140305	193159.84	348172.31	0.19
SH19APY002018	Tree Planting	Potomac River FR Cnty	02140301	183035.64	355652.30	0.10
SH19APY002019	Tree Planting	Potomac River FR Cnty	02140301	185438.90	356176.54	0.76
SH19APY002020	Tree Planting	Potomac River FR Cnty	02140301	182354.86	355561.42	0.12
SH19APY002021	Tree Planting	Catoctin Creek	02140305	201804.62	354599.01	0.24
SH19APY002022	Tree Planting	Catoctin Creek	02140305	205211.67	351291.80	0.12

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH19APY002023	Tree Planting	Catoctin Creek	02140305	199378.96	356194.25	0.10
SH19APY002024	Tree Planting	Catoctin Creek	02140305	187774.59	351960.90	0.28
SH19APY002025	Tree Planting	Catoctin Creek	02140305	187828.29	352576.21	0.16
SH19APY002026	Tree Planting	Potomac River FR Cnty	02140301	186830.28	356358.43	0.31
SH19APY002027	Tree Planting	Catoctin Creek	02140305	203591.43	353160.47	0.75
SH19APY002028	Tree Planting	Catoctin Creek	02140305	203271.34	353419.16	0.25
SH19APY002029	Tree Planting	Catoctin Creek	02140305	203208.28	353473.29	0.23
SH19APY002030	Tree Planting	Catoctin Creek	02140305	203068.96	353581.74	0.65
SH19APY002031	Tree Planting	Catoctin Creek	02140305	193822.81	349502.79	0.17
SH19APY002032	Tree Planting	Catoctin Creek	02140305	187889.32	352374.80	0.10
SH19APY002033	Tree Planting	Catoctin Creek	02140305	202170.00	354311.31	0.12
SH19APY002034	Tree Planting	Catoctin Creek	02140305	206931.26	349283.41	0.14
SH19APY002035	Tree Planting	Catoctin Creek	02140305	201902.93	354519.76	0.11
SH19APY002036	Tree Planting	Catoctin Creek	02140305	203436.53	353283.44	0.30
SH19APY002037	Tree Planting	Catoctin Creek	02140305	192845.10	347622.80	0.12
SH19APY002038	Tree Planting	Catoctin Creek	02140305	193176.70	348112.86	0.39
SH19APY002039	Tree Planting	Catoctin Creek	02140305	192874.07	347720.22	0.22
SH19APY002040	Tree Planting	Catoctin Creek	02140305	203619.90	350659.31	0.25
SH19APY002041	Tree Planting	Upper Monocacy River	02140303	218717.83	364774.23	0.09
SH19APY002042	Tree Planting	Catoctin Creek	02140305	194715.38	350504.13	0.16
SH19APY002043	Tree Planting	Potomac River FR Cnty	02140301	185940.47	344756.55	0.16
SH19APY002044	Tree Planting	Upper Monocacy River	02140303	198686.84	365702.41	0.15
SH19APY002045	Tree Planting	Deer Creek	02120202	212465.32	456918.32	0.21
SH19APY002046	Tree Planting	Broad Creek	02120205	225125.47	453707.35	0.47
SH19APY002047	Tree Planting	Broad Creek	02120205	224782.86	453643.21	0.20

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH19APY002048	Tree Planting	Broad Creek	02120205	223944.06	453302.46	0.43
SH19APY002049	Tree Planting	Broad Creek	02120205	223820.06	452788.25	0.45
SH19APY002050	Tree Planting	Broad Creek	02120205	226022.30	457285.76	0.37
SH19APY002051	Tree Planting	Swan Creek	02130706	212554.03	468920.21	0.36
SH19APY002052	Tree Planting	Swan Creek	02130706	212558.92	469012.32	0.13
SH19APY002053	Tree Planting	Swan Creek	02130706	212405.93	469814.85	0.24
SH19APY002054	Tree Planting	Atkisson Reservoir	02130703	211847.47	449385.55	0.37
SH19APY002055	Tree Planting	Lower Winters Run	02130702	201532.39	452871.70	0.24
SH19APY002056	Tree Planting	Broad Creek	02120205	224856.03	453648.54	0.24
SH19APY002057	Tree Planting	Broad Creek	02120205	223781.30	452651.09	0.31
SH19APY002058	Tree Planting	Atkisson Reservoir	02130703	209327.08	444220.90	0.13
SH19APY002059	Tree Planting	Loch Raven Reservoir	02130805	202786.84	428585.17	0.35
SH19APY002060	Tree Planting	Loch Raven Reservoir	02130805	208980.58	428449.71	0.22
SH19APY002061	Tree Planting	Loch Raven Reservoir	02130805	226113.97	431266.88	0.15
SH19APY002062	Tree Planting	Back River	02130901	175219.66	446756.89	0.46
SH19APY002063	Tree Planting	Deer Creek	02120202	227180.27	430182.59	0.47
SH19APY002064	Tree Planting	Loch Raven Reservoir	02130805	226466.96	430677.32	1.22
SH19APY002065	Tree Planting	Loch Raven Reservoir	02130805	209108.82	428592.63	0.29
SH19APY002066	Tree Planting	Loch Raven Reservoir	02130805	203093.86	428531.10	0.82
SH19APY002067	Tree Planting	Atkisson Reservoir	02130703	212123.02	452124.82	0.13
SH19APY002068	Tree Planting	S Branch Patapsco	02130908	197759.02	394923.03	0.25
SH19APY002069	Tree Planting	Loch Raven Reservoir	02130805	212693.48	428939.51	0.28
SH19APY002070	Tree Planting	Loch Raven Reservoir	02130805	212698.73	428879.58	0.05
SH19APY002071	Tree Planting	Loch Raven Reservoir	02130805	212640.18	428895.42	0.02
SH19APY002072	Tree Planting	Loch Raven Reservoir	02130805	212690.96	428511.55	0.05

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH19APY002073	Tree Planting	Catoctin Creek	02140305	202076.36	352717.55	0.12
SH19APY002074	Tree Planting	Lower Monocacy River	02140302	191042.61	360658.43	0.36
SH19APY002075	Tree Planting	Lower Monocacy River	02140302	192518.70	364606.68	1.06
SH19APY002076	Tree Planting	Lower Monocacy River	02140302	190535.01	377673.67	0.21
SH19APY002077	Tree Planting	Lower Monocacy River	02140302	194933.68	358381.37	0.23
SH19APY002078	Tree Planting	Lower Monocacy River	02140302	199613.78	388232.58	0.32
SH19APY002079	Tree Planting	Double Pipe Creek	02140304	219520.42	388838.33	0.14
SH19APY002080	Tree Planting	Double Pipe Creek	02140304	209666.62	396223.03	0.16
SH19APY002081	Tree Planting	Liberty Reservoir	02130907	208421.36	401062.99	0.46
SH19APY002082	Tree Planting	Little Gunpowder Falls	02130804	209105.81	444548.28	0.18
SH19APY002083	Tree Planting	Swan Creek	02130706	212524.55	469403.63	0.14
SH19APY002084	Tree Planting	Bynum Run	02130704	209483.43	454284.17	0.15
SH19APY002085	Tree Planting	Atkisson Reservoir	02130703	208067.34	454269.60	0.36
SH19APY002086	Tree Planting	Atkisson Reservoir	02130703	205930.30	450285.83	0.12
SH19APY002087	Tree Planting	Broad Creek	02120205	227103.77	455670.67	0.72
SH19APY002088	Tree Planting	Bynum Run	02130704	209750.62	454195.96	0.27
SH19APY002089	Tree Planting	Back River	02130901	192011.77	439007.27	0.23
SH19APY002090	Tree Planting	Gwynns Falls	02130905	189695.41	421990.29	0.19
SH19APY002091	Tree Planting	Gwynns Falls	02130905	190105.66	421199.81	0.35
SH19APY002092	Tree Planting	Gwynns Falls	02130905	189542.97	421934.86	0.08
SH19APY002093	Tree Planting	Jones Falls	02130904	190530.93	429200.74	0.32
SH19APY002094	Tree Planting	Gwynns Falls	02130905	190727.80	421047.17	0.15
SH19APY002095	Tree Planting	Loch Raven Reservoir	02130805	193970.55	433762.24	0.25
SH19APY002096	Tree Planting	Back River	02130901	181135.89	442750.63	0.16
SH19APY002097	Tree Planting	Back River	02130901	192037.81	438924.74	0.30

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH19APY002098	Tree Planting	Back River	02130901	191977.54	438844.12	0.23
SH19APY002099	Tree Planting	Bird River	02130803	191143.14	440513.36	0.21
SH19APY002100	Tree Planting	Back River	02130901	180624.99	441724.22	0.14
SH19APY002101	Tree Planting	Gwynns Falls	02130905	193925.71	417698.53	0.15
SH19APY002102	Tree Planting	Catoctin Creek	02140305	211760.30	350553.65	2.83
SH19APY002103	Tree Planting	<Null>	<Null>	216382.74	411091.64	4.02
SH19APY002104	Tree Planting	Catoctin Creek	02140305	211567.10	350540.23	0.85
SH12APY000411	Impervious Surface Elimination (to pervious)	Liberty Reservoir	02130907	407581.25	201145.56	0.12
SH12APY000412	Impervious Surface Elimination (to pervious)	Upper Monocacy River	02140303	386462.97	222920.45	0.21
SH12APY000413	Impervious Surface Elimination (to pervious)	Upper Monocacy River	02140303	389198.27	227220.34	0.15
SH17APY001539	Impervious Surface Elimination (to pervious)	Lower Monocacy River	02140302	368666.92	192192.50	0.69
SH17APY001538	Impervious Surface Elimination (to pervious)	S Branch Patapsco	02130908	394907.80	197771.27	0.13
SH17APY001537	Impervious Surface Elimination (to pervious)	Double Pipe Creek	02140304	409167.77	221259.12	0.06
SH17APY001536	Impervious Surface Elimination (to pervious)	Upper Monocacy River	02140303	386273.46	222614.69	0.14
SH17APY001535	Impervious Surface Elimination (to pervious)	Lower Monocacy River	02140302	362358.28	192986.66	0.07
SH17APY001534	Impervious Surface Elimination (to pervious)	Lower Monocacy River	02140302	362613.55	194079.77	0.47
SH17APY001533	Impervious Surface Elimination (to pervious)	Little Patuxent River	02131105	418273.00	167125.75	0.17

Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SH17APY001540	Impervious Surface Elimination (to pervious)	Catoctin Creek	02140305	349898.01	193900.00	0.11
SH18APY001872	Impervious Surface Elimination (to pervious)	Patapsco River L N Br	02130906	427830.15	175709.04	0.03
SH18APYXXXXX	Impervious Surface Elimination (to pervious)	Patapsco River L N Br	02130906	425953.13	174653.76	0.11
					Completed BMP Acreage Total	3204.24

Table 2-2b: Annual Operations and Redevelopment Impervious Restoration Practices

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
TBD	Redevelopment Credit	Area wide	Area wide	-	-	59.39
TBD	Inlet Cleaning	Area-wide	Area-wide	-	-	175.00
TBD	Street Sweeping Credit	Area wide	Area wide	-	-	33.00
					Completed BMP Acreage Total	267.39

Table 2-2c: Fiscal Year 2020 Capital Impervious Restoration Practices Planned

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA20ALN160015UR	Stream Restoration	Western Branch	02131103	123553.95	416879.12	234.80
SHA20ALN210019UR	Stream Restoration	Little Tonoloway Creek	02140509	227278.26	297281.74	59.37
SHA20ALN100017UR	Stream Restoration	Lower Monocacy River	02140302	193745.73	380246.33	141.24
SHA20ALN100018UR	Stream Restoration	Lower Monocacy River	02140302	189444.81	378465.88	101.55
SHA20ALN030021UR	Stream Restoration	Loch Raven Reservoir	02130805	220053.52	429984.76	59.76
SHA20ALN030023UR	Stream Restoration	Patapsco River L N Br	02130906	187701.93	414754.90	86.43
SHA20ALN120011UR	Stream Restoration	Deer Creek	02120202	213029.62	460551.69	296.55

Table 2-2c: Fiscal Year 2020 Capital Impervious Restoration Practices Planned						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA20ALN030024UR	Stream Restoration	Loch Raven Reservoir	02130805	208481.19	416443.05	181.89
SHA20ALN060008UR	Stream Restoration	Prettyboy Reservoir	02130806	225497.36	415879.60	239.16
SHA20ALN150022UR	Stream Restoration	Seneca Creek	02140208	168840.00	383435.25	91.95
SHA20ALN030025UR	Stream Restoration	Patapsco River L N Br	02130906	184105.61	413780.59	53.40
SHA20ALN130010UR	Stream Restoration	S Branch Patapsco	02130908	185053.75	402760.02	164.91
SHA20ALN100019UR	Stream Restoration	Lower Monocacy River	02140302	198154.63	384037.60	90.93
SHA20ALN020009UR	Stream Restoration	South River	02131003	147592.87	433669.12	359.40
SHA20ALN070011UR	Stream Restoration	Little Elk Creek	02130605	227221.24	495080.10	1095.03
SHA20ALN070012UR	Stream Restoration	Northeast River	02130608	225794.44	491183.52	421.35
SHA20ALN030026UR	Stream Restoration	Loch Raven Reservoir	02130805	200965.70	420487.42	104.01
SHA20ALN020010UR	Stream Restoration	South River	02131003	144074.48	430781.91	88.38
SHA20ALN100020UR	Stream Restoration	Catoctin Creek	02140305	188045.43	348120.78	179.58
SHA20ALN130009UR	Stream Restoration	Little Patuxent River	02131105	173219.98	410832.54	219.06
SHA20ALN160029UR	Stream Restoration	Patuxent River upper	02131104	151166.48	418126.04	40.00
SHA20ALN160028UR	Stream Restoration	Anacostia River	02140205	147391.11	404346.85	2.00
SHA20ALN030022UR	Stream Restoration	Lower Gunpowder Falls	02130802	201493.28	442028.20	279.39
SHA20RST020049	Retrofit	Severn River	02131002	156932.81	427884.13	4.04
SHA20RST020268	Retrofit	South River	02131003	146041.10	438420.88	8.58
SHA20RST020287	Retrofit	Severn River	02131002	151151.88	447394.03	1.63
SHA20RST020363	Retrofit	Baltimore Harbor	02130903	162503.42	431087.89	7.50
SHA20RST020404	Retrofit	South River	02131003	143356.31	430483.74	6.25
SHA20RST130027	Retrofit	Middle Patuxent River	02131106	168750.59	409054.44	16.15
SHA20RST130048	Retrofit	Little Patuxent River	02131105	162042.99	417605.99	2.05
SHA20RST130072	Retrofit	Little Patuxent River	02131105	173332.00	416317.62	1.70
SHA20RST130073	Retrofit	Little Patuxent River	02131105	173136.33	416480.11	1.68
SHA20RST130120	Retrofit	Little Patuxent River	02131105	162064.92	417898.00	1.88
SHA20RST130205	Retrofit	Patapsco River L N Br	02130906	168987.89	421130.67	1.04

Table 2-2c: Fiscal Year 2020 Capital Impervious Restoration Practices Planned						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA20RST130206	Retrofit	Patapsco River L N Br	02130906	168868.85	421040.63	0.66
SHA20RST130220	Retrofit	Patapsco River L N Br	02130906	171072.87	418731.51	2.25
SHA20RST132444	Retrofit	Brighton Dam	02131108	173287.07	416402.44	0.42
SHA20RST132445	Retrofit	Brighton Dam	02131108	173192.89	416478.64	0.35
SHA20RST132446	Retrofit	Brighton Dam	02131108	173134.67	416525.88	0.12
SHA20RST150205	Retrofit	Seneca Creek	02140208	168686.57	377811.16	5.68
SHA20RST150601	Retrofit	Anacostia River	02140205	157365.37	404456.01	7.49
SHA20RST150602	Retrofit	Western Branch	02131103	136258.93	414167.81	3.03
SHA20APY080160UT	Tree Planting	Mattawoman Creek	02140111	99481.20	396435.60	4.55
SHA20APY080162UT	Tree Planting	Mattawoman Creek	02140111	99600.08	396555.61	11.92
SHA20APY080120UT	Tree Planting	Mattawoman Creek	02140111	108027.83	402907.19	1.72
SHA20APY080118UT	Tree Planting	Mattawoman Creek	02140111	107738.05	403502.87	0.28
SHA20APY080119UT	Tree Planting	Mattawoman Creek	02140111	107965.72	403145.74	2.02
SHA20APY080121UT	Tree Planting	Mattawoman Creek	02140111	107733.77	402731.91	3.41
SHA20APY080122UT	Tree Planting	Mattawoman Creek	02140111	107540.50	402926.36	0.27
SHA20ALN160018UO	Outfall Stabilization	Piscataway Creek	02140203	115768.42	400797.44	2.79
SHA20ALN160008UO	Outfall Stabilization	Oxon Creek	02140204	132881.51	405513.86	1.22
SHA20ALN160009UO	Outfall Stabilization	Oxon Creek	02140204	132855.86	405436.27	0.91
SHA20ALN160010UO	Outfall Stabilization	Oxon Creek	02140204	132834.61	405363.35	0.97
SHA20ALN030010UO	Outfall Stabilization	Loch Raven Reservoir	02130805	220958.61	429624.85	5.25
SHA20ALN030012UO	Outfall Stabilization	Loch Raven Reservoir	02130805	220890.47	429566.12	5.25
SHA20ALN030011UO	Outfall Stabilization	Loch Raven Reservoir	02130805	220823.54	429480.65	5.25
SHA20ALN030013UO	Outfall Stabilization	Loch Raven Reservoir	02130805	220813.76	429465.50	5.25
SHA20ALN160020UO	Outfall Stabilization	Piscataway Creek	02140203	115965.33	400757.08	1.39
SHA20ALN160011UO	Outfall Stabilization	Piscataway Creek	02140203	118555.76	410326.01	1.59
SHA20ALN130011UO	Outfall Stabilization	Patapsco River L N Br	02130906	169594.81	420358.75	0.32
SHA20ALN150014UO	Outfall Stabilization	Cabin John Creek	02140207	154794.85	386729.26	9.98

Table 2-2c: Fiscal Year 2020 Capital Impervious Restoration Practices Planned						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA20ALN160025UR	Outfall Stabilization	Anacostia River	02140205	140032.61	409273.70	6.28
SHA20ALN130008UR	Outfall Stabilization	Patapsco River L N Br	02130906	170456.12	419802.31	1.63
SHA20ALN130011UR	Outfall Stabilization	Patapsco River L N Br	02130906	169598.34	420353.26	1.35
TBD	Impervious Surface Elimination (to pervious)	TBD	TBD	-	-	1.00
Planned BMP Acreage Total						4737.23

Table 2-2d: Fiscal Year 2021 Capital Impervious Restoration Practices Planned						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA21ALN070002UR	Stream Restoration	Big Elk Creek	02130606	223726.86	499656.60	164.19
SHA21ALN030011UR	Stream Restoration	Little Gunpowder Falls	02130804	205313.88	444235.01	70.38
SHA21ALN030016UR	Stream Restoration	Little Gunpowder Falls	02130804	204766.29	442050.23	54.87
SHA21ALN100015UR	Stream Restoration	Lower Monocacy River	02140302	199565.43	369962.93	95.55
SHA21ALN100016UR	Stream Restoration	Lower Monocacy River	02140302	207365.18	373533.12	112.17
SHA21ALN060006UR	Stream Restoration	S Branch Patapsco	02130908	191023.89	404475.96	508.50
TBD	Tree Planting	TBD	TBD	-	-	9.23
					Planned BMP Acreage Total	1014.89

Table 2-2e: Planned 2020-2021 Annual Operations and Redevelopment Impervious Restoration Practices						
Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
TBD	Redevelopment Credit	Area wide	Area wide	-	-	5.00
TBD	Inlet Cleaning Credit	Area wide	Area wide	-	-	100.00
TBD	ICD Retrofit/Outfalls/SWM	Areawide	Area wide	-	-	631.50
					Planned BMP Acreage Total	736.50

Table 2-2g: Total Planned Credit	
Table 2-2a: Fiscal Year 2010-2019 Capital Impervious Restoration Practices Constructed	3204.22
Table 2-2b: Annual Operations and Redevelopment Impervious Restoration Practices	267.39
Table 2-2c: Fiscal Year 2020 Capital Impervious Restoration Practices Planned	4737.23
Table 2-2d: Fiscal Year 2021 Capital Impervious Restoration Practices Planned	1014.89
Table 2-2e: Planned 2020-2021 Annual Operations and Redevelopment Impervious Restoration Practices	736.50
Grand Total	9960.23

Appendix C

MDOT SHA Impervious Restoration and Coordinated TMDL Implementation Plan, Part III - Addendum to Table 3-2

Appendix C

MDOT SHA Impervious Restoration and Coordinated TMDL Implementation Plan, Part II – Addendum to Table 3-2

MARYLAND DEPARTMENT OF TRANSPORTATION

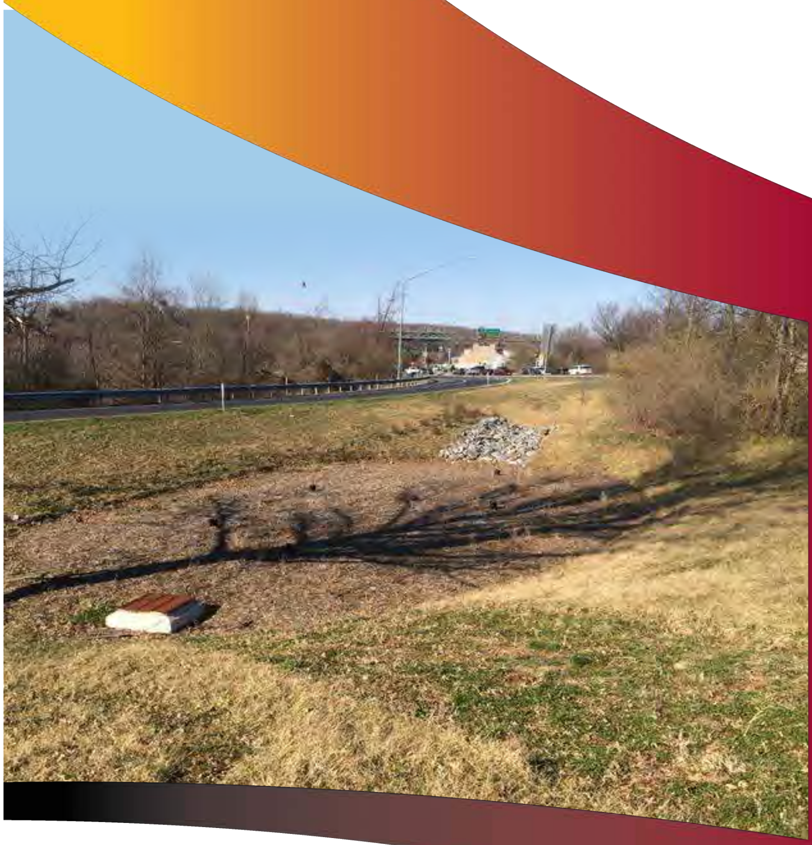
STATE HIGHWAY ADMINISTRATION

Table 3-2a: MDOT SHA Additional Attachment B Nutrient, Sediment, and Bacteria Modeling Results																
Watershed Name	Watershed Number	County	Pollutant	EPA Approval Date	Baseline Year	Unit	MDOT SHA Baseline Load	MDOT SHA % Reduction Target	MDOT SHA Reduction Target	MDOT SHA Proposed 2020 Interim Reduction Target	% 2020 Reduction Relative to Reduction Target	MDOT SHA Proposed 2025 Interim Reduction Target	% 2025 Reduction Relative to Reduction Target	MDOT SHA Target Year Reduction	% Target Year Reduction Relative to Reduction Target	Target Year
Nutrient and Sediment TMDLs																
Anacostia River - Nontidal*	02140205	MO	Nitrogen	6/5/2008	1997	EOS-lbs/yr	26,707	81.0%	21,633	3,342	15.4%					
			Phosphorus	6/5/2008	1997	EOS-lbs/yr	2,209	81.2%	1,793	1,793	100.0%					
			Sediment	7/25/2012	1997	EOS-lbs/yr	544,402	85.0%	462,742	462,742	100.0%					
Anacostia River - Tidal*	02140205	MO, PG	Nitrogen	6/5/2008	1997	EOS-lbs/yr	6,062	81.0%	4,910	42	0.9%					
			Phosphorus	6/5/2008	1997	EOS-lbs/yr	708	81.2%	575	17	2.9%					
			Sediment	7/25/2012	1997	EOS-lbs/yr	185,294	85.0%	157,500	5,011	3.2%					
Loch Raven Reservoir	02130805	BA, CL, HA	Phosphorus	3/27/2007	1995	EOS-lbs/yr	1,237	15.0%	186	186	100.0%					
Mattawoman Creek	02140111	CH, PG	Nitrogen	1/5/2005	2000	EOS-lbs/yr	5,317	54.0%	2,871	545	19.0%					
			Phosphorus	1/5/2005	2000	EOS-lbs/yr	693	47.0%	326	73	22.4%					
Non-Tidal Back River	02130901	BA, BC	Nitrogen	6/29/2005	1995	EOS-lbs/yr	8,707	15.0%	1,306	552	42.3%					
			Phosphorus	6/29/2005	1995	EOS-lbs/yr	851	15.0%	128	128	100.0%					
Potomac River WA County	02140501	WA	Sediment	9/30/2011	2005	EOS-lbs/yr	1,324,637	15.2%	201,345	55,562	27.6%					
Prettyboy Reservoir	02130806	BA, CL	Phosphorus	3/27/2007	1995	EOS-lbs/yr	121	15.0%	18	18	100.0%					
Rocky Gorge Reservoir	02131107	HO, MO, PG	Phosphorus	11/24/2008	2000	EOS-lbs/yr	327	15.0%	49	16	31.7%					
Triadelphia Reservoir	02131108	HO, MO	Phosphorus	11/24/2008	2000	EOS-lbs/yr	327	15.0%	49	3	5.7%					
Bacteria TMDLs																
Anacostia River, Downstream of NEB/NWB Confluence*	02140205	PG	Bacteria - enterococci	3/14/2007	2003	billion MPN/day	89,445	99.3%	88,819	1,022	1.2%					
Anacostia River, Upstream of NEB/NWB Confluence*	02140205	MO, PG	Bacteria - enterococci	3/14/2007	2003	billion MPN/day	311,792	84.1%	262,217	2,367	0.9%					
Antietam Creek	02140502	WA	Bacteria - E.coli	10/8/2009	2003	billion MPN/year	170,412	98.0%	167,004	3,587	2.1%					
Cabin John Creek	02140207	MO	Bacteria - E.coli	3/14/2007	2003	billion MPN/day	92,166	30.6%	28,203	512	1.8%					
Conococheague Creek	02140504	WA	Bacteria - E.coli	5/7/2009	2004	billion MPN/year	105,861	99.0%	104,802	830	0.8%					
Double Pipe Creek*	02140304	CL,FR	Bacteria - E.coli	12/3/2009	2004	billion MPN/year	72,412	98.5%	71,326	0	0.0%					
Gwynns Falls*	02130905	BA, BC	Bacteria - E.coli	12/4/2007	2003	billion MPN/day	157,179	99.3%	156,079	0	0.0%					
Herring Run*	02130901	BA, BC	Bacteria - E.coli	12/4/2007	2003	billion MPN/year	30,714	92.2%	28,318	0	0.0%					
Jones Falls*	02130904	BA, BC	Bacteria - E.coli	2/12/2008	2003	billion MPN/day	88,158	95.5%	84,191	0	0.0%					
Liberty Reservoir	02130907	BA, CL	Bacteria - E.coli	12/3/2009	2003	billion MPN/year	127,606	89.2%	113,824	6,811	6.0%					
Lower Monocacy River	02140302	CL, FR, MO	Bacteria - E.coli	12/3/2009	2004	billion MPN/year	224,924	96.9%	217,952	2,789	1.3%					
Lower Patuxent River - Indian Creek*	02131101 - Indian Creek	CH, SM	Bacteria - fecal coliform	5/25/2005	2001	billion counts/day	5,567	43.6%	2,427	151	6.2%					
Magothy River - Forked Creek*	02131001 - Forked Creek	AA	Bacteria - fecal coliform	2/20/2006	2001	billion counts/day	0	0.0%	0	0	0.0%					
Magothy River - subsegment*	02131001 - subsegment	AA	Bacteria - fecal coliform	2/20/2006	2001	billion counts/day	30,697	12.8%	3,929	86	2.2%					
Other West Chesapeake - Tracy and Rockhold Creeks*	02131005 - Tracy and Rockhold Creeks	AA	Bacteria - fecal coliform	2/20/2006	2001	billion counts/day	7,275	81.6%	5,936	0	0.0%					
Piscataway Creek*	02140203	PG	Bacteria - E.coli	9/20/2007	2003	billion MPN/day	32,126	42.5%	13,654	682	5.0%					
Rock Creek - Non-Tidal*	02140206 - Non-Tidal	MO	Bacteria - enterococci	7/30/2007	2003	billion MPN/day	120,947	96.5%	116,713	856	0.7%					
Severn River - Mill Creek*	02131002 - Mill Creek	AA	Bacteria - fecal coliform	4/10/2008	2002	billion counts/day	9,953	86.0%	8,560	220	2.6%					
Severn River - subsegment*	02131002 - subsegment	AA	Bacteria - fecal coliform	4/10/2008	2002	billion counts/day	88,467	19.0%	16,809	2,078	12.4%					
Severn River - Whitehall & Meredith Creeks*	02131002 - Whitehall & Meredith Creeks	AA	Bacteria - fecal coliform	4/10/2008	2002	billion counts/day	7,605	90.0%	6,844	558	8.2%					
South River - Duval Creek*	02131003 - Duval Creek	AA	Bacteria - fecal coliform	11/4/2005	2001	billion counts/day	0	0.0%	0	0	0.0%					
South River - Ramsey Lake*	02131003 - Ramsey Lake	AA	Bacteria - fecal coliform	11/4/2005	2001	billion counts/day	290	65.0%	189	0	0.0%					
South River - Selby Bay*	02131003 - Selby Bay	AA	Bacteria - fecal coliform	11/4/2005	2001	billion counts/day	4	45.8%	2	0	0.0%					
South River - subsegment*	02131003 - subsegment	AA	Bacteria - fecal coliform	11/4/2005	2001	billion counts/day	46,005	68.0%	31,283	4,946	15.8%					
Upper Monocacy River*	02140303	CL, FR	Bacteria - E.coli	12/3/2009	2004	billion MPN/year	79,007	97.0%	76,636	1,398	1.8%					
West River - Bear Neck Creek*	02131004 - Bear Neck Creek	AA	Bacteria - fecal coliform	2/20/2006	2001	billion counts/day	2,374	43.2%	1,026	0	0.0%					
West River - Cadle Creek*	02131004 - Cadle Creek	AA	Bacteria - fecal coliform	2/20/2006	2001	billion counts/day	957	72.2%	691	0	0.0%					
West River - Parish Creek*	02131004 - Parish Creek	AA	Bacteria - fecal coliform	2/20/2006	2001	billion counts/day	0	0.0%	0	0	0.0%					
West River - subsegment*	02131004 - subsegment	AA	Bacteria - fecal coliform	2/20/2006	2001	billion counts/day	3,563	35.3%	1,258	0	0.0%					

* = subwatershed

Note: Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Modeling results for Additional Attachment B local TMDLs are presented in Table 3-2 in Appendix E. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with proposed 2025 interim reduction targets and MDOT SHA target year are left blank and shaded gray.

Appendix D



MDOT SHA Restoration Modeling Protocol - 2019 Revision

Appendix D

Appendix D

MDOT SHA Restoration Modeling Protocol – 2019 Revision

MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

MDOT SHA RESTORATION MODELING PROTOCOL

Developed for Chesapeake Bay and Non-Tidal Waters TMDL Requirements for NPDES MS4 Permit Compliance

October 2016 | Revised October 2018| Revised October 2019

Maryland Department of Transportation
State Highway Administration
Office of Environmental Design - Water Programs Division

707 N. Calvert Street
Baltimore, MD 21202

TABLE OF CONTENTS

I. INTRODUCTION

The purpose of this document is to describe Maryland Department of Transportation State Highway Administration's (MDOT SHA) processes and procedures used in determining MDOT SHA pollutant load reduction requirements, modeling reductions achieved, programming future projects, and determining Total Maximum Daily Load (TMDL) implementation end dates. These processes and procedures will also be used to satisfy the following National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit conditions (MDE, 2015):

> (E)(2)(b)(iii) 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
>
> (E)(4) This assessment shall include complete descriptions of the analytical methodology used to evaluate the effectiveness of MDOT SHA's restoration plans and how these plans are working toward achieving compliance with EPA approved TMDLs.

This protocol also addresses stormwater wasteload allocations (SW-WLAs) in approved TMDL documents that are allocated to MDOT SHA as a NPDES regulated stormwater point source. Current pollutants with SW-WLAs assigned to MDOT SHA include total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), bacteria, polychlorinated biphenyls (PCBs), and trash. As TMDLs for different pollutants are issued with MDOT SHA responsibility, this protocol will be updated to describe new modeling methods as applicable to new pollutants.

The Maryland Department of the Environment (MDE) guidance, *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* (MDE 2014a) allows for alternative modeling methods to be employed to demonstrate permit compliance. MDOT SHA procedures have been designed to comply with MDE 2014a guidance as stated below.

> *While different models may generate different baseline pollutant loads, the reductions from implementing water quality improvement projects will be the same because they will all be based on the approved set of CBP urban BMPs and pollutant reduction efficiencies. As a result, all models will be comparable on a percent reduction basis as long as one model is consistently used throughout the permit term.*

This approach allows MDOT SHA to use its best land use and treatment data to develop baseline loads consistent with TMDL dates published by MDE on the TMDL Data Center (MDE 2019).

Section II describes the overall approach to determine required reductions in loads. Section III describes the data sources that MDOT SHA uses to estimate pollutant loads and manage data for compliance reporting. Planning scenarios are also discussed. Sections IV through VII present pollutant specific methodologies used to model progress towards compliance.

II. CALCULATING REQUIRED REDUCTIONS

The MDOT SHA modeling approach does not determine the current level of loading compared to a SW-WLA. Instead, reduction requirements have been developed based on MDE guidance (MDE 2014b) regarding the process for determining whether WLA requirements have been met:

> *… it is recommended that local jurisdictions demonstrate their progress towards achieving SW-WLAs by comparing reduction percentages rather than absolute loads.*

TMDL reduction percentages are indicated in TMDL documents published by MDE through the online TMDL Data Center (MDE 2019). Progress towards compliance is demonstrated by comparing reductions achieved to reductions required. MDOT SHA models; explained in detail in Sections IV, V, and VI; are used to calculate load reductions achieved that are then compared with the modeled baseline to determine if the percent reduction requirement has been met.

MDOT SHA local TMDL reduction requirements are calculated using the following formula.

$$Reqd\ Reduction_{MDOT\ SHA} = \frac{WLA}{(1 - Reqd\ Reduction\,\%)} - WLA$$

Where:

Reqd Reduction $_{MDOT\ SHA}$ = Reduction amount required for MDOT SHA

WLA = Published WLA or MDOT SHA disaggregated WLA $_{\text{MDOT SHA}}$ (defined below)

Reqd Reduction % = Published percent reduction

There are two types of WLAs for local TMDLs: individual (where loads are assigned to specific entities) and aggregate (where loads are allocated by broad categories or sectors). WLAs, whether individual or aggregate, are assigned either within the TMDL Main Report or the Point Source Technical Memorandum that accompanies the TMDL. MDOT SHA is usually aggregated geographically by county together with other MS4 permittees including county, municipality, industrial, and federal and state agencies.

In the past MDOT SHA has used the MDE recommend approach to disaggregate its specific WLA from the overall WLA listed in the TMDL Main Report or Point Source Technical Memorandum which is to divide the total MDOT SHA owned land area by the land area of the TMDL watershed area and then multiple the ratio found by the WLA presented in the MDE document(s). A disaggregated load must be derived before the percent reduction is applied to calculate the load reduction required. Please see the WLA disaggregation formula below.

$$WLA_{MDOT\ SHA} = WLA\left(\frac{A_{MDOT\ SHA}}{A_{TMDL}}\right)$$

Where:

$WLA_{MDOT\ SHA}$ = Disaggregated WLA for MDOT SHA
$A_{MDOT\ SHA}$ = Area of MDOT SHA-owned land
A_{TMDL} = Area of aggregate TMDL

In the modeling approaches described in the sections below, disaggregation occurs implicitly. This is because currently MDOT SHA loads are modeled using the best available land use and treatment data, and a disaggregated total is calculated for the MDOT SHA-specific area and no disaggregation of published individual MDOT SHA-specific SW-WLAs is required. MDOT SHA has followed the recommendation presented by the MDE Science Services Administration (SSA) [now the Integrated Water Planning Program] in the letter to MDOT SHA regarding the MDE review of the 2016 MS4 annual report.

"MDOT SHA will develop new reduction targets based on this SSA recommendation. MDOT SHA will subtract loads treated by baseline BMPs through the TMDL baseline year to develop an untreated baseline load, and then apply the TMDL listed reduction percent to this untreated baseline to determine the reduction target. MDOT SHA will use 'No Action' scenario loading extracted from MAST to derive the baselines. MDE clarified that the 'No Action' loading does not include any BMPs and is strictly based on landuse loads. To be consistent with the TMDLs and reductions applied to urban SW sources, the required reduction percentages should be applied to the baseline load reflective of both treated and untreated urban acres."

III. DATA SOURCES FOR ALL MODELS

III.A. MDOT SHA Land Uses

MDOT SHA land use is a critical factor for all types of pollutant load modeling. Although land use categorization varies between models, the same land use boundaries are used consistently between models to determine MDOT SHA responsibility and include both impervious and pervious. The limits of MDOT SHA-owned land was determined using MDOT SHA Right of Way (ROW) area derived from the best available information from MDOT SHA property management staff. Land uses within MDOT SHA-owned land were derived as part of the impervious surface accounting process. A GIS-automated spatial analysis was performed to analyze orthographic photos and determined impervious surfaces within MDOT SHA ROW. From this process, imperious surface GIS feature classes were developed. Areas within MDOT SHA ROW that were not determined to be impervious are assumed to be pervious.

The MDOT SHA ROW and impervious surfaces have been intersected with TMDL watershed boundaries to calculate MDOT SHA land uses by watershed. A similar intersection was done with county boundaries to quantify MDOT SHA land uses within each county.

Land use categorization varies by model and will be discussed in detail in Section IV.

III.B. Structural, ESD, and Alternative BMP Data

MDOT SHA uses several types of data to manage its restoration BMPs from planning through compliance reporting as described below. The MDOT SHA modeling relies on this data to model baselines as well as reductions planned by milestone and reductions achieved.

- TMDL Database: Alternative restoration BMPs that are completed, under construction, or in-design are stored within a geospatial data management system. This geodatabase includes spatial locations and attribute tables for all restoration BMP types except structural stormwater controls contained under the NPDES Database. BMP attributes include design criteria, inspection criteria, pollutant load reductions, impervious surface restoration credit, and results of verification, inspection, and maintenance assessments.

- NPDES Database: This is the MDOT SHA traditional NPDES MS4 geodatabase with all MDOT SHA storm sewer system assets collected to meet the Source Identification requirement of the MS4 permit. Structural stormwater and Environmental Site Design (ESD) BMPs for new development, redevelopment, and restoration are housed in this geodatabase that also contains all storm drain structures and conveyances associated with the MDOT SHA highway system. This database is not linked directly to the Automated Modeling Tool (AMT). Prior to model runs, relevant treatment data is exported into the TMDL Database.

- Task Management Database: Future projects are stored within a non-spatial Microsoft Access database. For these projects, the database includes information on the type of planned restoration, target watershed, amount of anticipated credit, and target milestone year.

III.C. Non-Rooftop Impervious Disconnection

Disconnection of non-rooftop runoff is one of the ESD BMPs approved in both the Maryland 2000 Stormwater Manual and the MDE MS4 Accounting Guidance (MDE 2014a). Pollutant reductions are calculated similarly to other efficiency BMPs, with reduction percentage based on P_E treated applied to loads from the treated area. Impervious areas treated through non-rooftop disconnection are determined using the GIS analysis described in the MDOT SHA *Non-Rooftop Runoff Disconnection Analysis Methodology* (McCormick Taylor, 2017). At the conclusion of the analysis, a GIS layer of treated area is created.

Loads from the treated area are calculated using the land use within the defined treated area and the loading rates derived from the Maryland Assessment Scenario Tool (MAST) for the land-river segment containing the treated area. Impervious disconnection is defined as a Runoff Reduction (RR) practice. Runoff depth treated is assumed to be $P_E = 1.0$. Reductions to be used are based on this level of treatment: TN 57%, TP 66%, and TSS 70%

III.D. Cross-Jurisdictional Treatment

Stormwater control structures owned by other jurisdictions may be treating runoff from portions of MDOT SHA impervious and pervious land uses. These areas that receive treatment from other jurisdictions can be removed from MDOT SHA pollutant loading calculations, thereby reducing MDOT SHA reduction requirements. In order to determine where these areas are and to quantify the load reductions, MDOT SHA acquires a geodatabase from MDE which includes BMP treatment data consolidated from other jurisdictions in Maryland.

Drainage areas and related new, redevelopment, and restoration stormwater features are included in this data. The cross-jurisdictional drainage areas are intersected with MDOT SHA ROW and impervious layers, then MDOT SHA treatment within those drainage areas is subtracted from MDOT SHA untreated areas. Load reductions are calculated by facility, summarized by local TMDL, and are subtracted from MDOT SHA baseline loading. The result is MDOT SHA impervious and pervious area treated by neighboring jurisdictions and not treated by MDOT SHA that can be subtracted from MDOT SHA's baseline loads and impervious area baseline.

III.E. Annual Operations BMPs

Pollutant removal as a result of annual operations activities is calculated using the Alternative Urban BMP credits described in Table 7 of MDE 2014a. Data for the calculations is provided by the MDOT SHA Office of Maintenance (OOM) each year with information recorded and stored in the eTAC work order database by maintenance shop staff.

Inlet Cleaning

OOM staff record information for inlet cleaning as Activity 437 (Deep Cleaning) in the eTAC database. The data is recorded by shop, which is a specific service area usually a county or subset of a county. Data includes the date of cleaning, number of inlets cleaned, labor hours, equipment, shop, and route number. The total number of inlets cleaned annually is calculated for each shop.

Currently, the eTAC data does not identify the specific inlets cleaned, only the number of inlets cleaned by the shop. Therefore, determination of the number of inlets per watershed is calculated by determining the percent of area within each shop boundary that lies within a watershed and multiplying the total inlets cleaned by that shop by the watershed area percent. MDOT SHA then uses an estimate of 210 lbs. dry weight per inlet and follows the guidelines from MDE 2014a to calculate pollutant removal and impervious area credit.

Street Sweeping

Street sweeping is recorded as Activity 410 (Mechanical Sweeping) in the eTAC database. The data includes date swept, shop, route number, and linear miles. Linear miles are the metric for the number of curb miles swept: one mile if one side of the road is swept, two if both sides, and four for divided highways where both outside and median roadsides are swept.

Sweeping credit is based on bi-weekly frequency, using the records of date swept and the number of days between sweeping occurrences for the same route. Bi-weekly is an interval between 11 and 17 days. Weekly sweeping is not credited, except in the case that it is carried out for two consecutive weeks, then it is credited as one bi-weekly occurrence.

Full credit for impervious area restoration is based on maintaining the bi-weekly frequency for the entire year. Credit was calculated by pro-rating the number of months per year that the bi-weekly frequency was met and converting it to a percent for that year. Impervious restoration credit is calculated using the percent applicable, acreage swept, and a 0.07 ac/ac or 0.13 ac/ac conversion factor from acres swept to impervious acre credit provided in MDE 2014a depending on the type of sweeping equipment used, mechanical or regen/vacuum. Pollutant removal is calculated by determining the loading rate (lb/ac), which varies by county, then calculating loads (lb) by pro-rated area swept and finally removal from the efficiencies provided in MDE 2014a.

III.F. Pollutant Reduction Planning Scenarios

For planning and reporting purposes, MDOT SHA needs to be able to track implementation status against the permit and TMDL goals. Status is based on progress in planning, design, and construction of structural, ESD, and alternative BMPs. As described in Section II, the information for these BMPs is stored in databases with the project development status identified as completed, under construction, or in-design for each restoration BMP. This allows MDOT SHA to assess pollutant reduction progress in near real time and plan BMPs needed to meet the remaining reduction goal. The database queries status and built dates allowing MDOT SHA to group the amount of unit treatment for each type of BMP based on project phase:

- Completed BMPs: Queries TMDL geospatial database using statuses that depict a functioning, built site.

- Under Construction or Design: Queries TMDL geospatial database using statuses that depict sites currently in design and construction phases.

- Future BMPs: Determined through a query that evaluates the difference between existing and programmed BMP projects as compared to estimates for planned projects derived from the non-spatial Task Management Access database. This approach prevents double counting.

Similar planning scenarios are prepared for operational BMPs. Historic information on inlet cleaning and street sweeping is exported from the eTAC database to determine treatment, equivalent to the Completed BMPs scenario for structural BMPs. Design and Future scenarios are estimated based on forecasts of work to be accomplished by MDOT SHA forces, current contracts, and planned contracting.

IV. NUTRIENT AND SEDIMENT - AUTOMATED MODELING TOOL (AMT)

IV.A. Background and Updates to AMT

MDOT SHA has updated its AMT Modeling Protocol for nutrients and sediment, originally submitted to MDE on June 30, 2016, to account for changes in the modeling approach, in response to MDE comments on MDOT SHA 2016 Annual Report, and to include other modifications that improve accuracy. The most significant changes are as follows:

- Revised local TMDL baseline loads, target load reductions, and progress load reductions to reflect the percent reduction method described in MDE guidance documents.
- Improved the estimates of stormwater treatment by incorporating treatment provided (P_E) data developed from BMP research, replacing the default value of 1.0, and using revised removal rate curve equations for ESD/Runoff Reduction (RR) and Stormwater Treatment (ST) practices.
- Improved reduction calculations for stormwater retrofits by incorporating the reduction efficiencies from existing and retrofit BMP types explicitly, rather than relying on Chesapeake Bay Program (CBP) rates for retrofits.
- Added the ability to model load reductions by BMP type.

The AMT makes use of current data from several production databases in order to estimate pollutant load reductions for various BMPs and to adhere to approved modeling parameters defined in MDE 2014a. The modeling tool will be used to produce planning scenarios and to track progress towards meeting nutrient (TN and TP) and sediment (TSS) pollutant load reductions for non-tidal waters and Chesapeake Bay (Bay) TMDLs.

Although this is a custom model, it draws on BMP efficiencies, loading rates, and delivery factors from MDE 2014, MAST, and published CBP BMP protocols as follows. Pollutant loads are based on CBP loading rates by land-river segment for edge of stream (EOS) for non-tidal waters and delivered (DEL) loads for the Bay. These have been calculated by dividing the untreated load output from MAST by the area of MDOT SHA impervious and pervious land use in each land-river segment. Pollutant reductions are calculated using the revised removal rate equations from the urban stormwater retrofit Expert Panel report (Schueler and Lane, 2015) for BMPs approved for water quality treatment in MDE 2014a.

IV.B. Purpose of Automating

The current MDOT SHA MS4 permit covers multiple Maryland counties that cross 84 8-digit watersheds representing larger (3rd order) rivers or streams. As of January 1, 2019, MDOT SHA is responsible for 74 TMDLs covering 46 8-digit watersheds. To further complicate the modeling, these local TMDLs have been written at different times, based on monitoring data from different years. TMDLs for different pollutants in the same watershed may have a different suite of existing stormwater treatment BMPs which could also be different from the baseline BMPs used in developing the Bay TMDL. This has resulted in complex load reduction modeling and tracking issues.

MDOT SHA is managing restoration BMP data associated with planning, design, construction, inspection, maintenance, and credit verification through spatial geodatabases and a Microsoft Access database. Depending upon where the BMP is in the project development process, different levels of data and tracking are required. Developing and preparing input data for model runs was proving to be overwhelming with the potential for error. In order to reduce the effort needed, improve the data management process, and increase accuracy, MDOT SHA developed the AMT that uses scripts within a Geographical Information System (GIS) to extract BMP treatment data from multiple sources and then apply algorithms derived from MAST and MDE guidance documents to calculate loads and load reductions.

This model has multiple benefits:

- Uses MDOT SHA production stormwater infrastructure and restoration BMP databases for the most up-to-date source of constructed, under-design, and future BMPs at any given time.

- Allows flexibility to easily develop, test, and adjust planning scenarios at the Bay and non-tidal watershed levels.

- Utilizes MAST loading and MDE 2014a load reduction data with revised curve equations. Revisions to these parameters can be made within the AMT easily.

- By including loads in a table by land-river segment and land use, the AMT provides the ability to assess the effects of potential changes in the Phase 6 Chesapeake Bay Watershed Model with a table modification, allowing MDOT SHA to quickly determine if changes in restoration strategies or approaches would be warranted.

IV.C. Model Structure

The AMT consists of three elements. **Figure 1** shows a schematic of the AMT modeling process, organized into three workflow areas: Project Portfolio, Look up Tables, and Progress Workbooks. Additional information is calculated directly with scripts that make calculations from the data prior to export. One example is the use of P_E to calculate the removal rate for each BMP.

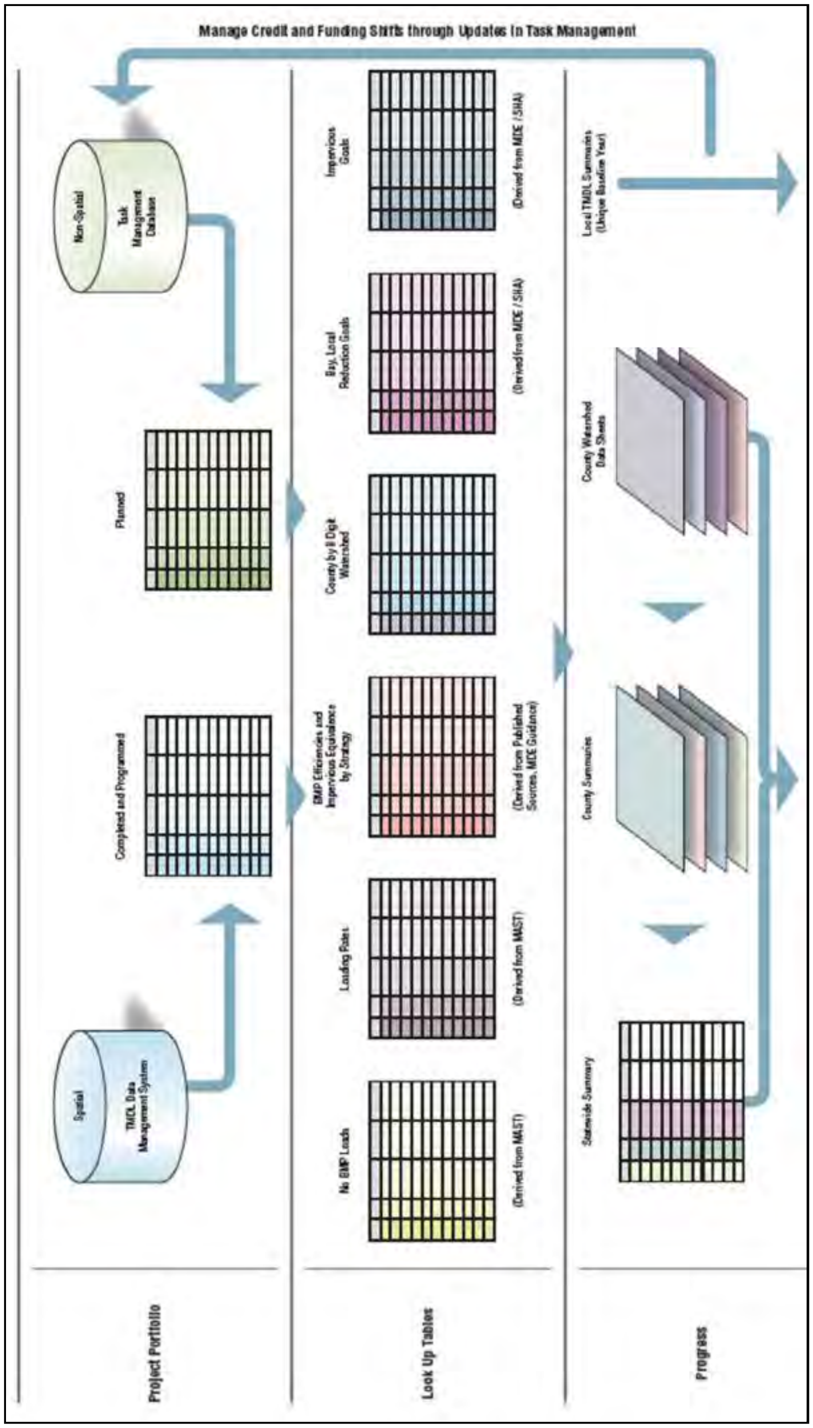


Figure 1: AMT Process and Workflow

Project Portfolio

The Project Portfolio stores and exports the restoration treatment to be modeled. It is based on the databases described in Section III.

The TMDL Data Management System is a spatial database that incorporates projects far enough along in the planning stage that a specific location is known. These projects have been sited and are in either concept design, design, or construction. Data is exported from this database into a table that describes completed and programmed treatment.

The Task Management Database is a non-spatial Microsoft Access database which stores information on planned projects which have not yet advanced to more concrete design phases. Many of these projects are defined by the need for a certain amount of treatment in a particular geographic area, without yet being sited. Data are exported from this database into a table that describes planned treatment.

Lookup Tables

These tables, described in Section IV.D, provide the pollutant loading, pollutant removal rates, and goals for impervious area restoration and TMDL compliance. The information in these tables is applied to the amount of treatment in the tables exported from the Project Portfolio to calculate loads and load reductions. When the Bay Program revises modeling parameters, or Expert Panels define new BMPs, the lookup tables can be updated easily to keep the AMT current with Bay Program or MDE standards.

Progress Workbooks

The outcome / output of the automated modeling process is the creation of a series of Excel workbooks which calculates total reductions (nutrients and sediments) by various geographic extents (watershed, state, and county). The composition of the model automation workbooks is described in Section IV.E.

IV.D. Calibration

Baseline load and target reductions, calibrated using AMT modeling methodologies, will allow MDOT SHA to accurately compare progress and planned load reductions against the target.

Baseline

Baseline loads have been calculated in two steps: first, to model the untreated load, and next, to apply treatment as of the baseline year for each TMDL. Untreated baseline loads were modeled by multiplying MDOT SHA pervious and impervious acres by land-river segment using MDOT SHA spatial data with loading rates calculated as described above. Load reductions from baseline

BMPs were calculated from MDOT SHA database information, then applied to the untreated load to determine the treated baseline load.

Load Reduction

In order to show that TMDL goals are being met, the reduction target and WLA for each TMDL is calculated based on MDOT SHA data. The reduction target is calculated by applying percent reduction, as published in the TMDL, to the calibrated treated baseline load. The modeled WLA is calculated by subtracting the calibrated reduction target from the calibrated treated baseline load. For Bay TMDL modeling, the sum of load reductions from all MDOT SHA BMPs within MS4 jurisdictions will be compared to reduction goals.

IV.E. Data Sources

Land Use

MDOT SHA's land use and impervious area spatial data are based on analysis of aerial imagery dated 2011. This is consistent with the baseline for the Bay TMDL, but it poses a challenge for modeling local TMDLs. TMDL dates published by MDE on the TMDL Data Center (MDE 2019) range from 2000 to 2010. Accurate MDOT SHA data for land use prior to 2011 is unavailable; so, baseline loads will be modeled using 2011 land use. This is likely a conservative approach since it overstates the amount of land area and imperviousness, relative to the TMDL analysis, which will lead to a higher restoration requirement for MDOT SHA. Better data for historical land use may become available in the future. If so, baseline conditions will be reviewed with updates for implementation plan progress.

MDOT SHA has mapped its impervious cover using remote sensing methods; specifically, an Esri application called Feature Analyst. The source data for analysis was statewide orthophotography as of 2011. This impervious cover layer was overlaid on the land use, clipped to MDOT SHA ROW, resulting in a summary table of pervious and impervious area for each TMDL watershed.

Loading Rates

Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chesapeake Bay model / MAST. To correspond with MDOT SHA's as-of date for land use, untreated loads and acres, per land-river segment, were derived from a No BMPs scenario in MAST at the Maryland statewide geographic scale using 2010 conditions. EOS loads have been used to derive loading rates for local TMDLs, and DEL loads have been used for modeling the Bay TMDL.

Treatment

MDOT SHA has committed significant resources to researching and updating BMP and other treatment data such that as-built or implementation dates are considered accurate enough for

TMDL modeling and the calculation of baseline treated loads for Bay and local TMDLs. Pollutant removal rates in the AMT are based on revised ESD/RR and ST removal rate curve equations (Schueler and Lane, 2013) and Expert Panel reports (Schueler and Lane, 2015) from the Bay Program.

IV.F. Lookup Tables

Lookup tables are incorporated in the AMT to provide input parameters for model calculations, as described below:

Loading Rate Lookup Tables

These tables provide untreated loading rates (lb/ac) for each land-river segment. This is the basis for calculating baseline loads and restoration load reductions. It is calculated using MAST data as follows:

- Run a No BMPs scenario in MAST at the Maryland statewide geographic scale using "2010, revised 10/2014" Initial Conditions and "2010 Loads" Processed Water Base Data.
- Export the loads from the No BMP MAST scenario into an Excel workbook using 2010 MAST land use acres and loads for the loading rate calculations to correspond with 2011 MDOT SHA and impervious land use data.
- Export the "Source Data" file from MAST documentation to obtain land-river segment data from the Geographic References tab in order to identify land-river segments within a particular local TMDL 8-digit watershed.
- Create pivot tables to display Sum of Acres and TN/TP/TSS EOS and DEL loads by land-river segment filtered to 1) MDOT SHA Phase I/II MS4 Impervious land use, and 2) MDOT SHA Phase I/II MS4 Pervious land use.
- Calculate loading rates per land-river segment from impervious and pervious pivot tables described above using the following equations:
    - $\textit{MDOT SHA impervious loading rates} = \frac{TN/TP/TSS\ EOS\ or\ DEL\ impervious\ loads}{Impervious\ acres}$
    - $\textit{MDOT SHA pervious loading rates} = \frac{TN/TP/TSS\ EOS\ or\ DEL\ pervious\ loads}{Pervious\ acres}$

The result is two lookup tables that provide loading rates for impervious and pervious land use within each land-river segment.

BMP Efficiencies and Load Reduction Lookup Table

This table is used in conjunction with planned structural and ESD stormwater control BMP efficiencies (RR and ST) and planned alternative BMPs (e.g. stream restoration, catch basin cleaning, and street sweeping) and was created following MDE 2014a. The BMP efficiencies in the lookup table are used in conjunction with the loads developed for each 8-digit watershed to determine specific amount-removed for individual BMP types within an 8-digit watershed.

Untreated Baseline Loads Lookup Table

This table is based on calculated baseline loads from the loading rate lookup tables and MDOT SHA land use data.

- GIS layers for MDOT SHA ROW and impervious cover were intersected with land-river segments from MAST data to calculate the MDOT SHA area in each TMDL watershed.

- Untreated baseline loads were modeled by multiplying MDOT SHA pervious and impervious acres by land-river segment using MDOT SHA spatial data with loading rates calculated by land-river segment.

- A pivot table of land-river segment untreated baseline loads was created showing the sum of TN/TP/TSS EOS loads by 8-digit watershed/land-river segment.

For local untreated baseline loads, local TMDLs are defined at various scales including segmentsheds, multi-8-digit watersheds, 8-digit watersheds, and subwatersheds (i.e., smaller than the 8-digit watershed scale). Untreated baseline loads were modeled using different scales for local TMDLs defined at the 8-digit watershed scale (including whole land-river segments) and those defined at a smaller, subwatershed scale (including partial land-river segments).

MDOT SHA baseline TN/TP/TSS EOS loads for all statewide 8-digit watersheds are included in the resultant pivot table. Therefore, if a new nutrient or sediment TMDL at the 8-digit watershed scale is issued by MDE, MDOT SHA will have untreated baseline loads already calculated for modeling. For TMDLs that are a subset of an 8-digit watershed, additional manual processing is needed.

IV.G. Calculations

Overview

The amount of pollutant removal attributed to each BMP type is calculated within the AMT based on the procedures described below.

For each BMP facility where impervious/pervious loading rates are used, pollutant reduction is calculated using lookup tables by first determining the removal in pounds per unit and then multiplying the loading rate by the BMP efficiency and area of treatment as follows:

<u>Step 1: Calculate Load Removed for Each BMP and Land Use</u>:

- Look up specific land use (impervious/pervious) loading rates for TN EOS/DEL, TP EOS/DEL, and TSS EOS/DEL from the *Loading Rate Lookup Tables*.
- Derive or look up BMP efficiency rates for each BMP based on each individual BMP type. These are detailed for each BMP type in the following sections.
- Multiply loading rates by BMP efficiency rates to find removal in lb/unit of each BMP within the specific county or-watershed.

Step 2: Calculate Pollutant Pounds Removed by Each BMP

- Multiply the removal lb/unit calculated in Step 1 by the BMP impervious/pervious area treated.

For load reduction BMPs such as streams, outfall stabilizations, inlet cleaning, and street sweeping, the model uses project specific data when available and rates provided by MDE 2014 for planning level data.

Step 3: Extract Data for Filtering Results

- Extract Built Date, Status, County, and other MDOT SHA operational fields.

The output data tables describing BMP pollutant removal are used in subsequent spreadsheet analysis (described below) to aggregate reductions by TMDL watershed, by baseline / restoration classification, or other parameters to assist MDOT SHA staff in planning and tracking progress.

Treatment Calculation Details

New Stormwater Efficiency BMPs

Load reductions are modeled per facility using the revised RR/ST curves (see Figure 2 below) and facility P_E. For new restoration projects, P_E is captured from design plans, and ultimately from as-built documents, but otherwise assumed to equal 1.0 inch for programmed facilities where the information is unknown.

Figure 1: RR and ST Removal Rate Curve Equations (Schueler and Lane, 2015)

TP	RR	$y = 0.0304x^5 - 0.2619x^4 + 0.9161x^3 - 1.6837x^2 + 1.7072x - 0.0091$
	ST	$y = 0.0239x^5 - 0.2058x^4 + 0.7198x^3 - 1.3229x^2 + 1.3414x - 0.0072$
TN	RR	$y = 0.0308x^5 - 0.2562x^4 + 0.8634x^3 - 1.5285x^2 + 1.501x - 0.013$
	ST	$y = 0.0152x^5 - 0.131x^4 + 0.4581x^3 - 0.8418x^2 + 0.8536x - 0.0046$
TSS	RR	$y = 0.0326x^5 - 0.2806x^4 + 0.9816x^3 - 1.8039x^2 + 1.8292x - 0.0098$
	ST	$y = 0.0304x^5 - 0.2619x^4 + 0.9161x^3 - 1.6837x^2 + 1.7072x - 0.0091$

Removal rates for a P_E of 1.0 inch, using the curve equations revised by Schueler and Lane (2015), are slightly higher than removal rates for a P_E of 1.0 inch using the curves presented in MDE 2014a. When P_E is above 1.0 inch and the revised curves are applied, treatment removal rates are slightly lower than those yielded by the curves in MDE 2014a. The curves presented in MDE 2014a are cited from the original publication by Schueler and Lane (2012) that defined removal rates for New SW BMPs.

For each of the following examples, it is assumed that the given BMPs have been built after the TMDL baseline dates and reductions can be applied to restoration credit.

Example 1: A bioswale and sand filter are each treating 0.5 acres of impervious area and 0.8 acres of pervious area in the Anne Arundel County portion of the Little Patuxent River watershed. The facilities fall within the land-river segment, A24003XU2_4270_4650, and have a P_E value of 1.5. The Little Patuxent watershed has a TMDL for sediment with a baseline year of 2005. Using the steps outlined in this section, the sediment load removed for each land use and BMP are derived as follows:

- Loading rate lookup value is queried by land-river segment for MDOT SHA MS4 Phase I/II Impervious and MDOT SHA MS4 Phase I/II Pervious.

Loading Rates for Example 1, Step 1A		
Land-River Segment	**MAST Land Use**	**TSS-EOS lb/ac**
A24003XU2_4270_4650	MDOT SHA Phase I/II MS4 Impervious	495.3
A24003XU2_4270_4650	MDOT SHA Phase I/II MS4 Pervious	75.9

- BMP efficiency value is derived for each BMP type using the revised curves from Schueler and Lane (2015). In this case the efficiencies for sediment removal are used for 1.5 inches of treatment over the impervious area:

BMP Efficiencies for Example 1, Step 1B		
BMP Type	**BMP Category**	**TSS Removal**
Bioswale	RR	82%
Sand Filter	ST	76%

- Loading rates are multiplied by the derived BMP efficiencies to obtain the following reductions by lb/unit:

Results for Example 1, Step 1C					
BMP Type	**Land use**	**TSS-EOS lb/unit**	**TSS Removal Efficiency**	**Calculation**	**TSS Reduction (lb/unit)**
Bioswale	Impervious	495.3	82%	495.3 * 82%	406.1

	Pervious	75.9	82%	75.9 * 82%	62.2
Sand Filter	Impervious	495.3	76%	495.3 * 76%	376.4
	Pervious	75.9	76%	75.9 * 76%	57.7

- Reductions by lb/unit are multiplied by units treated by each BMP. In this case the units treated are acres of impervious and pervious.

Results for Example 1, Step 2					
BMP Type	**Land use**	**TSS Reduction (lb/unit)**	**Unit Treated (Acres)**	**Calculation**	**TSS Reduction (lb)**
Bioswale	Impervious	406.1	0.5	406.1*0.5	203.1
	Pervious	62.2	0.8	62.2*0.8	49.8
Sand Filter	Impervious	376.4	0.5	376.4*0.5	188.2
	Pervious	57.7	0.8	57.7*0.8	46.2
				Total	**487.3**

For these two facilities, 487.3 pounds of sediment are removed annually, counting as progress towards the local sediment TMDL for the Little Patuxent watershed.

Stormwater Retrofits:

Retrofits use the same modeling process applied to new efficiency BMPs, but before and after specifications are used to determine the net number of pounds reduced by a facility for each nutrient. The previous conditions are subtracted from the proposed conditions to provide the change in nutrient reduction provided by the facility. If the facility was providing some water quality prior to being retrofit, its prior treatment will also be counted towards the baseline.

Tree Planting and Impervious Removal:

For tree planting and impervious surface removal, BMP efficiencies are derived from table '3.E. Alternative Urban BMPs' from MDE 2014a. The pervious loading rate for the land-river segment is used alongside the efficiency to calculate the amount of nutrient reduced by the facility.

Example 2: A tree planting project has an area of 1.65 acres in the Catoctin Creek watershed in Frederick County. The Catoctin Creek watershed has a TMDL for sediment with a baseline year of 2000 and a TMDL for phosphorus with a baseline year of 2009. The sediment load removed for the BMP is derived as follows:

- Loading rate lookup value is queried by land-river segment for MDOT SHA MS4 Phase I/II Pervious.

Loading Rates for Example 1, Step 1A		
Land-River Segment	**MAST Land Use**	**TSS-EOS lb/ac**

B24021PM1_4000_4290	MDOT SHA Phase I/II MS4 Pervious	339.63

- BMP efficiency lookup value is queried for each BMP type. In this case the efficiency for sediment removal are used for Reforestation on Pervious Urban:

BMP Efficiencies for Example 1, Step 1B		
BMP Type	**BMP Category**	**TSS Removal**
FPU	Alternative	57%

- Loading rates are multiplied by the derived BMP efficiency to obtain reduction by lb/unit:

Results for Example 1, Step 1C					
BMP Type	**Land use**	**TSS-EOS lb/unit**	**TSS Removal Efficiency**	**Calculation**	**TSS Reduction (lb/unit)**
Tree Planting	Pervious	339.63	57%	339.63 * 57%	193.59

- The reduction by lb/unit is multiplied by units treated by the BMP. In this case the units treated are acres of pervious.

Results for Example 1, Step 2					
BMP Type	**Land use**	**TSS Reduction (lb/unit)**	**Unit Treated (Acres)**	**Calculation**	**TSS Reduction (lb)**
Tree Planting	Pervious	193.59	1.65	193.59*1.65	319.42
				Total	**319.42**

For this facility, 319.42 pounds of sediment are removed annually, counting as progress towards the local sediment TMDL for the Catoctin Creek watershed.

Stream Restoration:

Load reductions are calculated per project by the stream restoration design team during the project design phase. For projects where MDOT SHA design teams have not yet provided project specific load reduction information, interim rates based on MDE 2014a will be used. Currently, interim rates for lbs/lf removed are being used for all stream restoration projects until project specific load reductions are migrated into the database. As designs progress and project specific information becomes available, load reductions based on stream design protocols will be incorporated.

Example 3: A stream restoration project is estimated to treat 2,000 linear feet in the Double Pipe Creek watershed in Frederick County. The Double Pipe Creek watershed has a TMDL for phosphorus with a baseline year of 2009. The phosphorus load removed for the BMP is derived as follows:

- Loading rate lookup value is not required for load reduction BMPs such as this one. Reductions are based on a fixed amount of pollutant removed instead of a percentage of the load delivered to the BMP. Therefore, the first step in this analysis is the same as the second step in Example 1.

- BMP load reduction is queried for stream restoration. In this case, the project is not far enough along in design to estimate reductions from the Expert Panel protocols (Schueler and Stack, 2014) so the interim rate per linear foot is used.

BMP Load Reduction for Example 2, Step 1B	
BMP Type	**TP Removal (lb/LF)**
Stream Restoration	0.068

- It is not necessary to determine reduction by lb/unit by multiplying loading rates by BMP efficiencies becausethis reduction factor is given in the lookup table.

- Reduction by lb/unit is multiplied by units treated by the BMP. In this case the units treated are linear feet of restoration.

Results for Example 1, Step 2				
BMP Type	**TP Reduction (lb/unit)**	**Unit Treated (LF)**	**Calculation**	**TP Reduction (lb)**
Stream Restoration	0.068	2,000	2,000* 0.068	136.0
			Total	**136.0**

For this project, 136.0 pounds of phosphorus are removed annually, counting as progress towards the local phosphorus TMDL for Double Pipe Creek watershed.

Outfall Stabilization:

Outfall stabilization projects are expected to have project-specific load reduction information available at the time the facility is built. For planning purposes, MDOT SHA has incorporated its own research on load reductions from outfall stabilization. Based on the results, the assumption for linear feet of treatment provided by planned outfall projects was doubled to 400 linear feet of stream restoration credit as opposed to the maximum of 200 linear feet in MDE 2014a. Based on initial research by the MDOT SHA stream and outfall teams and individual project results, this is still believed to be a conservative estimate. This number will be adjusted in the future as more project specific data will help determine planning estimates.

IV.H. GIS Data Processing

Once the calculated load reduction for each facility is determined through the automated script, all treatment data is joined, to a point shapefile based on BMP location. This layer is subsequently intersected with TMDL polygons provided on MDE's TMDL Data Center website in order to apply the appropriate treatment to each TMDL. The resulting table lists every BMP within a TMDL along with the load reductions for each facility. Subsequent spreadsheet analysis, as defined below, applies filtering and queries to the data, providing a dynamic view of MDOT SHA's treatment scenarios within a local TMDL.

The GIS analysis results in a series of data tables which are imported into Excel workbooks. The data tables, which can be generated on demand, essentially list every BMP within MDOT SHA's databases and summarize the total reductions (nutrients and sediments) for each individual BMP.

IV.I. Spreadsheet Analysis

The AMT data export includes the amount of impervious area credit and pollutant reductions for every BMP in the inventory. The GIS analysis adds the geographic location of each BMP to the data tables. Together, this information is the basis for reporting progress towards meeting TMDL reductions and impervious treatment. An step is necessary to summarize the information for each TMDL, which has a unique set of the following variables: watershed, baseline year, pollutant.

MDOT SHA summarizes the amount of pollutant removal achieved for each TMDL by creating a series of pivot tables in an Excel workbook from the data export generated by the AMT. The pivot tables aggregate the amount of treatment and load reductions by type of BMP, TMDL pollutant, and planning scenario (i.e., baseline, progress, and future).

Because baseline dates vary by TMDL, each BMP could be classified as baseline treatment for some TMDLs and restoration for others, depending on the year built. This is managed in the TMDL analysis by creating a separate pivot table for each TMDL by pollutant and built date. Therefore, multiple pivot tables are required per TMDL pollutant to calculate load reductions accurately per level of treatment.

Different aspects of the AMT results are used in the pivot table TMDL summaries, varying based on the pollutant being summarized:

- <u>TN AMT result:</u> sum of treatment and sum of TN EOS lbs/yr removed by planning scenario
- <u>TP AMT result:</u> sum of treatment and sum of TP EOS lbs/yr removed by planning scenario
- <u>TSS AMT result:</u> sum of treatment and sum of TSS EOS lbs/yr removed by planning scenario
- <u>PCBs AMT result:</u> sum of treatment and sum of TSS EOS lbs/yr removed by planning scenario. TSS EOS lbs/yr removed is then converted to g/yr removed and then multiplied by the average sediment tPCB concentration from the TMDL document to calculate load reduction in PCB g/yr (MDOT SHA, 2016).

- Bacteria AMT result: sum of treatment by planning scenario is used in the WTM and described in the Bacteria Modeling Protocol to calculate bacteria load reductions from stormwater BMPs (MDOT SHA, 2016).

Treatment and Load Reduction Pivot Tables

The following pivot table filters are applied per TMDL pollutant:

Baseline Pivot Tables

Pollutant: varies by TMDL

Baseline year: varies by TMDL

BMP type:

TN/TP/TSS: Excludes BMPs coded as XDED, XDPD, XOGS, XOTH, or blank

PCB: Excludes tree planting, outfall stabilization, and stream restoration in addition to BMPs coded as XDED, XDPD, XOGS, XOTH, or blank

Bacteria: Excludes tree planting, impervious surface reduction, grass swales, outfall stabilization, and stream restoration in addition to BMPs coded as XDED, XDPD, XOGS, XOTH, or blank

Status: BMPs coded as construction complete

Built date: BMPs with a built date before July 1 of the baseline year (e.g., For a TMDL with a baseline year of 2005: BMPs before 7/1/2005 are filtered)

Progress Pivot Tables

Pollutant: varies by TMDL

Baseline year: varies by TMDL

BMP type:

TN/TP/TSS: Excludes BMPs coded as XDED, XDPD, XOGS, XOTH, or blank

PCB: Excludes tree planting, outfall stabilization, and stream restoration in addition to BMPs coded as XDED, XDPD, XOGS, XOTH, or blank

Bacteria: Excludes tree planting, impervious surface reduction, grass swales, outfall stabilization, and stream restoration in addition to BMPs coded as XDED, XDPD, XOGS, XOTH, or blank

Construction purpose: Restoration BMPs (excludes new development BMPs)

Status: BMPs coded as construction completed

Built date: BMPs with a built date between the TMDL baseline year and end of current fiscal year (e.g., FY17 progress BMPs for a TMDL with a baseline year of 2005: BMPs between 7/1/2005 and 6/30/2017)

Future BMP Pivot Tables

Pollutant: varies by TMDL

BMP type:

TN/TP/TSS: Excludes BMPs coded as XDED, XDPD, XOGS, XOTH, or blank

PCB: Excludes tree planting, outfall stabilization, and stream restoration in addition to BMPs coded as XDED, XDPD, XOGS, XOTH, or blank

Bacteria: Excludes tree planting, impervious surface reduction, grass swales, outfall stabilization, and stream restoration in addition to BMPs coded as XDED, XDPD, XOGS, XOTH, or blank

Construction purpose: Restoration BMPs (excludes new development BMPs)

Status: BMPs coded as under construction, proposed, in design concept, potential, and planned

Fiscal year: Current fiscal year (e.g. FY17) and after, excluding blanks

IV.J. On-the-Fly (Potential Scenario) Modeling Tool

Background and Purpose

The AMT developed for nutrient and sediment modeling uses up-to-date information to calculate and update progress for TN, TP, and TSS TMDLs. The AMT's source data includes BMPs that are far enough along in planning, design, and construction to establish a location and be recorded in one of the geodatabases used for source data. However, the AMT does not provide a method to determine the additional level of treatment and estimated cost needed to meet TMDL compliance targets. These "potential" BMPs are in addition to MDOT SHA's database / Task Management / GIS data, or BMPs estimated to meet MDOT SHA's IA restoration targets. They are applied on top of load reductions from Programmed BMPs modeled in MDOT SHA's Local TMDL AMT.

Modeling this gap of potential BMPs is the purpose of the on-the-fly Modeling Tool (OTF Tool). It is intended for use by MDOT SHA staff to make broad decisions about alternative scenarios for compliance, and to quickly revise and adjust scenarios as conditions or assumptions change.

Modeling Approach

Model Description

The OTF Tool is an Excel spreadsheet with multiple worksheets. It consists of a summary table which lists all TN/TP/TSS TMDLs that include a MDOT SHA reduction requirement and separate worksheets for each TMDL watershed, at the 8-digit level. It also includes a summary table showing pollutant load reductions and cost estimates for the potential BMPs

Summary Worksheet

The summary worksheet provides the information needed to determine if the proposed potential treatment will meet the TMDL targets. It incorporates data from the TMDL to set the reduction target and results from the AMT to show load reductions from progress and programmed BMPs to date and then compares the cumulative results, including the OTF Tool, to show whether or not the TMDL target has been met.

TMDL Watershed Worksheet

This spreadsheet design allows tracking and planning for multiple TMDL listed pollutants in the same watershed. For example, for the Double Pipe Creek TMDLs, the load reduction of TP and TSS lbs will be calculated for potential BMPs entered in the Double Pipe Creek watershed tab. The "Resulting % Progress" is shown for both TP and TSS.

Data Sources / Lookup Tables

Land Use / Loading Rates

Loading rates (lbs/ac) for pervious and impervious land cover, used for calculations within each TMDL watershed, are derived from MAST output (CBP WM P5.3.2), which is the same source used for the ATM. Loading rates are entered in two lookup table worksheets (*ImperviousWatershedLRs- lookup* and *ImperviousWatershedLRs- lookup*), and the rates used in each watershed worksheet are linked to these two worksheets.

Treatment

Ten types of treatment are modeled:

- Structural / ESD
    - New Stormwater - RR
    - New Stormwater - ST
    - Grass Swales
    - Retrofits
- Alternative
    - Stream Restoration

    - Outfall Stabilization
    - Tree Planting
- Operations
    - Inlet Cleaning
    - Storm Drain Vacuuming
    - Street Sweeping

Pollutant removal rates are entered in a lookup table worksheet: *Pollutant_Removal.* derived from MDE 2014.

Load Reduction and IA Credit Calculations

TMDL Watershed Worksheet

The worksheets have been set up to calculate results by BMP type, including the amount of treatment, impervious restoration credit, TN/TP/TSS removal, and estimated cost for TMDL compliance.

Data Entry: IA credit and pollutant reductions are based on data entry for two data elements entered by the analyst:

- Amount of impervious area to be treated in the watershed (ac)
- Mix of BMP strategies, by percent

Another necessary element is average BMP size. Default values are provided based on MDOT SHA experience. Cost estimates for structural, ESD, and alternative BMPs are calculated based on default values from MDOT SHA experience as well. Costs for operations BMPs are based on units achieved instead of impervious acre credit.

Calculations: At this level of modeling BMPs will not have a physical location and there is not enough information to determine pollutant removal by individual BMP; therefore, calculations of impervious area credit and pollutant removal are both based on the number of units planned for each type of BMP. Each type is represented by a different unit (e.g. ac, LF, tons). Pollutant removal calculations and impervious area credit are based on units and the Unit/IA factors derived from MDE 2014.

The approach to determining the BMP units need to reach 100% of the reduction goal is based on the MDOT SHA planning method that focuses on impervious area credit. BMP units planned are calculated from the input data of IA Credit planned for the watershed, the mix of BMPs in the proposed scenario, and the average BMP size. The result is a proportion for each BMP type relative to the total portfolio/scenario of BMPs needed in order to reach 100% attainment of the reduction goal. These proportions are then applied to the appropriate BMP unit to reach the amount of pollutant to be removed by BMP type in the overall attainment portfolio/scenario.

The cost calculation is based on impervious area credit for each BMP type and the cost per IA based on MDOT SHA experience.

Local TMDL Summary Table Worksheet

The summary table consists of 26 fields which provide data from the TMDL to set reduction goals and results from AMT calculations of pollutant removal for Baseline, Progress, Operations, Programmed 2020, and Programmed 2025 scenarios. The total reduction from these scenarios is compared to the target reduction to establish the amount of pollutant removal remaining to be achieved with the Potential scenario BMPs planned using the OTF Tool.

V. PCB

V.A. PCB TMDLs

Based on a review of MDE's PCB TMDLs, along with monitoring and analysis of its shops and facilities, MDOT SHA concluded that its land use and MS4 are not a source of PCBs but are a conduit for PCBs mobilized elsewhere. This conclusion is supported by research conducted locally and nationwide. Two documents from the Chesapeake Bay Program discuss PCB sources, pathways, and treatment. Schueler and Youngk (2015) summarized PCB research nationwide. They reported that PCB sampling in San Francisco Bay showed urban stormwater was the dominant pathway for PCBs to enter the Bay. The Chesapeake Bay Toxic Contaminants Policy and Prevention Outcome (CBP, 2015) concluded that stormwater was a significant pathway for both particulate and dissolved PCBs and that land use was also a factor.

While PCBs can exist in stormwater in both dissolved and particulate forms, they are generally insoluble in water. Lighter compounds may dissolve and subsequently volatize to the air and heavier compounds bind to sediment. Schueler and Youngk (2015) discussed research indicating that a large portion of the PCB load was attached to sediment, including a sampling study in the Susquehanna River basin that showed 75 percent of PCB loads were associated with particulates. CBP (2015) concluded that contaminated soils were a predominant source of PCBs in stormwater. Both these reports and others (Gilbreath et al., 2012) found that older industrial areas tended to have a higher concentration of PCBs in runoff and in sediments.

Based on the current state of PCB research, it is understood that removal of contaminated sediment from stormwater can be an effective method of reducing PCB loads. The initial approach applied by MDOT SHA to meet PCB TMDLs will focus on stormwater BMPs that treat sediment. If it proves to be infeasible or impractical to meet the reduction targets with stormwater treatment, additional strategies may be explored. According to MDE's recommendations for addressing PCB WLAs (MDE 2014c), other scientific methods that can adequately document and validate PCB load reduction may be submitted to MDE for approval. MDOT SHA has sponsored research at the University of Maryland regarding PCB sources and remediation (Davis et al., 2018) and will continue to investigate new methods of PCB reduction.

V.B. Modeling Approach

The modeling approach will focus on stormwater BMPs, and the basis will be TSS loading and reduction calculations based on approved rates from MAST (2016) and MDE (2014). This approach has also been documented by the Interstate Commission on the Potomac River Basin in the Tidal Potomac PCB TMDL (Haywood et al., 2007).

PCB loads are related to sediment by a concentration factor which describes the mass of PCB associated with sediment. In order to estimate PCB reductions, a concentration factor for PCBs in sediment will be applied to the TSS reductions. Schueler and Youngk (2015) summarized concentrations in ng/g from nationwide studies and reported results that varied from 7 to 7,650 ng/g. However, local data, from PCB TMDL documents, is available to derive the PCB concentrations discussed below.

Thirteen PCB TMDLs have sufficient information on monitored sediment concentrations in the receiving water to estimate an average value by watershed, shown in **Table 1**. No sediment data was reported in the TMDL for the Anacostia River Northeast and Northwest Branch. In lieu of this, data from the Tidal Potomac TMDL for Anacostia has been used.

Table 1: PCB Concentration Factors for Listed Watersheds

Watershed	Concentration (ng/g)	Source (MDE 2019)
Back River	124.9	Back River TMDL Table K-1
Baltimore Harbor	196.8	Baltimore Harbor TMDL, Tables K-1 and K-2
Bird River	20.5	Gunpowder and Bird TMDL, Table G-2
Bush River	17.2	Bush River TMDL, Table G-1
Gunpowder River	15.5	Gunpowder and Bird TMDL, Table G-1
Lake Roland	84.3	Lake Roland TMDL, Table J-1
Magothy River	19.6	Magothy River TMDL, Table J-1
Patuxent River	3.7	Patuxent TMDL, Table G-1
Severn River	55.3	Severn River TMDL, Table I-1
South River	24.1	South River TMDL, Table I-1
Tidal Potomac - Anacostia	212.0	Tidal Potomac TMDL, Figure A-3A
Tidal Potomac - Fresh	42.0	Tidal Potomac TMDL, Figure A-3A
Tidal Potomac - Oligohaline	15.0	Tidal Potomac TMDL, Figure A-3A
Tidal Potomac - Mesohaline	9.0	Tidal Potomac TMDL, Figure A-3A
West and Rhode Rivers	9.0	West/Rhode Rivers TMDL, Table I-1

Sediment Load Reductions

Section IV describes the data sources and calculations used to derive load reductions for sediment. These results are the basis for calculating PCB reductions through stormwater treatment.

V.C. Model Description

The model is based on output from the AMT. It is presented in an Excel spreadsheet format, using data derived from MAST and MDOT SHA's stormwater geodatabases. The spreadsheet calculates load reductions by all BMPs in all TMDL watersheds in a single worksheet, then sums the reduction by watershed with a pivot table. Load reductions are calculated separately for efficiency BMPs and one load reduction BMP, inlet cleaning.

V.D. Load Reduction Calculations

PCB load reduction calculations are based on the TSS removal calculated for efficiency BMPs and inlet cleaning and is summarized in the *PCB REDUCTION* worksheet. Calculations are as follows:

1. Add stormwater BMP and inlet cleaning pounds removed to find total TSS removed in each TMDL watershed. Convert to grams.
2. Multiply by PCB concentration factor (see **Table 1**) to find PCB load removed.
3. Results are in g/yr.

VI. BACTERIA

VI.A. Bacteria TMDLs

Unlike TMDLs for nutrients and sediment, MDE's bacteria TMDLs were not prepared using a watershed model. Nutrient and sediment TMDLs are based on modeling performed for the Chesapeake Bay program, which has developed and calibrated both a watershed model, which generates pollutant loads, and a receiving water model, which uses the loads to determine water quality concentrations. By using both of these models, the Bay model can estimate EOS loads from the watershed, and DEL loads, which enter the Bay.

All loads discussed in the bacteria TMDLs are based on monitoring in the impaired waterbody. Fate and transport from the watershed are not accounted for, including the quantity of bacteria from various sources in the watershed, die-off (or growth) in transit to the waterbody, potential sequestering, resuspension from bottom sediments, or other factors.

Bacteria Sources

For most of the bacteria TMDLs, MDE has included some type of Bacterial Source Tracking (BST), which is a method of estimating the source of the bacteria by matching DNA or RNA with a library of samples from known species. BST has been used to categorize the fraction of bacteria coming from four source sectors: humans, domestic pets, wildlife, or livestock. It is important to note that BST is performed on samples from the impaired waterbody, and thus the estimate of the fraction from each source is for the watershed as a whole, not from particular locations, jurisdictions, or permittees.

The sources of bacteria in the four categories can be identified in further detail, as shown in **Table 2**. These have been derived from MDE 2014d and Watershed Protection Techniques Article 17 (Schueler, 2000) which describes the sources to be addressed for load reduction in an implementation plan, as follows:

Table 2: Bacteria Sources

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

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

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

If it is infeasible or impractical to meet the reduction from these sources, additional strategies that address other sectors may be explored. An alternate approach is described in MDE's bacteria TMDL guidance (MDE 2014d) which states that the priority is to address human sources due to the greater health risk. Thus, per the guidance, reducing loads from non-MS4 sources such as SSOs or septic systems will be an acceptable method of meeting the TMDL requirement.

Significance of Source Analysis for MDOT SHA

MDOT SHA-owned land is a small portion of each of the TMDL watersheds addressed in implementation planning. It becomes a more significant issue for bacteria TMDLs. Reviewing the sources above, it becomes clear that very few of these sources exist within MDOT SHA's land.

Human sources should be minimal. MDOT SHA does not own or maintain sanitary sewers in its ROW, so these sources should be rare. There are only two septic systems in these watersheds; one at the Hereford shop in Loch Raven and one at a salt storage facility in Patapsco Lower North Branch. Homeless people are a potential source in urban areas near MDOT SHA ROW. .

There are no houses or legal residents living in the ROW, so the only source of domestic pet bacteria would be feral animals or adjacent residents walking dogs along MDOT SHA roads. Other than stormwater flowing on to MDOT SHA property from adjacent land not under MDOT SHA's control, there are no livestock sources. On the other hand, wildlife sources either from adjacent land or within the ROW are potential sources where MDOT SHA could be contributing bacteria to the watershed.

TMDL Summary

Table 3 shows a summary of the reduction requirements in percent for the current four bacteria TMDLs. Two dates are shown, the final approval date by EPA and the baseline year set by MDE and two reduction percentages are shown, the Maximum Practicable Reduction (MPR) and the target reduction. The MPR is MDE's assessment of the best achievable reductions. Both are provided in each TMDL document.

MPR is based on reductions for each of the four source categories. Human sources potentially have the highest risk of causing disease, so the maximum reduction was set at 95%. The domestic pet reduction was based on uncertainty in effectiveness of urban BMPs, along with best professional judgment, set at 75%. The livestock target, also 75%, was based on the level of sediment reductions from agricultural BMPs. Wildlife reductions were assumed to be 0%, with the assumption that there were no programmatic approaches for wildlife bacteria reduction, and that the health risk from this source is orders of magnitude less than that associated with human waste.

The target reduction is based on MDE's requirement to determine a TMDL which will meet water quality standards. This analysis removes the practicality constraints, with a maximum allowable reduction of 98% for all sources. The resulting reduction requirements were higher than the MPR in several watersheds.

In the TMDL documents, MDE has recognized that "…the goal of meeting water quality standards may require very high reductions that are not achievable with current technologies and management practices… In cases where such high reductions are required to meet standards, it is expected that the first stage of implementation will be to carry out the MPR scenario." (MDE, 2019).

Table 3: TMDL Description and Reductions (Percent) (MDE 2019)

TMDL	Basin Name	Pollutant	EPA Approval Date	Baseline Year	Maximum Practicable Reduction	Target Reduction
TMDL of Fecal Bacteria for the Anacostia River Basin	Anacostia River, US of	Enterococci	3/14/2007	2003		87.7% MO/ 80.3% PG

TMDL	Basin Name	Pollutant	EPA Approval Date	Baseline Year	Maximum Practicable Reduction	Target Reduction
	NEB/NWB Confluence					
	Anacostia River, DS of NEB/NWB Confluence	Enterococci	3/14/2007	2003		99.3% PG
TMDL of Fecal Bacteria for Antietam Creek	Antietam Creek	*E. Coli*	10/8/2009	2003	59.4%	98.0%
TMDL of Fecal Bacteria for the Non-Tidal Cabin John Creek Basin	Cabin John Creek	*E. Coli*	3/14/2007	2003	30.6%	30.6%
TMDL of Fecal Bacteria for the Conococheague Creek Basin	Conococheague Creek	*E. Coli*	5/7/2009	2004	50.0%	99.0%
TMDL of Fecal Bacteria for Double Pipe Creek	Double Pipe Creek	*E. Coli*	12/3/2009	2004		98.5% CL /98.8% FR
TMDL of Fecal Bacteria for the Non-Tidal Gwynns Falls Basin	Gwynns Falls	*E. Coli*	12/4/2007	2003		99.3%
TMDL of Fecal Bacteria for the Herring Run Basin	Herring Run	*E. Coli*	12/4/2007	2003		92.2%
TMDL of Fecal Bacteria for the Non-Tidal Jones Falls Basin	Jones Falls	E. Coli	2/12/2008	2003		95.5%
TMDL of Bacteria for Impaired Recreational Areas in Marley Creek and Furnace Creek of Baltimore Harbor Basin	Furnace Creek	Enterococci	3/10/2011	2006	Not analyzed	77.8%
	Marley Creek	Enterococci	3/10/2011	2006	Not analyzed	75.8%
TMDL of Fecal Bacteria for Liberty Reservoir	Liberty Reservoir	*E. Coli*	12/3/2009	2003		89.2%
TMDL of Fecal Bacteria for the Loch Raven Reservoir Basin	Loch Raven Reservoir	*E. Coli*	12/3/2009	2004	40.6%	76.6%
TMDL of Fecal Bacteria for the Lower Monocacy River	Lower Monocacy	*E. Coli*	12/3/2009	2004		92.5% FR/98.4% CL, 72.5% MO
TMDL for Island Creek, Town Creek, Trent Hall Creek, St. Thomas Creek, Harper and Pearson Creeks, Goose Creek and Indian Creek and a Water Quality Analysis for Battle Creek of Fecal Coliform for Shellfish Harvesting Areas in the Lower Patuxent River Basin	Lower Patuxent River– Indian Creek	Fecal Coliform	5/25/2005	2001	Not analyzed	43.6%

TMDL	Basin Name	Pollutant	EPA Approval Date	Baseline Year	Maximum Practicable Reduction	Target Reduction
TMDL of Fecal Coliform for Restricted Shellfish Harvesting Areas in Magothy River, Tar Cove, and Forked Creek and a Water Quality Analysis of Fecal Coliform for Deep Creek of the Magothy River Basin	Magothy River-Forked Creek	Fecal Coliform	2/20/2006	2001	Not analyzed	26.3%
	Magothy River-subsegment	Fecal Coliform	2/20/2006	2001	Not analyzed	12.8%
TMDL of Fecal Bacteria for the Patapsco River Lower North Branch Basin	Patapsco River Lower North Branch	*E. Coli*	12/3/2009	2003	15.6%	16.0%
TMDL of Fecal Bacteria for the Patuxent River Upper Basin	Upper Patuxent River	*E. Coli*	8/9/2011	2009	49.9%	49.9%
TMDL of Fecal Bacteria for the Non-Tidal Piscataway Creek Basin	Piscataway Creek	*E. Coli*	9/20/2007	2003		42.6%
TMDL of Fecal Bacteria for the Prettyboy Reservoir Basin	Prettyboy Reservoir	*E. Coli*	10/8/2009	2004	58.9%	0%
TMDL of Fecal Bacteria for the Non-Tidal Rock Creek Basin	Rock Creek – Non-Tidal	Enterococci	7/30/2007	2003		96.5%
TMDL of Fecal Coliform for the Restricted Shellfish Harvesting Areas in Whitehall and Meredith Creeks, Mill Creek, and the Severn River Mainstem of the Severn River Basin	Severn River-Mill Creek	Fecal Coliform	4/10/2008	2002	Not analyzed	86.0%
	Severn River-subsegment	Fecal Coliform	4/10/2008	2002	Not analyzed	19.0%
TMDL of Fecal Coliform for Restricted Shellfish Harvesting Areas in the South River, Duvall Creek, Selby Bay, and Ramsey Lake of the South River Basin	South River-Duvall Creek	Fecal Coliform	11/4/2005	2001	Not analyzed	17.4%
	South River-Ramsey Lake	Fecal Coliform	11/4/2005	2001	Not analyzed	65.0%
	South River-subsegment	Fecal Coliform	11/4/2005	2001	Not analyzed	68.0%
TMDL of Fecal Bacteria for the Upper Monocacy River	Upper Monocacy River	*E. Coli*	12/3/2009	2004		97.0%
TMDL of Fecal Coliform for Restricted Shellfish Harvesting Areas in Bear Neck Creek, Cadle Creek, West River, and Parish Creek for the West River Basin	West River-Bear Neck Creek	Fecal Coliform	2/20/2006	2001	Not analyzed	43.3%
	West River-Cadle Creek	Fecal Coliform	2/20/2006	2001	Not analyzed	72.2%
	West River-Parish Creek	Fecal Coliform	2/20/2006	2001	Not analyzed	53.1%
	West River-subsegment	Fecal Coliform	2/20/2006	2001	Not analyzed	35.3%

VI.B. Modeling Approach

Bacteria modeling has been conducted outside of the AMT, with the exception of summarizing treatment data for watersheds with bacteria TMDLs. The approach is based on the Watershed Treatment Model (Caraco, 2013) recommended by MDE as one of the models which could be used for implementation modeling for nutrients, sediment, and bacteria. It is a spreadsheet-based model which is capable of modeling loads from runoff and also other secondary sources that in general are associated with dry weather flows. For bacteria, it allows for input for all human sources except homeless populations, along with domestic pets, and livestock. Loads from wildlife are not modeled except as a contributor to runoff. It provides methods to estimate load reductions from both stormwater BMPs and source controls, as well.

Model Selection

The model was selected based on three factors. It was recommended by MDE, it could model almost all of the sources and controls that MDOT SHA would require, and as a spreadsheet, it was relatively easy to use.

There are a number of more complex models which can model bacteria loads, including HSPF, LPSC, and SWAT, but the additional effort required to assemble input data and run these models was not considered justified based on MDE's recommendation to compare reductions by percentages rather than loads.

Model Description

The WTM models a single watershed. Loads from runoff and other sources are calculated individually, then added to find the total untreated load for the watershed. Load reductions from source controls and stormwater BMPs are calculated individually, then summed to find the total reduction. For stormwater BMPs, load reductions are calculated based on percent removal by BMP against the lumped total load in the watershed. Loads to each BMP are based on the total drainage area and percent impervious rather than the type of land use in the treated drainage area.

Three scenarios can be modeled. *Existing Loads* include current land use and treatment. *Loads with Future Practices* consist of current land use and proposed (future) treatment. *Loads with New Development* include forecast changes in land use and the treatment associated with it. Models prepared for this analysis have not included any new development. Only the first two WTM scenarios have been used.

The model consists of multiple interconnected worksheets, described in **Table 4** from the 2013 User's Guide (Caraco, 2013). Not all of them have been used for this analysis.

Table 4: WTM Worksheets

Worksheet	Description
Primary Sources	This worksheet summarizes the loads from sources that can be determined solely by land cover or land use. It requires basic land use information and calculates surface runoff loads. In addition, it

Worksheet	Description
	requires basic watershed data, such as annual rainfall, stream length, and soils distribution. This load calculated in this worksheet incorporate data from the “turf management” section of the “Existing Management Practices” tab, and model default values reflect typical lawn care practices.
Secondary Sources (Not Used)	Secondary sources are pollutant sources that cannot be calculated based on land use information alone. Some of these sources, such as septic systems, CSOs and SSOs, are at least partially composed of wastewater Other secondary bacteria sources include illicit discharges, livestock, and marinas.
Existing Management Practices	This sheet reflects programs currently in place to control loads from urban land, including both source controls and stormwater BMPs. Users need to input information about the effectiveness and level of implementation of various programs and practices.
Retrofit Worksheet	Stormwater retrofits are BMP put in place after development has occurred. The retrofit worksheet allows the user to input individual stormwater retrofit practices. These are then reported in the “Future Management Practices” sheet.
Stream Restoration (Not Used)	This sheet summarizes load reductions from future stream restoration projects. Results are shown in the “Future Management Practices” sheet if the assessment option “Option 2. Enter Removal from Stream Restoration Worksheet” is selected.
Future Management Practices	This sheet reflects the planned extent of programs to control loads from urban land. By default, the model populates this sheet with values from the “Existing Management Practices” sheet. The user then enters data that describe proposed or “future” management practices.
New Development (Not Used)	This sheet calculates the loads from future development, based changes in land use and proposed future treatment. The sheet calculates new “primary source” loadings based on the increase in area of certain land uses, then asks the user to describe the types of stormwater controls on new development. Next, it adds secondary sources, such as loads from new septic customers and wastewater treatment plant loads. Finally, it calculates the loads from active construction as land is developed.

VI.C. Data Sources

The bacteria model uses several data sources. The type of data needed is similar to what is used for the AMT: Land Use, Loading Rates, and Treatment. However, other than the amount of stormwater treatment derived from MDOT SHA’s databases through the AMT, the other data sources are unique to this model.

Databases

Baseline and Restoration BMPs

The core of MDOT SHA’s implementation planning is the databases, both spatial and tabular, which MDOT SHA uses to manage its restoration BMPs from planning through compliance reporting. BMPs which treat bacteria are exported with the AMT to be entered into WTM models for each TMDL watershed.

Land Use

Nutrient and sediment modeling with the AMT rely on two types of land use: pervious and impervious, with no distinction among types of pervious cover (forest, turf, agriculture) or impervious (buildings, roads). Bacteria loading rates were found to vary significantly based land use, so an alternate source was used.

The best source for land use mapping in Maryland is the GIS coverage developed by the Maryland Department of Planning (MDP) (MDP, 2010). The land use layer was first published as of 1997 and has since been updated twice, in 2002 and 2010.

Two approaches to mapping MDOT SHA's land were investigated, in light of the pollutant loading rates available. The first was to treat the ROW of all roadway classifications as a single land use, Transportation, which would result in one loading rate for all of MDOT SHA's land. After review of mapping and aerial photography, MDOT SHA decided that land use within and adjacent to the ROW was more accurately described by using the wider variety of land use classifications, (i.e. residential, commercial, industrial, forest, agriculture) mapped by MDP.

None of the TMDL baselines matched either of the land use mapping dates. For baseline modeling, the land use layer with the closest date was used.

Loading Rates

The WTM uses a variation of the Simple Method (Schueler, 1987) to calculate loads from urban areas and export coefficients to calculate rural loads. The Simple Method requires area and percent impervious for each land use to calculate annual runoff, and an Event Mean Concentration (EMC) to calculate loads. The program's default data were used for rural loads, but urban loads were calculated using EMCs reported in the National Stormwater Quality Database (NSQD) (Pitt et al., 2004). The database included stormwater runoff data from NPDES permit applications and annual monitoring reports nationwide, organized by land use. Numerous constituents were analyzed, including two pathogens, fecal coliforms and fecal streptococci.

EMCs used in the model are shown in **Table 5**, which also cross-references land use categories from MDP and the NSQD.

Table 5: EMCs Used for Modeling

MDP Land Use	MDP LU Codes	NSQD Land Use	EMC
Residential	11,12,13,191,192	Residential	8,345
Open Urban	18	Open Space	7,200
Commercial / Institutional	14,16	Commercial (1)	4,300
Roadway	80	Freeways	1,700
Industrial	15	Industrial	2,500

(1) NSQD has a category for institutional, but no bacteria samples were reported.

Treatment

There are two variables needed for calculating treatment. The first is the amount of treatment provided in each watershed for a particular planning scenario, and the second is the pollutant removal rate for each type of treatment.

Amount of Treatment

The amount of treatment for bacteria modeling is calculated with the pivot table spreadsheet analysis in conjunction with the AMT, in the same manner as with nutrient and sediment TMDLs. Pivot tables are set up by watershed, baseline date, and planning scenario and a summary by type of BMPs and amount of treatment is produced. This information is entered into the WTM for baseline and retrofit load reduction calculations.

Pollutant Removal Rates by BMP Type

There are no commonly accepted bacteria pollutant removal rates from stormwater BMPs as there are for nutrients and sediment. They are not modeled by the Chesapeake Bay Program and MDE hasn't provided modeling guidance. As a result, the first step was for MDOT SHA to conduct a literature review for reports that summarized the results of BMP performance sampling for bacteria removal. Two major reports were found:

International Stormwater BMP Database (Leisenring, et al., 2014)– This study was sponsored by the Water Research Foundation (WRF), Federal Highway Administration (FHWA), American Public Works Association (APWA) and the Environmental and Water Resources Institute (EWRI) of the American Society of Civil Engineers (ASCE). It presents a statistical analysis of BMP performance, reporting influent and effluent concentrations. The database was first published in 2010 and has been updated several times, with the most recent results published in 2014. The report does not provide removal as a percent. For this analysis, percent removal was derived from the reported median inflow and outflow at the 95% confidence interval.

National Pollutant Removal Performance Database (CWP, 2007)– CWP first prepared this study in 2000 summarizing the results of 139 BMP performance studies and has updated it periodically since that time. The latest version 3.0 includes 27 additional studies. The study consolidates the results of sampling research on stormwater BMPs, providing the median, minimum, and maximum removal percentage for each, as well as the 25th and 75th percentile values. Note that a few of the 2012 results were dropped in 2014 with a reevaluation because there were only 3 or fewer studies available.

Table 6 shows the BMPs in each report with the number of studies represented in each. Leisenring, et al. (2014) consolidates a larger number of studies and thus appears to be a better source for the data. It should be noted that monitoring data have not been collected or reported for all of the BMPs that MDOT SHA could potentially use for TMDL implementation.

Table 6: Sources of BMP Pollutant Removal Rates with Number of Sampling Studies)

	Leisenring, et al. 2014			CWP 2007	
BMP Name	**Entero-coccus**	**E. coli**	**Fecal Coliform**	**BMP Name**	**All bacteria**
Grass Strip			2	Open Channel	3
Bioswale / Grass Swale		5	11		
Bioretention	3	4		Bioretention	

	Leisenring, et al. 2014			CWP 2007	
BMP Name	**Entero-coccus**	**E. coli**	**Fecal Coliform**	**BMP Name**	**All bacteria**
Composite			4		
Detention Basin		3	15	Dry Pond	2
Green Roof		1			
Infiltration				Infiltration	
Media Filter				Filtering	6
Retention Pond		4	11	Wet Pond	11
Wetland Basin	4	5	5	Wetland	3
Wetland Basin / Retention Pond	6	9	15		

Three of the four TMDLs were based on sampling for *E. coli*. therefore, the data used to develop BMP efficiencies for this assessment used *E. coli* if available and fecal coliform otherwise. For BMPs which are not represented in Leisenring, et al. (2014), alternate sources were used and noted.

Removal efficiencies were calculated as follows:

$$Removal\ Rate = \frac{EMC_{in} - EMC_{out}}{EMC_{in}}$$

Table 7 shows the BMP efficiencies to be used in the model to guide implementation planning.

Table 7: BMP Removal Rates

BMP	MDE Codes	SW BMP Database Type	Bacteria Type	Bacteria Reduction	Note
Bioretention (all soils)	FBIO, MMBR	Bioretention	E. coli	65%	(1)
Bioswales	ODSW, MSWB		E. coli	-4%	(1)
Dry Detention Ponds	XDPD	Detention Basin	FC	60%	(1)
Dry Extended Detention Ponds	XDED	Detention Basin		60%	(7)
Impervious Surface Reduction*	NDNR, NDRR, NSCA, IMPF, IMPP			0%	(3)
Infiltration (all types).	IBAS, ITRN, MIBR, MIDW, MILS			90%	(4)
Outfall Enhancement with SPSC	SPSC			N/A	(5)
Permeable Pavement (all types).	APRP	Porous Pavement		58%	(2)
Stream Restoration	STRE			0%	(3)
Street Sweeping	MSS, VSS			N/A	(5)

BMP	MDE Codes	SW BMP Database Type	Bacteria Type	Bacteria Reduction	Note
Urban Filtering	FSND, FUND, FORG, FPER	Media Filter	FC	58%	(1)
Urban Tree Plantings	FPU			0%	(3)
Vegetated Open Channels	MSWG	Biofilter - Grass Swale		0%	(6)
Wet Ponds	PWET, PPKT, PWED, PMED, PMPS	Retention Pond	E. coli	95%	(1)
Grass Strip	--	Biofilter - Grass Strip		N/A	(5)
Green Roof	AGRE, AGRI			0%	(3)
Wetland	WSHW, WEDW, WPKT, WPWS	Wetland Basin	E. coli	53%	(1)

Notes:
[1]Source is Leisenring, et al. (2014); Median, 95% confidence inflow/outflow in MPN/100mL, E. coli or FC, FC preferred.
[2]Permeable pavement with sand functions as a media filter.
[3]Not a bacteria source
[4]Source is the WTM v.3.0 Manual, 2001, based on Schueler estimate in 1987 that it's equivalent to septic systems.
[5]No data available.
[6]Studies not cited here indicate grass channels increase bacteria levels rather than removing them.
[7]Dry ED ponds assumed to be as effective as dry ponds.

VII. TRASH

VII.A. Trash TMDLs

There are two EPA approved trash TMDLs with MDOT SHA responsibility spanning three Maryland 8-digit watersheds: Anacostia River and Patapsco River Mesohaline (PATMH) (MDE 2019). These trash TMDLs are not written as traditional TMDLs. They are expressed in terms of a quantity to be removed, rather than in terms of the maximum allowable pollutant input. Because they are focused on a load to be removed, the term 'baseline' represents the desired level of trash removal and the trash TMDL endpoint is 100 percent removal of the baseline load. A TMDL target equal to 100 percent removal of the baseline load is not the same as zero trash in the watershed, but that the assigned baseline loads are to be removed in their entirety each year.

VII.B. Modeling Approach

The trash WLAs are the amount of trash to be removed and therefore no additional computations are necessary to determine MDOT SHA reduction requirements. Meeting the WLAs will entail both maintaining current levels of trash collection and increasing efforts to meet the additional WLA. MDOT SHA must continue to measure and report annually levels of trash collected by the shops to ensure enough trash is collected to include the total from both baseline and proposed increased activities. Activities will increase gradually until the full baseline plus WLA is being met. The results of the increased trash pickup activities plus current trash pickup data will be modeled in an Excel sheet.

The approach uses spreadsheet calculations of load removed compared to the WLA required to be removed. Unlike MDOT SHA's reporting for other TMDLs, the trash TMDL modeling does not use percent reduction as a target, but instead uses absolute loads of trash in lbs/yr.

MDOT SHA will first determine the baseline loading of trash in the watershed in lbs/yr at the year of TMDL publishing according to the MDE Data Center. The trash baseline load can be calculated by summing removal from all of the trash pickup activities (**Table 8**) used by MDOT SHA based on monitoring performed while the TMDL was being written.

Table 8: Anacostia River Baseline / Enhanced / Initiated Practices

Practice or Activity	Baseline	Enhanced After 2010	Initiated After 2010
Roadside Cleanups	✓		
Inlet Cleaning	✓	✓	
Street Sweeping	✓	✓	
Stormwater Management Facilities	✓		✓
Media Relations		✓	
Outreach Programs			✓[1]
Stream Cleanups			✓[1]
(1) In Anacostia watershed only			

VII.C. Data Sources

Baseline Loading Rates

Loading rates for different land uses are assigned in the TMDL documents and for MDOT SHA they are 2.22 lbs/ac/yr (Anacostia) and 2.06 lbs/ac/yr (PATMH). Different sampling methodologies were used to determine the baseline trash loading rates for each of the trash TMDLs:

- The Anacostia River TMDL sampling methodology is based on stormwater outfall sampling – storm drain data were collected downstream of outfalls through the use of either trash fencing or trash nets.
- The Patapsco River sampling methodology is based on sampling within SW control structures – trash was collected within the fenced boundary of the facilities.

Any upstream practices that were already in place during the trash monitoring studies are inherently captured in these baseline rates. The differing sampling methodologies listed above have implications as to which MDOT SHA trash removal processes were captured in the measured baseline rates. Because the Anacostia sampling was performed downstream of outfalls, all upstream practices including SW control structures are included in the baseline. Alternatively, since the Patapsco sampling was performed within SW control structures, trash reductions they provided were not included in the baseline. Therefore, MDOT SHA includes any SW control structures whether built prior to and after 2010 as program enhancements for the PATMH TMDL reductions, but only includes SW control structures built after 2010 for the Anacostia TMDL reductions.

Baseline Activities

MDOT SHA currently performs these activities to pick up litter and trash along roadsides:

- Maintenance Crew Clean-ups – MDOT SHA's maintenance crews are responsible to perform a number of routine activities including trash clean-up as well as mowing, plowing, and other activities to ensure safety and environmental stewardship along the ROW. Trash clean-ups are performed regularly before mowing and supplemental clean-ups occur as needed or upon public request when possible.

- Contracted Crew Clean-ups – In addition to MDOT SHA maintenance crew clean-ups, OOM also issues trash removal contracts for supplemental clean-ups along the ROW. Contractors include private companies and inmate cleaning crews. Contracts are awarded for designated roadway segments and contractors are required to pick up on a regular schedule.

- Adopt-A-Highway (AAH) – MDOT SHA's AAH program utilizes volunteer groups that pick up litter along one to three mile stretches of non-interstate roadways. The groups are encouraged to perform this community service a minimum of four times per year for a two-year period. (Not included in baseline calculations.)

- Sponsor-A-Highway (SAH) – The SAH program allows corporate sponsors to fund contracted clean-ups for one-mile sections of Maryland roadways. The sponsor has an agreement with a maintenance provider to remove litter from the sponsored highway segment. Segments are typically interstate roadways.

Since no significant changes or enhancements have occurred to these programs since 2010, these roadside clean-up activities are not included in modeling for the WLA reduction and attempts to quantify changes relative to 2010 are not planned.

Restoration Activities

In addition to trash pickup along the roadside, MDOT SHA also conducts trash removal from other BMPs such as:

- Inlet Cleaning – MDOT SHA owns and operates vacuum pump trucks and routinely cleans storm drain inlets to remove sediment, gross solids, litter, and debris that accumulate inside drainage inlets and catch basins. Truckloads of debris removed are tracked and reported by MDOT SHA maintenance shop personnel.

- Street Sweeping – The TMDL street sweeping program was created in fiscal year 2014 for the purpose of gaining impervious acre credits. MDOT SHA dedicated select urban routes throughout its MS4 area for bi-weekly sweeping. For this newly created program, all the trash reduction associated with TMDL street sweeping will be counted towards the trash WLA.

- Structural Stormwater Control Routine Maintenance – MDE guidance from the TMDL Data Center, *Guidance for Developing Stormwater Wasteload Allocation Implementation Plans for Trash/Debris Total Maximum Daily Loads*, (MDE, 2014e) lists structural stormwater controls as an allowable trash load reduction practice

VII.D. Load Reduction Calculations

Stormwater Management

Load reductions from structural BMPs are calculated with the same approach used for other pollutants, by first estimating the load in the area draining to the BMP, then applying a removal efficiency to calculate the amount removed. Trash calculations use the loading rates discussed in Section VII.C. above. Reductions are based on a 95 percent removal efficiency, as described in the Baltimore County Trash TMDL Implementation Plan (BA-EPS, 2016) and the Anacostia Watershed Implementation Plan (Biohabitats et al., 2012a). Structural BMPs with trash collecting capabilities include:

- Structural - Ponds, Wetlands, and Open Channels
  - Dry Extended Detention Pond
  - Dry Pond
  - ED Shallow Wetland
  - Micropool Extended Detention Pond
  - Pond/Wetland System
  - Wet Extended Detention Pond
  - Wet Pond
  - Wet Swale

- Structural - Filters and Infiltration
  - Bioretention
  - Infiltration Basin
  - Other Filtering
  - Shallow Marsh

- ESD
  - Micro-Bioretention
  - Submerged Gravel Wetland

- Wet Swale

The method for calculating reductions is different for the two trash TMDLs issued as of 2019. Based on the methodology used in the PATMH trash TMDL, MDOT SHA can calculate reductions from structural BMPs (both pre- and post- baseline monitoring) and apply them towards the WLA reduction. However, the Anacostia River watershed trash TMDL does not allow MDOT SHA to use structural BMPs that were in place prior to the baseline year. Only facilities constructed after the baseline year can provide credit for trash reduction.

Inlet Cleaning

MDOT SHA routinely cleans storm drain inlets and catch basins to remove sediment, gross solids, litter, and debris that accumulate inside. Currently, MDOT SHA staff perform these activities in response to complaints, flooding, or as routine practice. Recently, MDOT SHA has focused on educating operations forces concerning the value of deep cleaning inlets rather than just the surface debris on grates and developing improved data collection methods. This is the first level of enhancement the inlet cleaning program has undergone.

The second level of inlet cleaning enhancement involves using contracted crews to clean significantly increased numbers of inlets in targeted watersheds. Additional funds have been secured for the operations budget to support this work. It is anticipated that this enhancement will take effect in fiscal year 2019. The Anacostia, Jones Falls, and Gwynns Falls watersheds fall within this enhanced inlet cleaning area.

In conjunction with these enhancements, a research study (MSU & CWP, 2018) was performed that characterized inlet material and determined that approximately five pounds of trash is removed each time an inlet is cleaned, based on a literature review of inlet debris characterization studies and reviewing and documenting MDOT SHA inlet cleaning operations.

Street Sweeping

To determine reductions achieved, loading rates discussed in Section VII.C. are used along with the curb-miles of roadway swept at a bi-weekly frequency, and a 32 percent calculated effectiveness is applied based on the San Francisco Bay trash TMDL technical report, *Trash Load Reduction Tracking Method* (Bay Area Stormwater Management Agencies Association [BASMAA], 2012).

Outreach and Stream Cleanup

BASMAA, 2012 also provides methods to assign reduction efficiencies for several alternative practices including outreach, stream clean-up, and enhanced street sweeping as detailed in **Table 9**. MDOT SHA conducts several of these types of programs, including media relations, social media, and outreach activities for both school aged/youth and communities.

Table 9: Summary of Trash Load Reduction Credits from BASMAA (2012)

Alternative Practice	Credit	Qualifiers
Outreach to School-age Children or Youth	2%	Annual Reduction; Min. 8 events if >250,000 population
Media Relations	1%	Annual Reduction
Community Outreach	2%	Annual Reduction; Min. 8 events if >250,000 population
Enhanced Street Sweeping	32%	Wet weather effectiveness based on >9 days between sweepings2; H-4.5/S
1. Source: *Trash Load Reduction Tracking Method* (BASMAA, 2012) 2. H = effectiveness, S = number of days between sweepings.		

VIII. CONCLUSION

The databases, models, and calculation procedures described in this document will be used to develop treatment scenarios and implementation plans for the TMDLs allocated to MDOT SHA for compliance as part of its NPDES MS4 permit including:

- Total nitrogen (TN),
- Total phosphorus (TP),
- Total suspended solids (TSS),
- Bacteria (including fecal coliform, *e. coli*, and enterococcus)
- Polychlorinated biphenyls (PCBs)
- Tash

This protocol will be updated periodically to describe new or revised modeling methods, and for additional pollutants that may be covered in future TMDLs.

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Appendix E

Optional Worksheets for MS4 Stormwater WLA Implementation Progress Documentation

Appendix E

Optional Worksheets for MS4 Stormwater WLA
Implementation Progress Documentation

MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

MDE

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

Watershed Name	Anacostia River - Nontidal
County Name	Montgomery
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	1997
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1997
Impervious Acres in Implementation Baseline Year	1,098
Pervious Acres in Implementation Baseline Year	868

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	81.2%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

Practice Group	Category	BMP Name	Type	Unit (Scenario Name:)	Baseline Year 1997: BMPs installed before 1997	Progress Fiscal Year 2019 (Progress Reductions): BMPs installed from 1997 to 2019	Reductions achieved between 1997 and 2019: TN lbs/year	TP lbs/year	TSS lbs/year	Target Year TBD (Future Reductions): BMPs planned for installation from 2019 to TBD	Planned reductions from 2019 to TBD: TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		0.7		0.8						0.7
				Pervious Acres Treated		0.8								0.8
		Grass Swales	Cumulative	Impervious Acres Treated	75.4									75.4
				Pervious Acres Treated	93.5									93.5
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		1.4		1.5						1.4
				Pervious Acres Treated		1.1								1.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	16.1									16.1
				Pervious Acres Treated	20.7									20.7
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	2.3									2.3
				Pervious Acres Treated	0.2									0.2
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	22.5		31.6						22.5
				Pervious Acres Treated	n/a	51.5								51.5
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	61.1									61.1
				Pervious Acres Treated	36.6									36.6
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		12.7		0.03						12.7
		Pipe Cleaning	Annual **	Dry tons removed		23.1		13.9						23.1
		Inlet Cleaning	Annual **	Dry tons removed		11.2		15.7						11.2
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		61.9		11.0						61.9
		Urban Stream Restoration	Cumulative	Linear feet restored		33,289.0		2,263.7						33,289.0
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	13.1									13.1
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	15.9									15.9
				Pervious Acres Treated	10.7									10.7
				REDUCTIONS:		TOTAL	0	2,338	0	TOTAL	0	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load	TN	TP	TSS
		2,209	

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

Current Load	TN	TP	TSS
	0	-129	0

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

Load under full implementation	TN	TP	TSS
	0	-129	0

This represents the load from the watershed in the year that the plan is fully implemented

Legend: meets TMDL | Does not meet TMDL

TMDL Reductions	TN	TP	TSS
	0.0%	81.2%	0.0%

From top of worksheet

Target Load	TN	TP	TSS
	0	415	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1997 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

MDE

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

Watershed Name	Anacostia River - Tidal
County Name	Montgomery / Prince George's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	1997
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1997
Impervious Acres in Implementation Baseline Year	437
Pervious Acres in Implementation Baseline Year	419

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	81.2%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year	TBD			
					1997	Progress Reductions				Future Reductions				
							Reductions achieved between 1997 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 1997	BMPs installed from 1997 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to TBD	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	0.4									0.4
				Pervious Acres Treated	0.3									0.3
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.2									0.2
				Pervious Acres Treated	0.1									0.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.7									0.7
				Pervious Acres Treated	0.1									0.1
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed		0.4		0.2						0.4
		Inlet Cleaning	Annual **	Dry tons removed		0.1		0.2						0.1
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	1.2									1.2
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0.4	0	TOTAL	0	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
	708	

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

Current Load

TN	TP	TSS
0	707	0

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

Load under full implementation

TN	TP	TSS
0	707	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	81.2%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
0	133	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1997 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Antietam Creek
County Name	Washington
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2009
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2009
Impervious Acres in Implementation Baseline Year	717
Pervious Acres in Implementation Baseline Year	1,244

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	21.4%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Scenario Name: Baseline Year 2009 BMPs installed before 2009	Progress Fiscal Year 2019 – Progress Reductions BMPs installed from 2009 to 2019	Reductions achieved between 2009 and 2019 TN lbs/year	TP lbs/year	TSS lbs/year	Target Year 2030 – Future Reductions BMPs planned for installation from 2019 to 2030	Planned reductions from 2019 to 2030 TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						3.2		1.3		3
				Pervious Acres Treated						4.9				5
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		7.0		9.6						7.0
				Pervious Acres Treated		15.7								15.7
		Grass Swales	Cumulative	Impervious Acres Treated	16.7					16.2		6.4		32.9
				Pervious Acres Treated	35.0					24.3				59.3
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		11.5		18.4						11.5
				Pervious Acres Treated		34.4								34.4
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	2.0									2.0
				Pervious Acres Treated	2.4									2.4
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						6.5		2.0		6.5
				Pervious Acres Treated						9.7				9.7
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	8.9		12.4		48.6		15.1		57.5
				Pervious Acres Treated	n/a	19.9				72.9				92.8
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	1.8	3.0		2.5						4.8
				Pervious Acres Treated	0.9	4.2								5.1
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		67.2		2.2						67.2
		Pipe Cleaning	Annual **	Dry tons removed		5.3		3.2						5.3
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious	6.7	94.6		17.1		85.3		5.1		179.9
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet						3,240.0		220.3		3,240.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	65	0	TOTAL	0	250	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
TN	TP	TSS
	1,295	

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

Current Load		
TN	TP	TSS
0	1,230	0

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

Load under full implementation		
TN	TP	TSS
0	979	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
TN	TP	TSS
0.0%	21.4%	0.0%

From top of worksheet

Target Load		
TN	TP	TSS
0	1,018	0

This represents the load that must be achieved when the plan is fully implemented. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

MDE

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

Watershed Name	Catoctin Creek
County Name	Frederick
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2009
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2009
Impervious Acres in Implementation Baseline Year	401
Pervious Acres in Implementation Baseline Year	844

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	9.0%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year	2025			
					2009	Progress Reductions				Future Reductions				
							Reductions achieved between 2009 and 2019				Planned reductions from 2019 to 2025			
		BMP Name	Type	Unit	BMPs installed before 2009	BMPs installed from 2009 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2025	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						1.0		1.4		1
				Pervious Acres Treated						1.5				2
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	11.7					5.1		6.9		16.8
				Pervious Acres Treated	43.2					7.7				50.9
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						2.0		2.2		2.0
				Pervious Acres Treated						3.1				3.1
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.1									0.1
				Pervious Acres Treated	0.1									0.1
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a					15.3		16.3		15.3
				Pervious Acres Treated	n/a					23.0				23.0
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		0.03		0.001						0.0
		Pipe Cleaning	Annual **	Dry tons removed		0.9		0.5						0.9
		Inlet Cleaning	Annual **	Dry tons removed		0.1		0.1						0.1
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious		0.2		0.1						0.2
		Urban Tree Planting	Cumulative	Acres planted on pervious	16.0	61.6		31.0		36.8		11.8		98.4
		Urban Stream Restoration	Cumulative	Linear feet restored	719.0					200.2		13.6		919.2
		Outfall Stabilization	Cumulative	Linear feet						1020.0		69.4		1,020.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	32	0	TOTAL	0	122	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
	1,704	

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

Current Load

TN	TP	TSS
0	1,672	0

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

Load under full implementation

TN	TP	TSS
0	1,551	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	9.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
0	1,551	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Double Pipe Creek
County Name	Carroll / Frederick
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2009
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2009
Impervious Acres in Implementation Baseline Year	408
Pervious Acres in Implementation Baseline Year	654

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	66.0%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year			2019	Target Year			2030	
					2009	Progress Reductions				Future Reductions				
							Reductions achieved between 2009 and 2019				Planned reductions from 2019 to 2030			
		BMP Name	Type	Unit	BMPs installed before 2009	BMPs installed from 2009 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2030	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						1.6		3.3		2
				Pervious Acres Treated						2.4				2
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.4									0.4
				Pervious Acres Treated	1.9									1.9
		Grass Swales	Cumulative	Impervious Acres Treated	6.5					8.1		16.4		14.6
				Pervious Acres Treated	16.4					12.1				28.5
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	0.2									0.2
				Pervious Acres Treated	1.4									1.4
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						3.2		5.2		3.2
				Pervious Acres Treated						4.8				4.8
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	1.0									1.0
				Pervious Acres Treated	4.8									4.8
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a					24.2		38.8		24.2
				Pervious Acres Treated	n/a					36.2				36.2
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		8.4		0.2						8.4
		Pipe Cleaning	Annual **	Dry tons removed		3.6		2.2						3.6
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious		0.1		0.0						0.1
		Urban Tree Planting	Cumulative	Acres planted on pervious		69.1		31.5		57.4		20.8		126.5
		Urban Stream Restoration	Cumulative	Linear feet restored						11,938.0		811.8		11,938.0
		Outfall Stabilization	Cumulative	Linear feet						1,610.0		109.5		1,610.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	34	0	TOTAL	0	1,006	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
TN	TP	TSS
	1,575	
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
TN	TP	TSS
0	1,541	0
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
TN	TP	TSS
0	535	0
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
TN	TP	TSS
0.0%	66.0%	0.0%
From top of worksheet		

Target Load		
TN	TP	TSS
0	536	0
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Liberty Reservoir
County Name	Baltimore
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2009
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2009
Impervious Acres in Implementation Baseline Year	622
Pervious Acres in Implementation Baseline Year	1,284

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	45.0%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Baseline Year 2009: BMPs installed before 2009	Progress Fiscal Year 2019 – Progress Reductions: BMPs installed from 2009 to 2019	Reductions achieved between 2009 and 2019: TN lbs/year	TP lbs/year	TSS lbs/year	Target Year 2035 – Future Reductions: BMPs planned for installation from 2019 to 2035	Planned reductions from 2019 to 2035: TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						0.6		0.4		1
				Pervious Acres Treated						0.9				1
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.1									0.1
				Pervious Acres Treated	3.6									3.6
		Grass Swales	Cumulative	Impervious Acres Treated	33.9					2.9		1.8		36.8
				Pervious Acres Treated	59.4					4.3				63.7
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	3.4									3.4
				Pervious Acres Treated	9.5									9.5
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						1.1		0.6		1.1
				Pervious Acres Treated						1.7				1.7
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a					8.6		4.3		8.6
				Pervious Acres Treated	n/a					12.8				12.8
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	31.1	22.8		37.1						53.9
				Pervious Acres Treated	99.5	105.3								204.8
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		43.3		0.8						43.3
		Pipe Cleaning	Annual **	Dry tons removed		10.1		6.1						10.1
		Inlet Cleaning	Annual **	Dry tons removed		0.8		1.2		2.1		2.9		2.9
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious		0.2		0.0						0.2
		Urban Tree Planting	Cumulative	Acres planted on pervious		133.3		31.3		15.0		1.6		148.3
		Urban Stream Restoration	Cumulative	Linear feet restored						5,938.0		403.8		5,938.0
		Outfall Stabilization	Cumulative	Linear feet						807.0		71.0		807.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	76	0	TOTAL	0	486	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
	1,251	

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

Current Load

TN	TP	TSS
0	1,175	0

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

Load under full implementation

TN	TP	TSS
0	688	0

This represents the load from the watershed in the year that the plan is fully implemented

Legend: meets TMDL | Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	45.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
0	688	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Loch Raven Reservoir
County Name	Baltimore / Carroll / Harford
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	1995
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1995
Impervious Acres in Implementation Baseline Year	716
Pervious Acres in Implementation Baseline Year	835

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	15.0%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year	TBD			
					1995	Progress Reductions				Future Reductions				
							Reductions achieved between 1995 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 1995	BMPs installed from 1995 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to TBD	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		10.1		15.0						10.1
				Pervious Acres Treated		27.6								27.6
		Grass Swales	Cumulative	Impervious Acres Treated	24.3	1.0		1.1						25.3
				Pervious Acres Treated	33.5	3.0								36.5
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		0.4		0.5						0.4
				Pervious Acres Treated		0.8								0.8
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	4.7									4.7
				Pervious Acres Treated	11.9									11.9
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	1.8		2.5						1.8
				Pervious Acres Treated	n/a	3.1								3.1
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	2.9									2.9
				Pervious Acres Treated	0.4									0.4
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		9.1		0.1						9.1
		Pipe Cleaning	Annual **	Dry tons removed		9.7		5.8						9.7
		Inlet Cleaning	Annual **	Dry tons removed		10.8		15.1						10.8
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		76.2		13.8						76.2
		Urban Stream Restoration	Cumulative	Linear feet restored		568.0		38.6						
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	6.5									6.5
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	3.2									3.2
				Pervious Acres Treated	1.8									1.8
				REDUCTIONS:		TOTAL	0	93	0	TOTAL	0	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
TN	TP	TSS
	1,237	

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

Current Load		
TN	TP	TSS
0	1,144	0

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

Load under full implementation		
TN	TP	TSS
0	1,144	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
TN	TP	TSS
0.0%	15.0%	0.0%

From top of worksheet

Target Load		
TN	TP	TSS
0	1,051	0

This represents the load that must be achieved when the plan is fully implemented. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1995 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Lower Monocacy River
County Name	Carroll / Frederick / Montgomery
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2009
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2009
Impervious Acres in Implementation Baseline Year	1,336
Pervious Acres in Implementation Baseline Year	2,189

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	25.0%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year		2019		Target Year		2025		
					2009	Progress Reductions				Future Reductions				
							Reductions achieved between 2009 and 2019				Planned reductions from 2019 to 2025			
		BMP Name	Type	Unit	BMPs installed before 2009	BMPs installed from 2009 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2025	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						0.6		1.0		1
				Pervious Acres Treated						0.8				0.8
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	2.9	9.7		22.8						12.6
				Pervious Acres Treated	3.8	8.8								12.6
		Grass Swales	Cumulative	Impervious Acres Treated	64.4					2.8		4.9		67.2
				Pervious Acres Treated	120.1					4.1				124.2
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	6.3	5.2		15.5						11.5
				Pervious Acres Treated	30.2	8.7								38.9
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	10.0									10.0
				Pervious Acres Treated	28.1									28.1
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						1.1		1.5		1.1
				Pervious Acres Treated						1.7				1.7
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	1.0									1.0
				Pervious Acres Treated	3.8									3.8
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	14.4		32.9		8.3		11.5		22.7
				Pervious Acres Treated	n/a	48.8				12.4				61.2
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	112.9									112.9
				Pervious Acres Treated	911.4									911.4
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		31.8		0.7						31.8
		Pipe Cleaning	Annual **	Dry tons removed		4.9		2.9						4.9
		Inlet Cleaning	Annual **	Dry tons removed		0.3		0.4		4.2		5.9		4.5
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious		1.6		0.7						1.6
		Urban Tree Planting	Cumulative	Acres planted on pervious	6.9	131.5		58.0		38.8		15.2		170.3
		Urban Stream Restoration	Cumulative	Linear feet restored						13,341.2		907.2		13,341.2
		Outfall Stabilization	Cumulative	Linear feet						550.0		37.4		550.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	134	0	TOTAL	0	985	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
TN	TP	TSS
	4,474	

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

Current Load		
TN	TP	TSS
0	4,340	0

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

Load under full implementation		
TN	TP	TSS
0	3,356	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
TN	TP	TSS
0.0%	25.0%	0.0%

From top of worksheet

Target Load		
TN	TP	TSS
0	3,356	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

MDE

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

Watershed Name	Mattawoman Creek
County Name	Charles / Prince George's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2000
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2000
Impervious Acres in Implementation Baseline Year	481
Pervious Acres in Implementation Baseline Year	377

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	47.0%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Baseline Year 2000: BMPs installed before 2000	Progress Fiscal Year 2019 (Progress Reductions): BMPs installed from 2000 to 2019	Reductions achieved between 2000 and 2019: TN lbs/year	TP lbs/year	TSS lbs/year	Target Year TBD (Future Reductions): BMPs planned for installation from 2019 to TBD	Planned reductions from 2019 to TBD: TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	38.8									38.8
				Pervious Acres Treated	38.6									38.6
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.5	1.3		1.4						1.8
				Pervious Acres Treated	0.5	0.5								1.0
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	3.8									3.8
				Pervious Acres Treated	4.8									4.8
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	1.1		1.9						1.1
				Pervious Acres Treated	n/a	3.7								3.7
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	9.3	4.6		4.5						13.9
				Pervious Acres Treated	5.7	3.8								9.5
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		126.6		0.9						126.6
		Pipe Cleaning	Annual **	Dry tons removed		4.8		2.9						4.8
		Inlet Cleaning	Annual **	Dry tons removed		4.9		6.9						4.9
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		39.3		9.3						39.3
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	12.6									12.6
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	19.2									19.2
				Pervious Acres Treated	6.6									6.6
				REDUCTIONS:		TOTAL	0	28	0	TOTAL	0	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
	693	

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

Current Load

TN	TP	TSS
0	665	0

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

Load under full implementation

TN	TP	TSS
0	665	0

This represents the load from the watershed in the year that the plan is fully implemented

Legend: meets TMDL | Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	47.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
0	367	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2000 land use is unavailable; so baseline loads will be modeled using 20105 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

MDE

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

Watershed Name	Non-Tidal Back River
County Name	Baltimore
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	1995
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1995
Impervious Acres in Implementation Baseline Year	518
Pervious Acres in Implementation Baseline Year	661

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	15.0%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Scenario Name: Baseline Year 1995 — BMPs installed before 1995	Progress Fiscal Year 2019 — Progress Reductions — BMPs installed from 1995 to 2019	Reductions achieved between 1995 and 2019 — TN lbs/year	TP lbs/year	TSS lbs/year	Target Year TBD — Future Reductions — BMPs planned for installation from 2019 to TBD	Planned reductions from 2019 to TBD — TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	26.6									26.6
				Pervious Acres Treated	46.7									46.7
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	7.0									7.0
				Pervious Acres Treated	11.7									11.7
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	4.7		3.9						4.7
				Pervious Acres Treated	n/a	7.7								7.7
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	6.9	1.1		1.6						8.0
				Pervious Acres Treated	7.7	3.0								10.7
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		46.9		0.7						46.9
		Pipe Cleaning	Annual **	Dry tons removed		39.9		23.9						39.9
		Inlet Cleaning	Annual **	Dry tons removed		16.9		23.7						16.9
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		43.5		7.2						43.5
		Urban Stream Restoration	Cumulative	Linear feet restored		770.0		52.4						770.0
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	5.9									5.9
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	7.5									7.5
				Pervious Acres Treated	8.2									8.2
				REDUCTIONS:		TOTAL	0	113	0	TOTAL	0	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
TN	TP	TSS
	851	

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

Current Load		
TN	TP	TSS
0	738	0

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

Load under full implementation		
TN	TP	TSS
0	738	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
TN	TP	TSS
0.0%	15.0%	0.0%

From top of worksheet

Target Load		
TN	TP	TSS
0	723	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1995 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

MDE

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

Watershed Name	Prettyboy Reservoir
County Name	Baltimore / Carroll
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	1995
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1995
Impervious Acres in Implementation Baseline Year	75
Pervious Acres in Implementation Baseline Year	30

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	15.0%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

Practice Group	Category	BMP Name	Type	Unit	Baseline Year 1995: BMPs installed before 1995	Progress Fiscal Year 2019 (Progress Reductions): BMPs installed from 1995 to 2019	Reductions achieved between 1995 and 2019: TN lbs/year	TP lbs/year	TSS lbs/year	Target Year TBD (Future Reductions): BMPs planned for installation from 2019 to TBD	Planned reductions from 2019 to TBD: TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed		0.9		0.6						0.9
		Inlet Cleaning	Annual **	Dry tons removed		0.1		0.1						0.1
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	1.8									1.8
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	2.2									2.2
				Pervious Acres Treated	1.4									1.4
				REDUCTIONS:		TOTAL	0	1	0	TOTAL	0	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
	121	

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

Current Load

TN	TP	TSS
0	120	0

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

Load under full implementation

TN	TP	TSS
0	120	0

This represents the load from the watershed in the year that the plan is fully implemented

Legend: meets TMDL | Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	15.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
0	103	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1995 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

MDE

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

Watershed Name	Rock Creek
County Name	Montgomery
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2009
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2009
Impervious Acres in Implementation Baseline Year	730
Pervious Acres in Implementation Baseline Year	441

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	32.0%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Baseline Year 2009: BMPs installed before 2009	Progress Fiscal Year 2019 – Progress Reductions: BMPs installed from 2009 to 2019	Reductions achieved between 2009 and 2019: TN lbs/year	TP lbs/year	TSS lbs/year	Target Year 2023 – Future Reductions: BMPs planned for installation from 2019 to 2023	Planned reductions from 2019 to 2023: TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.9									0.9
				Pervious Acres Treated	2.2									2.2
		Grass Swales	Cumulative	Impervious Acres Treated	11.6									11.6
				Pervious Acres Treated	18.4									18.4
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	16.4									16.4
				Pervious Acres Treated	32.7									32.7
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	9.6									9.6
				Pervious Acres Treated	11.6									11.6
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	7.4		9.0						7.4
				Pervious Acres Treated	n/a	22.0								22.0
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	6.6									6.6
				Pervious Acres Treated	31.2									31.2
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		2.1		0.01						2.1
		Pipe Cleaning	Annual **	Dry tons removed		19.9		11.9						19.9
		Inlet Cleaning	Annual **	Dry tons removed		4.2		5.9						4.2
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		6.7		1.1						6.7
		Urban Stream Restoration	Cumulative	Linear feet restored		14,053.0		955.6						14,053.0
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	984	0	TOTAL	0	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
TN	TP	TSS
	1,106	

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

Current Load		
TN	TP	TSS
0	122	0

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

Load under full implementation		
TN	TP	TSS
0	122	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
TN	TP	TSS
0.0%	32.0%	0.0%

From top of worksheet

Target Load		
TN	TP	TSS
0	752	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Rocky Gorge Reservoir
County Name	Howard / Montgomery / Prince George's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2000
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2000
Impervious Acres in Implementation Baseline Year	184
Pervious Acres in Implementation Baseline Year	229

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	15.0%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year	TBD			
					2000	Progress Reductions				Future Reductions				
							Reductions achieved between 2000 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2000	BMPs installed from 2000 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to TBD	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	5.7									5.7
				Pervious Acres Treated	6.6									6.6
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	5.6									5.6
				Pervious Acres Treated	6.6									6.6
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	8.9									8.9
				Pervious Acres Treated	8.7									8.7
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	4.9									4.9
				Pervious Acres Treated	1.6									1.6
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		6.3		0.2						6.3
		Pipe Cleaning	Annual **	Dry tons removed		2.9		1.7						2.9
		Inlet Cleaning	Annual **	Dry tons removed		0.5		0.7						0.5
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		13.6		2.6						13.6
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	4.9									4.9
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	0.9									0.9
				Pervious Acres Treated	3.2									-
				REDUCTIONS:		TOTAL	0	5	0	TOTAL	0	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
TN	TP	TSS
	327	

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

Current Load		
TN	TP	TSS
0	321	0

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

Load under full implementation		
TN	TP	TSS
0	321	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
TN	TP	TSS
0.0%	15.0%	0.0%

From top of worksheet

Target Load		
TN	TP	TSS
0	278	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2000 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

MDE

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

Watershed Name	Triadelphia Reservoir (Brighton Dam)
County Name	Howard / Montgomoery
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2000
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2000
Impervious Acres in Implementation Baseline Year	171
Pervious Acres in Implementation Baseline Year	247

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	15.0%
Required reduction % for TSS	

Available on TMDL Data Center WLA Search

		BMP Name	Type	Unit	Baseline Year 2000: BMPs installed before 2000	Progress Fiscal Year 2019: BMPs installed from 2000 to 2019	Reductions achieved between 2000 and 2019: TN lbs/year	TP lbs/year	TSS lbs/year	Target Year TBD: BMPs planned for installation from 2019 to TBD	Planned reductions from 2019 to TBD: TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	12.5									12.5
				Pervious Acres Treated	23.3									23.3
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	1.4									1.4
				Pervious Acres Treated	0.3									0.3
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	2.2									2.2
				Pervious Acres Treated	0.1									0.1
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed		0.7		0.4						0.7
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		4.0		0.9						4.0
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	4.0									4.0
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	4.3									4.3
				Pervious Acres Treated	2.4									-
				REDUCTIONS:		TOTAL	0	1	0	TOTAL	0	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
	327	

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

Current Load

TN	TP	TSS
0	326	0

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

Load under full implementation

TN	TP	TSS
0	326	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	15.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
0	278	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2000 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

MDE

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

Watershed Name	Upper Monocacy River
County Name	Carroll / Frederick
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2009
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2009
Impervious Acres in Implementation Baseline Year	546
Pervious Acres in Implementation Baseline Year	624

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	3.0%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year			2019	Target Year			2025	
					2009	Progress Reductions				Future Reductions				
							Reductions achieved between 2009 and 2019				Planned reductions from 2019 to 2025			
		BMP Name	Type	Unit	BMPs installed before 2009	BMPs installed from 2009 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2025	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		16.9		46.4						16.9
				Pervious Acres Treated		30.7								30.7
		Grass Swales	Cumulative	Impervious Acres Treated	67.1									67.1
				Pervious Acres Treated	114.4									114.4
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	2.6	5.5		16.2						8.1
				Pervious Acres Treated	2.2	12.7								14.9
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	0.1									0.1
				Pervious Acres Treated	0.3									0.3
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	3.7		10.7						3.7
				Pervious Acres Treated	n/a	11.9								11.9
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	0.9									0.9
				Pervious Acres Treated	5.9									5.9
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		22.3		0.5						22.3
		Pipe Cleaning	Annual **	Dry tons removed		2.8		1.7						2.8
		Inlet Cleaning	Annual **	Dry tons removed		0.1		0.1						0.1
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious		0.7		0.3						0.7
		Urban Tree Planting	Cumulative	Acres planted on pervious	0.2	51.7		23.9						51.7
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	100	0	TOTAL	0		0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
	1,808	

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

Current Load

TN	TP	TSS
0	1,708	0

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

Load under full implementation

TN	TP	TSS
0	1,708	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	3.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
0	1,754	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

MDE

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

Watershed Name	Anacostia River - Nontidal
County Name	Montgomery
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	1997
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1997
Impervious Acres in Implementation Baseline Year	1,098
Pervious Acres in Implementation Baseline Year	868

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	81.0%
Required reduction % for TP	
Required reduction % for TSS	

Available on TMDL Data Center WLA Search

				Scenario Name: Baseline Year 1997	Progress Fiscal Year 2019 — Progress Reductions				Target Year TBD — Future Reductions				
						Reductions achieved between 1997 and 2019				Planned reductions from 2019 to TBD			
Category	BMP Name	Type	Unit	BMPs installed before 1997	BMPs installed from 1997 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to TBD	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices — Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
			Pervious Acres Treated										-
	Rain Gardens	Cumulative	Impervious Acres Treated										-
			Pervious Acres Treated										-
	Bioswales	Cumulative	Impervious Acres Treated		0.7	5.9							0.7
			Pervious Acres Treated		0.8								0.8
	Grass Swales	Cumulative	Impervious Acres Treated	75.4									75.4
			Pervious Acres Treated	93.5									93.5
	Permeable Pavement	Cumulative	Impervious Acres Treated										-
			Pervious Acres Treated										-
	Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		1.4	10.1							1.4
			Pervious Acres Treated		1.1								1.1
	Urban Infiltration Practices	Cumulative	Impervious Acres Treated	16.1									16.1
			Pervious Acres Treated	20.7									20.7
Runoff Reduction Practices — Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
			Pervious Acres Treated										-
	Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	2.3									2.3
			Pervious Acres Treated	0.2									0.2
	Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	22.5	325.2							22.5
			Pervious Acres Treated	n/a	51.5								51.5
	Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
			Pervious Acres Treated		n/a				n/a				
	Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
			Pervious Acres Treated		n/a				n/a				
	Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	61.1									61.1
			Pervious Acres Treated	36.6									36.6
Alternative Practices — MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		12.7	0.3							12.7
	Pipe Cleaning	Annual **	Dry tons removed		23.1	62.4							23.1
	Inlet Cleaning	Annual **	Dry tons removed		11.2	39.3							11.2
	Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
	Urban Tree Planting	Cumulative	Acres planted on pervious		61.9	285.3							61.9
	Urban Stream Restoration	Cumulative	Linear feet restored		33,289.0	2,496.7							33,289.0
	Outfall Stabilization	Cumulative	Linear feet										-
	Impervious Disconnects	Cumulative	Credit Acres	13.1									13.1
	Cross-Jurisdictional	Cumulative	Impervious Acres Treated	15.9									15.9
			Pervious Acres Treated	10.7									10.7
			REDUCTIONS:		TOTAL	3,225	0	0	TOTAL	0	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
26,707		

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

Current Load

TN	TP	TSS
23,482	0	0

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

Load under full implementation

TN	TP	TSS
23,482	0	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
81.0%	0.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
5,074	0	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1997 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

MDE

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

Watershed Name	Anacostia River - Tidal
County Name	Montgomery / Prince George's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	1997
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1997
Impervious Acres in Implementation Baseline Year	437
Pervious Acres in Implementation Baseline Year	419

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	81.0%
Required reduction % for TP	
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year	TBD			
					1997	Progress Reductions				Future Reductions				
							Reductions achieved between 1997 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 1997	BMPs installed from 1997 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to TBD	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	0.4									0.4
				Pervious Acres Treated	0.3									0.3
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.2									0.2
				Pervious Acres Treated	0.1									0.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.7									0.7
				Pervious Acres Treated	0.1									0.1
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed		0.4	1.0							0.4
		Inlet Cleaning	Annual **	Dry tons removed		0.1	0.4							0.1
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	1.2									1.2
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	1	0	0	TOTAL	0	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
6,062		

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

Current Load

TN	TP	TSS
6,060	0	0

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

Load under full implementation

TN	TP	TSS
6,060	0	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
81.0%	0.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
1,152	0	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1997 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

MDE

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

Watershed Name	Mattawoman Creek
County Name	Charles / Prince George's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2000
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2000
Impervious Acres in Implementation Baseline Year	481
Pervious Acres in Implementation Baseline Year	377

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	54.0%
Required reduction % for TP	
Required reduction % for TSS	

Available on TMDL Data Center WLA Search

		BMP Name	Type	Unit	Scenario Name: Baseline Year 2000 — BMPs installed before 2000	Progress Fiscal Year 2019 — Progress Reductions — BMPs installed from 2000 to 2019	Reductions achieved between 2000 and 2019 — TN lbs/year	TP lbs/year	TSS lbs/year	Target Year TBD — Future Reductions — BMPs planned for installation from 2019 to TBD	Planned reductions from 2019 to TBD — TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	38.8									38.8
				Pervious Acres Treated	38.6									38.6
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.5	1.3	7.5							1.8
				Pervious Acres Treated	0.5	0.5								1.0
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	3.8									3.8
				Pervious Acres Treated	4.8									4.8
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	1.1	18.5							1.1
				Pervious Acres Treated	n/a	3.7								3.7
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	9.3	4.6	21.4							13.9
				Pervious Acres Treated	5.7	3.8								9.5
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		126.6	5.2							126.6
		Pipe Cleaning	Annual **	Dry tons removed		4.8	13.0							4.8
		Inlet Cleaning	Annual **	Dry tons removed		4.9	17.3							4.9
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		39.3	147.0							39.3
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	12.6									12.6
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	19.2									19.2
				Pervious Acres Treated	6.6									6.6
				REDUCTIONS:		TOTAL	230	0	0	TOTAL	0	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
5,317		

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

Current Load

TN	TP	TSS
5,087	0	0

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

Load under full implementation

TN	TP	TSS
5,087	0	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
54.0%	0.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
2,446	0	0

This represents the load that must be achieved when the plan is fully implemented. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2000 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Non-Tidal Back River
County Name	Baltimore
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	1995
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1995
Impervious Acres in Implementation Baseline Year	518
Pervious Acres in Implementation Baseline Year	661

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	15.0%
Required reduction % for TP	
Required reduction % for TSS	

Available on TMDL Data Center WLA Search

				Scenario Name:	Baseline Year	Progress Fiscal Year 2019				Target Year TBD				
					1995	Progress Reductions				Future Reductions				
							Reductions achieved between 1995 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 1995	BMPs installed from 1995 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to TBD	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	26.6									26.6
				Pervious Acres Treated	46.7									46.7
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	7.0									7.0
				Pervious Acres Treated	11.7									11.7
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	4.7	27.5							4.7
				Pervious Acres Treated	n/a	7.7								7.7
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	6.9	1.1	18.6							8.0
				Pervious Acres Treated	7.7	3.0								10.7
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		46.9	6.3							46.9
		Pipe Cleaning	Annual **	Dry tons removed		39.9	107.8							39.9
		Inlet Cleaning	Annual **	Dry tons removed		16.9	59.2							16.9
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		43.5	183.4							43.5
		Urban Stream Restoration	Cumulative	Linear feet restored		770.0	57.8							770.0
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	5.9									5.9
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	7.5									7.5
				Pervious Acres Treated	8.2									8.2
				REDUCTIONS:		TOTAL	461	0	0	TOTAL	0	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
8,707		

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

Current Load

TN	TP	TSS
8,247	0	0

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

Load under full implementation

TN	TP	TSS
8,247	0	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
15.0%	0.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
7,401	0	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1995 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Anacostia River - Nontidal
County Name	Montgomery
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	1997
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1997
Impervious Acres in Implementation Baseline Year	1,098
Pervious Acres in Implementation Baseline Year	868

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	85.0%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year	TBD			
					1997	Progress Reductions				Future Reductions				
							Reductions achieved between 1997 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 1997	BMPs installed from 1997 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to TBD	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		0.7			225.3					0.7
				Pervious Acres Treated		0.8								0.8
		Grass Swales	Cumulative	Impervious Acres Treated	75.4									75.4
				Pervious Acres Treated	93.5									93.5
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		1.4			455.5					1.4
				Pervious Acres Treated		1.1								1.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	16.1									16.1
				Pervious Acres Treated	20.7									20.7
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	2.3									2.3
				Pervious Acres Treated	0.2									0.2
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	22.5			9,392.2					22.5
				Pervious Acres Treated	n/a	51.5								51.5
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	61.1									61.1
				Pervious Acres Treated	36.6									36.6
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		12.7			39.1					12.7
		Pipe Cleaning	Annual **	Dry tons removed		23.1			6,929.0					23.1
		Inlet Cleaning	Annual **	Dry tons removed		11.2			4,718.7					11.2
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		61.9			2,627.1					61.9
		Urban Stream Restoration	Cumulative	Linear feet restored		33,289.0			1,268,235					33,289.0
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	13.1									13.1
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	15.9									15.9
				Pervious Acres Treated	10.7									10.7
				REDUCTIONS:		TOTAL	0	0	1,292,622	TOTAL	0	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
TN	TP	TSS
		544,402

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

Current Load		
TN	TP	TSS
0	0	-748,220

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

Load under full implementation		
TN	TP	TSS
0	0	-748,220

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
TN	TP	TSS
0.0%	0.0%	85.0%

From top of worksheet

Target Load		
TN	TP	TSS
0	0	81,660

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1997 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Anacostia River - Tidal
County Name	Montgomery / Prince George's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	1997
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1997
Impervious Acres in Implementation Baseline Year	437
Pervious Acres in Implementation Baseline Year	419

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	85.0%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year 2019				Target Year TBD				
					1997	Progress Reductions				Future Reductions				
							Reductions achieved between 1997 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 1997	BMPs installed from 1997 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to TBD	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	0.4									0.4
				Pervious Acres Treated	0.3									0.3
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.2									0.2
				Pervious Acres Treated	0.1									0.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.7									0.7
				Pervious Acres Treated	0.1									0.1
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed		0.4			115.8					0.4
		Inlet Cleaning	Annual **	Dry tons removed		0.1			44.1					0.1
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	1.2									1.2
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	160	TOTAL	0	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
TN	TP	TSS
		185,294

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

Current Load		
TN	TP	TSS
0	0	185,134

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

Load under full implementation		
TN	TP	TSS
0	0	185,134

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
TN	TP	TSS
0.0%	0.0%	85.0%
From top of worksheet		

Target Load		
TN	TP	TSS
0	0	27,794

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1997 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Antietam Creek
County Name	Washington
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2000
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2000
Impervious Acres in Implementation Baseline Year	711
Pervious Acres in Implementation Baseline Year	1,253

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	58.1%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year				Target Year				
					2000	2019	Progress Reductions			2045	Future Reductions			
							Reductions achieved between 2000 and 2019				Planned reductions from 2019 to 2045			
		BMP Name	Type	Unit	BMPs installed before 2000	BMPs installed from 2000 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2045	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						3.2			1,596.9	3
				Pervious Acres Treated						4.9				5
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		7.0			14,169.9					7.0
				Pervious Acres Treated		15.7								15.7
		Grass Swales	Cumulative	Impervious Acres Treated	16.3					16.2			7,984.3	32.5
				Pervious Acres Treated	34.3					24.3				58.6
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		11.5			27,685.8					11.5
				Pervious Acres Treated		34.4								34.4
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						6.5			3,011.2	6.5
				Pervious Acres Treated						9.7				9.7
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	8.9			18,270.9	48.6			22,584.1	57.5
				Pervious Acres Treated	n/a	19.9				72.9				92.8
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	1.8	3.0			3,951.0					4.8
				Pervious Acres Treated	0.9	4.2								5.1
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		67.2			5,278.1					67.2
		Pipe Cleaning	Annual **	Dry tons removed		5.3			1,592.5					5.3
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		101.3			22,198.0	85.3			5,450.2	186.6
		Urban Stream Restoration	Cumulative	Linear feet restored						16,200.0			729,000.0	16,200.0
		Outfall Stabilization	Cumulative	Linear feet						3,240.0			145,800.0	3,240.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	93,146	TOTAL	0	0	915,427	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
		1,734,045

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

Current Load

TN	TP	TSS
0	0	1,640,899

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

Load under full implementation

TN	TP	TSS
0	0	725,472

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	0.0%	58.1%

From top of worksheet

Target Load

TN	TP	TSS
0	0	726,565

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2000 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Bynum Run
County Name	Harford
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2005
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2005
Impervious Acres in Implementation Baseline Year	157
Pervious Acres in Implementation Baseline Year	232

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	19.3%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year	2030			
					2005	Progress Reductions				Future Reductions				
							Reductions achieved between 2005 and 2019				Planned reductions from 2019 to 2030			
		BMP Name	Type	Unit	BMPs installed before 2005	BMPs installed from 2005 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2030	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						0.0			11.1	-
				Pervious Acre Treated						0.1				0
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	3.4					0.2			55.7	3.6
				Pervious Acre Treated	4.3					0.3				4.6
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	1.5									1.5
				Pervious Acre Treated	6.6									6.6
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	5.6									5.6
				Pervious Acre Treated	37.0									37.0
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						0.1			21.0	0.1
				Pervious Acre Treated						0.1				0.1
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	6.2			1,463.7	0.5			157.6	6.7
				Pervious Acre Treated	n/a	5.4				0.8				6.2
		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	17.8									17.8
				Pervious Acre Treated	47.5									47.5
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed		10.9			3,283.8					10.9
		Inlet Cleaning	Annual **	Dry tons removed		2.5			1,058.4	15.8			6,615.0	18.3
		Impervious Urban Surface Elimination	Cumulative	Impervious acre converted to pervious										-
		Urban Tree Planting	Cumulative	Acre planted on pervious		25.8			1,625.6	18.6			586.7	44.4
		Urban Stream Restoration	Cumulative	Linear feet restored						175.0			7,875.0	175.0
		Outfall Stabilization	Cumulative	Linear feet						35.0			1,575.0	35.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										35.0
				Pervious Acre Treated										-
				REDUCTIONS:		TOTAL	0	0	7,432	TOTAL	0	0	16,897	

* 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
		125,987

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

Current Load		
TN	TP	TSS
0	0	118,556

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

Load under full implementation		
TN	TP	TSS
0	0	101,658

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%	19.3%

From top of worksheet

Target Load		
TN	TP	TSS
0	0	101,672

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

MDE

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

Watershed Name	Cabin John Creek
County Name	Montgomery
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2005
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2005
Impervious Acres in Implementation Baseline Year	409
Pervious Acres in Implementation Baseline Year	398

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	22.9%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year			2019	Target Year			2045	
					2005	Progress Reductions				Future Reductions				
							Reductions achieved between 2005 and 2019				Planned reductions from 2019 to 2045			
		BMP Name	Type	Unit	BMPs installed before 2005	BMPs installed from 2005 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2045	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						0.1			119.7	0
				Pervious Acres Treated						0.2				0
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	5.7					0.6			598.7	6.3
				Pervious Acres Treated	6.1					0.9				7.0
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	5.6									5.6
				Pervious Acres Treated	8.9									8.9
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						0.2			225.8	0.2
				Pervious Acres Treated						0.4				0.4
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.1									0.1
				Pervious Acres Treated	1.2									1.2
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	3.3			7,988.3	1.8			1,693.4	5.1
				Pervious Acres Treated	n/a	10.9				2.7				13.6
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	18.6									18.6
				Pervious Acres Treated	150.8									150.8
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		1.9			13.8					1.9
		Pipe Cleaning	Annual **	Dry tons removed		5.7			1,704.6					5.7
		Inlet Cleaning	Annual **	Dry tons removed		8.3			3,483.9	28.9			12,127.5	37.2
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		3.5			715.5	3.2			319.8	6.7
		Urban Stream Restoration	Cumulative	Linear feet restored						530.0			23,850.0	530.0
		Outfall Stabilization	Cumulative	Linear feet		940.0			84,600.0	1,118.0			95,220.0	2,058.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	98,506	TOTAL	0	0	134,155	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
TN	TP	TSS
		1,012,693

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

Current Load		
TN	TP	TSS
0	0	914,187

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

Load under full implementation		
TN	TP	TSS
0	0	780,032

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%	22.9%

From top of worksheet

Target Load		
TN	TP	TSS
0	0	780,786

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Catoctin Creek
County Name	Frederick
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2000
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2000
Impervious Acres in Implementation Baseline Year	397
Pervious Acres in Implementation Baseline Year	850

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	49.1%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Scenario Name: Baseline Year 2000 — BMPs installed before 2000	Progress Fiscal Year 2019 — Progress Reductions — BMPs installed from 2000 to 2019	Reductions achieved between 2000 and 2019 — TN lbs/year	TP lbs/year	TSS lbs/year	Target Year 2035 — Future Reductions — BMPs planned for installation from 2019 to 2035	Planned reductions from 2019 to 2035 — TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						1.0			1,019.3	1
				Pervious Acre Treated						1.5				2
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	11.7					5.1			5,096.5	16.8
				Pervious Acre Treated	43.2					7.7				50.9
		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						2.0			1,922.1	2.0
				Pervious Acre Treated						3.1				3.1
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a					15.3			14,415.7	15.3
				Pervious Acre Treated	n/a					23.0				23.0
		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		0.03			2.0					0.03
		Pipe Cleaning	Annual **	Dry tons removed		0.9			270.4					0.9
		Inlet Cleaning	Annual **	Dry tons removed		0.1			44.1					0.1
		Impervious Urban Surface Elimination	Cumulative	Impervious acre converted to pervious		0.2			42.8					0.2
		Urban Tree Planting	Cumulative	Acre planted on pervious		78.6			17,092.4	55.3			7,075.9	133.9
		Urban Stream Restoration	Cumulative	Linear feet restored		719.0			32,355.0	10,425.0			469,125.0	11,144.0
		Outfall Stabilization	Cumulative	Linear feet						1,020.0			45,900.0	1,020.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
				REDUCTIONS:		TOTAL	0	0	49,807	TOTAL	0	0	544,555	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
		1,210,465

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

Current Load

TN	TP	TSS
0	0	1,160,658

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

Load under full implementation

TN	TP	TSS
0	0	616,104

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%	49.1%

From top of worksheet

Target Load

TN	TP	TSS
0	0	616,127

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2000 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Conococheague Creek
County Name	Washington
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2000
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2000
Impervious Acres in Implementation Baseline Year	438
Pervious Acres in Implementation Baseline Year	925

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	45.3%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year			2019	Target Year			2045	
					2000	Progress Reductions				Future Reductions				
							Reductions achieved between 2000 and 2019				Planned reductions from 2019 to 2045			
		BMP Name	Type	Unit	BMPs installed before 2000	BMPs installed from 2000 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2045	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						1.6			2,062.1	2
				Pervious Acres Treated						2.4				2
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		6.3			12185.3					6.3
				Pervious Acres Treated		9.4								9.4
		Grass Swales	Cumulative	Impervious Acres Treated	23.4					7.9			10,310.6	31.3
				Pervious Acres Treated	55.7					11.9				67.6
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	1.0									1.0
				Pervious Acres Treated	2.3									2.3
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						3.2			3,888.6	3.2
				Pervious Acres Treated						4.7				4.7
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	3.0			8,269.6	23.7			29,164.3	26.7
				Pervious Acres Treated	n/a	9.6				35.6				45.2
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	5.3	2.1			4,988.0					7.4
				Pervious Acres Treated	14.0	4.5								18.5
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		7.7			607.9					7.7
		Pipe Cleaning	Annual **	Dry tons removed		1.7			509.4					1.7
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		57.5			13,147.9	41.6			7,038.5	99.1
		Urban Stream Restoration	Cumulative	Linear feet restored						7,900.0			355,500.0	7,900.0
		Outfall Stabilization	Cumulative	Linear feet						1,580.0			71,100.0	1,580.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	39,708	TOTAL	0	0	479,064	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
TN	TP	TSS
		1,152,566
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
TN	TP	TSS
0	0	1,112,858
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
TN	TP	TSS
0	0	633,794
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%	45.3%
From top of worksheet		

Target Load		
TN	TP	TSS
0	0	630,454
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2000 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

MDE

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

Watershed Name	Double Pipe Creek
County Name	Carroll / Frederick
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2000
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2000
Impervious Acres in Implementation Baseline Year	407
Pervious Acres in Implementation Baseline Year	655

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	46.8%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year	2030			
					2000	Progress Reductions				Future Reductions				
							Reductions achieved between 2000 and 2019				Planned reductions from 2019 to 2030			
		BMP Name	Type	Unit	BMPs installed before 2000	BMPs installed from 2000 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2030	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						1.6			2,598.4	2
				Pervious Acres Treated						2.4				2
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	5.7					8.1			12,992.2	13.8
				Pervious Acres Treated	12.3					12.1				24.4
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	0.2									0.2
				Pervious Acres Treated	1.4									1.4
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						3.2			4,899.9	3.2
				Pervious Acres Treated						4.8				4.8
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a					24.2			36,749.4	24.2
				Pervious Acres Treated	n/a					36.2				36.2
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		8.4			348.8					8.4
		Pipe Cleaning	Annual **	Dry tons removed		3.6			1,079.4					3.6
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious		0.1			19.2					0.1
		Urban Tree Planting	Cumulative	Acres planted on pervious		69.1			11,937.4	42.4			7,038.5	111.5
		Urban Stream Restoration	Cumulative	Linear feet restored						6,776.4			304,936.7	6,776.4
		Outfall Stabilization	Cumulative	Linear feet						1,610.0			72,450.0	1,610.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	13,385	TOTAL	0	0	441,665	

* 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
		972,329

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

Current Load

TN	TP	TSS
0	0	958,944

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

Load under full implementation

TN	TP	TSS
0	0	517,279

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%	46.8%

From top of worksheet

Target Load

TN	TP	TSS
0	0	517,279

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2000 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

MDE

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

Watershed Name	Gwynns Falls
County Name	Baltimore
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2005
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2005
Impervious Acres in Implementation Baseline Year	565
Pervious Acres in Implementation Baseline Year	853

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	36.4%

Available on TMDL Data Center WLA Search

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year	2050			
					2005	Progress Reductions				Future Reductions				
							Reductions achieved between 2005 and 2019				Planned reductions from 2019 to 2050			
		BMP Name	Type	Unit	BMPs installed before 2005	BMPs installed from 2005 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2050	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						1.6			937.0	2
				Pervious Acres Treated						2.4				2
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	14.6					8.0			4,685.0	22.6
				Pervious Acres Treated	43.3					12.0				55.3
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	0.5									0.5
				Pervious Acres Treated	0.1									0.1
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						3.2			1,766.9	3.2
				Pervious Acres Treated						4.8				4.8
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.6									0.6
				Pervious Acres Treated	3.0									3.0
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a					24.0			13,251.9	24.0
				Pervious Acres Treated	n/a					36.0				36.0
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	1.8									1.8
				Pervious Acres Treated	2.6									2.6
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		30.2			863.9					30.2
		Pipe Cleaning	Annual **	Dry tons removed		21.3			6,400.0					21.3
		Inlet Cleaning	Annual **	Dry tons removed		10.9			4,586.4	34.7			14,553.0	45.6
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		65.1			10,396.2	159.9			8,644.4	225.0
		Urban Stream Restoration	Cumulative	Linear feet restored						8,000.0			360,000.0	8,000.0
		Outfall Stabilization	Cumulative	Linear feet						1,600.0			72,000.0	1,600.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	22,246	TOTAL	0	0	475,838	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
		1,368,169

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

Current Load

TN	TP	TSS
0	0	1,345,923

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

Load under full implementation

TN	TP	TSS
0	0	870,084

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%	36.4%

From top of worksheet

Target Load

TN	TP	TSS
0	0	870,155

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

MDE

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

Watershed Name	Jones Falls
County Name	Baltimore
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2005
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2005
Impervious Acres in Implementation Baseline Year	435
Pervious Acres in Implementation Baseline Year	397

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	21.7%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year	2025			
					2005	Progress Reductions				Future Reductions				
							Reductions achieved between 2005 and 2019				Planned reductions from 2019 to 2025			
		BMP Name	Type	Unit	BMPs installed before 2005	BMPs installed from 2005 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2025	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						0.1			12.3	0
				Pervious Acres Treated						0.1				0
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	10.5					0.3			61.3	10.8
				Pervious Acres Treated	11.4					0.5				11.9
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	3.8									3.8
				Pervious Acres Treated	24.5									24.5
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	7.7									7.7
				Pervious Acres Treated	4.4									4.4
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						0.1			23.1	0.1
				Pervious Acres Treated						0.2				0
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a					0.9			173.3	1
				Pervious Acres Treated	n/a					1.4				1
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	25.4									25.4
				Pervious Acres Treated	18.6									18.6
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		33.2			859.2					33.2
		Pipe Cleaning	Annual **	Dry tons removed		7.0			2,092.1					7.0
		Inlet Cleaning	Annual **	Dry tons removed		12.1			5,071.5	23.6			9,922.5	35.7
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		19.7			1,486.6	105.6			1,989.8	125.3
		Urban Stream Restoration	Cumulative	Linear feet restored		1,264.0			56,880.0	300.0			13,500.0	1,564.0
		Outfall Stabilization	Cumulative	Linear feet						60.0			2,700.0	60.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	66,389	TOTAL	0	0	28,382	

* 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
		436,719
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
TN	TP	TSS
0	0	370,330
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
TN	TP	TSS
0	0	341,947
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%	21.7%
From top of worksheet		

Target Load		
TN	TP	TSS
0	0	341,951
This represents the load that must be achieved when the plan is fully implemented. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Liberty Reservoir
County Name	Baltimore
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2009
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2009
Impervious Acres in Implementation Baseline Year	622
Pervious Acres in Implementation Baseline Year	1,284

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	45.0%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Baseline Year 2009: BMPs installed before 2009	Progress Fiscal Year 2019 (Progress Reductions): BMPs installed from 2009 to 2019	Reductions achieved between 2009 and 2019: TN lbs/year	TP lbs/year	TSS lbs/year	Target Year 2035 (Future Reductions): BMPs planned for installation from 2019 to 2035	Planned reductions from 2019 to 2035: TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						0.6			384.8	1
				Pervious Acres Treated						0.9				1
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.1									0.1
				Pervious Acres Treated	3.6									3.6
		Grass Swales	Cumulative	Impervious Acres Treated	33.9					2.9			1,924.1	36.8
				Pervious Acres Treated	59.4					4.3				63.7
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	3.4									3.4
				Pervious Acres Treated	9.5									9.5
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						1.1			725.7	1.1
				Pervious Acres Treated						1.7				1.7
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a					8.6			5,442.6	8.6
				Pervious Acres Treated	n/a					12.8				12.8
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	31.1	22.8			39,994.9					53.9
				Pervious Acres Treated	99.5	105.3								204.8
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		43.3			1,796.3					43.3
		Pipe Cleaning	Annual **	Dry tons removed		10.1			3,033.9					10.1
		Inlet Cleaning	Annual **	Dry tons removed		0.8			352.8	2.1			882.0	2.9
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious		0.2			30.5					0.2
		Urban Tree Planting	Cumulative	Acres planted on pervious		133.3			17,264.7	109.3			7,164.0	242.6
		Urban Stream Restoration	Cumulative	Linear feet restored						8,464.0			380,880.0	8,464.0
		Outfall Stabilization	Cumulative	Linear feet						807.0			46,980.0	807.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	62,473	TOTAL	0	0	444,383	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
TN	TP	TSS
		1,126,330
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
TN	TP	TSS
0	0	1,063,857
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
TN	TP	TSS
0	0	619,474
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%	45.0%
From top of worksheet		

Target Load		
TN	TP	TSS
0	0	619,482
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Little Patuxent River
County Name	Anne Arundel / Howard
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2005
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2005
Impervious Acres in Implementation Baseline Year	969
Pervious Acres in Implementation Baseline Year	1,745

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	36.1%

Available on TMDL Data Center WLA Search

		BMP Name	Type	Unit	Scenario Name: Baseline Year 2005 — BMPs installed before 2005	Progress Fiscal Year 2019 — Progress Reductions — BMPs installed from 2005 to 2019	Reductions achieved between 2005 and 2019 — TN lbs/year	TP lbs/year	TSS lbs/year	Target Year 2025 — Future Reductions — BMPs planned for installation from 2019 to 2025	Planned reductions from 2019 to 2025 — TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	2.1	15.0			28,747.9					17.1
				Pervious Acres Treated	3.6	27.1								30.7
		Grass Swales	Cumulative	Impervious Acres Treated	97.2					0.9			1,900.1	98.1
				Pervious Acres Treated	174.4					0.5				174.9
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		0.5			1,061.6					0.5
				Pervious Acres Treated		0.6								0.6
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	54.1									54.1
				Pervious Acres Treated	191.2									191.2
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	12.3									12.3
				Pervious Acres Treated	18.3									18.3
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a					16.1			15,129.0	16.1
				Pervious Acres Treated	n/a					23.0				23.0
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	93.0									93.0
				Pervious Acres Treated	440.5									440.5
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		52.6			3,121.5					52.6
		Pipe Cleaning	Annual **	Dry tons removed		7.3			2,178.8					7.3
		Inlet Cleaning	Annual **	Dry tons removed		0.6			264.6					0.6
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious		0.2			11.3					0.2
		Urban Tree Planting	Cumulative	Acres planted on pervious		93.2			13,009.0					93.2
		Urban Stream Restoration	Cumulative	Linear feet restored		7,517.0			338,265.0					7,517.0
		Outfall Stabilization	Cumulative	Linear feet						7,301.0			328,545.0	7,301.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	386,660	TOTAL	0	0	345,574	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
		1,454,208

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

Current Load

TN	TP	TSS
0	0	1,067,548

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

Load under full implementation

TN	TP	TSS
0	0	721,974

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%	36.1%

From top of worksheet

Target Load

TN	TP	TSS
0	0	929,239

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Lower Gunpowder Falls
County Name	Baltimore
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2009
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2009
Impervious Acres in Implementation Baseline Year	127
Pervious Acres in Implementation Baseline Year	95

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	67.0%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Baseline Year 2009: BMPs installed before 2009	Progress Fiscal Year 2019 (Progress Reductions): BMPs installed from 2009 to 2019	Reductions achieved between 2009 and 2019: TN lbs/year	TP lbs/year	TSS lbs/year	Target Year 2030 (Future Reductions): BMPs planned for installation from 2019 to 2030	Planned reductions from 2019 to 2030: TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.4									0.4
				Pervious Acres Treated	1.3									1.3
		Grass Swales	Cumulative	Impervious Acres Treated	1.2	1.2			1,256.1					2.4
				Pervious Acres Treated	1.7	0.9								2.6
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		7.1			11,842.6					7.1
				Pervious Acres Treated		7.8								7.8
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	6.0									6.0
				Pervious Acres Treated	17.9									17.9
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	1.5									1.5
				Pervious Acres Treated	7.0									7.0
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		4.9			149.6					4.9
		Pipe Cleaning	Annual **	Dry tons removed		8.7			2,612.6					8.7
		Inlet Cleaning	Annual **	Dry tons removed		1.4			573.3					1.4
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		56.2			8,519.1					56.2
		Urban Stream Restoration	Cumulative	Linear feet restored						9,313.0			419,085.0	9,313.0
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	24,953	TOTAL	0	0	419,085	

* 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
		254,358
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
TN	TP	TSS
0	0	229,405
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
TN	TP	TSS
0	0	-189,680
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%	67.0%
From top of worksheet		

Target Load		
TN	TP	TSS
0	0	83,938
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Lower Monocacy River - Subsegment
County Name	Frederick / Montgomery
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2000
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2000
Impervious Acres in Implementation Baseline Year	833
Pervious Acres in Implementation Baseline Year	1,524

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	60.8%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year			2019	Target Year			2045	
					2000	Progress Reductions				Future Reductions				
							Reductions achieved between 2000 and 2019				Planned reductions from 2019 to 2045			
		BMP Name	Type	Unit	BMPs installed before 2000	BMPs installed from 2000 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2045	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						0.6			454.4	1
				Pervious Acres Treated						0.8				1
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.5	9.7			14,561.5					10.2
				Pervious Acres Treated	0.4	8.8								9.2
		Grass Swales	Cumulative	Impervious Acres Treated	61.7					2.8			2,271.8	64.5
				Pervious Acres Treated	114.8					4.1				118.9
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	6.3	5.2			6,617.8					11.5
				Pervious Acres Treated	30.2	8.7								38.9
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	9.1									9.1
				Pervious Acres Treated	25.2									25.2
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						1.1			856.8	1.1
				Pervious Acres Treated						1.7				1.7
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	14.4			17,879.1	8.3			6,425.8	22.7
				Pervious Acres Treated	n/a	48.8				12.4				61.2
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	60.9									60.9
				Pervious Acres Treated	542.5									542.5
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		29.4			1,044.8					29.4
		Pipe Cleaning	Annual **	Dry tons removed		4.3			1,280.5					4.3
		Inlet Cleaning	Annual **	Dry tons removed		0.3			132.3	4.2			1,764.0	4.5
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious		1.6			298.0					1.6
		Urban Tree Planting	Cumulative	Acres planted on pervious		136.2			16,349.3	38.8			4,565.4	175.0
		Urban Stream Restoration	Cumulative	Linear feet restored						20,063.3			902,848.5	20,063.3
		Outfall Stabilization	Cumulative	Linear feet						550.0			24,750.0	550.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	58,163	TOTAL	0	0	943,937	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
		1,648,092

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

Current Load

TN	TP	TSS
0	0	1,589,929

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

Load under full implementation

TN	TP	TSS
0	0	645,992

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%	60.8%

From top of worksheet

Target Load

TN	TP	TSS
0	0	646,052

This represents the load that must be achieved when the plan is fully implemented. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Modeling was completed at the Lower Monocacy River subsegmentshed for the TSS local TMDL.
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2000 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Non-Tidal Back River
County Name	Baltimore
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2009
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2009
Impervious Acres in Implementation Baseline Year	519
Pervious Acres in Implementation Baseline Year	659

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	75.0%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year			2019	Target Year			2045	
					2009	Progress Reductions				Future Reductions				
							Reductions achieved between 2009 and 2019				Planned reductions from 2019 to 2045			
		BMP Name	Type	Unit	BMPs installed before 2009	BMPs installed from 2009 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2045	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						1.8			408.9	2
				Pervious Acres Treated						2.7				3
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	28.0					9.1			2,044.6	37.1
				Pervious Acres Treated	50.8					13.6				64.4
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	7.0									7.0
				Pervious Acres Treated	14.8									14.8
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						3.6			771.1	3.6
				Pervious Acres Treated						5.4				5.4
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	1.9									1.9
				Pervious Acres Treated	13.2									13.2
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	4.7			1,386.7	27.2			5,783.4	31.9
				Pervious Acres Treated	n/a	7.7				40.7				48.4
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	12.6	1.1			484.5					13.7
				Pervious Acres Treated	178.9	3.0								181.9
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		46.9			1,474.6					46.9
		Pipe Cleaning	Annual **	Dry tons removed		39.9			11,973.3					39.9
		Inlet Cleaning	Annual **	Dry tons removed		16.9			7,100.1	26.3			11,025.0	43.2
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		43.5			2,196.6	47.6			993.3	91.1
		Urban Stream Restoration	Cumulative	Linear feet restored		770.0			34,650.0	8,988.8			134,832.0	9,758.8
		Outfall Stabilization	Cumulative	Linear feet						1,810.0			27,150.0	1,810.0
		Impervious Disconnects	Cumulative	Credit Acres	5.9									5.9
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	59,266	TOTAL	0	0	183,008	

* 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
		322,978

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

Current Load		
TN	TP	TSS
0	0	263,712

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

Load under full implementation		
TN	TP	TSS
0	0	80,704

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%	75.0%

From top of worksheet

Target Load		
TN	TP	TSS
0	0	80,745

This represents the load that must be achieved when the plan is fully implemented. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2009
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2009
Impervious Acres in Implementation Baseline Year	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	

		BMP Name	Type	Unit	Baseline Year 2009: BMPs installed before 2009	Progress Fiscal Year 2019 (Progress Reductions): BMPs installed from 2009 to 2019	Reductions achieved between 2009 and 2019: TN lbs/year	TP lbs/year	TSS lbs/year	Target Year 2025 (Future Reductions): BMPs planned for installation from 2019 to 2025	Planned reductions from 2019 to 2025: TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						0.2			22.3	0
				Pervious Acres Treated						0.3				0
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	1.6					0.9			111.3	2.5
				Pervious Acres Treated	5.2					1.4				6.6
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						0.4			42.0	0.4
				Pervious Acres Treated						0.6				0.6
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a					2.8			314.9	2.8
				Pervious Acres Treated	n/a					4.2				4.2
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed		0.4			123.8					0.4
		Inlet Cleaning	Annual **	Dry tons removed		0.1			44.1	1.1			441.0	1.2
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious	1.7	3.3			149.6	4.9			59.4	8.2
		Urban Stream Restoration	Cumulative	Linear feet restored						943.4			14,151.0	943.4
		Outfall Stabilization	Cumulative	Linear feet						185.0			2,775.0	185.0
		Impervious Disconnects	Cumulative	Credit Acres	4.6									4.6
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	317	TOTAL	0	0	17,917	

* 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	54,930

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

Load under full implementation

TN	TP	TSS
0	0	37,013

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 implemented. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Patapsco River Lower North Branch
County Name	Anne Arundel / Baltimore / Howard
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2005
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2005
Impervious Acres in Implementation Baseline Year	1,415
Pervious Acres in Implementation Baseline Year	2,020

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	18.0%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year			2019	Target Year			2030	
					2005	Progress Reductions				Future Reductions				
							Reductions achieved between 2005 and 2019				Planned reductions from 2019 to 2030			
		BMP Name	Type	Unit	BMPs installed before 2005	BMPs installed from 2005 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2030	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						0.3			348.6	0
				Pervious Acres Treated						0.4				0.4
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.3	7.2			11,018.5					7.5
				Pervious Acres Treated	0.3	10.8								11.1
		Grass Swales	Cumulative	Impervious Acres Treated	52.0	16.6			20,455.2	1.5			1,743.2	70.1
				Pervious Acres Treated	95.5	10.6				2.2				108.3
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	4.1	3.8			7,582.0					7.9
				Pervious Acres Treated	8.9	5.7								14.6
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	48.5									48.5
				Pervious Acres Treated	164.1									164.1
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						0.6			657.4	0.6
				Pervious Acres Treated						0.9				0.9
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a					12.7			9,686.7	12.7
				Pervious Acres Treated	n/a					22.2				22.2
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	88.4	0.3			605.0					88.7
				Pervious Acres Treated	219.3	0.4								219.7
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		56.7			2,724.7					56.7
		Pipe Cleaning	Annual **	Dry tons removed		28.6			8,571.7					28.6
		Inlet Cleaning	Annual **	Dry tons removed		13.4			5,644.8	53.6			22,491.0	67.0
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious		0.6			124.8					0.6
		Urban Tree Planting	Cumulative	Acres planted on pervious		117.5			18,249.3	7.6			894.0	125.1
		Urban Stream Restoration	Cumulative	Linear feet restored		538.0			15,210.0	7,265.9			326,966.9	7,803.9
		Outfall Stabilization	Cumulative	Linear feet						386.0			21,690.0	386.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	90,186	TOTAL	0	0	384,478	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
		2,631,967

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

Current Load

TN	TP	TSS
0	0	2,541,781

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

Load under full implementation

TN	TP	TSS
0	0	2,157,303

This represents the load from the watershed in the year that the plan is fully implemented

Legend: meets TMDL | Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	0.0%	18.0%

From top of worksheet

Target Load

TN	TP	TSS
0	0	2,158,213

This represents the load that must be achieved when the plan is fully implemented. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Patuxent River Lower
County Name	AA / CV / CH / PG / SM
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2009
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2009
Impervious Acres in Implementation Baseline Year	174
Pervious Acres in Implementation Baseline Year	162

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

		BMP Name	Type	Unit	Scenario Name: Baseline Year 2009 — BMPs installed before 2009	Progress Fiscal Year 2019 — Progress Reductions: BMPs installed from 2009 to 2019	Reductions achieved between 2009 and 2019: TN lbs/year	TP lbs/year	TSS lbs/year	Target Year 2030 — Future Reductions: BMPs planned for installation from 2019 to 2030	Planned reductions from 2019 to 2030: TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						0.3			17.6	0
				Pervious Acres Treated						0.5				1
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	2.5	2.6			541.8					5.1
				Pervious Acres Treated	2.1	3.3								5.4
		Grass Swales	Cumulative	Impervious Acres Treated	15.6					1.6			87.9	17.2
				Pervious Acres Treated	16.7					2.3				19.0
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.3									0.3
				Pervious Acres Treated	0.0									-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	6.7									6.7
				Pervious Acres Treated	2.5									2.5
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						0.6			33.2	0.6
				Pervious Acres Treated						0.9				0.9
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	3.2									3.2
				Pervious Acres Treated	0.9									0.9
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a					4.7			248.7	4.7
				Pervious Acres Treated	n/a					7.0				7.0
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	27.0									27.0
				Pervious Acres Treated	29.2									29.2
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed		1.0			285.2					1.0
		Inlet Cleaning	Annual **	Dry tons removed		2.7			1,146.6	2.6			1,102.5	5.4
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious	1.7	93.2			603.7	8.2			50.7	101.4
		Urban Stream Restoration	Cumulative	Linear feet restored						1,128.9			16,933.5	1,128.9
		Outfall Stabilization	Cumulative	Linear feet						310.0			4,650.0	310.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	1.6									1.6
				Pervious Acres Treated	0.8									0.8
				REDUCTIONS:		TOTAL	0	0	2,577	TOTAL	0	0	23,124	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
		44,293

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

Current Load

TN	TP	TSS
0	0	41,716

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

Load under full implementation

TN	TP	TSS
0	0	18,592

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	0.0%	58.0%

From top of worksheet

Target Load

TN	TP	TSS
0	0	18,603

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Patuxent River Middle
County Name	Anne Arundel / Calvert / Prince George's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2009
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2009
Impervious Acres in Implementation Baseline Year	245
Pervious Acres in Implementation Baseline Year	466

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	56.0%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year			2019	Target Year			2040	
					2009	Progress Reductions				Future Reductions				
							Reductions achieved between 2009 and 2019				Planned reductions from 2019 to 2040			
		BMP Name	Type	Unit	BMPs installed before 2009	BMPs installed from 2009 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2040	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						0.6			184.0	1
				Pervious Acres Treated						0.8				1
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.4	4.7			2,025.1					5.1
				Pervious Acres Treated	0.5	6.9								7.4
		Grass Swales	Cumulative	Impervious Acres Treated	10.9					2.8			920.0	13.7
				Pervious Acres Treated	18.1					4.1				22.2
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	1.4									1.4
				Pervious Acres Treated	2.6									2.6
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	18.0									18.0
				Pervious Acres Treated	33.1									33.1
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						1.1			347.0	1.1
				Pervious Acres Treated						1.7				1.7
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	1.2			697.0	8.3			2,602.3	9.5
				Pervious Acres Treated	n/a	8.8				12.4				21.2
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	3.0									3.0
				Pervious Acres Treated	5.1									5.1
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed		1.4			423.4					1.4
		Inlet Cleaning	Annual **	Dry tons removed		2.2			926.1	4.7			1,984.5	6.9
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		29.4			745.5	14.5			519.4	43.9
		Urban Stream Restoration	Cumulative	Linear feet restored						2,618.2			39,273.0	2,618.2
		Outfall Stabilization	Cumulative	Linear feet						550.0			8,250.0	550.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	4,817	TOTAL	0	0	54,080	

* 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
		105,112

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

Current Load

TN	TP	TSS
0	0	100,295

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

Load under full implementation

TN	TP	TSS
0	0	46,215

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%	56.0%

From top of worksheet

Target Load

TN	TP	TSS
0	0	46,249

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Patuxent River Upper
County Name	Anne Arundel / Howard / Prince George's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2005
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2005
Impervious Acres in Implementation Baseline Year	636
Pervious Acres in Implementation Baseline Year	927

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	11.4%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit (Scenario Name:)	Baseline Year 2005: BMPs installed before 2005	Progress Fiscal Year 2019 – Progress Reductions: BMPs installed from 2005 to 2019	Reductions achieved between 2005 and 2019: TN lbs/year	TP lbs/year	TSS lbs/year	Target Year 2025 – Future Reductions: BMPs planned for installation from 2019 to 2025	Planned reductions from 2019 to 2025: TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	2.3	3.4			1,355.2					5.7
				Pervious Acres Treated	12.5	3.3								15.8
		Grass Swales	Cumulative	Impervious Acres Treated	38.7									38.7
				Pervious Acres Treated	79.3									79.3
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.5									0.5
				Pervious Acres Treated	0.3									0.3
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	15.4									15.4
				Pervious Acres Treated	37.1									37.1
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated		0.2			127.3					0.2
				Pervious Acres Treated		1.0								1.0
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	54.4	5.5			3,060.9					59.9
				Pervious Acres Treated	253.3	24.6								277.9
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		6.5			247.2					6.5
		Pipe Cleaning	Annual **	Dry tons removed		2.5			740.3					2.5
		Inlet Cleaning	Annual **	Dry tons removed		2.9			1,234.8	5.3			2,205.0	8.2
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		8.9			519.1					8.9
		Urban Stream Restoration	Cumulative	Linear feet restored						2,000.0			30,000.0	2,000.0
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	7,285	TOTAL	0	0	32,205	

* 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
		343,714

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

Current Load

TN	TP	TSS
0	0	336,429

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

Load under full implementation

TN	TP	TSS
0	0	304,224

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%	11.4%

From top of worksheet

Target Load

TN	TP	TSS
0	0	304,531

This represents the load that must be achieved when the plan is fully implemented. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

MDE

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

Watershed Name	Potomac River MO County
County Name	Montgomery
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2005
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2005
Impervious Acres in Implementation Baseline Year	596
Pervious Acres in Implementation Baseline Year	524

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	36.2%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Scenario Name: Baseline Year 2005 — BMPs installed before 2005	Progress Fiscal Year 2019 (Progress Reductions) — BMPs installed from 2005 to 2019	Reductions achieved between 2005 and 2019 — TN lbs/year	TP lbs/year	TSS lbs/year	Target Year 2045 (Future Reductions) — BMPs planned for installation from 2019 to 2045	Planned reductions from 2019 to 2045 — TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						0.9			407.1	1
				Pervious Acres Treated						1.3				1
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		1.5			1,851.2					1.5
				Pervious Acres Treated		1.9								1.9
		Grass Swales	Cumulative	Impervious Acres Treated	12.3					4.3			2,035.3	16.6
				Pervious Acres Treated	14.8					6.4				21.2
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	15.2									15.2
				Pervious Acres Treated	37.0									37.0
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						1.7			767.6	1.7
				Pervious Acres Treated						2.6				2.6
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a					12.8			5,756.9	12.8
				Pervious Acres Treated	n/a					19.1				19.1
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated	48.7	n/a				n/a				
				Pervious Acres Treated	496.9	n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		0.7			4.8					0.7
		Pipe Cleaning	Annual **	Dry tons removed		10.1			3,028.8					10.1
		Inlet Cleaning	Annual **	Dry tons removed		15.3			6,438.6	55.7			23,373.0	71.0
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		52.3			6,790.5	22.4			1,087.1	74.7
		Urban Stream Restoration	Cumulative	Linear feet restored	201.0					1,050.0			47,250.0	1,251.0
		Outfall Stabilization	Cumulative	Linear feet						4,082.6			183,716.6	4,082.6
		Impervious Disconnects	Cumulative	Credit Acres						850.0			38,250.0	850.0
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	18,114	TOTAL	0	0	302,644	

* 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
		885,933

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

Current Load		
TN	TP	TSS
0	0	867,819

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

Load under full implementation		
TN	TP	TSS
0	0	565,176

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%	36.2%
From top of worksheet		

Target Load		
TN	TP	TSS
0	0	565,225

This represents the load that must be achieved when the plan is fully implemented. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2018 progress reductions which are defined as reductions achieved between baseline year and FY2018.

MDE

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

Watershed Name	Potomac River - WA County
County Name	Washington
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2005
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2005
Impervious Acres in Implementation Baseline Year	359
Pervious Acres in Implementation Baseline Year	805

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	15.2%
Available on TMDL Data Center WLA Search	

	BMP Name	Type	Unit	Baseline Year 2005: BMPs installed before 2005	Progress Fiscal Year 2019: BMPs installed from 2005 to 2019	Reductions achieved between 2005 and 2019: TN lbs/year	TP lbs/year	TSS lbs/year	Target Year TBD: BMPs planned for installation from 2019 to TBD	Planned reductions from 2019 to TBD: TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices – Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
			Pervious Acres Treated										-
	Rain Gardens	Cumulative	Impervious Acres Treated										-
			Pervious Acres Treated										-
	Bioswales	Cumulative	Impervious Acres Treated		13.0			38,851.7					13.0
			Pervious Acres Treated		27.3								27.3
	Grass Swales	Cumulative	Impervious Acres Treated	7.7	2.3			7,012.6					10.0
			Pervious Acres Treated	12.7	7.0								19.7
	Permeable Pavement	Cumulative	Impervious Acres Treated										-
			Pervious Acres Treated										-
	Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		0.3			1,254.0					0.3
			Pervious Acres Treated		1.9								1.9
	Urban Infiltration Practices	Cumulative	Impervious Acres Treated	6.2									6.2
			Pervious Acres Treated	13.4									13.4
Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
			Pervious Acres Treated										-
	Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
			Pervious Acres Treated										-
	Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
			Pervious Acres Treated	n/a									-
	Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
			Pervious Acres Treated		n/a				n/a				
	Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
			Pervious Acres Treated		n/a				n/a				
	Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
			Pervious Acres Treated										-
Alternative Practices – MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
	Pipe Cleaning	Annual **	Dry tons removed		1.3			390.7					1.3
	Inlet Cleaning	Annual **	Dry tons removed										-
	Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
	Urban Tree Planting	Cumulative	Acres planted on pervious		27.4			8,052.9					27.4
	Urban Stream Restoration	Cumulative	Linear feet restored										-
	Outfall Stabilization	Cumulative	Linear feet										-
	Impervious Disconnects	Cumulative	Credit Acres	6.7									6.7
	Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
			Pervious Acres Treated										-
			REDUCTIONS:		TOTAL	0	0	55,562	TOTAL	0	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
		1,324,637

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

Current Load

TN	TP	TSS
0	0	1,269,075

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

Load under full implementation

TN	TP	TSS
0	0	1,269,075

This represents the load from the watershed in the year that the plan is fully implemented

Legend: meets TMDL | Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	0.0%	15.2%

From top of worksheet

Target Load

TN	TP	TSS
0	0	1,123,292

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Rock Creek
County Name	Montgomery
Date	10/21/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2005
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2005
Impervious Acres in Implementation Baseline Year	703
Pervious Acres in Implementation Baseline Year	472

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	37.9%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year 2019				Target Year 2030				
					2005	Progress Reductions				Future Reductions				
							Reductions achieved between 2005 and 2019				Planned reductions from 2019 to 2030			
		BMP Name	Type	Unit	BMPs installed before 2005	BMPs installed from 2005 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2030	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.5									0.5
				Pervious Acres Treated	0.5									0.5
		Grass Swales	Cumulative	Impervious Acres Treated	11.6									11.6
				Pervious Acres Treated	18.4									18.4
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	16.4									16.4
				Pervious Acres Treated	32.7									32.7
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.3									0.3
				Pervious Acres Treated	0.1									0.1
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	7.4			18,702.1					7.4
				Pervious Acres Treated	n/a	22.0								22.0
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	6.6									6.6
				Pervious Acres Treated	31.2									31.2
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		2.1			15.8					2.1
		Pipe Cleaning	Annual **	Dry tons removed		19.9			5,966.1					19.9
		Inlet Cleaning	Annual **	Dry tons Removed		4.2			1,764.0					4.2
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		6.7			1,388.5	46.6			5,989.5	53.3
		Urban Stream Restoration	Cumulative	Linear feet restored		14,053.0			632,385.0					14,053.0
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	660,221	TOTAL	0	0	5,989	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
TN	TP	TSS
		1,757,766

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

Current Load		
TN	TP	TSS
0	0	1,097,545

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

Load under full implementation		
TN	TP	TSS
0	0	1,091,555

This represents the load from the watershed in the year that the plan is fully implemented

Legend		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
TN	TP	TSS
0.0%	0.0%	37.9%
From top of worksheet		

Target Load		
TN	TP	TSS
0	0	1,091,573

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

MDE

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

Watershed Name	Seneca Creek
County Name	Montgomery
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2005
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2005
Impervious Acres in Implementation Baseline Year	733
Pervious Acres in Implementation Baseline Year	743

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	44.9%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Baseline Year 2005: BMPs installed before 2005	Progress Fiscal Year 2019 – Progress Reductions: BMPs installed from 2005 to 2019	Reductions achieved between 2005 and 2019: TN lbs/year	TP lbs/year	TSS lbs/year	Target Year 2045 – Future Reductions: BMPs planned for installation from 2019 to 2045	Planned reductions from 2019 to 2045: TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						0.8			590.4	1
				Pervious Acres Treated						1.2				1
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.2	1.7			2,845.8					1.9
				Pervious Acres Treated	0.6	2.1								2.7
		Grass Swales	Cumulative	Impervious Acres Treated	36.3					4.1			2,952.1	40.4
				Pervious Acres Treated	41.9					6.1				48.0
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	2.6									2.6
				Pervious Acres Treated	2.1									2.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	6.0									6.0
				Pervious Acres Treated	7.1									7.1
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						1.6			1,113.4	1.6
				Pervious Acres Treated						2.4				2.4
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	10.5									10.5
				Pervious Acres Treated	17.7									17.7
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	5.8			11,094.4	16.5			17,420.9	22.3
				Pervious Acres Treated	n/a	13.5				27.1				40.6
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	59.6									59.6
				Pervious Acres Treated	500.3									500.3
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed		8.0			2,414.6					8.0
		Inlet Cleaning	Annual **	Dry tons removed		0.3			132.3	58.8			24,696.0	59.1
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		27.2			4,169.9	21.3			1,576.9	48.5
		Urban Stream Restoration	Cumulative	Linear feet restored		3,991.0			179,595.0	6,956.0			313,020.0	10,947.0
		Outfall Stabilization	Cumulative	Linear feet						810.0			36,450.0	810.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	200,252	TOTAL	0	0	397,820	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
		1,328,366

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

Current Load

TN	TP	TSS
0	0	1,128,114

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

Load under full implementation

TN	TP	TSS
0	0	730,294

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%	44.9%

From top of worksheet

Target Load

TN	TP	TSS
0	0	731,930

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

MDE

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

Watershed Name	South River
County Name	Anne Arundel
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2009
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2009
Impervious Acres in Implementation Baseline Year	438
Pervious Acres in Implementation Baseline Year	853

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	28.0%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year			2019	Target Year			2025	
					2009	Progress Reductions				Future Reductions				
							Reductions achieved between 2009 and 2019				Planned reductions from 2019 to 2025			
		BMP Name	Type	Unit	BMPs installed before 2009	BMPs installed from 2009 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2025	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated		0.9			1,156.1					1
				Pervious Acres Treated		9.1								9
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.6	2.1			608.9					2.7
				Pervious Acres Treated	1.1	1.2								2.3
		Grass Swales	Cumulative	Impervious Acres Treated	4.4	10.4			3,561.9					14.8
				Pervious Acres Treated	7.7	13.4								21.1
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	41.8					20.8			4,497.8	62.6
				Pervious Acres Treated	100.1					19.4				119.5
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	3.1									3.1
				Pervious Acres Treated	14.3									14.3
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	29.7			9,087.6	6.1			2,817.6	35.8
				Pervious Acres Treated	n/a	31.7				22.8				54.5
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	58.4									58.4
				Pervious Acres Treated	192.9									192.9
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		12.8			46.9					12.8
		Pipe Cleaning	Annual **	Dry tons removed		6.4			1,914.4					6.4
		Inlet Cleaning	Annual **	Dry tons removed		1.3			529.2					1.3
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious	0.6	7.0			324.8					7.0
		Urban Stream Restoration	Cumulative	Linear feet restored		2,414.0			36,210.0	24,914.0			373,710.0	27,328.0
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	53,440	TOTAL	0	0	381,025	

* 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
		229,305
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
TN	TP	TSS
0	0	175,865
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
TN	TP	TSS
0	0	-205,160
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%	28.0%
From top of worksheet		

Target Load		
TN	TP	TSS
0	0	165,100
This represents the load that must be achieved when the plan is fully implemented. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

MDE

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

Watershed Name	Swan Creek
County Name	Harford
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2009
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2009
Impervious Acres in Implementation Baseline Year	142
Pervious Acres in Implementation Baseline Year	110

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	13.0%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Baseline Year 2009: BMPs installed before 2009	Progress Fiscal Year 2019: BMPs installed from 2009 to 2019	Reductions achieved between 2009 and 2019: TN lbs/year	TP lbs/year	TSS lbs/year	Target Year 2025: BMPs planned for installation from 2019 to 2025	Planned reductions from 2019 to 2025: TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						0.0			2.0	0
				Pervious Acres Treated						0.0				0
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	7.0					0.1			10.1	7.1
				Pervious Acres Treated	22.9					0.1				23.0
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						0.0			3.8	0.0
				Pervious Acres Treated						0.0				0.0
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a					0.2			28.5	0.2
				Pervious Acres Treated	n/a					0.3				0.3
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed		5.4			1,621.9					5.4
		Inlet Cleaning	Annual **	Dry tons removed		0.9			396.9	5.8			2,425.5	6.7
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		3.6			119.0	0.3			5.2	3.9
		Urban Stream Restoration	Cumulative	Linear feet restored						56.2			2,528.1	56.2
		Outfall Stabilization	Cumulative	Linear feet						12.0			540.0	12.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	2,138	TOTAL	0	0	5,543	

* 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
		59,038

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

Current Load		
TN	TP	TSS
0	0	56,900

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

Load under full implementation		
TN	TP	TSS
0	0	51,357

This represents the load from the watershed in the year that the plan is fully implemented

Legend		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
TN	TP	TSS
0.0%	0.0%	13.0%
From top of worksheet		

Target Load		
TN	TP	TSS
0	0	51,363

This represents the load that must be achieved when the plan is fully implemented. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Upper Monocacy River
County Name	Carroll / Frederick
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2000
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2000
Impervious Acres in Implementation Baseline Year	547
Pervious Acres in Implementation Baseline Year	623

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	49.0%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Scenario Name: Baseline Year 2000 — BMPs installed before 2000	Progress Fiscal Year 2019 — BMPs installed from 2000 to 2019	Progress Reductions (Reductions achieved between 2000 and 2019) TN lbs/year	TP lbs/year	TSS lbs/year	Target Year 2035 — BMPs planned for installation from 2019 to 2035	Future Reductions (Planned reductions from 2019 to 2035) TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						1.2			1,246.3	1
				Pervious Acres Treated						1.8				2
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		16.9			30,917.5					16.9
				Pervious Acres Treated		30.7								30.7
		Grass Swales	Cumulative	Impervious Acres Treated	66.7					6.0			6,231.4	72.7
				Pervious Acres Treated	112.6					8.9				121.5
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		5.5			10,840.4					5.5
				Pervious Acres Treated		12.7								12.7
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	0.1									0.1
				Pervious Acres Treated	0.3									0.3
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						2.4			2,350.1	2.4
				Pervious Acres Treated						3.6				3.6
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	3.7			8,350.5	17.9			17,625.9	21.6
				Pervious Acres Treated	n/a	11.9				26.8				38.7
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		22.3			720.1					22.3
		Pipe Cleaning	Annual **	Dry tons removed		2.8			852.2					2.8
		Inlet Cleaning	Annual **	Dry tons removed		0.1			44.1					0.1
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious		0.7			103.0					0.7
		Urban Tree Planting	Cumulative	Acres planted on pervious		51.9			6,019.5	57.0			6,236.4	108.9
		Urban Stream Restoration	Cumulative	Linear feet restored						5,950.0			267,750.0	5,950.0
		Outfall Stabilization	Cumulative	Linear feet						1,190.0			53,550.0	1,190.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0	0	57,847	TOTAL	0	0	354,990	

* 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
		842,512

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

Current Load

TN	TP	TSS
0	0	784,665

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

Load under full implementation

TN	TP	TSS
0	0	429,675

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%	49.0%

From top of worksheet

Target Load

TN	TP	TSS
0	0	429,681

This represents the load that must be achieved when the plan is fully implemented. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2000 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.

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

Watershed Name	Anacostia River, Downstream of NEB/NWB Confluence
County Name	Prince George's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	476
Pervious Acres in Implementation Baseline Year	516

REDUCTIONS REQUIRED UNDER THE TMDL

Required Reduction BN MPN/yr	99.3%

Available on TMDL Data Center WLA Search

		BMP Name	Type	Unit	Baseline Year 2003: BMPs installed before 2003	Progress Fiscal Year 2019 (Progress Reductions): BMPs installed from 2003 to 2019	Reductions achieved between 2003 and 2019: Bacteria billion MPN/day			Target Year TBD (Future Reductions): BMPs planned for installation from 2019 to TBD	Planned reductions from 2019 to TBD: Bacteria billion MPN/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		0.7								0.7
				Pervious Acres Treated		0.8								0.8
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.6									0.6
				Pervious Acres Treated	0.1									0.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	3.3									3.3
				Pervious Acres Treated	3.9									3.9
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.3									0.3
				Pervious Acres Treated	0.0									-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	9.5								9.5
				Pervious Acres Treated	n/a	16.5								16.5
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	11.8									11.8
				Pervious Acres Treated	8.8									8.8
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	1,022			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion MPN/day		
89,445		

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

Current Load

billion MPN/day		
88,423		

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

Load under full implementation

billion MPN/day		
88,423		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

billion MPN/day		
99.3%		

From top of worksheet

Target Load

billion MPN/day		
626		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Anacostia River, Upstream of NEB/NWB Confluence
County Name	Montgomery / Prince George's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	1,627
Pervious Acres in Implementation Baseline Year	1,460

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	84.1%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year 2019				Target Year TBD				
					2003	Progress Reductions				Future Reductions				
							Reductions achieved between 2003 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2003	BMPs installed from 2003 to 2019	Bacteria billion MPN/day			BMPs planned for installation from 2019 to TBD	Bacteria billion MPN/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		1.4								1.4
				Pervious Acres Treated		1.1								1.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	15.7									15.7
				Pervious Acres Treated	18.8									18.8
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	7.9									7.9
				Pervious Acres Treated	5.4									5.4
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	13.1								13.1
				Pervious Acres Treated	n/a	35.0								35.0
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated	0.0	n/a				n/a				
				Pervious Acres Treated	7.8	n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	73.1									73.1
				Pervious Acres Treated	49.6									49.6
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	10.7									10.7
				Pervious Acres Treated	15.9									15.9
				REDUCTIONS:		TOTAL	1,695			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion MPN/day		
311,792		

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

Current Load		
billion MPN/day		
310,097		

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

Load under full implementation		
billion MPN/day		
310,097		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion MPN/day		
84.1%		

From top of worksheet

Target Load		
billion MPN/day		
49,575		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

MDE

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

Watershed Name	Antietam Creek
County Name	Washington
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	836
Pervious Acres in Implementation Baseline Year	1,500

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	98.0%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019		Target Year		TBD		
					2003	Progress Reductions			Future Reductions				
							Reductions achieved between 2003 and 2019			Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2003	BMPs installed from 2003 to 2019	Bacteria billion MPN/yr			BMPs planned for installation from 2019 to TBD	Bacteria billion MPN/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated									-
				Pervious Acres Treated									-
		Rain Gardens	Cumulative	Impervious Acres Treated									-
				Pervious Acres Treated									-
		Bioswales	Cumulative	Impervious Acres Treated		7.0							7.0
				Pervious Acres Treated		15.7							15.7
		Grass Swales	Cumulative	Impervious Acres Treated									-
				Pervious Acres Treated									-
		Permeable Pavement	Cumulative	Impervious Acres Treated									-
				Pervious Acres Treated									-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		11.5							11.5
				Pervious Acres Treated		34.4							34.4
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated									-
				Pervious Acres Treated									-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated									-
				Pervious Acres Treated									-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated									-
				Pervious Acres Treated									-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	8.9							8.9
				Pervious Acres Treated	n/a	19.9							19.9
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a			n/a				
				Pervious Acres Treated		n/a			n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a			n/a				
				Pervious Acres Treated		n/a			n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	1.8	3.0							4.8
				Pervious Acres Treated	0.9	4.2							5.1
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept									-
		Pipe Cleaning	Annual **	Dry tons removed									-
		Inlet Cleaning	Annual **	Dry tons removed									-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious									-
		Urban Tree Planting	Cumulative	Acres planted on pervious									-
		Urban Stream Restoration	Cumulative	Linear feet restored									-
		Outfall Stabilization	Cumulative	Linear feet									-
		Impervious Disconnects	Cumulative	Credit Acres									-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated									-
				Pervious Acres Treated									-
				REDUCTIONS:		TOTAL	3,587			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion MPN/yr		
170,412		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion MPN/yr		
166,825		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion MPN/yr		
166,825		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion MPN/yr		
98.0%		
From top of worksheet		

Target Load		
billion MPN/yr		
3,408		
This represents the load that must be achieved when the plan is fully impleméted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Baltimore Harbor - Furnace Creek
County Name	Anne Arundel
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2006
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2006
Impervious Acres in Implementation Baseline Year	379
Pervious Acres in Implementation Baseline Year	458

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	77.8%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year		2050		
					2006	Progress Reductions				Future Reductions				
							Reductions achieved between 2006 and 2019				Planned reductions from 2019 to 2050			
		BMP Name	Type	Unit	BMPs installed before 2006	BMPs installed from 2006 to 2019	Bacteria billion counts/day			BMPs planned for installation from 2019 to 2050	Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		0.6								0.6
				Pervious Acres Treated		1.0								1.0
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		0.8				128.0				128.8
				Pervious Acres Treated		1.6				64.0				65.6
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	48.1									48.1
				Pervious Acres Treated	282.6									282.6
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	6.1									6.1
				Pervious Acres Treated	3.6									3.6
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	5.1				64.0				69.1
				Pervious Acres Treated	n/a	41.3				32.0				73.3
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	13.6	0.6				128.0				142.2
				Pervious Acres Treated	99.0	0.5				64.0				163.5
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	1,027			TOTAL	27,185			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion counts/day		
34,094		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion counts/day		
33,067		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion counts/day		
5,882		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion counts/day		
77.8%		
From top of worksheet		

Target Load		
billion counts/day		
7,569		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WMT as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2006 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

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

Watershed Name	Baltimore Harbor - Marley Creek
County Name	Anne Arundel
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2006
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2006
Impervious Acres in Implementation Baseline Year	288
Pervious Acres in Implementation Baseline Year	356

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	75.7%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year 2019				Target Year 2050				
					2006	Progress Reductions				Future Reductions				
							Reductions achieved between 2006 and 2019				Planned reductions from 2019 to 2050			
		BMP Name	Type	Unit	BMPs installed before 2006	BMPs installed from 2006 to 2019	Bacteria billion counts/day			BMPs planned for installation from 2019 to 2050	Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated		11.7								11.7
				Pervious Acres Treated		26.4								26.4
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		0.6				36.0				36.6
				Pervious Acres Treated		0.3				18.0				18.3
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	51.3									51.3
				Pervious Acres Treated	256.7									256.7
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	18.3				18.0				36.3
				Pervious Acres Treated	n/a	39.3				9.0				48.3
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	30.9					36.0				66.9
				Pervious Acres Treated	223.1					18.0				241.1
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	3,960			TOTAL	12,508			

* 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 installed at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion counts/day		
20,684		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion counts/day		
16,724		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion counts/day		
4,216		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion counts/day		
75.7%		
From top of worksheet		

Target Load		
billion counts/day		
5,026		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WMT as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2006 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

MDE

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

Watershed Name	Cabin John Creek
County Name	Montgomery
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	442
Pervious Acres in Implementation Baseline Year	421

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	30.6%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year	TBD			
					2003	Progress Reductions				Future Reductions				
							Reductions achieved between 2003 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2003	BMPs installed from 2003 to 2019	Bacteria billion MPN/day			BMPs planned for installation from 2019 to TBD	Bacteria billion MPN/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	5.5									5.5
				Pervious Acres Treated	18.8									18.8
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.1									0.1
				Pervious Acres Treated	0.4									0.4
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	3.3								3.3
				Pervious Acres Treated	n/a	10.9								10.9
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated			n/a				n/a			
				Pervious Acres Treated			n/a				n/a			
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated			n/a				n/a			
				Pervious Acres Treated			n/a				n/a			
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	19.7									19.7
				Pervious Acres Treated	29.5									29.5
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	0.8									0.8
				Pervious Acres Treated	0.8									0.8
				REDUCTIONS:		TOTAL	512			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion MPN/day		
92,166		

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

Current Load		
billion MPN/day		
91,654		

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

Load under full implementation		
billion MPN/day		
91,654		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion MPN/day		
30.6%		

From top of worksheet

Target Load		
billion MPN/day		
63,963		

This represents the load that must be achieved when the plan is fully impleneted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Conococheague Creek
County Name	Washington
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2004
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2004
Impervious Acres in Implementation Baseline Year	472
Pervious Acres in Implementation Baseline Year	958

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	99.0%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year			TBD	
					2004	Progress Reductions				Future Reductions				
							Reductions achieved between 2004 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2004	BMPs installed from 2004 to 2019	Bacteria billion MPN/yr			BMPs planned for installation from 2019 to TBD	Bacteria billion MPN/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.2	6.3								6.5
				Pervious Acres Treated	0.2	9.4								9.6
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	1.0									1.0
				Pervious Acres Treated	0.7									0.7
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	3.0								3.0
				Pervious Acres Treated	n/a	9.6								9.6
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	5.3	2.1								7.4
				Pervious Acres Treated	12.8	4.5								17.3
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	830			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion MPN/yr		
105,861		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion MPN/yr		
105,031		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion MPN/yr		
105,031		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion MPN/yr		
99.0%		
From top of worksheet		

Target Load		
billion MPN/yr		
1,059		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2004 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

MDE

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

Watershed Name	Double Pipe Creek
County Name	Carroll
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2004
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2004
Impervious Acres in Implementation Baseline Year	414
Pervious Acres in Implementation Baseline Year	682

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	98.5%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year	TBD			
					2004	Progress Reductions				Future Reductions				
							Reductions achieved between 2004 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2004	BMPs installed from 2004 to 2019	Bacteria billion MPN/yr			BMPs planned for installation from 2019 to TBD	Bacteria billion MPN/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.4									0.4
				Pervious Acres Treated	0.1									0.1
		Grass Swales	Cumulative	Impervious Acres Treated	4.6									4.6
				Pervious Acres Treated	6.5									6.5
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	0.2									0.2
				Pervious Acres Treated	0.0									-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Clenaing	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	1.9									1.9
				Pervious Acres Treated	1.5									1.5
				REDUCTIONS:		TOTAL	0			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion MPN/yr		
72,412		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion MPN/yr		
72,412		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion MPN/yr		
72,412		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion MPN/yr		
98.5%		
From top of worksheet		

Target Load		
billion MPN/yr		
1,086		
This represents the load that must be achieved when the plan is fully impleméted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2004 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Gwynns Falls
County Name	Baltimore
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	682
Pervious Acres in Implementation Baseline Year	980

REDUCTIONS REQUIRED UNDER THE TMDL

Required Reduction BN MPN/yr	99.3%

Available on TMDL Data Center WLA Search

				Scenario Name:	Baseline Year	Progress Fiscal Year 2019				Target Year TBD				
					2003	Progress Reductions				Future Reductions				
							Reductions achieved between 2003 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2003	BMPs installed from 2003 to 2019	Bacteria billion MPN/day			BMPs planned for installation from 2019 to TBD	Bacteria billion MPN/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	0.5									0.5
				Pervious Acres Treated	0.1									0.1
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	9.1									9.1
				Pervious Acres Treated	25.5									25.5
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	0.8									0.8
				Pervious Acres Treated	0.1									0.1
				REDUCTIONS:		TOTAL	0			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion MPN/day		
157,179		

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

Current Load

billion MPN/day		
157,179		

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

Load under full implementation

billion MPN/day		
157,179		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

billion MPN/day		
99.3%		

From top of worksheet

Target Load

billion MPN/day		
1,100		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Herring Run
County Name	Baltimore
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	128
Pervious Acres in Implementation Baseline Year	76

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	92.2%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year	TBD			
					2003	Progress Reductions				Future Reductions				
							Reductions achieved between 2003 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2003	BMPs installed from 2003 to 2019	Bacteria billion MPN/yr			BMPs planned for installation from 2019 to TBD	Bacteria billion MPN/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion MPN/yr		
30,714		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion MPN/yr		
30,714		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion MPN/yr		
30,714		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion MPN/yr		
92.2%		
From top of worksheet		

Target Load		
billion MPN/yr		
2,396		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Jones Falls
County Name	Baltimore
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	481
Pervious Acres in Implementation Baseline Year	431

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	95.5%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year			2019	Target Year			TBD	
					2003	Progress Reductions				Future Reductions				
							Reductions achieved between 2003 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2003	BMPs installed from 2003 to 2019	Bacteria billion MPN/day			BMPs planned for installation from 2019 to TBD	Bacteria billion MPN/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	3.8									3.8
				Pervious Acres Treated	6.9									6.9
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	7.7									7.7
				Pervious Acres Treated	1.7									1.7
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated	2.7	n/a				n/a				
				Pervious Acres Treated	0.6	n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	26.0									26.0
				Pervious Acres Treated	22.8									22.8
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	7.4									7.4
				Pervious Acres Treated	3.7									3.7
				REDUCTIONS:		TOTAL	0			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion MPN/day		
88,158		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion MPN/day		
88,158		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion MPN/day		
88,158		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion MPN/day		
95.5%		
From top of worksheet		

Target Load		
billion MPN/day		
3,967		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Liberty Reservoir
County Name	Baltimore / Carroll
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	641
Pervious Acres in Implementation Baseline Year	1,361

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	89.2%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year		TBD		
					2003	Progress Reductions				Future Reductions				
							Reductions achieved between 2003 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2003	BMPs installed from 2003 to 2019	Bacteria billion MPN/yr			BMPs planned for installation from 2019 to TBD	Bacteria billion MPN/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.1									0.1
				Pervious Acres Treated	1.2									1.2
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	4.7									4.7
				Pervious Acres Treated	1.6									1.6
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	8.3	22.8								31.1
				Pervious Acres Treated	13.7	105.3								119.0
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	7.5									7.5
				Pervious Acres Treated	2.9									2.9
				REDUCTIONS:		TOTAL	6,811			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion MPN/yr		
127,606		

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

Current Load		
billion MPN/yr		
120,795		

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

Load under full implementation		
billion MPN/yr		
120,795		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion MPN/yr		
89.2%		

From top of worksheet

Target Load		
billion MPN/yr		
13,781		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

MDE

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

Watershed Name	Loch Raven Reservoir
County Name	Baltimore / Carroll / Howard
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2004
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2004
Impervious Acres in Implementation Baseline Year	751
Pervious Acres in Implementation Baseline Year	856

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	88.0%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Baseline Year 2004: BMPs installed before 2004	Progress Fiscal Year 2019 (Progress Reductions): BMPs installed from 2004 to 2019	Reductions achieved between 2004 and 2019: Bacteria BN MPN/yr			Target Year 2050 (Future Reductions): BMPs planned for installation from 2019 to 2050	Planned reductions from 2019 to 2050: Bacteria BN MPN/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.2	10.1								10.3
				Pervious Acres Treated	0.6	27.6								28.2
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.0	0.4				393.8				394.2
				Pervious Acres Treated	1.0	0.8				196.9				198.7
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	4.7									4.7
				Pervious Acres Treated	30.7									30.7
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.4									0.4
				Pervious Acres Treated	0.6									0.6
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	1.8								1.8
				Pervious Acres Treated	n/a	3.1								3.1
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	2.7					731.3				734.0
				Pervious Acres Treated	21.3					365.6				386.9
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	861			TOTAL	99,305			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
BN MPN/yr		
113,344		

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

Current Load		
BN MPN/yr		
112,483		

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

Load under full implementation		
BN MPN/yr		
13,178		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
BN MPN/yr		
88.0%		

From top of worksheet

Target Load		
BN MPN/yr		
13,601		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WMT as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2004 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

MDE

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

Watershed Name	Lower Monocacy River
County Name	Carroll / Frederick / Montgomery
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2004
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2004
Impervious Acres in Implementation Baseline Year	1,400
Pervious Acres in Implementation Baseline Year	2,383

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	96.9%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Scenario Name: Baseline Year 2004 — BMPs installed before 2004	Progress Fiscal Year 2019 — Progress Reductions — BMPs installed from 2004 to 2019	Reductions achieved between 2004 and 2019 — Bacteria billion MPN/yr			Target Year TBD — Future Reductions — BMPs planned for installation from 2019 to TBD	Planned reductions from 2019 to TBD — Bacteria billion MPN/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.5	9.7								10.2
				Pervious Acres Treated	0.2	8.8								9.0
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	6.3	5.2								11.5
				Pervious Acres Treated	5.2	8.7								13.9
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	10.0									10.0
				Pervious Acres Treated	11.1									11.1
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.3									0.3
				Pervious Acres Treated	0.1									0.1
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	14.4								14.4
				Pervious Acres Treated	n/a	48.8								48.8
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	70.7									70.7
				Pervious Acres Treated	135.9									135.9
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious		1.6								1.6
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	6.3									6.3
				Pervious Acres Treated	8.0									8.0
				REDUCTIONS:		TOTAL	2,789			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion MPN/yr		
224,924		

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

Current Load		
billion MPN/yr		
222,136		

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

Load under full implementation		
billion MPN/yr		
222,136		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion MPN/yr		
96.9%		

From top of worksheet

Target Load		
billion MPN/yr		
6,973		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2004 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Lower Patuxent River - Indian Creek
County Name	Charles / St. Mary's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	42
Pervious Acres in Implementation Baseline Year	48

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	43.6%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Scenario Name: Baseline Year 2001 — BMPs installed before 2001	Progress Fiscal Year 2019 — Progress Reductions: BMPs installed from 2001 to 2019	Reductions achieved between 2001 and 2019: Bacteria billion counts/day			Target Year TBD — Future Reductions: BMPs planned for installation from 2019 to TBD	Planned reductions from 2019 to TBD: Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		2.6								2.6
				Pervious Acres Treated		3.3								3.3
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	1.0									1.0
				Pervious Acres Treated	0.6									0.6
				REDUCTIONS:		TOTAL	151			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion counts/day		
5,567		

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

Current Load		
billion counts/day		
5,416		

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

Load under full implementation		
billion counts/day		
5,416		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion counts/day		
43.6%		

From top of worksheet

Target Load		
billion counts/day		
3,140		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Magothy River - Forked Creek
County Name	Anne Arundel
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	
Pervious Acres in Implementation Baseline Year	

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	0.0%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Baseline Year 2001: BMPs installed before 2001	Progress Fiscal Year 2019 (Progress Reductions): BMPs installed from 2001 to 2019	Reductions achieved between 2001 and 2019: Bacteria billion counts/day			Target Year TBD (Future Reductions): BMPs planned for installation from 2019 to TBD	Planned reductions from 2019 to TBD: Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion counts/day		
0		

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

Current Load		
billion counts/day		
0		

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

Load under full implementation		
billion counts/day		
0		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion counts/day		
0.0%		

From top of worksheet

Target Load		
billion counts/day		
0		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

MDE

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

Watershed Name	Magothy River - subsegment
County Name	Anne Arundel
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	224
Pervious Acres in Implementation Baseline Year	332

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	12.8%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year			2019	Target Year			TBD	
					2001	Progress Reductions				Future Reductions				
							Reductions achieved between 2001 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2001	BMPs installed from 2001 to 2019	Bacteria billion counts/day			BMPs planned for installation from 2019 to TBD	Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		1.2								1.2
				Pervious Acres Treated		0.8								0.8
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	23.7									23.7
				Pervious Acres Treated	30.4									30.4
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	8.4									8.4
				Pervious Acres Treated	5.4									5.4
				REDUCTIONS:		TOTAL	86			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion counts/day		
30,697		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion counts/day		
30,611		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion counts/day		
30,611		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion counts/day		
12.8%		
From top of worksheet		

Target Load		
billion counts/day		
26,768		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Other West Chesapeake - Tracy and Rockhold Creeks
County Name	Anne Arundel
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	46
Pervious Acres in Implementation Baseline Year	93

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	81.6%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019		Target Year	TBD			
					2001	Progress Reductions			Future Reductions				
							Reductions achieved between 2001 and 2019			Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2001	BMPs installed from 2001 to 2019	Bacteria billion counts/day			BMPs planned for installation from 2019 to TBD	Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated						n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion counts/day		
7,275		

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

Current Load		
billion counts/day		
7,275		

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

Load under full implementation		
billion counts/day		
7,275		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion counts/day		
81.6%		

From top of worksheet

Target Load		
billion counts/day		
1,339		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Patapsco River LN Branch
County Name	Anne Arundel / Baltimore / Carroll / Howard
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	1,668
Pervious Acres in Implementation Baseline Year	2,285

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	15.2%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year		2050		
					2003	Progress Reductions				Future Reductions				
							Reductions achieved between 2003 and 2019				Planned reductions from 2019 to 2050			
		BMP Name	Type	Unit	BMPs installed before 2003	BMPs installed from 2003 to 2019	Bacteria BN MPN/yr			BMPs planned for installation from 2019 to 2050	Bacteria BN MPN/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		7.2								7.2
				Pervious Acres Treated		10.8								10.8
		Grass Swales	Cumulative	Impervious Acres Treated						1.5				1.5
				Pervious Acres Treated						2.2				2.2
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	4.1	3.8				106.8				114.7
				Pervious Acres Treated	8.9	5.7				53.7				68.3
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	47.6									47.6
				Pervious Acres Treated	160.7									160.7
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	3.5					213.6				217.1
				Pervious Acres Treated	5.6					107.4				113.0
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a					39.9				39.9
				Pervious Acres Treated	n/a					24.3				24.3
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	81.2	0.3								81.5
				Pervious Acres Treated	204.0	0.4								204.4
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious		0.6								0.6
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	1,136			TOTAL	34,092			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
BN MPN/yr		
231,593		
This represents the load from the watershed at the baseline year of the implementation plan		

TMDL Reductions		
BN MPN/yr		
15.2%		
From top of worksheet		

Current Load		
BN MPN/yr		
230,457		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
BN MPN/yr		
196,365		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

Target Load		
BN MPN/yr		
196,391		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WMT as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

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

Watershed Name	Patuxent River Upper
County Name	Anne Arundel / Prince George's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2009
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2009
Impervious Acres in Implementation Baseline Year	257
Pervious Acres in Implementation Baseline Year	366

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	49.5%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year		2019		Target Year		2050		
					2009	Progress Reductions				Future Reductions				
							Reductions achieved between 2009 and 2019				Planned reductions from 2019 to 2050			
		BMP Name	Type	Unit	BMPs installed before 2009	BMPs installed from 2009 to 2019	Bacteria BN MPN/yr			BMPs planned for installation from 2019 to 2050	Bacteria BN MPN/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.5	0.9								1.4
				Pervious Acres Treated	0.4	0.5								0.9
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	1.5					56.0				57.5
				Pervious Acres Treated	1.1					28.0				29.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	15.0									15.0
				Pervious Acres Treated	35.2									35.2
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	35.8					104.0				139.8
				Pervious Acres Treated	100.8					52.0				152.8
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	45			TOTAL	12,925			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
BN MPN/yr		
26,200		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
BN MPN/yr		
26,155		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
BN MPN/yr		
13,230		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
BN MPN/yr		
49.5%		
From top of worksheet		

Target Load		
BN MPN/yr		
13,231		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WMT as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2010 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

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

Watershed Name	Piscataway
County Name	Prince George's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	259
Pervious Acres in Implementation Baseline Year	294

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	42.5%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year 2019				Target Year TBD				
					2003	Progress Reductions				Future Reductions				
							Reductions achieved between 2003 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2003	BMPs installed from 2003 to 2019	Bacteria billion MPN/day			BMPs planned for installation from 2019 to TBD	Bacteria billion MPN/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated		1.1								1.1
				Pervious Acres Treated		1.2								1.2
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	41.0								41.0
				Pervious Acres Treated	n/a	39.1								39.1
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	39.2									39.2
				Pervious Acres Treated	14.9									14.9
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	0.3									0.3
				Pervious Acres Treated	0.6									0.6
				REDUCTIONS:		TOTAL	682			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion MPN/day		
32,126		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion MPN/day		
31,444		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion MPN/day		
31,444		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion MPN/day		
42.5%		
From top of worksheet		

Target Load		
billion MPN/day		
18,472		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Rock Creek - Non-Tidal
County Name	Montgomery
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	741
Pervious Acres in Implementation Baseline Year	489

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	96.5%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year 2019				Target Year TBD				
					2003	Progress Reductions				Future Reductions				
							Reductions achieved between 2003 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2003	BMPs installed from 2003 to 2019	Bacteria billion MPN/day			BMPs planned for installation from 2019 to TBD	Bacteria billion MPN/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.9									0.9
				Pervious Acres Treated	0.3									0.3
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	2.7									2.7
				Pervious Acres Treated	0.3									0.3
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	16.4									16.4
				Pervious Acres Treated	17.8									17.8
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	9.2									9.2
				Pervious Acres Treated	3.8									3.8
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	7.4								7.4
				Pervious Acres Treated	n/a	22.0								22.0
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	6.6									6.6
				Pervious Acres Treated	3.5									3.5
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	11.9									11.9
				Pervious Acres Treated	6.1									6.1
				REDUCTIONS:		TOTAL	856			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion MPN/day		
120,947		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion MPN/day		
120,091		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion MPN/day		
120,091		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion MPN/day		
96.5%		
From top of worksheet		

Target Load		
billion MPN/day		
4,233		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2010 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Severn River - Mill Creek
County Name	Anne Arundel
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2002
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2002
Impervious Acres in Implementation Baseline Year	64
Pervious Acres in Implementation Baseline Year	61

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	86.0%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Baseline Year (Scenario Name): 2002 — BMPs installed before 2002	Progress Fiscal Year 2019 — Progress Reductions: BMPs installed from 2002 to 2019	Reductions achieved between 2002 and 2019: Bacteria billion counts/day			Target Year TBD — Future Reductions: BMPs planned for installation from 2019 to TBD	Planned reductions from 2019 to TBD: Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		1.4								1.4
				Pervious Acres Treated		1.9								1.9
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		0.5								0.5
				Pervious Acres Treated		0.8								0.8
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	8.3									8.3
				Pervious Acres Treated	10.4									10.4
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	220			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion counts/day		
9,953		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion counts/day		
9,733		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion counts/day		
9,733		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion counts/day		
86.0%		
From top of worksheet		

Target Load		
billion counts/day		
1,393		
This represents the load that must be achieved when the plan is fully impleméted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

MDE

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

Watershed Name	Severn River - subsegment
County Name	Anne Arundel
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2002
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2002
Impervious Acres in Implementation Baseline Year	699
Pervious Acres in Implementation Baseline Year	890

REDUCTIONS REQUIRED UNDER THE TMDL

Required Reduction BN MPN/yr	19.0%

Available on TMDL Data Center WLA Search

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year	TBD			
					2002	Progress Reductions				Future Reductions				
							Reductions achieved between 2002 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2002	BMPs installed from 2002 to 2019	Bacteria billion counts/day			BMPs planned for installation from 2019 to TBD	Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.9	0.7								1.6
				Pervious Acres Treated	1.3	0.5								1.8
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		1.4								1.4
				Pervious Acres Treated		2.0								2.0
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	90.8									90.8
				Pervious Acres Treated	136.3									136.3
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	16.2								16.2
				Pervious Acres Treated	n/a	69.1								69.1
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	60.5									60.5
				Pervious Acres Treated	108.9									108.9
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	5.7									5.7
				Pervious Acres Treated	5.9									5.9
				REDUCTIONS:		TOTAL	2,091			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion counts/day		
88,467		

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

Current Load

billion counts/day		
86,376		

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

Load under full implementation

billion counts/day		
86,376		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

billion counts/day		
19.0%		

From top of worksheet

Target Load

billion counts/day		
71,658		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

MDE

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

Watershed Name	Severn River - Whitehall & Meredith
County Name	Anne Arundel
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2002
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2002
Impervious Acres in Implementation Baseline Year	83
Pervious Acres in Implementation Baseline Year	93

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	90.0%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Scenario Name: Baseline Year 2002 — BMPs installed before 2002	Progress Fiscal Year 2019 — Progress Reductions — BMPs installed from 2002 to 2019	Reductions achieved between 2002 and 2019 — Bacteria billion counts/day			Target Year TBD — Future Reductions — BMPs planned for installation from 2019 to TBD	Planned reductions from 2019 to TBD — Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	5.9								5.9
				Pervious Acres Treated	n/a	6.0								6.0
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	26.6									26.6
				Pervious Acres Treated	38.7									38.7
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	0.6									0.6
				Pervious Acres Treated	0.1									0.1
				REDUCTIONS:		TOTAL	498			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion counts/day		
7,605		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion counts/day		
7,107		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion counts/day		
7,107		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion counts/day		
90.0%		
From top of worksheet		

Target Load		
billion counts/day		
761		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	South River - Duval Creek
County Name	Anne Arundel
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	
Pervious Acres in Implementation Baseline Year	

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	0.0%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Scenario Name: Baseline Year 2001 — BMPs installed before 2001	Progress Fiscal Year 2019 — Progress Reductions — BMPs installed from 2001 to 2019	Reductions achieved between 2001 and 2019 — Bacteria billion counts/day			Target Year TBD — Future Reductions — BMPs planned for installation from 2019 to TBD	Planned reductions from 2019 to TBD — Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion counts/day		
0		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion counts/day		
0		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion counts/day		
0		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion counts/day		
0.0%		
From top of worksheet		

Target Load		
billion counts/day		
0		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	South River - Ramsey Lake
County Name	Anne Arundel
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	1
Pervious Acres in Implementation Baseline Year	0

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	65.0%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year			2019	Target Year			TBD	
					2001	Progress Reductions				Future Reductions				
							Reductions achieved between 2001 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2001	BMPs installed from 2001 to 2019	Bacteria billion counts/day			BMPs planned for installation from 2019 to TBD	Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion counts/day		
290		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion counts/day		
290		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion counts/day		
290		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion counts/day		
65.0%		
From top of worksheet		

Target Load		
billion counts/day		
102		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	South River - Selby Bay
County Name	Anne Arundel
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	0
Pervious Acres in Implementation Baseline Year	0

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	45.8%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year		2019		Target Year		TBD		
					2001	Progress Reductions				Future Reductions				
							Reductions achieved between 2001 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2001	BMPs installed from 2001 to 2019	Bacteria billion counts/day			BMPs planned for installation from 2019 to TBD	Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion counts/day		
4		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion counts/day		
4		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion counts/day		
4		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion counts/day		
45.8%		
From top of worksheet		

Target Load		
billion counts/day		
2		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	South River - subsegment
County Name	Anne Arundel
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	516
Pervious Acres in Implementation Baseline Year	1,001

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	68.0%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Baseline Year: 2001 — BMPs installed before 2001	Progress Fiscal Year 2019 — Progress Reductions — BMPs installed from 2001 to 2019	Reductions achieved between 2001 and 2019 — Bacteria billion counts/day			Target Year TBD — Future Reductions — BMPs planned for installation from 2019 to TBD	Planned reductions from 2019 to TBD — Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated		0.9								1
				Pervious Acres Treated		9.1								9
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		2.1								2.1
				Pervious Acres Treated		1.2								1.2
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	40.8									40.8
				Pervious Acres Treated	84.5									84.5
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	29.7								29.7
				Pervious Acres Treated	n/a	31.7								31.7
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	8.5									8.5
				Pervious Acres Treated	6.0									6.0
				REDUCTIONS:		TOTAL	1,859			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion counts/day		
46,005		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion counts/day		
44,146		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion counts/day		
44,146		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion counts/day		
68.0%		
From top of worksheet		

Target Load		
billion counts/day		
14,722		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Upper Monocacy River
County Name	Carroll / Frederick
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2004
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2004
Impervious Acres in Implementation Baseline Year	545
Pervious Acres in Implementation Baseline Year	630

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	97.0%
Available on TMDL Data Center WLA Search	

Scenario Name: Baseline Year 2004 | Progress Fiscal Year 2019 (Progress Reductions; Reductions achieved between 2004 and 2019) | Target Year TBD (Future Reductions; Planned reductions from 2019 to TBD)

Practice Category	BMP Name	Type	Unit	BMPs installed before 2004	BMPs installed from 2004 to 2019	Bacteria billion MPN/yr	BMPs planned for installation from 2019 to TBD	Bacteria billion MPN/yr	BMP Total
Runoff Reduction Practices – Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						-
			Pervious Acres Treated						-
	Rain Gardens	Cumulative	Impervious Acres Treated						-
			Pervious Acres Treated						-
	Bioswales	Cumulative	Impervious Acres Treated		13.8				13.8
			Pervious Acres Treated		26.4				26.4
	Grass Swales	Cumulative	Impervious Acres Treated						-
			Pervious Acres Treated						-
	Permeable Pavement	Cumulative	Impervious Acres Treated						-
			Pervious Acres Treated						-
	Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	2.6	4.7				7.3
			Pervious Acres Treated	1.7	11.3				13.0
	Urban Infiltration Practices	Cumulative	Impervious Acres Treated	0.3					0.3
			Pervious Acres Treated	0.1					0.1
Runoff Reduction Practices – Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						-
			Pervious Acres Treated						-
	Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated						-
			Pervious Acres Treated						-
	Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a					-
			Pervious Acres Treated	n/a					-
	Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a		n/a		
			Pervious Acres Treated		n/a		n/a		
	Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a		n/a		
			Pervious Acres Treated		n/a		n/a		
	Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	0.9					0.9
			Pervious Acres Treated	4.5					4.5
Alternative Practices – MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept						-
	Pipe Cleaning	Annual **	Dry tons removed						-
	Inlet Cleaning	Annual **	Dry tons removed						-
	Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious						-
	Urban Tree Planting	Cumulative	Acres planted on pervious						-
	Urban Stream Restoration	Cumulative	Linear feet restored						-
	Outfall Stabilization	Cumulative	Linear feet						-
	Impervious Disconnects	Cumulative	Credit Acres						-
	Cross-Jurisdictional	Cumulative	Impervious Acres Treated	0.4					0.4
			Pervious Acres Treated	0.6					0.6
			REDUCTIONS:		TOTAL	1,398	TOTAL	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load
billion MPN/yr: 79,007
This represents the load from the watershed at the baseline year of the implementation plan

Current Load
billion MPN/yr: 77,609
This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation
billion MPN/yr: 77,609
This represents the load from the watershed in the year that the plan is fully implemented
Legend: meets TMDL | Does not meet TMDL

TMDL Reductions
billion MPN/yr: 97.0%
From top of worksheet

Target Load
billion MPN/yr: 2,370
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2004 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	West River - Bear Neck Creek
County Name	Anne Arundel
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	11
Pervious Acres in Implementation Baseline Year	5

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	43.2%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year			2019	Target Year			TBD	
					2001	Progress Reductions				Future Reductions				
							Reductions achieved between 2001 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2001	BMPs installed from 2001 to 2019	Bacteria billion counts/day			BMPs planned for installation from 2019 to TBD	Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	0.4									0.4
				Pervious Acres Treated	0.3									0.3
				REDUCTIONS:		TOTAL	0			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion counts/day		
2,374		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion counts/day		
2,374		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion counts/day		
2,374		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion counts/day		
43.2%		
From top of worksheet		

Target Load		
billion counts/day		
1,348		
This represents the load that must be achieved when the plan is fully impleméted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	West River - Cadle Creek
County Name	Anne Arundel
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	3
Pervious Acres in Implementation Baseline Year	1

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	72.2%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Baseline Year 2001: BMPs installed before 2001	Progress Fiscal Year 2019 – Progress Reductions: BMPs installed from 2001 to 2019	Reductions achieved between 2001 and 2019: Bacteria billion counts/day			Target Year TBD – Future Reductions: BMPs planned for installation from 2019 to TBD	Planned reductions from 2019 to TBD: Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion counts/day		
957		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion counts/day		
957		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion counts/day		
957		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion counts/day		
72.2%		
From top of worksheet		

Target Load		
billion counts/day		
266		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	West River - Parish Creek
County Name	Anne Arundel
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	0
Pervious Acres in Implementation Baseline Year	0

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	0.0%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year			2019	Target Year			TBD	
					2001	Progress Reductions				Future Reductions				
							Reductions achieved between 2001 and 2019				Planned reductions from 2019 to TBD			
		BMP Name	Type	Unit	BMPs installed before 2001	BMPs installed from 2001 to 2019	Bacteria billion counts/day			BMPs planned for installation from 2019 to TBD	Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion counts/day		
0		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion counts/day		
0		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion counts/day		
0		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion counts/day		
0.0%		
From top of worksheet		

Target Load		
billion counts/day		
0		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	West River - subsegment
County Name	Anne Arundel
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	32
Pervious Acres in Implementation Baseline Year	26

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	35.3%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Baseline Year 2001: BMPs installed before 2001	Progress Fiscal Year 2019 – Progress Reductions: BMPs installed from 2001 to 2019	Reductions achieved between 2001 and 2019: Bacteria billion counts/day			Target Year TBD – Future Reductions: BMPs planned for installation from 2019 to TBD	Planned reductions from 2019 to TBD: Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	0.4									0.4
				Pervious Acres Treated	0.1									0.1
				REDUCTIONS:		TOTAL	0			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion counts/day		
3,563		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion counts/day		
3,563		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion counts/day		
3,563		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion counts/day		
35.3%		
From top of worksheet		

Target Load		
billion counts/day		
2,305		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Per MDE's comments from a review of MDOT SHA's FY16 Annual Report, modeling results for a group of local TMDLs identified as "Additional Attachment B" local TMDLs are due with the submission of MDOT SHA's FY19 Annual Report. Implementation plans will be completed during the last year of the permit's annual reporting. Therefore, no future modeling has been completed to date and columns associated with future BMPs and reductions and MDOT SHA target year are left blank.

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

Watershed Name	Anacostia River - NE Branch
County Name	Montgomery / Prince George's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2005
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2005
Impervious Acres in Implementation Baseline Year	196
Pervious Acres in Implementation Baseline Year	171

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for PCBs	99.0%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year			2019	Target Year			2045	
					2005	Progress Reductions				Future Reductions				
							Reductions achieved between 2005 and 2019				Planned reductions from 2019 to 2045			
		BMP Name	Type	Unit	BMPs installed before 2005	BMPs installed from 2005 to 2019	PCBs g/yr			BMPs planned for installation from 2019 to 2045	PCBs g/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass swales	Cumulative	Impervious Acres Treated	59.7									59.7
				Pervious Acres Treated	112.8									112.8
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		1.4								1.4
				Pervious Acres Treated		1.1								1.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	11.1									11.1
				Pervious Acres Treated	24.1									24.1
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	4.4									4.4
				Pervious Acres Treated	20.5									20.5
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	4.6				6.9				11.5
				Pervious Acres Treated	n/a	8.4				5.9				14.3
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	27.9									27.9
				Pervious Acres Treated	122.6									122.6
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		3.1								3.1
		Pipe Cleaning	Annual **	Dry tons removed		6.2								6.2
		Inlet Cleaning	Annual **	Dry tons removed		1.6				10.5				12.1
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0.1			TOTAL	0.2			

* 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		
PCBs		
7.9		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
PCBs		
7.8		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
PCBs		
7.7		
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		
PCBs		
99.0%		
From top of worksheet		

Target Load		
PCBs		
0.1		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology. BMPS with PCB reductions are first modeled as TSS EOS lbs/yr load reductions. TSS load reductions are then converted to PCB g/yr.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- PCB load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not provide reductions by BMP type.

MDE

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

Watershed Name	Anacostia River - NW Branch
County Name	Montgomery / Prince George's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2005
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2005
Impervious Acres in Implementation Baseline Year	481
Pervious Acres in Implementation Baseline Year	284

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for PCBs	98.0%

Available on TMDL Data Center WLA Search

		BMP Name	Type	Unit	Baseline Year 2005: BMPs installed before 2005	Progress Fiscal Year 2019 – Progress Reductions: BMPs installed from 2005 to 2019	Reductions achieved between 2005 and 2019: PCBs g/yr			Target Year 2045 – Future Reductions: BMPs planned for installation from 2019 to 2045	Planned reductions from 2019 to 2045: PCBs g/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass swales	Cumulative	Impervious Acres Treated	3.9									3.9
				Pervious Acres Treated	6.3									6.3
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.2									0.2
				Pervious Acres Treated	0.1									0.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	4.6									4.6
				Pervious Acres Treated	8.4									8.4
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	3.9									3.9
				Pervious Acres Treated	26.5									26.5
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	8.5								8.5
				Pervious Acres Treated	n/a	26.6								26.6
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	25.8									25.8
				Pervious Acres Treated	134.8									134.8
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		1.9								1.9
		Pipe Cleaning	Annual **	Dry tons removed		15.4								15.4
		Inlet Cleaning	Annual **	Dry tons removed		4.0								4.0
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0.2			TOTAL	0.0			

Scenario Name: Baseline Year / Progress Fiscal Year 2019 / Target Year 2045

* 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

PCBs		
7.7		

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

Current Load

PCBs		
7.5		

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

Load under full implementation

PCBs		
7.5		

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

PCBs		
98.0%		

From top of worksheet

Target Load

PCBs		
0.2		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology. BMPS with PCB reductions are first modeled as TSS EOS lbs/yr load reductions. TSS load reductions are then converted to PCB g/yr.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- PCB load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not provide reductions by BMP type.

MDE

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

Watershed Name	Anacostia River Tidal
County Name	Prince George's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2005
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2005
Impervious Acres in Implementation Baseline Year	422
Pervious Acres in Implementation Baseline Year	414

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for PCBs	99.9%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year		2050		
					2005	Progress Reductions				Future Reductions				
							Reductions achieved between 2005 and 2019				Planned reductions from 2019 to 2050			
		BMP Name	Type	Unit	BMPs installed before 2005	BMPs installed from 2005 to 2019	PCBs g/yr			BMPs planned for installation from 2019 to 2050	PCBs g/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		0.7								0.7
				Pervious Acres Treated		0.8								0.8
		Grass Swales	Cumulative	Impervious Acres Treated	12.7									12.7
				Pervious Acres Treated	12.0									12.0
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.0									-
				Pervious Acres Treated	0.3									0.3
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	3.3									3.3
				Pervious Acres Treated	5.7									5.7
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.3									0.3
				Pervious Acres Treated	0.2									0.2
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	9.5								9.5
				Pervious Acres Treated	n/a	16.5								16.5
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	21.9									21.9
				Pervious Acres Treated	109.1									109.1
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		7.8								7.8
		Pipe Cleaning	Annual **	Dry tons removed		1.9								1.9
		Inlet Cleaning	Annual **	Dry tons removed		5.8								5.8
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0.6			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
PCBs		
16.1		

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

Current Load		
PCBs		
15.5		

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

Load under full implementation		
PCBs		
15.5		

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		
PCBs		
99.9%		

From top of worksheet

Target Load		
PCBs		
0.0		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology. BMPS with PCB reductions are first modeled as TSS EOS lbs/yr load reductions. TSS load reductions are then converted to PCB g/yr.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- PCB load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not provide reductions by BMP type.

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

Watershed Name	Back River Oligohaline Tidal
County Name	Baltimore
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	518
Pervious Acres in Implementation Baseline Year	661

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for PCBs	53.0%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year			2019	Target Year			2045	
					2001	Progress Reductions				Future Reductions				
							Reductions achieved between 2001 and 2019				Planned reductions from 2019 to 2045			
		BMP Name	Type	Unit	BMPs installed before 2001	BMPs installed from 2001 to 2019	PCBs g/yr			BMPs planned for installation from 2019 to 2045	PCBs g/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	27.4									27.4
				Pervious Acres Treated	50.5									50.5
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	7.0									7.0
				Pervious Acres Treated	14.8									14.8
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	4.7								4.7
				Pervious Acres Treated	n/a	7.7								7.7
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	0.6	1.1								1.7
				Pervious Acres Treated	17.2	3.0								20.2
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		46.9								46.9
		Pipe Cleaning	Annual **	Dry tons removed		39.9								39.9
		Inlet Cleaning	Annual **	Dry tons removed		16.9				26.3				43.2
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	1.3			TOTAL	0.6			

* 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		
PCBs		
19.3		

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

Current Load		
PCBs		
18.0		

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

Load under full implementation		
PCBs		
17.4		

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		
PCBs		
53.0%		
From top of worksheet		

Target Load		
PCBs		
9.1		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology. BMPS with PCB reductions are first modeled as TSS EOS lbs/yr load reductions. TSS load reductions are then converted to PCB g/yr.
- 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 2001 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- PCB load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not provide reductions by BMP type.

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

Watershed Name	Baltimore Harbor Embayment
County Name	Anne Arundel / Baltimore
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2004
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2004
Impervious Acres in Implementation Baseline Year	176
Pervious Acres in Implementation Baseline Year	98

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for PCBs	91.0%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Baseline Year 2004: BMPs installed before 2004	Progress Fiscal Year 2019 – Progress Reductions: BMPs installed from 2004 to 2019	Reductions achieved between 2004 and 2019: PCBs g/yr			Target Year 2038 – Future Reductions: BMPs planned for installation from 2019 to 2038	Planned reductions from 2019 to 2038: PCBs g/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	3.4									3.4
				Pervious Acres Treated	2.6									2.6
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		3.1								3.1
		Pipe Cleaning	Annual **	Dry tons removed		3.4								3.4
		Inlet Cleaning	Annual **	Dry tons removed		1.3								1.3
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0.2			TOTAL	0.0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
PCBs		
6.2		

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

Current Load	
PCBs	
6.1	

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

Load under full implementation		
PCBs		
6.1		

This represents the load from the watershed in the year that the plan is fully implemented

Legend: meets TMDL | Does not meet TMDL

TMDL Reductions		
PCBs		
91.0%		

From top of worksheet

Target Load		
PCBs		
0.6		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology. BMPS with PCB reductions are first modeled as TSS EOS lbs/yr load reductions. TSS load reductions are then converted to PCB g/yr.
- 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 2004 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- PCB load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not provide reductions by BMP type.

MDE

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

Watershed Name	Bear Creek
County Name	Anne Arundel / Baltimore
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2004
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2004
Impervious Acres in Implementation Baseline Year	97
Pervious Acres in Implementation Baseline Year	69

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for PCBs	92.0%

Available on TMDL Data Center WLA Search

				Scenario Name:	Baseline Year 2004	Progress Fiscal Year 2019 – Progress Reductions	Reductions achieved between 2004 and 2019	Target Year 2038 – Future Reductions	Planned reductions from 2019 to 2038	
		BMP Name	Type	Unit	BMPs installed before 2004	BMPs installed from 2004 to 2019	PCBs g/yr	BMPs planned for installation from 2019 to 2038	PCBs g/yr	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated						-
				Pervious Acres Treated						-
		Rain Gardens	Cumulative	Impervious Acres Treated						-
				Pervious Acres Treated						-
		Bioswales	Cumulative	Impervious Acres Treated						-
				Pervious Acres Treated						-
		Grass Swales	Cumulative	Impervious Acres Treated	4.5					4.5
				Pervious Acres Treated	5.5					5.5
		Permeable Pavement	Cumulative	Impervious Acres Treated						-
				Pervious Acres Treated						-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated						-
				Pervious Acres Treated						-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated						-
				Pervious Acres Treated						-
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated						-
				Pervious Acres Treated						-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated						-
				Pervious Acres Treated						-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a					-
				Pervious Acres Treated	n/a					-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a		n/a		
				Pervious Acres Treated		n/a		n/a		
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a		n/a		
				Pervious Acres Treated		n/a		n/a		
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated						-
				Pervious Acres Treated						-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		24.9				24.9
		Pipe Cleaning	Annual **	Dry tons removed		9.5				9.5
		Inlet Cleaning	Annual **	Dry tons removed		1.4				1.4
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious						-
		Urban Tree Planting	Cumulative	Acres planted on pervious						-
		Urban Stream Restoration	Cumulative	Linear feet restored						-
		Outfall Stabilization	Cumulative	Linear feet						-
		Impervious Disconnects	Cumulative	Credit Acres						-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated						-
				Pervious Acres Treated						-
				REDUCTIONS:		TOTAL	0.4	TOTAL	0.0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

PCBs		
6.3		

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

Current Load

PCBs		
5.9		

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

Load under full implementation

PCBs		
5.9		

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

PCBs		
92.0%		

From top of worksheet

Target Load

PCBs		
0.5		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology. BMPS with PCB reductions are first modeled as TSS EOS lbs/yr load reductions. TSS load reductions are then converted to PCB g/yr.
- 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 2004 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- PCB load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not provide reductions by BMP type.

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

Watershed Name	Bird River
County Name	Baltimore County
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2010
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2010
Impervious Acres in Implementation Baseline Year	199
Pervious Acres in Implementation Baseline Year	254

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for PCBs	70.0%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year	2050			
					2010	Progress Reductions				Future Reductions				
							Reductions achieved between 2010 and 2019				Planned reductions from 2019 to 2050			
		BMP Name	Type	Unit	BMPs installed before 2010	BMPs installed from 2010 to 2019	PCBs g/yr			BMPs planned for installation from 2019 to 2050	PCBs g/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass swales	Cumulative	Impervious Acres Treated	4.3									4.3
				Pervious Acres Treated	8.7									8.7
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	2.5									2.5
				Pervious Acres Treated	4.1									4.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	10.1									10.1
				Pervious Acres Treated	70.0									70.0
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	1.0									1.0
				Pervious Acres Treated	0.6									0.6
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	3.7								3.7
				Pervious Acres Treated	n/a	7.5								7.5
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	25.2									25.2
				Pervious Acres Treated	83.1									83.1
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		4.4								4.4
		Pipe Cleaning	Annual **	Dry tons removed		17.8								17.8
		Inlet Cleaning	Annual **	Dry tons removed		4.8								4.8
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0.1			TOTAL	0.0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
PCBs		
1.3		

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

Current Load		
PCBs		
1.2		

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

Load under full implementation		
PCBs		
1.2		

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		
PCBs		
70.0%		

From top of worksheet

Target Load		
PCBs		
0.4		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology. BMPS with PCB reductions are first modeled as TSS EOS lbs/yr load reductions. TSS load reductions are then converted to PCB g/yr.
- 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 2010 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- PCB load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not provide reductions by BMP type.

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

Watershed Name	Bush River Oligohaline
County Name	Harford
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2010
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2010
Impervious Acres in Implementation Baseline Year	796
Pervious Acres in Implementation Baseline Year	1,046

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for PCBs	62.0%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year	2050			
					2010	Progress Reductions				Future Reductions				
							Reductions achieved between 2010 and 2019				Planned reductions from 2019 to 2050			
		BMP Name	Type	Unit	BMPs installed before 2010	BMPs installed from 2010 to 2019	PCBs g/yr			BMPs planned for installation from 2019 to 2050	PCBs g/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	1.6	8.6								10.2
				Pervious Acres Treated	1.8	16.4								18.2
		Grass swales	Cumulative	Impervious Acres Treated	14.2	0.9								15.1
				Pervious Acres Treated	28.8	0.8								29.6
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	2.2	3.5								5.7
				Pervious Acres Treated	8.1	8.9								17.0
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	29.7									29.7
				Pervious Acres Treated	217.0									217.0
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	2.0									2.0
				Pervious Acres Treated	5.6									5.6
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	8.2								8.2
				Pervious Acres Treated	n/a	19.5								19.5
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	45.7									45.7
				Pervious Acres Treated	207.2									207.2
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed		38.6								38.6
		Inlet Cleaning	Annual **	Dry tons removed		8.1								8.1
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0.4	0	0	TOTAL	0.0	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
PCBs		
11.1		

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

Current Load		
PCBs		
10.7		

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

Load under full implementation		
PCBs		
10.7		

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		
PCBs		
62.0%		
From top of worksheet		

Target Load		
PCBs		
4.2		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Bush River Oligohaline PCB TMDL is the aggregate of the following MD 8-digit watersheds: Atkisson Reservoir, Lower Winters Run, Bush River, and Bynum Run.
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology. BMPs with PCB reductions are first modeled as TSS EOS lbs/yr load reductions. TSS load reductions are then converted to PCB g/yr.
- 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 2010 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- PCB load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not provide reductions by BMP type.

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

Watershed Name	Curtis Creek/Bay
County Name	Anne Arundel / Baltimore County
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2004
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2004
Impervious Acres in Implementation Baseline Year	743
Pervious Acres in Implementation Baseline Year	968

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for PCBs	94.0%
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Baseline Year 2004: BMPs installed before 2004	Progress Fiscal Year 2019: BMPs installed from 2004 to 2019	Reductions achieved between 2004 and 2019: PCBs g/yr			Target Year 2038: BMPs planned for installation from 2019 to 2038	Planned reductions from 2019 to 2038: PCBs g/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated		11.7								11.7
				Pervious Acres Treated		26.4								26.4
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		0.6								0.6
				Pervious Acres Treated		1.0								1.0
		Grass swales	Cumulative	Impervious Acres Treated	16.5	11.9								28.4
				Pervious Acres Treated	33.0	8.5								41.5
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		1.8								1.8
				Pervious Acres Treated		2.5								2.5
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	110.2									110.2
				Pervious Acres Treated	604.7									604.7
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	34.1				7.9				42.0
				Pervious Acres Treated	n/a	105.4				5.7				111.1
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	65.9	1.4								67.3
				Pervious Acres Treated	469.5	0.9								470.4
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed		12.1								12.1
		Inlet Cleaning	Annual **	Dry tons removed		6.7								6.7
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	2.4			TOTAL	0.3			

* 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		
PCBs		
31.3		

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

Current Load		
PCBs		
28.9		

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

Load under full implementation		
PCBs		
28.6		

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		
PCBs		
94.0%		

From top of worksheet

Target Load		
PCBs		
1.9		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology. BMPS with PCB reductions are first modeled as TSS EOS lbs/yr load reductions. TSS load reductions are then converted to PCB g/yr.
- 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 2004 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- PCB load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not provide reductions by BMP type.

MDE

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

Watershed Name	Lake Roland
County Name	Baltimore County
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2010
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2010
Impervious Acres in Implementation Baseline Year	364
Pervious Acres in Implementation Baseline Year	627

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for PCBs	29.0%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2019			Target Year	2025			
					2010	Progress Reductions				Future Reductions				
							Reductions achieved between 2010 and 2019				Planned reductions from 2019 to 2025			
		BMP Name	Type	Unit	BMPs installed before 2010	BMPs installed from 2010 to 2019	PCBs g/yr			BMPs planned for installation from 2019 to 2025	PCBs g/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass swales	Cumulative	Impervious Acres Treated	10.5									10.5
				Pervious Acres Treated	11.4									11.4
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	4.2									4.2
				Pervious Acres Treated	27.6									27.6
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	7.7									7.7
				Pervious Acres Treated	4.4									4.4
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	3.2									3.2
				Pervious Acres Treated	7.7									7.7
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	17.9									17.9
				Pervious Acres Treated	13.1									13.1
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		31.9								31.9
		Pipe Cleaning	Annual **	Dry tons removed		6.1								6.1
		Inlet Cleaning	Annual **	Dry tons removed		11.0								11.0
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0.3			TOTAL	0.0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
PCBs		
16.1		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
PCBs		
15.8		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
PCBs		
15.8		
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		
PCBs		
29.0%		
From top of worksheet		

Target Load		
PCBs		
11.4		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology. BMPS with PCB reductions are first modeled as TSS EOS lbs/yr load reductions. TSS load reductions are then converted to PCB g/yr.
- 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 2010 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- PCB load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not provide reductions by BMP type.

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

Watershed Name	Patuxent River Tidal Fresh
County Name	Anne Arundel/Howard/Montgomery/Prince George's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2010
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2010
Impervious Acres in Implementation Baseline Year	3,693
Pervious Acres in Implementation Baseline Year	5,607

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for PCBs	99.9%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year 2019				Target Year 2050				
					2010	Progress Reductions				Future Reductions				
							Reductions achieved between 2010 and 2019				Planned reductions from 2019 to 2050			
		BMP Name	Type	Unit	BMPs installed before 2010	BMPs installed from 2010 to 2019	PCBs g/yr			BMPs planned for installation from 2019 to 2050	PCBs g/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	11.8	36.3				0.9				49.0
				Pervious Acres Treated	23.0	54.7				0.5				78.2
		Grass swales	Cumulative	Impervious Acres Treated	266.5									266.5
				Pervious Acres Treated	512.1									512.1
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	10.6	3.0								13.6
				Pervious Acres Treated	15.7	2.5								18.2
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	135.6									135.6
				Pervious Acres Treated	837.4									837.4
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated		0.2								0.2
				Pervious Acres Treated		1.0								1.0
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	26.4									26.4
				Pervious Acres Treated	41.6									41.6
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	3.8				31.1				34.9
				Pervious Acres Treated	n/a	12.5				56.4				68.9
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	326.7	9.9								336.6
				Pervious Acres Treated	1,463.2	37.4								1,500.6
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		100.8								100.8
		Pipe Cleaning	Annual **	Dry tons removed		20.4								20.4
		Inlet Cleaning	Annual **	Dry tons removed		24.7								24.7
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious		0.2								0.2
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0.1			TOTAL	0.1			

* 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		
PCBs		
5.1		

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

Current Load		
PCBs		
5.0		

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

Load under full implementation		
PCBs		
4.9		

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		
PCBs		
99.9%		

From top of worksheet

Target Load		
PCBs		
0.0		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Patuxent River Tidal Fresh PCB TMDL is the aggregate of the following MD 8-digit watersheds: Brighton Dam, Rocky Gorge Dam, Middle Patuxent River, Little Patuxent River, Patuxent River Upper, Western Branch, and Patuxent River Middle.
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology. BMPS with PCB reductions are first modeled as TSS EOS lbs/yr load reductions. TSS load reductions are then converted to PCB g/yr.
- 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 2010 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Reduction requirements are only within PAXTF subwatershed.
- PCB load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not provide reductions by BMP type.

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

Watershed Name	Potomac River Upper Tidal
County Name	Charles / Prince George's
Date	10/23/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2005
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2005
Impervious Acres in Implementation Baseline Year	497
Pervious Acres in Implementation Baseline Year	556

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for PCBs	92.1%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year		2019		Target Year			2050	
					2005	Progress Reductions				Future Reductions				
							Reductions achieved between 2005 and 2019				Planned reductions from 2019 to 2050			
		BMP Name	Type	Unit	BMPs installed before 2005	BMPs installed from 2005 to 2019	PCBs g/yr			BMPs planned for installation from 2019 to 2050	PCBs g/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	Non-Specified RR Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.6									0.6
				Pervious Acres Treated	0.8									0.8
		Grass swales	Cumulative	Impervious Acres Treated	24.9									24.9
				Pervious Acres Treated	31.0									31.0
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	1.2									1.2
				Pervious Acres Treated	1.3									1.3
	Stormwater Treatment (ST) Practices	Non-Specified ST Retrofits	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	71.2									71.2
				Pervious Acres Treated	119.2									119.2
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		30.1								30.1
		Pipe Cleaning	Annual **	Dry tons removed		2.4								2.4
		Inlet Cleaning	Annual **	Dry tons removed		4.3								4.3
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
				REDUCTIONS:		TOTAL	0.0			TOTAL	0.0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
PCBs		
1.2		

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

Current Load		
PCBs		
1.2		

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

Load under full implementation		
PCBs		
1.2		

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		
PCBs		
92.1%		

From top of worksheet

Target Load		
PCBs		
0.1		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology. BMPS with PCB reductions are first modeled as TSS EOS lbs/yr load reductions. TSS load reductions are then converted to PCB g/yr.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- PCB load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not provide reductions by BMP type.

Appendix F

Little Catoctin Creek Watershed Monitoring Report

Appendix F

Appendix F

Little Catoctin Creek Watershed Monitoring Report

MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

Little Catoctin Creek Watershed Monitoring Implementation Document

MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

October 2019

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1 Introduction

The Maryland Department of Transportation State Highway Administration (MDOT SHA) Water Programs Division (WPD) has completed a stream restoration project on Little Catoctin Creek (LCC). The restoration extents originate at MDOT SHA bridge structure number 10081 along MD 180 (Jefferson Pike) and continues downstream approximately 3,100 LF of the existing channel. The floodplain restoration project consisted of stabilization and relocation of approximately 3,000 linear feet of Little Catoctin Creek, south of MD-180. The goals of the stream and floodplain restoration were to restore impaired vital ecosystems, and return hydrology, geomorphic, and hydraulic stream functions back to pre-development conditions within the 100-year floodplain. Construction of the Little Catoctin Creek stream restoration project was completed in April 2019.

MDOT SHA is in the process of monitoring the physical, chemical, and biological features of the project stream for five years: This report documents the findings from the third year of monitoring per the NPDES/MS4 Assessment of Controls for Stream Restoration of Little Catoctin Creek at U.S. 340. The following sections of this yearly report include activities for chemical, biological, and physical monitoring for the pre-restoration baseline between July 2017 and June 2019.

2 Study Area

The Little Catoctin Creek watershed occupies 17.72 square miles (11,340.3 acres) in the southwestern corner of Frederick County in the Blue Ridge physiographic province. It flows 8.5 stream-miles southeast from its headwaters on the eastern side of South Mountain to the mouth east of the town of Brunswick and drains directly into the Potomac River. Land use in the watershed is primarily agricultural. Approximately 20 percent of the watershed draining to the study reach is forested. Impervious surface comprises less than 3 percent of the watershed (SHA 2016).

The study area is located north of the town of Rosemont between US-340 at the upstream end and Petersville Road (MD-79) at the downstream end. Within the study area, Little Catoctin Creek flows through active and old pasture. Prior to restoration, much of the riparian area (especially in reaches adjacent to MD-180) contained few trees – leaving much of the stream open to direct sunlight. Stream banks within the open pasture were steep and heavily eroded. Riffle and run habitats within the creek were predominantly cobble and gravel. Heavy deposits of fine silt and sand were found in pools and depositional areas.

3 Chemical Monitoring

Per the NPDES/MS4 Assessment of Controls monitoring plan, chemical monitoring of the Little Catoctin Creek was performed as specified in the chemical monitoring methodology. The monitoring efforts through January 31, 2018 fall under phase CHEM 1 activity to establish pre-restoration conditions. Monitoring efforts beginning February 1, 2018 through April 15, 2019 occurred during the construction phase (CHEM 2). Monitoring efforts beginning on April 16, 2019 and continuing through December 2021, are conducted under the post-construction phase (CHEM 3). Stage, discharge, velocity, continuous water quality measurements, and discrete water quality sample analyses are reported on the U.S. Geological Survey's National Water Information Service (NWIS) and are available online at: https://www.waterqualitydata.us/. At time of writing (July 2019), a portion of the hydrologic and continuous water-quality monitoring data remain "provisional" and are subject to change upon review. The monitoring locations referenced in the following sections of the report can be found in Figure 1.

Figure 1. Chemical Monitoring Locations

It should also be noted that chemical data submitted to MDE in FY18 is being overwritten with new data in the FY19 submittal because the previous submittal included some observations still flagged by USGS as provisional. Moving forward with the submission of some data in this state was necessary to meet the 2019 reporting deadline and was done so with the understanding that subsequent files would update any provisional entries accordingly.

Primarily, the largest differences relate with changes to discharge observations. Since discharge is a variable in the computation of Event Mean Concentration (EMC), differences from 2018 propagate throughout observations in 2019 EMC data. Differences in total volume associated with baseflow sample entries are a result of using the total volume of flow passing each site during the time of sampling instead of simply using an instantaneous, single-point observation. This change was made to provide consistency in reporting total flows and provide a more representative value for modeling purposes. Total storm-flow discrepancies result from an ability to now refine the delineation of storm events more accurately using knowledge gained from the collection of temperature and specific conductance time series.

3.1 Surface Water Stage/Discharge/Velocity

In September 2016, U.S. Geological Survey Site 01636845 (Little Catoctin Creek Near Rosemont, MD; upstream) was established (see Figure 2), which included a radar stage sensor and acoustic doppler velocity meter (ADVM) for velocity. Since the time of equipment installation the, 82 discrete discharge measurements have been made with a range of 0.49 cubic feet per second to 307 cubic feet per second. These measurements were used to establish the relation between stage-velocity and discharge. Thirty-six calibration measurements were made within the 2018-2019 reporting period (July 1, 2018 – June 30, 2019); measurements were also made during stream sampling when the gage was decommissioned during stream reconstruction (January 18, 2019 – May 23, 2019). Current and historic observations can be found online at: *https://nwis.waterdata.usgs.gov/md/nwis/uv/?site_no=01636845*

In December 2016, U.S. Geological Survey established the downstream site 01636846 (Little Catoctin Creek at Rosemont, MD), this site was instrumented with an ADVM to measure stream velocity. In September 2017, a bubbler-style gage unit was installed at this site to record stage needed for the computing discharge. Discharge was deemed important because of the possibility that construction would enhance groundwater flow into the stream through the channel bottom. In addition, numerous springs and seeps were observed along the banks of the Little Catoctin Creek that undoubtedly contribute to the stream flow. An accurate measure of discharge at the upstream and downstream stations is needed to calculate (mass-balance) gains or losses in nutrients and sediments through the restoration reach. Since the time of installation, 52 discrete discharge measurements have been made for calibration purposes, covering a range of 0.45 cubic feet per second to 108 ft3/s. This range was indirectly extended to 9630 ft3/s during the historic flood in 2018. Current and historic observations can be found at:

https://waterdata.usgs.gov/nwis/inventory/?site_no=01636846&agency_cd=USGS

Figure 2. U.S. Geological Survey Site 01636845 (Little Catoctin Creek near Rosemont, MD; upstream)

Figure 3. U.S. Geological Survey Site 01636846 (Little Catoctin Creek at Rosemont, MD; downstream)

3.1.1 Summary of Discharge and Velocity Data

The continuous discharge and water velocity data were downloaded, tabulated and inspected for completeness; completeness is defined as the percent of time when measurements were recorded compared to the total time of gage operation. Completeness is an important consideration when attempting to compare hydrologic and chemical parameters among time periods. For example, a high percentage of missing data will greatly hinder the ability to compare volumes and loadings among pre- and post-construction periods. Missing data are the result of equipment failures, icing, or other unforeseen incidents including the loss of equipment from the major storm flood in 2018. Another factor is the percentage of data "approved" by the USGS for use. Hydrologic data collected by the USGS undergoes a rigorous review process before becoming "approved" – data classified as "provisional" are subject to change upon USGS review, possibly affecting loading values.

A summary of the continuous hydrologic data is presented in Table 3-1. This data are divided into four intervals in FY18 and FY19: (1) the total time over which the instrumentation was in place (10/1/17 to 6/30/19); (2) the pre-construction period beginning when sampling was initiated on 1/3/17 until construction began on 1/31/18; (3) the construction period occurring between 2/1/18 and 4/15/19; and (4) the post-construction period 4/16/19 through present. The post-construction monitoring effort will continue until spring 2020. Note that the upstream gage equipment was removed on 1/18/19 for 126 days due to the floodplain restoration. The gage was reinstalled and began operating again on 4/9/19. The down-time resulted in the low percentage of completeness shown in Table 3-1. Velocity and discharge (calculated from stage-velocity relationship) are presently being collected at the upstream station along with additional calibration measurements needed to refine the hydrologic data. Discharge reported at the upstream station after 5/23/19 are estimated values and are based on a preliminary gage height-rating curve - these data are provisional and are subject to revision.

Discharge and water velocity data are available for 93% of the study period at the upstream station (excluding the 1/18/19 to 4/9/19 down time), while at the downstream site, data coverage is 98% for discharge and 84% for velocity. Discharge, both the maximum and median values, at the upstream station are lower at the downstream station, indicating the stream is gaining in this reach. The lack of discharge data for the upstream site during construction will limit the calculation of incoming loadings during the construction period. A comparison of concurrently measured discharge at the upstream and downstream stations show that discharge increases by approximately 15% through the study area. Therefore, the "missing" discharge at the upstream station during the construction period were estimated to be 85% of the discharge measured downstream.

Also listed in Table 3-1 is a summary of precipitation data that were collected at the site. Data were obtained at the site for only about 30% of the study period. The rain gage the site began operation on 2/25/18, so precipitation data were not available the pre-construction monitoring period. For consistency, therefore, data from the Fredrick Airport (station KFDK) station, retrieved from MesoWest (https://mesowest.utah.edu/), were used to determine precipitation totals and intensities for the sampled storm events.

Table 3-1. Summary statistics of discharge, water velocity, and precipitation recorded at the upstream (1636845) and downstream (1636846) stations on Little Catoctin Creek, Md
[ft, feet; ft3/s, cubic feet per second; ft/s, feet per second; in, inches; min, minutes; --, not available]

	Gage height (ft)	Discharge (ft^3/s)	Velocity (ft/s)	Precipitation[1] (in. per 5 min.)
UPSTREAM (1636845)				
All Data 1/3/17 to 6/30/19				
% of data available	93	94	62	30
% of data “Approved”	93	89	62	52
Maximum	8.96	9,050	7.28	0.46
Minimum	0.16	0.36	0.0	0.00
Median	1.32	2.44	0.11	<0.01
Pre-construction 1/3/17 – 2/1/18				
% of data available	98	97	97	0.00
Maximum	5.59	454	2.92	0.00
Minimum	0.16	0.36	0.0	0.00
Median	1.12	1.42	0.10	--
Construction 2/1/18 – 4/15/19				
% of data available	70	72	23	48
Maximum	8.96	9,050	7.28	0.30
Minimum	0.88	1.08	0.00	0.00
Median	1.75	4.95	0.20	<0.01
Post-construction 4/16/19 to 6/30/19				
% of data available	16	16	--	13
Maximum	3.79	98.4	--	0.46
Minimum	1.91	1.40	--	0.00
Median	2.06	2.76	--	<0.01

[1] Statistics are for precipitation recorded at the upstream USGS station, which began operation on 2/25/18. Precipitation amounts are collected at 5-minute intervals.

Table 3-1. Summary statistics of discharge, water velocity and precipitation data recorded at the upstream (1636845) and downstream (1636846) stations on Little Catoctin Creek, Md. – Continued.
[ft, feet; ft^3/s, cubic feet per second; ft/s, feet per second; in, inches; min, minutes; --, not available]

	Gage height (ft)	Discharge (ft^3/s)	Velocity (ft/s)
	DOWNSTREAM (1636846)		
	All Data 1/3/17 to 6/30/19		
% of data available	66	98	84
% of data “Approved	75	49	27
Maximum	12.1	9,630	8.12
Minimum	0.74	0.33	0.00
Median	1.61	3.28	0.10
	Pre-construction 1/3/17 – 2/1/18		
% of data available	29	96	68
Maximum	5.03	562	3.63
Minimum	1.32	0.38	0.00
Median	1.44	1.59	0.03
	Construction 2/1/18 – 4/15/19		
% of data available	99	98	98
Maximum	12.1	9,630	8.12
Minimum	1.22	0.33	0.00
Median	1.65	6.95	0.23
	Post-construction 4/16/19 to 6/30/19		
% of data available	99	99	98
Maximum	4.81	913	3.54
Minimum	0.74	0.87	0.00
Median	1.54	4.52	0.19

[1] Statistics are for precipitation recorded at the upstream USGS station, which began operation on 2/25/18. Precipitation amounts are collected at 5-minute intervals.

3.2 Continuous Water Quality

In November and December 2016, multiparameter water quality sondes (YSI EXO-2) were installed at site 01636845 and 01636846, respectively (Figure 3 and Figure 4). These sondes measure temperature, specific conductivity, pH, and turbidity at 5-minute intervals. The sondes have been operational since installation and data are available in near- real time on the NWIS website listed above. These data have been approved by the USGS through 1/18/19- after which, data are considered “provisional” and subject to change. As mentioned previously, due to the restoration activities, the upstream data sonde was removed 1/18/19 and returned to operation on 4/9/19.

Figure 4. U.S. Geological Survey Site 01636846 (Little Catoctin Creek at Rosemont, MD; downstream) Continuous water quality measurements

3.2.1 Summary of Available Continuous Water Quality Data

The continuous water-quality data measured using the data sondes were retrieved from NWIS, inspected for completeness, and tabulated. Short periods of missing data were replaced using the average of the measurement at the beginning and end of each missing interval. Temperature, specific conductance, pH, and turbidity data are summarized in Table 3-2. Note that due to the short time of monitoring during the post-construction period (beginning 4/16/19), summaries of these data are not considered to be comparable with the data collected in earlier phases of the study.

Table 3-2. Summary statistics of continuous water quality data recorded at the upstream (1636845) and downstream (1636846) stations on Little Catoctin Creek, Md
[FNU, formazin nephelometric units; µS/cm, micro-siemens per centimeter; F, degrees Fahrenheit]

	Turbidity (FNU)	Specific conductance (µS/cm)	Water temperature (ºF)	pH (standard Units)
UPSTREAM (1636845)				
All Data 1/3/17 to 6/30/19				
% of data available[1]	87	89	86	90
% of data “Approved”[2]	87	87	92	88
Maximum	2,260	2,470	91.8	9.4
Minimum	0.8	54	31.6	5.3
Median	6.1	322	56.8	7.3
Pre-construction 1/3/17 – 2/1/18				
% of data available	82	84	86	84
Maximum	2,010	1,980	80.4	8.8
Minimum	1.3	135	31.6	6.9
Median	6.1	349	53.9	7.3
Construction 2/1/18 – 4/15/19				
% of data available	67	69	67	70
Maximum	2,260	2,470	87.8	9.4
Minimum	0.8	54	32.0	5.3
Median	5.1	295	54.7	7.4
Post-construction 4/16/19 to 6/30/19				
% of data available	25	19	12	19
Maximum	2,130	534	91.8	9.0
Minimum	2.0	61	57.6	5.7
Median	9.8	267	73.8	7.4

1. Percent of data available is equal to the total number of recorded measurements divided by the total number of possible measurements in time period, time 100. Measurements were made at 5-minute intervals.
2. Percent of data approved is equal to the total number of recorded measurements that are stamped “Approved” divided by the total number of measurements made, times 100.

*Table 3.2. Summary statistics of continuous water quality data recorded at the upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. – Continued.*
[FNU, formazin nephelometric units; µS/cm, micro-siemens per centimeter; F, degrees Fahrenheit]

	Turbidity (FNU)	Specific conductance (µS/cm)	Water temperature (ºF)	pH (stnd. Units)
		DOWNSTREAM (1636846)		
		All Data 1/3/17 to 6/30/19		
% of data available	89	88	90	87
% of data "Approved	99	99	89	99
Maximum	270	2,070	94.6	9.8
Minimum	1.3	47	31.6	6.8
Median	5.1	325	57.2	7.4
		Pre-construction 1/3/17 – 2/1/18		
% of data available	78	76	80	78
Maximum	2,040	1,300	86.5	9.4
Minimum	1.3	51	31.6	7.1
Median	4.0	361	56.3	7.4
		Construction 2/1/18 – 4/15/19		
% of data available	99	98	100	95
Maximum	2,170	2,070	88.7	9.8
Minimum	1.3	47	31.8	6.8
Median	6.0	300	51.4	7.4
		Post-construction 4/16/19 to 6/30/19		
% of data available	96	99	98	98
Maximum	2,170	501	94.6	9.3
Minimum	2.2	120	49.8	7.0
Median	7.7	281	70.3	7.5

1. Percent of data available is equal to the total number of recorded measurements divided by the total number of possible measurements in time period, time 100. Measurements were made at 5-minute intervals.
2. Percent of data approved is equal to the total number of recorded measurements that are stamped "Approved" divided by the total number of measurements made, times 100.

3.3 Discrete Water Quality

The goals of the water-quality sampling are: (1) to fulfill monitoring requirements outlined in the NPDES/MS4 assessment of controls permit; (2) to facilitate calculation of nutrient and sediment loads or yields; and (3) to document the changes in loads of sediment and nutrients caused by the floodplain restoration. Water-quality sampling was also used to verify cross-channel homogeneity in suspended sediment (SS) and dissolved species, and to provide data for generating relationships between turbidity and suspended-sediment concentration (SSC).

During storm events, samples are collected during the rise, peak, and falling stages of the hydrograph. These three samples, termed sub-samples, are weighted using the stream discharge at the time of sampling, and then summed to determine the mean concentration for the event, termed EMC:

$$\text{EMC} = \sum_{1}^{n} \left(\frac{\text{Qt}}{\text{QTotal}}\right) * \text{Ct}$$

Where:

EMC is the event mean concentration

Qt is the instantaneous discharge at the time (t) of sub-sample was collected

QTotal is the sum of the instantaneous discharges at times the sub-samples were collected

Ct is the concentration of component measured in sub-sample collected at time t

n is the number of sub-samples collected (2 to 5)

During most storms, three sub-samples were collected at each station; however, on some occasions, only 2 sub-samples were obtained due to equipment failure or other unavoidable conditions. During a few events, up to 5 sub-samples were collected to provide replicate data needed to evaluate variability and precision. Replicate samples were used in calculating EMC. Sub-samples were collected either manually by wading or by using automatic samplers. When the stream was wadable (during low-flow and typically during the falling stage), composite samples were prepared by collecting up to 10 vertically depth-integrated grab samples. These grab samples are obtained at equally spaced intervals across the stream and then are composited in a plastic churn, mixed, and sub-sampled for the various analytic protocols. In contrast, the automatic samplers collect a sample from a point in the stream. During storm events when wading is not possible (typically the rising and cresting stages), the autosamplers are used to collect discrete samples for nutrient and sediment (either suspended-sediment concentration SSC, or total suspended solids (TSS) and bacteriologic constituents. Total petroleum hydrocarbon (TPH) samples were collected manually whenever wading was possible, so fewer sub-samples have been obtained for this constituent.

Over the course of the study, the autosamplers were calibrated by making cross-sectional measurements of turbidity and specific conductance (SC) while the autosampler was collecting point samples for SSC, conductivity, and turbidity. Cross-channel turbidity is used to evaluate the cross-channel distribution of suspended materials in the river, while SC is used to evaluate the cross-channel homogeneity of dissolved constituents. SSC can be related to turbidity (and possibly also to discharge), thereby allowing the continuous turbidity record to be used as a surrogate of SSC. The data collected to date show the stream is well mixed with respect to suspended and dissolved materials, and therefore, samples collected using the autosamplers are considered to accurately represent conditions in the stream. Because the upstream station was removed during the construction phase and subsequently replaced, new calibration sampling is currently untaken to recalibrate this station.

Samples collected during times of low-flow are used to represent baseflow chemistry - these may not represent “baseflow” in the strict hydrologic sense where only groundwater is contributing to the stream flow. Baseflow sampling was conducted only if no precipitation had occurred within 7 days prior to sampling and the stage was low and steady. As discussed below, baseflow discharge ranged from 0.60 to 16.3 ft3/s, with higher values generally in winter months and during the construction period.

Samples for analysis of constituents that make up TPH were collected manually as grab samples (during both storm and baseflow) and were not composited across the stream. TPH samples are collected using a stainless-steel weighted sampler that holds multiple VOC vials. Because samples for TPH were collected manually, some storm events are represented by less than 3 sub-samples (because of non-wadable conditions). During storms, bacteriologic samples are collected directly by the autosampler into sterilized plastic bottles.

Table 3-3 summarizes the number of storm and baseflow events, and the discrete sub-samples collected for nutrients, bacteriologic, and TPH constituents. In total, 47 events were sampled at the upstream site, and 50 at the downstream site, of which 44 events were sampled concurrently at both stations. Baseflow was sampled 14 times at the upstream site and 17 times at the downstream station. Over 200 samples for SSC have been collected at the upstream and downstream stations, fewer samples were collected for TSS (114 and 109, respectively). Of the 119 sub-samples collected from the upstream station for chemical analysis, 36% were obtained using the autosampler, and of the 222 samples collected for SSC, 76% were collected using the autosampler. At the downstream site, of the 109 sub-samples collected for chemical analysis, 32% were obtained using the autosampler, and of samples collected for SSC, 74% were obtained using the autosampler. Bacteriologic samples were collected during all storm events and totaled 123 and 117 sub-samples at the upstream and downstream stations, respectively. TPH sub-samples totaled 80 and 77 at the upstream and downstream stations, respectively. As mentioned earlier, fewer samples for TPH constituents were collected because of the need to use manual collection methods.

Upon completion of analyses, results are uploaded into the U.S. Geological Survey's NWIS and are available for download at https://water.usgs.gov/owq/data.html#USGS. In addition to the storm and baseflow events, a variety of field and equipment blanks have also been prepared and analyzed for quality assurance purposes. These data are also available from the NWIS site.

Table 3-3. Summary of samples collected at the upstream (1636845) and downstream (1636846) stations on Little Catoctin Creek, Md.

	Total number of samples for EMC calculation	Number of sample sets collected during storms (2 or 3 sub-samples)	Number of sample sets collected during baseflow (1 sample)	Number of sub-samples collected for chemical analyses	Number of sub-samples collected for SSC	Number of sub-samples collected for TSS	Number of sub-samples collected for bacteria	Number of sub-samples collected for TPH
UPSTREAM 1636845								
All samples 1/3/17 to 6/30/19	47	35	14	119*	222	114	123	80
[1]Samples collected in FY19	20	15	5	46*	29	41	51	25
Samples collected during preconstruction 1/3/17 to 1/31/18	19	13	4	49	128	49	50	39
Samples collected during construction 2/1/18 to 4/15/19	22	17	5	56	94	55	54	40
Samples collected during post-construction 4/16/19 to 6/30/19	7	5	2	14*	0*	10*	19	1*
DOWNSTREAM 1636846								
All samples 1/3/17 to 6/30/19	50	33	17	109*	214	109	117	77
[1]Samples collected in FY19	20	15	5	44*	27	67	46	25
Samples collected during preconstruction 1/3/17 to 1/31/18	19	12	7	41	115	43	46	37
Samples collected during construction 2/1/18 to 4/15/19	24	16	8	55	99	53	53	40
Samples collected during post-construction 4/16/19 to 6/30/19	7	5	2	13*	0*	8*	18*	1*

[1]FY19 includes samples collected from 7/1/18 to 6/30/19

*Not all analyses from sub-samples collected after 4/16/19 have been received from laboratory at time of writing.

3.4 Conditions During Sampled Storm and Baseflow Events

The discharge and precipitation during each event were tabulated and inspected for completeness. To calculate the total discharge for an event, the volume of water passing the gage during each 5-minute interval between measurement was calculated and then summed for the period of interest:

$$Q_{total} = \sum_{start}^{finish} \Delta t * Qt * K$$

Where
Qt is the total volume of water in liters
Δt is the time step between measurements, typically 5 minutes
Qt is the instantaneous discharge measured at time t
K is a constant to change ft3/s to liters/minute (1699)

In order to standardize the loading calculations, calculations for each event were started at 0:00 on the day when the stream gage height first responded to precipitation and continued to 23:55 on the day the gage height returned to (or near) pre-storm heights. For some events, additional precipitation occurred after sampling was completed but before the stage returned to its pre-storm level. In these cases, the volume summation was ended at the time when the lowest post-storm gage height was reached. Volumes for baseflow samples were calculated for the day (24-hours, 0:00 to 23:55) of sampling – this results in volumes and loads in units of L/day or mass/day, respectively.

As mentioned above, the precipitation record at the upstream site was sporadic, so it was necessary to use precipitation data from the Frederick Airport (station KFDK, MesoWest). Data are recorded at the airport station every time 0.01-in of rain was collected. Rainfall amount and intensity was determined by summing the precipitation volume that occurred over the defined interval of the event. Intensity was then calculated by dividing the total precipitation by the minutes between the first and the final precipitation recorded.

A summary of the conditions at LCC during the storm and baseflow events is provided in Table 3-4, and includes the date the first sample of the event was collected, the conditions in the stream (pre-construction, construction, and post-construction), whether upstream or downstream samples were collected, the rainfall amount and intensity, the maximum discharge reached at the upper sampling station, and the total volumes of discharge crossing the upstream and downstream stations. Additional data including SSC, turbidity, and other parameters that were not used for calculating EMC, nor data used in calibrating equipment are not represented in this table. Because the precipitation data listed in this table is from the Fredrick Airport station, it is possible that an event may be labeled as being a “storm” although no precipitation was recorded at the airport – isolated thunderstorms may have affected the LCC basin but not the Fredrick Airport.

As mentioned earlier, the historically large storm that occurred in May 2018 caused considerable damage to the monitoring equipment and effected changes to the stream channel geometry. During the period of May 15-May 18, the discharge at the two stations contained a lengthy stretch of missing data (2860 and 3925 minutes at the upstream and downstream stations, respectively). Discharge during these two intervals was estimated from gage height and other indirect estimation methods. The available data suggests that gage heights and discharges reached maximums of 8.96 ft and 9,050 ft3/s at the upstream station, and 12.1 ft and 9,630 ft3/s at the downstream station. The calculated volumes presented in Table

3-4 should be considered rough estimates for this event. However, the difference between the volume crossing the upstream and downstream stations differs by 20%, which is typical of the differences for other large storms monitored at the site to date. Only a few other events showed what could be anomalous gains (as measured by percent difference) between volumes measured at the upstream and downstream stations.

In order to evaluate how well the sampling effort represented the flow regimes occurring at LCC, the maximum discharge recorded at the upstream station for each event was compared with the percentile rankings of discharge in the river. Table 3-5 lists the percentile ranking discharge at the upstream and downstream stations for the record beginning in October 2016. The percentile discharges at the downstream station are slightly greater than those at the upstream station, again indicating this is a gaining reach of the stream. Also listed are the percentiles during the different phases of the project; these data indicate that higher discharge occurred during the construction phase. Because these percentiles were calculated for the upstream gage, the increased discharge is not related to the stream restoration but is related to climate or other unknown activity occurring upstream in the basin. Comparing the maximum discharge reached during each sampled event with the percentile ranges (calculated for the entire period of record) shows that during most storms sampled during the pre- and construction phases, discharge exceeded 8.95 ft3/s (the 95-percentile discharge). Overall, the samples collected during these phases are considered to provide a good representation of the water-quality during high flow regains in LCC. No such large storm events have been sampled to date in the post construction phases. Only four (4) samples were obtained during the construction and post-construction phases at discharges of less than 1.33 ft3/s, the 10th percentile discharge.

3.5 Event Mean Concentrations

Event Mean Concentrations are summarized in Table 3-6, with the results from each sampled event presented in Table 3-7.

The following helps describes the EMC calculations.

1. Concentrations in sub-samples reported as being less-than the method detection level (MDL) were ***replaced with the MDL for the purpose of calculating EMCs***. Few of the inorganic species had concentrations reported below their MDL, with only zinc and total suspended solids (TSS) having multiple analyses reported below their MDL. Because MDL values were used, the event loads for some constituents should be considered to be estimated maximum loads.
2. Event mean concentrations were also calculated by replacing concentrations reported below the MDL with 0. These EMCs were not used for calculating loads and are not discussed in this report.
3. Total Kjeldahl nitrogen was calculated as the sum of the dissolved organic nitrogen and dissolved ammonia.
4. Concentrations of some constituents in samples collected after May 2019 may not have been received from the laboratory at the time of writing; this especially the case for SSC, TSS, and the organic compounds used for TPH.
5. Because EMCs are calculated as sums of sub-sample concentrations weighted for discharge, it is possible that EMCs can be less than their respective MDL. This occurs in only a few cases and are noted in tables.

TPH values deserve further explanation. Several analytic methods are available for measuring TPH in water samples; different methods may produce different TPH depending upon the analytes included in the method. In this work, four individual organic compounds were analyzed, and the results summed to obtain a surrogate TPH value, these include: toluene (MDL = 0.05 µg/L); benzene (MDL=0.036 µg/L); ethylbenzene (MDL=0.036 µg/L); o-xylene (MDL=0.032 µg/L); and methyl tert-butyl ether (MTBE, MDL = 0.1 and 0.2 µg/L). For any sample that had a reported quantifiable concentration (a “hit”) in any of its 3 sub-samples, the EMC for TPH was calculated using the detected concentration and the MDL value (for a non-detect in a sub-sample). Events where no sub-sample had a quantifiable concentration of any of the individual organic species, the EMC was assigned the MDL for MTBE, which is the highest reported for the suite of organic analytes. It should be noted that although an EMC is provided for TPH (based on maximum MDL), in most samples none of the constituents had quantifiable concentrations, so there is no evidence that TPH was present in the stream water during these events.

Quantifiable concentrations of the four organic compounds analyzed in the sub-samples were found in samples collected on 1/23/17 (both stations), 3/1/17 (upstream), 3/31/17 (both), 4/6/17 (both), 5/5/17 (both), 5/25/17 (both), 6/19/17 (both), 7/6/17 (both), 2/7/18 (upstream), 2/11/18 (both), 3/23/18 (both), 4/6/18 (upstream), 12/15/18 (both) and 3/21/19 (both). Toluene was the only organic detected prior to 3/21/18, after which date only benzene was detected (samples collected on 3/23/18, 12/15/18, and 3/21/19). The highest quantifiable TPH concentration was 0.95 µg/L in one sub-sample collected at the upstream station during the 3/1/17 event, which produced an EMC of 0.49 µg/L for this event. At the downstream station the highest TPH concentration was 0.17 µg/L for a subsample collected during the 1/23/17 event (producing an EMC of 0.16 µg/L).

There appears to be no seasonal relation in the presence of the toluene or benzene, as “hits” were observed in samples collected during both winter and summer, and “hits” were observed in both upstream and downstream samples. Finally, it should be noted that quantifiable concentrations are much lower than would be expected if “free-product” such as gasoline or diesel fuel were in the water column. While the data can be interpreted to show petroleum may occasionally be present in the stream, it is more likely these are random low-level contamination from either sampling equipment or laboratory contamination.

Table 3-4. Summary of precipitation, maximum discharge reached, and total discharge during sampled events. upstream (1636845) and downstream (1636846) stations on Little Catoctin Creek, Md.
[in, inches; in/hr, inches per hour; ft3/s, cubic feet per second; L, liters]

Date	Stream status	Sample collected downstream?	Sample collected upstream?	Event type	Precipitation amount (in)	Rainfall intensity (in/hr)	**UPSTREAM** maximum discharge reached (ft3/s)	**UPSTREAM** total volume (L)	**DOWNSTREAM** total volume (L)	**Percent difference between downstream and upstream**
1/3/17	Pre	N	Y	Storm	0.06	0.011	84.9	8.403E+07	9.191E+07	9.0
1/23/17	Pre	Y	Y	Storm	0.09	0.009	198	1.420E+08	1.552E+08	8.9
2/23/17	Pre	Y	Y	Base	0	--	1.85	4.430E+06	4.844E+06	8.9
3/1/17	Pre	Y	Y	Storm	0.19	0.095	7.53	1.419E+07	1.552E+07	9.0
3/31/17	Pre	Y	Y	Storm	0.08	0.137	73.7	6.365E+07	6.962E+07	9.0
4/6/17	Pre	Y	Y	Storm	0.00	--	181	1.350E+08	1.475E+08	8.8
5/5/17	Pre	Y	Y	Storm	1.23	0.049	90.9	6.587E+07	7.205E+07	9.0
5/25/17	Pre	Y	Y	Storm	1.15	0.052	123	1.383E+08	1.512E+08	8.9
6/19/17	Pre	Y	Y	Storm	0.00	--	22.0	1.439E+07	1.574E+07	9.0
7/6/17	Pre	Y	Y	Storm	0.30	0.033	303	1.117E+08	1.222E+08	9.0
8/7/17	Pre	Y	Y	Base[1]	0.00	--	2.07	7.257E+06	7.902E+06	8.5
8/24/17	Pre	Y	Y	Base	0	--	0.79	1.682E+06	1.781E+06	5.7
9/26/17	Pre	Y	Y	Base	0	--	0.60	1.371E+06	1.225E+06	-11
10/9/17	Pre	Y	Y	Storm	0.73	0.090	7.7	8.743E+06	1.294E+07	39
10/24/17	Pre	Y	Y	storm	0.45	0.064	4.99	7.490E+06	9.203E+06	21
10/29/17	Pre	Y	Y	Storm	0.46	0.060	122	9.983E+07	9.641E+07	-3.5
11/29/17	Pre	Y	Y	Base	0	--	1.11	2.635E+06	2.981E+06	12
12/20/17	Pre	Y	N	Base	0	--	0.91	2.101E+06	2.871E+06	31
12/24/17	Pre	N	Y	Base	0	--	2.6	4.095E+06	5.124E+06	22
1/12/18	Pre	Y	Y	Storm	1.16	0.048	454	1.748E+08	2.359E+08	30
1/26/18	Pre	Y	Y	Base	0	--	2.5	5.735E+06	6.087E+06	6.0

Note: Light shaded dates represent storm or baseflow events when only 1 station was sampled

[1] On 8/7/17 0.02-in of precipitation was recorded at Frederick Airport.

*Table 3-4. Summary of precipitation, maximum discharge reached, and total discharge during sampled events. upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md.—Continued*
[in, inches; in/hr, inches per hour; ft3/s, cubic feet per second; L, liters]

Date	Stream status	Sample collected downstream?	Sample collected upstream?	Event type	Precipitation amount (in)	Rainfall intensity (in/hr)	**UPSTREAM** maximum discharge reached (ft3/s)	**UPSTREAM** total volume (L)	**DOWNSTREAM** total volume (L)	**Percent difference between downstream and upstream**
2/7/18	Const.	Y	Y	Storm	0.03	0.040	88.5	7.209E+07	8.542E+07	17
2/11/18	Const.	Y	Y	Storm	0.52	0.047	48.3	6.619E+07	7.914E+07	18
2/23/18	Const.	Y	Y	Storm	0.17	0.039	26.0	9.864E+07	9.660E+07	-2.1
3/1/18	Const.	Y	N	Storm	0.53	0.169	19.6	2.806E+07	1.312E+08	130
3/23/18	Const.	Y	Y	Base	0	--	12.0	2.502E+07	3.025E+07	19
4/15/18	Const.	Y	Y	Storm	2.69	0.336	235	2.392E+08	2.555E+08	6.6
4/27/18	Const.	Y	Y	Storm	0.34	0.132	7.51	1.157E+07	1.402E+07	19
5/6/18	Const.	N	Y	Base	0.28	0.070	5.99	1.651E+07	2.799E+07	52
5/13/18	Const.	Y	Y	Storm[2]	7.7	0.052	9,050	2.623E+09	3.192E+09	20
5/22/18	Const.	Y	Y	Storm	0	--	397	1.180E+08	1.208E+08	2.3
Samples collected and analyzed after 2018 report submittal										
6/2/18	Const.	Y	N	Storm	1.4	0.030	1,820	3.351E+08	3.912E+08	15
6/20/18	Const.	Y	N	Storm	0.01	0.002	62.2	2.146E+07	2.790E+07	26
7/16/18	Const.	Y	Y	Base	0	--	1.86	4.068E+06	5.038E+06	21
8/21/18	Const.	Y	N	Storm	0.98	0.363	327	9.671E+07	1.191E+08	21
9/9/18	Const.	N	Y	Storm	1.55	0.049	471	4.279E+08	4.932E+08	14
9/17/18	Const.	Y	Y	Storm	0.36	0.360	410	1.399E+08	1.616E+08	14
10/26/18	Const.	Y	Y	Storm	0.63	0.067	32.8	6.899E+07	8.426E+07	20

Note: Light shaded dates represent storm or baseflow events when only 1 station was sampled

[1] Rainfall between 5/13/18 @7:15am and 5/19/18 @10:45am (147.75 hours) totaled 7.7-inches, however, this precipitation occurred in 7 distinct time intervals. The maximum precipitation was 1.9” and occured over 8 minutes on 5/16/18 @00:55am. Discharge at upstream site was estimated beginning on 5/15/18 @20:50 for the following 2860 minutes. Discharge at downstream station was estimated beginning on 5/15/18 @21:25 for the following 3925 minutes.

*Table 3-4. Summary of precipitation, maximum discharge reached, and total discharge during sampled events. upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md.--Continued*
[in, inches; in/hr, inches per hour; ft3/s, cubic feet per second; L, liters]

Date	Stream status	Sample collected downstream?	Sample collected upstream?	Event type	Precipitation amount (in)	Rainfall intensity (in/hr)	**UPSTREAM** maximum discharge reached (ft^3/s)	**UPSTREAM** total volume (L)	**DOWNSTREAM** total volume (L)	**Percent difference between downstream and upstream**
11/9/18	Const.	Y	Y	Storm	0	--	94.4	7.334E+07	8.221E+07	11
11/29/18	Const.	Y	Y	Base	0	--	6.3	1.486E+07	1.876E+07	23
12/15/18	Const.	Y	Y	Storm	1.24	0.037	308	3.823E+08	4.644E+08	19
12/20/18	Const.	Y	Y	Storm	0.48	0.051	81.5	7.403E+07	8.169E+07	9.8
2/3/19	Const.	Y	Y	Base	0	--	9.1	3.36E+07	3.951E+07	15
2/6/19	Const.	Y	Y	Storm	0	--	8.8	3.54E+07	4.168E+07	15
2/11/19	Const.	Y	Y	Storm	0.45	0.014	168	1.77E+08	2.088E+08	15
2/21/19	Const.	Y	Y	Storm	0.03	0.007	53.5	7.08E+07	8.335E+07	15
3/21/19	Const.	Y	Y	Storm	0.24	0.012	739	5.32E+08	6.257E+08	15
4/19/19	Post	Y	Y	Storm	0.82	0.154	45.3	6.59E+07	7.753E+07	15
4/26/19	Post	Y	Y	Storm	0.3	0.039	8.0	1.32E+07	1.554E+07	15
5/23/19	Post	Y	Y	Storm	0	--	52.1	3.237E+07	4.686E+07	37
5/30/19	Post	Y	Y	Base	0	--	4.3	1.026E+07	1.122E+07	8.9
6/13/19	Post	Y	Y	Storm	0.800	0.069	34.2	3.029E+07	3.766E+07	22
6/27/19	Post	Y	Y	Base	0.75	0.900	16.3	1.538E+07	1.887E+07	20
6/29/19	Post	Y	Y	Storm	0.07	0.030	5.98	1.361E+07	1.562E+07	11

Note: Light shaded dates represent storm or baseflow events when only 1 station was sampled

Volumes shaded in dark gray were estimated as 85% of the discharge measured at downstream station. The upstream gaging equipment was not operational during this period due to the construction activity.

Table 3-5. Maximum discharge reached during storm or baseflow event and percentiles of flow measured at the upstream (1636845) and downstream (1636846) stations on Little Catoctin Creek, Md from 2016-2019.
[ft3/s; cubic feet per second]

Percentile range	Upstream station discharge 10/1/16 to 6/30/19 (ft^3/s)	Downstream station discharge 10/1/16 to 6/30/19 (ft^3/s)	Discharge during pre-construction 10/1/19 to 1/31/18 (ft^3/s)	Discharge during construction 2/1/18 to 4/15/19 (ft^3/s)	Discharge range (ft^3/s)	Number of events[1] sampled during pre-construction phase	Number of events[1] sampled during construction phase	Number of events[1] sampled during post-construction phase
99	75.7	81.6	23.4	24.0	>75.7	8	13	0
95	8.89	12.1	3.18	6.25	8.89--75.7	2	8	4
75	4.64	7.12	2.25	4.29	4.64--8.89	3	4	3
50	2.44	3.28	1.42	3.3	2.44--4.64	1	0	0
25	1.33	1.71	0.9	2.6	1.33--2.44	3	1	0
10	0.81	0.95	0.72	2.35	0.81--1.33	2	0	0
0-10	--	--	--	--	0--0.81	2	0	0

[1.] Storm events when 2-3 subsamples were collected, or baseflow events when 1 sub-sample was collected.

Table 3-6. Summary of event mean concentrations calculated for upstream (1636845) and downstream (1636846) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.
[EMC, event mean concentration; kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MPN, most probable number; MDL, method detection level]

	Average[1] temperature C	Average pH (stnd. Units)	BOD-5 (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Nitrite + Nitrate (mg/L)	Total phosphorous (mg/L)	Suspended sediment (mg/L)	TSS (mg/L)	Copper (µg/L)
				UPSTREAM					
Count	42	40	36	46	46	46	32	43	42
Maximum	24.8	7.7	40	3.6	5.1	3.43	1,250	1,300	41
Minimum	1.0	7.1	1.2	0.11	0.66	0.048	1	15	0.70
Median	11.6	7.4	8.0	0.90	2.8	0.522	58	77	6.3
# of EMCs below MDL	0	0	1	2	0	0	0	5	0
				DOWNSTREAM					
Count	48	49	41	47	47	47	34	45	44
Maximum	25.3	8.8	41	4.0	4.9	3.46	1,380	1,200	37
Minimum	1.50	6.7	0.80	0.01	0.030	0.033	1	15	0.28
Median	11.3	7.5	6.9	0.76	2.7	0.500	136	90	7.4
# of EMCs below MDL	0	0	1	3	0	0	0	11	0

	Lead (µg/L)	Zinc (µg/L)	HARDNESS (mg/L)	*Enterococcus* (MPN)	*E. coli* (MPN)	TPH (µg/L)
				UPSTREAM		
Count	42	42	42	44	44	35
Maximum	29	120	129	1,000,000	16,500,000	1.1
Minimum	0.1	2	38	51	1,100	0.14
Median	2.0	12	86	23,200	191,000	0.29
# of EMCs below MDL	0	7	0	0	0	21
				DOWNSTREAM		
Count	43	44	44	48	48	36
Maximum	24	107	133	994,000	5,180,000	0.39
Minimum	0.1	1.0	39	21	1,400	0.23
Median	2.7	15	84	9,280	121,000	0.25
# of EMCs below MDL	0	10	0	0	0	24

1. Summary statistics were calculated after replacing non-detected concentrations with respective MDLs.

Table 3-7. Summary of event mean concentrations calculated for upstream (1636845) and downstream (1636846) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.
[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

UPSTREAM (1636845)

Event date	Stream condition	Average temperature (ºF)	Average pH (stnd. units)	BOD-5 (mg/L)	Total Kjeldahl nitrogen (mg/L)	Nitrite + Nitrate (mg/L)	Total phosphorous (mg/L)
MDL	--	--	--	2	0.05	0.01	0.004
1/3/17	Storm-Pre	5.9	7.6	--	1.8	1.88	1.43
1/23/17	Storm-Pre	5.0	7.4	18	1.3	1.18	3.08
2/23/17	Baseflow-Pre	12.3	7.5	2	0.49	4.38	0.048
3/1/17	Storm-Pre	11.6	7.4	13	0.78	2.91	0.590
3/31/17	Storm-Pre	8.6	7.5	12	2.6	1.81	2.18
4/6/17	Storm-Pre	11.5	7.4	18	1.7	0.92	2.40
5/5/17	Storm-Pre	14.6	7.3	15	2.5	2.02	1.38
5/25/17	Storm-Pre	15.2	7.2	11	1.9	3.14	1.83
6/19/17	Storm-Pre	23.7	7.3	40	1.8	2.09	1.24
7/6/17	Storm-Pre	22.3	7.1	8.0	2.0	3.43	1.63
8/7/17	Baseflow-Pre	20.7	--	26	3.0	3.36	0.558
8/24/17	Baseflow-Pre	21.1	--	1.2	0.38	3.30	0.098
9/26/17	Baseflow-Pre	--	--	--	0.26	2.36	0.102
10/9/17	Storm-Pre	21.4	7.2	30	1.2	2.13	0.990
10/24/17	Storm-Pre	17.2	7.2	--	3.6	2.57	1.28
10/29/17	Storm-Pre	11.7	7.4	29	1.7	2.89	3.44
11/29/17	Baseflow-Pre	7.5	7.6	1.7	0.22	4.41	0.050
12/24/17	Baseflow-Pre	6.2	7.4	--	1.0	3.55	0.212
1/26/18	Baseflow-Pre	2.6	7.3	2.5	0.73	5.10	0.067

Notes: The EMCs presented here were calculated by replacing ‘non-detects” with respective MDL.

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Italicized TPH concentrations indicate one or more individual compounds were above their MDL

All data for samples collected after 4/19/19 may not have yet been received from laboratory

*Table 3-7. Summary of event mean concentrations calculated for upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.--Continued*

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

UPSTREAM (1636845)

Event date	Stream condition	Average temperature (°F)	Average pH (stnd. units)	BOD-5 (mg/L)	Total Kjeldahl nitrogen (mg/L)	Nitrite + Nitrate (mg/L)	Total phosphorous (mg/L)
MDL	--	--	--	2	0.05	0.01	0.004
2/7/18	Storm-Const	1.0	7.3	--	1.0	2.37	0.594
2/11/18	Storm-Const	3.8	7.4	--	1.4	3.06	0.759
2/23/18	Storm-Const	8.2	7.4	--	0.95	3.07	0.339
3/23/18	Baseflow--Const	--	--	6.4	0.40	4.35	0.095
4/15/18	Storm-Const.	8.9	7.1	4.6	1.5	1.65	1.42
4/27/18	Storm-Const.	12.6	7.4	8.6	0.82	2.84	0.170
5/6/18	Baseflow-Const.	15.3	7.5	--	2.1	2.69	0.434
5/22/18	Storm-Const.	21.1	7.3	11	1.5	1.45	1.25
7/16/18	Baseflow-Const.	--	--	2.3	0.11	3.75	0.085
9/9/18	Storm-Const.	17.9	7.2	6.5	0.74	0.66	1.21
9/17/18	Storm-Const.	21.9	7.4	6.7	0.86	2.62	0.497
10/26/18	Storm-Const.	10.1	7.5	7.9	0.93	2.84	0.521
11/9/18	Storm-Const.	8.7	7.2	--	0.68	2.04	0.733
11/29/18	Baseflow-Const.	4.5	7.4	2.7	0.51	4.96	0.051
12/15/18	Storm-Const.	6.4	7.5	23	1.8	1.60	2.18
12/20/18	Storm-Const.	7.5	7.4	9.6	0.86	2.56	0.345
2/3/19	Baseflow-Const.	4.2	7.3	--	0.72	4.62	0.096
2/6/19	Storm-Const.	7.4	7.4	3.7	0.47	3.90	0.070
2/11/19	Storm-Const.	3.0	7.4	7.0	0.63	1.71	0.881
2/21/19	Storm-Const.	6.3	7.4	7.0	0.78	2.82	0.390
3/21/19	Storm-Const.	6.4	7.3	14	1.4	1.96	2.86

Notes: The EMCs presented here were calculated by replacing 'non-detects" with respective MDL.

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Italicized TPH concentrations indicate one or more individual compounds were above their MDL

All data for samples collected after 4/19/19 may not have yet been received from laboratory

*Table 3-7. Summary of event mean concentrations calculated for upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.--Continued*

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

UPSTREAM (1636845)

Event date	Stream condition	Average temperature (ºF)	Average pH (stnd. units)	BOD-5 (mg/L)	Total Kjeldahl nitrogen (mg/L)	Nitrite + Nitrate (mg/L)	Total phosphorous (mg/L)
MDL	--	--	--	2	0.05	0.01	0.004
4/19/19	Storm-Post	16.8	7.5	2.4	0.56	1.50	0.156
4/26/19	Storm-Post	17.8	7.5	12	0.93	3.08	0.182
5/23/19	Storm-Post	21.2	7.6	13	0.72	3.20	0.522
5/30/19	Baseflow-Post	--	--	1.6	0.56	3.62	0.085
6/13/19	Storm-Post	19.0	7.7	5.4	0.73	2.95	0.178
6/27/19	Baseflow-Post	24.8	7.5	2.7	0.43	3.41	0.109
6/29/19	Storm-Post	--	--	--	--	--	--

Notes: The EMCs presented here were calculated by replacing ‘non-detects” with respective MDL.

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Italicized TPH concentrations indicate one or more individual compounds were above their MDL

All data for samples collected after 4/19/19 may not have yet been received from laboratory

*Table 3-7. Summary of event mean concentrations calculated for upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.--Continued*
[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

UPSTREAM (1636845)						
Event date	Stream condition	Suspended sediment (mg/L)	Total suspended solids (mg/L)	Dissolved copper (µg/L)	Dissolved lead (µg/L)	Dissolved zinc (µg/L)
MDL	--	0.5	15	1.4	0.04	2
1/3/17	Storm-Pre	264	217	15	5.1	30.0
1/23/17	Storm-Pre	1,250	1,250	35	25	108.9
2/23/17	Baseflow-Pre	4	15	0.9	0.07	2
3/1/17	Storm-Pre	102	77	4.8	2.4	17
3/31/17	Storm-Pre	583	497	20	11	54
4/6/17	Storm-Pre	833	618	26	17	78
5/5/17	Storm-Pre	202	162	12	3.7	21
5/25/17	Storm-Pre	402	381	29	8.3	46
6/19/17	Storm-Pre	147	141	9.6	4.1	32
7/6/17	Storm-Pre	396	354	19	7.6	37
8/7/17	Baseflow-Pre	15	16	3.1	0.31	7.0
8/24/17	Baseflow-Pre	5	15	1.3	0.09	2.0
9/26/17	Baseflow-Pre	6	15	1.5	0.19	2.0
10/9/17	Storm-Pre	57	43	5.8	0.78	11
10/24/17	Storm-Pre	29	31	6.2	0.57	12
10/29/17	Storm-Pre	723	525	26	13	85
11/29/17	Baseflow-Pre	1	15	1.2	0.07	2.0
12/24/17	Baseflow-Pre	12	15	3.8	0.29	4.0
1/26/18	Baseflow-Pre	4	15	0.8	0.12	2.0

Notes: The EMCs presented here were calculated by replacing ‘non-detects” with respective MDL.

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Italicized TPH concentrations indicate one or more individual compounds were above their MDL

All data for samples collected after 4/19/19 may not have yet been received from laboratory

*Table 3-7. Summary of event mean concentrations calculated for upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.--Continued*

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

UPSTREAM (1636845)

Event date	Stream condition	Suspended sediment (mg/L)	Total suspended solids (mg/L)	Dissolved copper (µg/L)	Dissolved lead (µg/L)	Dissolved zinc (µg/L)
MDL	--	1	15	1.4	0.04	2
2/7/18	Storm-Const	132	100	7.4	2.4	12
2/11/18	Storm-Const	141	128	8.2	3.4	17
2/23/18	Storm-Const	38	25	--	--	--
3/23/18	Baseflow-Const	3	15	1.3	0.08	2.0
4/15/18	Storm-Const.	440	328	8.5	2.3	13
4/27/18	Storm-Const.	16	16	2.1	0.37	5.4
5/6/18	Baseflow-Const.	21	15	4.1	0.32	10
5/22/18	Storm-Const.	351	356	11	8.2	31
7/16/18	Baseflow-Const.	7	15	1.1	0.12	2.0
9/9/18	Storm-Const.	59	318	13	6.7	29
9/17/18	Storm-Const.	80	83	6.7	1.8	10
10/26/18	Storm-Const.	50	56	5.2	1.1	8.1
11/9/18	Storm-Const.	--	116	6.4	3.0	17
11/29/18	Baseflow-Const.	4	15	0.7	0.10	2.0
12/15/18	Storm-Const.	--	616	34	18	82
12/20/18	Storm-Const.	--	50	10	1.4	11
2/3/19	Baseflow-Const.	--	--	--	--	--
2/6/19	Storm-Const.	--	15	2.4	0.18	2.7
2/11/19	Storm-Const.	--	475	14	11	42
2/21/19	Storm-Const.	--	135	5.2	3.0	19
3/21/19	Storm-Const.	--	1,300	41	29	120

Notes: The EMCs presented here were calculated by replacing ‘non-detects” with respective MDL.

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Italicized TPH concentrations indicate one or more individual compounds were above their MDL

All data for samples collected after 4/19/19 may not have yet been received from laboratory

*Table 3-7. Summary of event mean concentrations calculated for upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.--Continued*

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

UPSTREAM (1636845)						
Event date	Stream condition	Suspended sediment (mg/L)	Total suspended solids (mg/L)	Dissolved copper (µg/L)	Dissolved lead (µg/L)	Dissolved zinc (µg/L)
MDL	--	1	15	1.4	0.04	2
4/19/19	Storm-Post	--	20	4.8	0.70	4.2
4/26/19	Storm-Post	--	16	1.7	0.48	5.3
5/23/19	Storm-Post	--	133	11	3.3	20
5/30/19	Baseflow-Post	--	15	1.3	0.27	3.0
6/13/19	Storm-Post	--	--	--	--	--
6/27/19	Baseflow-Post	--	--	--	--	--
6/29/19	Storm-Post	--	--	--	--	--

Notes: The EMCs presented here were calculated by replacing ‘non-detects” with respective MDL.

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Italicized TPH concentrations indicate one or more individual compounds were above their MDL

All data for samples collected after 4/19/19 may not have yet been received from laboratory

*Table 3-7. Summary of event mean concentrations calculated for upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.--Continued*
[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

UPSTREAM (1636845)					
Event date	Stream condition	Hardness (mg/L)	*Enterococcus* (MPN)	*E. coli* (MPN)	TPH (µg/L)
MDL	--	1	--	--	0.1/0.2
1/3/17	Storm-Pre	73	23,500	207,000	*0.21*
1/23/17	Storm-Pre	52	43,400	230,000	*0.36*
2/23/17	Baseflow-Pre	106	1,300	1,900	0.14
3/1/17	Storm-Pre	107	45,000	120,000	*1.07*
3/31/17	Storm-Pre	62	37,400	203,000	*0.26*
4/6/17	Storm-Pre	50	62,200	231,000	*0.40*
5/5/17	Storm-Pre	73	155,000	240,000	*0.25*
5/25/17	Storm-Pre	64	175,000	2,240,000	*0.24*
6/19/17	Storm-Pre	91	192,000	1,630,000	*0.34*
7/6/17	Storm-Pre	48	105,000	4,180,000	*0.32*
8/7/17	Baseflow-Pre	127	26,000	240,000	0.14
8/24/17	Baseflow-Pre	129	2,400	31,000	0.14
9/26/17	Baseflow-Pre	128	1,300	31,000	0.14
10/9/17	Storm-Pre	109	1,000,000	2,400,000	*0.55*
10/24/17	Storm-Pre	114	274,000	6,510,000	--
10/29/17	Storm-Pre	70	712,000	16,500,000	--
11/29/17	Baseflow-Pre	107	930	14,000	0.14
12/24/17	Baseflow-Pre	95	--	--	--
1/26/18	Baseflow-Pre	110	63	2,900	0.14

Notes: The EMCs presented here were calculated by replacing ‘non-detects” with respective MDL.

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Italicized TPH concentrations indicate one or more individual compounds were above their MDL

All data for samples collected after 4/19/19 may not have yet been received from laboratory

*Table 3-7. Summary of event mean concentrations calculated for upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.--Continued*

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

UPSTREAM (1636845)

Event date	Stream condition	Hardness (mg/L)	*Enterococcus* (MPN)	*E. coli* (MPN)	TPH (µg/L)
MDL	--	1	--	--	0.1/0.2
2/7/18	Storm-Const	59	2,200	69,800	*0.27*
2/11/18	Storm-Const	81	2,600	194,000	*0.14*
2/23/18	Storm-Const	--	--	--	--
3/23/18	Baseflow--Const	122	350	3,000	*0.14*
4/15/18	Storm-Const.	49	22,800	188,000	0.14
4/27/18	Storm-Const.	88	8,820	54,800	0.14
5/6/18	Baseflow-Const.	102	33,000	170,000	--
5/22/18	Storm-Const.	50	65,700	2,290,000	0.14
7/16/18	Baseflow-Const.	99	1,400	17,000	0.14
9/9/18	Storm-Const.	38	42,500	2,330,000	0.29
9/17/18	Storm-Const.	95	97,900	2,370,000	0.29
10/26/18	Storm-Const.	89	55,400	2,210,000	0.29
11/9/18	Storm-Const.	73	38,000	702,000	0.29
11/29/18	Baseflow-Const.	88	580	3,100	0.29
12/15/18	Storm-Const.	54	26,700	601,000	*0.29*
12/20/18	Storm-Const.	74	7,930	130,000	0.29
2/3/19	Baseflow-Const.	--	51	1,100	--
2/6/19	Storm-Const.	86	338	8,820	0.29
2/11/19	Storm-Const.	49	1,930	24,900	0.29
2/21/19	Storm-Const.	91	2,900	10,200	0.29
3/21/19	Storm-Const.	48	17,400	665,400	*0.30*

Notes: The EMCs presented here were calculated by replacing ‘non-detects” with respective MDL.

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Italicized TPH concentrations indicate one or more individual compounds were above their MDL

All data for samples collected after 4/19/19 may not have yet been received from laboratory

*Table 3-7. Summary of event mean concentrations calculated for upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.--Continued*

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

UPSTREAM (1636845)					
Event date	Stream condition	Hardness (mg/L)	*Enterococcus* (MPN)	*E. coli* (MPN)	TPH (µg/L)
MDL	--	1	--	--	0.1/0.2
4/19/19	Storm-Post	80	14,200	680,000	--
4/26/19	Storm-Post	86	47,200	98,800	--
5/23/19	Storm-Post	81	83,700	576,000	--
5/30/19	Baseflow-Post	105	5,200	19,000	--
6/13/19	Storm-Post	--	18,700	93,400	0.29
6/27/19	Baseflow-Post	--	1,400	19,000	--
6/29/19	Storm-Post	--	--	--	--

Notes: The EMCs presented here were calculated by replacing 'non-detects" with respective MDL.

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Italicized TPH concentrations indicate one or more individual compounds were above their MDL

All data for samples collected after 4/19/19 may not have yet been received from laboratory

*Table 3-7. Summary of event mean concentrations calculated for upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.--Continued*
[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

DOWNSTREAM (1636846)

Event date	Stream condition	Average temperature (ºF)	pH (standard units)	BOD-5 (mg/L)	Total Kjeldahl nitrogen (mg/L)	Nitrite + Nitrate (mg/L)	Total phosphorous (mg/L)
MDL	--	--	--	2	0.05	0.01	0.004
1/23/17	Storm-Pre	5.7	7.5	5.4	1.34	1.3	3.459
2/23/17	Baseflow-Pre	10.6	7.6	1.1	0.12	4.2	0.046
3/1/17	Storm-Pre	11.2	7.5	2.2	0.48	3.0	0.138
3/31/17	Storm-Pre	8.6	7.4	11.7	3.09	1.8	2.126
4/6/17	Storm-Pre	11.3	7.4	21.9	1.45	1.3	3.057
5/5/17	Storm-Pre	14.9	7.3	18.4	2.40	2.1	1.738
5/25/17	Storm-Pre	15.5	7.4	11.3	1.91	2.4	1.573
6/19/17	Storm-Pre	23.0	7.3	27.0	1.42	1.9	1.120
7/6/17	Storm-Pre	22.2	7.3	7.9	1.72	3.2	1.663
8/7/17	Baseflow-Pre	20.8	7.4	1.0	0.40	3.1	0.093
8/24/17	Baseflow-Pre	23.0	7.5	1.0	0.38	2.7	0.102
9/26/17	Baseflow-Pre	21.1	7.5	1.0	0.46	2.1	0.081
10/9/17	Storm-Pre	21.4	7.3	9.0	0.73	2.0	0.546
10/24/17	Storm-Pre	17.0	7.4	0.0	0.45	1.2	0.216
10/29/17	Storm-Pre	10.4	7.3	41.3	1.65	2.5	2.075
11/29/17	Baseflow-Pre	5.9	7.8	1.9	0.09	4.0	0.039
12/20/17	Storm-Pre	5.9	7.6	1.7	4.01	0.0	0.033
1/12/18	Storm-Pre	1.5	7.3	8.6	1.08	3.1	0.363
1/26/18	Baseflow-Pre	1.5	7.4	0.8	0.27	3.1	0.067

Notes: The EMCs presented here were calculated by replacing ‘non-detects” with respective MDL.

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Italicized TPH concentrations indicate one or more individual compounds were above their MDL

All data for samples collected after 4/19/19 may not have yet been received from laboratory

*Table 3-7. Summary of event mean concentrations calculated for upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.--Continued*

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

DOWNSTREAM (1636846)

Event date	Stream condition	Average temperature (ºF)	pH (standard units)	BOD-5 (mg/L)	Total Kjeldahl nitrogen (mg/L)	Nitrite + Nitrate (mg/L)	Total phosphorous (mg/L)
MDL	--	--	--	2	0.05	0.01	0.004
2/7/18	Storm-Const.	1.8	7.4	--	0.61	4.3	0.134
2/11/18	Storm-Const.	3.9	7.4	--	1.15	3.0	0.743
2/23/18	Storm-Const.	6.9	7.5	--	0.92	2.6	0.930
3/2/18	Storm-Const.	6.6	7.5	5.5	0.57	2.7	0.314
3/23/18	Baseflow-Pre	2.9	8.1	2.9	0.01	4.2	0.036
4/16/18	Storm-Const.	9.0	7.3	9.7	1.25	1.7	1.324
4/27/18	Storm-Const.	13.2	7.8	4.5	0.63	2.8	0.097
5/14/18	Storm-Const.	19.4	7.2	3.6	0.76	2.2	0.451
5/22/18	Storm-Const.	20.5	7.4	12.7	1.13	1.5	1.562
6/2/18	Storm-Const.	23.1	6.7	13.1	1.45	1.3	1.960
6/20/18	Storm-Const.		8.5	--	1.60	3.2	0.934
7/16/18	Baseflow-Pre	24.7	7.7	--	0.36	3.4	0.079
8/21/18	Storm-Const.	22.0	7.2	12.9	1.10	1.6	1.913
9/17/18	Storm-Const.	22.1	7.7	6.9	0.68	3.2	0.508
10/26/18	Storm-Const.	10.2	7.6	6.9	0.85	2.7	0.586
11/9/18	Storm-Const.	--	--	0.0	0.68	2.6	0.847
11/29/18	Baseflow-Pre	4.4	7.6	2.3	0.37	4.9	0.049
12/15/18	Storm-Const.	6.7	7.5	16.9	1.73	2.4	2.529
12/21/18	Storm-Const.	8.2	7.6	8.6	0.85	1.7	0.500
2/3/19	Baseflow-Pre	3.7	7.5	--	0.81	4.4	0.090
2/6/19	Storm-Const.	7.5	7.7	5.3	0.57	3.9	0.129
2/11/19	Storm-Const.	2.7	7.5	6.6	0.64	1.7	0.908
2/21/19	Storm-Const.	7.0	7.5	6.3	0.68	3.1	0.249
3/21/19	Storm-Const.	7.0	7.5	12.7	1.40	2.0	2.396

Notes: The EMCs presented here were calculated by replacing ‘non-detects” with respective MDL.

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Italicized TPH concentrations indicate one or more individual compounds were above their MDL

All data for samples collected after 4/19/19 may not have yet been received from laboratory

*Table 3-7. Summary of event mean concentrations calculated for upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.--Continued*

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

DOWNSTREAM (1636846)

Event date	Stream condition	Average temperature (ºF)	pH (standard units)	BOD-5 (mg/L)	Total Kjeldahl nitrogen (mg/L)	Nitrite + Nitrate (mg/L)	Total phosphorous (mg/L)
MDL	--	--	--	2	0.05	0.01	0.004
4/19/19	Storm-Post	18.0	7.8	2.8	--	--	--
4/26/19	Storm-Post	17.5	7.8	8.7	0.76	3.0	0.128
5/23/19	Storm-Post	22.2	7.6	10.2	0.80	3.1	0.393
5/30/19	Baseflow-Pre	24.6	8.0	--	--	--	--
6/13/19	Storm-Post	18.1	7.5	0.8	0.71	3.0	0.543
6/27/19	Baseflow-Pre	25.0	8.8	3.1	0.43	2.9	0.091
6/29/19	Storm-Post	25.3	7.8	14.6	--	--	--

Notes: The EMCs presented here were calculated by replacing ‘non-detects” with respective MDL.

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Italicized TPH concentrations indicate one or more individual compounds were above their MDL

All data for samples collected after 4/19/19 may not have yet been received from laboratory

*Table 3-7. Summary of event mean concentrations calculated for upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.--Continued*
[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

DOWNSTREAM (1636846)

Event date	Stream condition	Suspended sediment (mg/L)	Total suspended solids (mg/L)	Dissolved copper (µg/L)	Dissolved lead (µg/L)	Dissolved zinc (µg/L)
MDL		1	15	1.4	0.04	2
1/23/17	Storm-Pre	1,380	1,110	31.7	22.9	107
2/23/17	Baseflow-Pre	4	15	0.9	0.1	2
3/1/17	Storm-Pre	23	18	2.2	0.5	2
3/31/17	Storm-Pre	543	332	16.6	8.0	37
4/6/17	Storm-Pre	1,250	901	30.3	22.0	95
5/5/17	Storm-Pre	375	271	14.9	6.2	32
5/25/17	Storm-Pre	398	356	20.9	8.2	44
6/19/17	Storm-Pre	147	162	9.3	3.5	24
7/6/17	Storm-Pre	518	477	20.7	10.5	49
8/7/17	Baseflow-Pre	7	15	1.1	0.2	2
8/24/17	Baseflow-Pre	8	15	1.2	0.1	2
9/26/17	Baseflow-Pre	3	15	1.5	0.1	2
10/9/17	Storm-Pre	27	26	4.4	0.5	4
10/24/17	Storm-Pre	15	15	1.7	0.1	1
10/29/17	Storm-Pre	364	321	15.7	7.0	41
11/29/17	Baseflow-Pre	1	15	1.4	0.1	2
12/20/17	Storm-Pre	3	15	3.2	0.1	2
1/12/18	Storm-Pre	37	35	3.5	0.7	4
1/26/18	Baseflow-Pre	2	18	0.3	--	2

Notes: The EMCs presented here were calculated by replacing ‘non-detects” with respective MDL.

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Italicized TPH concentrations indicate one or more individual compounds were above their MDL

All data for samples collected after 4/19/19 may not have yet been received from laboratory

*Table 3-7. Summary of event mean concentrations calculated for upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.--Continued*
[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

DOWNSTREAM (1636846)

Event date	Stream condition	Suspended sediment (mg/L)	Total suspended solids (mg/L)	Dissolved copper (µg/L)	Dissolved lead (µg/L)	Dissolved zinc (µg/L)
MDL		1	15	1.4	0.04	2
2/7/18	Storm-Const.	9	15	1.7	0.3	2
2/11/18	Storm-Const.	145	130	7.5	3.3	16
2/23/18	Storm-Const.	294	280	15.8	7.9	31
3/2/18	Storm-Const.	46	43	5.8	1.3	6
3/23/18	Baseflow-Pre	5	15	1.0	0.1	2
4/16/18	Storm-Const.	480	361	21.7	6.6	36
4/27/18	Storm-Const.	11	16	1.7	0.3	2
5/14/18	Storm-Const.	127	78	6.0	2.4	12
5/22/18	Storm-Const.	564	530	16.0	11.8	48
6/2/18	Storm-Const.	812	696	22.9	14.9	64
6/20/18	Storm-Const.	337	254	10.1	6.3	33
7/16/18	Baseflow-Pre	10	15	2.5	0.2	2
8/21/18	Storm-Const.	1,000	812	26.4	16.9	79
9/17/18	Storm-Const.	155	150	7.3	3.0	15
10/26/18	Storm-Const.	182	176	8.4	3.7	19
11/9/18	Storm-Const.	--	201	9.9	6.3	29
11/29/18	Baseflow-Pre	--	15	1.0	0.1	2
12/15/18	Storm-Const.	--	771	36.4	20.6	93
12/21/18	Storm-Const.	--	97	9.4	2.7	16
2/3/19	Baseflow-Pre	--	--	--	--	--
2/6/19	Storm-Const.	--	26	3.8	0.7	6
2/11/19	Storm-Const.	--	437	13.4	10.3	41
2/21/19	Storm-Const.	--	71	3.2	1.5	12
3/21/19	Storm-Const.	--	1,200	36.6	24.4	106

Notes: The EMCs presented here were calculated by replacing ‘non-detects” with respective MDL.

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Italicized TPH concentrations indicate one or more individual compounds were above their MDL

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*Table 3-7. Summary of event mean concentrations calculated for upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.--Continued*
[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

DOWNSTREAM (1636846)						
Event date	Stream condition	Suspended sediment (mg/L)	Total suspended solids (mg/L)	Dissolved copper (µg/L)	Dissolved lead (µg/L)	Dissolved zinc (µg/L)
MDL	--	1	15	1.4	0.04	2
4/19/19	Storm-Post	--	22	--	--	--
4/26/19	Storm-Post	--	15	1.6	0.4	4
5/23/19	Storm-Post	--	90	11.1	2.4	14
5/30/19	Baseflow-Pre	--	--	--	--	--
6/13/19	Storm-Post	--	--	--	--	--
6/27/19	Baseflow-Pre	--	--	--	--	--
6/29/19	Storm-Post	--	--	--	--	--

Notes: The EMCs presented here were calculated by replacing ‘non-detects” with respective MDL.

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Italicized TPH concentrations indicate one or more individual compounds were above their MDL

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*Table 3-7. Summary of event mean concentrations calculated for upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.--Continued*

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

DOWNSTREAM (1636846)					
Event date	Stream condition	Hardness (mg/L)	*Enterococcus* (MPN)	*E. coli* (MPN)	TPH (µg/L)
MDL		1	--	--	0.1/0.2
1/23/17	Storm-Pre	62	46,100	216,000	*0.35*
2/23/17	Baseflow-Pre	105	640	1,400	0.24
3/1/17	Storm-Pre	102	2,390	18,800	*0.24*
3/31/17	Storm-Pre	54	41,700	228,000	*0.25*
4/6/17	Storm-Pre	61	50,500	212,000	*0.32*
5/5/17	Storm-Pre	70	129,000	240,000	*0.27*
5/25/17	Storm-Pre	63	132,000	1,720,000	*0.27*
6/19/17	Storm-Pre	95	994,000	2,070,000	*0.26*
7/6/17	Storm-Pre	51	83,800	2,770,000	*0.32*
8/7/17	Baseflow-Pre	116	2,200	80,000	0.24
8/24/17	Baseflow-Pre	124	830	61,000	0.24
9/26/17	Baseflow-Pre	133	590	41,000	0.24
10/9/17	Storm-Pre	116	699,000	2,090,000	*0.25*
10/24/17	Storm-Pre	44	126,000	3,230,000	--
10/29/17	Storm-Pre	62	365,000	5,180,000	--
11/29/17	Baseflow-Pre	114	980	17,000	0.24
12/20/17	Storm-Pre	103	310	16,000	0.24
1/12/18	Storm-Pre	78	3,490	214,000	0.24
1/26/18	Baseflow-Pre	39	21	4,500	0.24

Notes: The EMCs presented here were calculated by replacing 'non-detects" with respective MDL.

Shaded values had one or more sub-samples with a concentration reported below the MDL.

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*Table 3-7. Summary of event mean concentrations calculated for upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.--Continued*

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

DOWNSTREAM (1636846)					
Event date	Stream condition	Hardness (mg/L)	*Enterococcus* (MPN)	*E. coli* (MPN)	TPH (µg/L)
MDL	--	1	--	--	0.1/0.2
2/7/18	Storm-Const.	92	310	34,000	0.24
2/11/18	Storm-Const.	82	3,240	115,000	*0.23*
2/23/18	Storm-Const.	85	9,100	82,000	--
3/2/18	Storm-Const.	94	2,600	39,000	--
3/23/18	Baseflow-Pre	120	300	3,700	*0.23*
4/16/18	Storm-Const.	46	11,100	227,000	0.24
4/27/18	Storm-Const.	91	8,020	60,200	0.24
5/14/18	Storm-Const.	63	19,600	305,000	0.24
5/22/18	Storm-Const.	54	40,000	2,250,000	0.24
6/2/18	Storm-Const.	54	38,000	2,400,000	--
6/20/18	Storm-Const.	101	79,000	2,400,000	--
7/16/18	Baseflow-Pre	104	590	25,000	0.24
8/21/18	Storm-Const.	58	307,000	2,400,000	--
9/17/18	Storm-Const.	99	130,000	2,600,000	0.39
10/26/18	Storm-Const.	90	23,700	1,920,000	0.39
11/9/18	Storm-Const.	77	--	--	0.39
11/29/18	Baseflow-Pre	91	210	3,500	0.39
12/15/18	Storm-Const.	62	22,200	533,000	*0.38*
12/21/18	Storm-Const.	57	6,740	174,000	0.39
2/3/19	Baseflow-Pre	--	52	2,500	--
2/6/19	Storm-Const.	89	1,070	12,600	0.39
2/11/19	Storm-Const.	52	1,660	24,900	0.39
2/21/19	Storm-Const.	98	3,750	12,800	0.39
3/21/19	Storm-Const.	52	13,600	57,700	*0.38*

Notes: The EMCs presented here were calculated by replacing ‘non-detects” with respective MDL.

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Italicized TPH concentrations indicate one or more individual compounds were above their MDL

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*Table 3-7. Summary of event mean concentrations calculated for upstream (**1636845**) and downstream (**1636846**) stations on Little Catoctin Creek, Md. Concentrations were calculated after replacing non-detected values with the minimum detection level.--Continued*

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured or data not yet received]

DOWNSTREAM (1636846)					
Event date	Stream condition	Hardness (mg/L)	*Enterococcus* (MPN)	*E. coli* (MPN)	TPH (µg/L)
MDL	--	1	--	--	0.1/0.2
4/19/19	Storm-Post	--	2,770	19,400	--
4/26/19	Storm-Post	90	34,800	127,000	--
5/23/19	Storm-Post	84	62,700	539,000	--
5/30/19	Baseflow-Pre	--	--	--	--
6/13/19	Storm-Post	--	60,100	24,000	0.39
6/27/19	Baseflow-Pre	--	2,500	18,000	--
6/29/19	Storm-Post	--	9,460	1,190,000	--

Notes: The EMCs presented here were calculated by replacing ‘non-detects” with respective MDL.

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Italicized TPH concentrations indicate one or more individual compounds were above their MDL

All data for samples collected after 4/19/19 may not have yet been received from laboratory

4 Biological Monitoring

This section summarizes biological monitoring data collected during the spring index period (March 1 - April 30) in 2019 by the MDNR Resource Assessment Service, and provides a preliminary synopsis of the post-restoration biological conditions present within Little Catoctin Creek. It was compiled to support MDOT SHA's MS4 reporting requirements (FY2019) for this restoration project. Data collected in the summer index period (June 1 – September 30), including fish and more extensive physical habitat parameters, were unavailable at the time of this report and will be added to the next annual report.

MDOT SHA and MDNR identified three stream reaches on Little Catoctin Creek to monitor over the course of the study to assess changes in biological condition and stream physical habitat quality associated with the restoration. The study reaches included:

1. Control reach located west of MD 180 (upstream of the planned restoration);
2. Restoration reach extending approximately 3,100 linear feet east of MD 180; and
3. Downstream reach located east (downstream) of the restoration reach.

Two sites were allocated to each of these study reaches (Figure 5). When possible, biological monitoring sites were co-located at proposed geomorphological transects (MDOT SHA) and chemical monitoring stations (USGS) to improve interpretation of all monitoring data over the course of the study. DNR also monitored a seventh site located on a small tributary entering the Control reach just west of MD 180 to assess its potential influence on conditions in the Little Catoctin Creek main stem. Only benthic macroinvertebrates were sampled at this site. Fish and physical habitat were not assessed at this site.

To provide an understanding of natural variability in stream biological conditions, DNR monitors 29 reference streams known as the Maryland Biological Stream Survey (MBSS) Sentinel site network (Saville et al. 2014). Although monitoring of these sites is not related to nor funded under this project, we will use data from these nearby reference sites to better interpret pre- and post-restoration biological conditions in Little Catoctin Creek. Specifically, annual data collected from the sites during the course of this project will allow us to differentiate natural changes in stream conditions occurring within the region from changes associated with the restoration. Two of these sites, Fifteen Mile Creek (FIMI-207-S) in Washington County, and Jones Falls (JONE-315-S) in Baltimore County, are of similar size to Little Catoctin Creek. We present data from these reference sites in this post-restoration report.

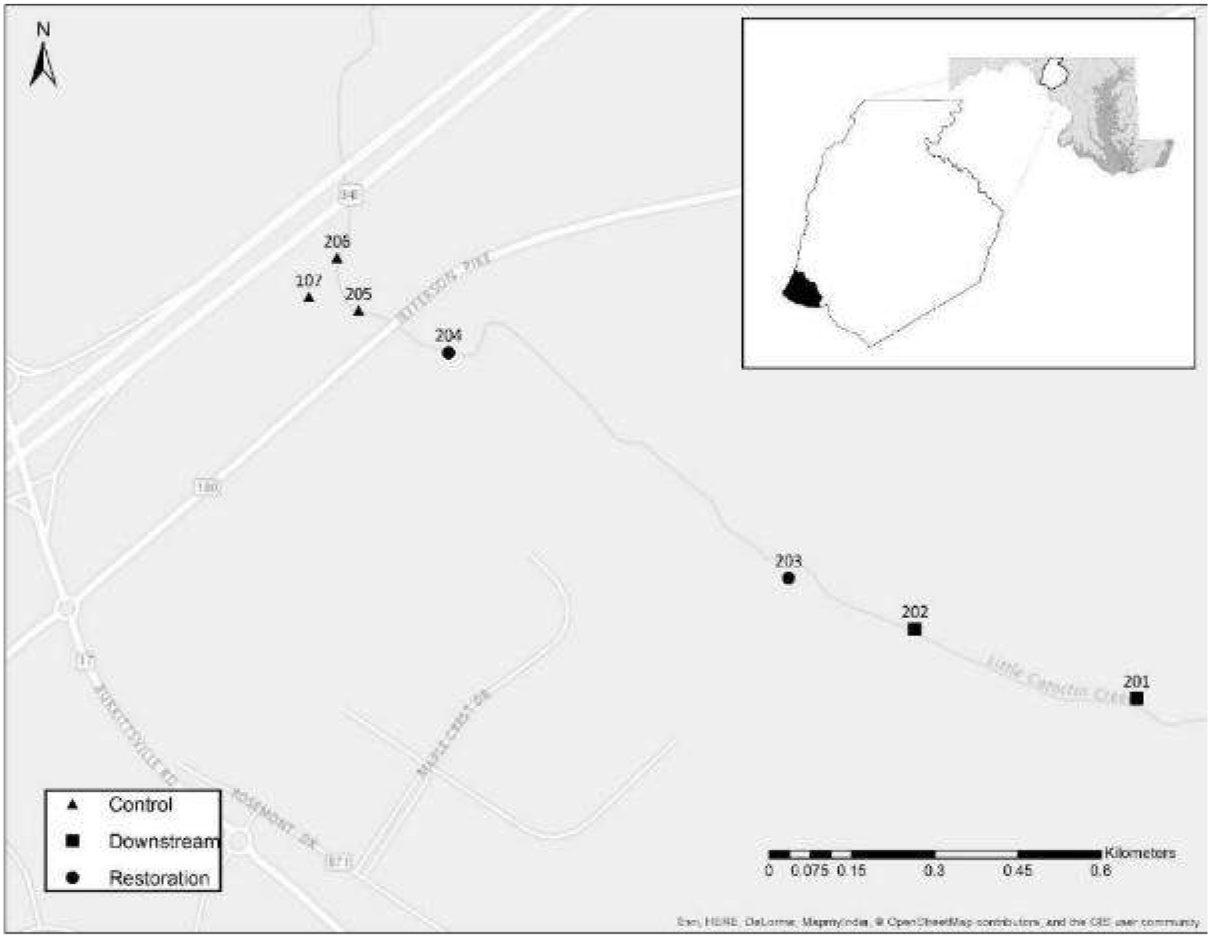

Figure 5. Locations of the seven biological monitoring sites in Little Catoctin Creek.

4.1 Methods

Biological and physical habitat assessments at all sites summarized in this report were conducted following Maryland Biological Stream Survey (MBSS) sampling protocols. Detailed descriptions of these protocols are provided by Stranko et al. (2014). However, a brief description of sampling protocols used for this project are as follows:

Spring MBSS Methods

Sites were surveyed during the spring index period (March 1 - April 30). The stream was measured following the thalweg, and marked at the site boundaries (0 m, 75 m) and at two transects (25 m, 50 m). The location and access routes were described, and from the midpoint, the stream was photographed in both upstream and downstream directions.

Physical habitat quality was assessed at each site. Habitat parameters measured include riparian buffer, channelization, aesthetic score, distance from the nearest road, surrounding land use, descriptions of any road culverts in the site, and vernal pool presence or absence.

Benthic macroinvertebrate sampling targeted the most productive habitats in each site. Twenty 0.09 m^2 (1 ft^2) jabs were collected using a 540 µm mesh D-net and compiled into a single sample and preserved in denatured ethanol. DNR's benthic laboratory in Annapolis processed the sample by picking a 100-organism subsample for calculation of a Benthic Index of Biotic Integrity (BIBI), and an additional 100 organism subsample to provide greater resolution and a more complete understanding of the benthic macroinvertebrate community at each site (Boward et al. 2019). The organisms were identified to genus or the lowest practical taxonomic level. The subsequent taxa list and counts were analyzed following methods described in Southerland et al. (2008), resulting in BIBI score. The score may fall within the range of 1 (worst) to 5 (best), indicating the health of the benthic community in the site.

While at each site, qualitative data were collected on any reptiles, amphibians (seen or heard), crayfish (or their burrows), freshwater mussels and Asiatic clams.

Summer MBSS Methods

Summer MBSS methods were not conducted in fiscal year 2019, but will occur later in the summer index period as a part of fiscal year 2020. When surveyed, the methods are as follows:

The spring sites are revisited during the summer index period (June 1 - Sept. 30). Each site was enclosed by block nets at the upstream and downstream ends, and two-pass electrofishing was conducted. All fish were counted, identified to species and weighed in aggregate. As with the BIBI score, a Fish Index of Biotic Integrity (FIBI) score was calculated using methods described in Southerland et al. (2008) using the same scale of 1 to 5.

Summer physical habitat quality assessment included the following parameters: Velocity/depth diversity, Riffle/run quality, Pool/glide/eddy quality, Embeddedness, Shading, habitat suitability for benthic macroinvertebrates (Epifaunal Substrate) and fish (Instream Habitat), extent and severity of bank erosion, bar formation and substrate, and counts of woody debris and rootwads. Stream discharge, maximum depth and thalweg depth/width/flow velocity at the four predetermined transects within the site (at 0 m, 25 m, 50 m and 75 m) were also measured. Additionally, any exotic plants within the site or in the surrounding riparian area were recorded.

Quantitative data for stream salamanders and crayfish, and qualitative data for other herpetofauna, freshwater mussels and Asiatic clams were also recorded at each site.

4.2 Summary of Post-Restoration Biological and Physical Habitat Conditions

Biological and physical habitat data collected at all seven sites in 2019 are summarized below. We compare conditions documented in the spring survey of the three study reaches and also present data collected during the same period from the two reference sites (MBSS Sentinel sites).

4.2.1 Biological Conditions

A total of 59 benthic macroinvertebrate taxa were collected in the 100-organism subsamples in Little Catoctin Creek. Taxa richness at each site ranged from 13 to 27 taxa, generally decreasing in an upstream direction throughout the study reaches. Taxa richness at the reference sites ranged from 22 at Fifteen Mile Creek to 27 at Jones Falls in 2019.

Downstream sites had three Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa present in 2019 (Table 4-1), restoration sites had from two to three EPT taxa (Table 4-2), and Control sites had from one to four EPT taxa (Table 4-3). These numbers are generally comparable to taxa collected before restoration occurred. By comparison, the Jones Falls Sentinel site had 10 EPT taxa in 2019, while the Fifteen Mile Creek Sentinel site had 14 in 2019 (Table 4-4).

Presence of pollution-intolerant taxa showed a similar pattern in the study area, spanning from one to five in 2019. Samples from the upstream control sites contained from one to three intolerant taxa, those from the restoration sites had two intolerant taxa, and from the downstream sites contained from one to five intolerant taxa. The Jones Falls Sentinel site had 15 intolerant taxa and the Fifteen Mile Creek Sentinel site had seven intolerant taxa in 2019.

The presence of taxa tolerant to pollution was comparable among all sites across the study reach. Control sites had from six to 11 tolerant taxa present, restoration reach sites had from 10 to 13 tolerant taxa present, and downstream sites had from 10 to 11 tolerant taxa present. The Fifteen Mile Creek Sentinel site had two tolerant taxa present, and the Jones Falls Sentinel site had nine tolerant taxa present.

BIBI scores varied little between years at sites in the study area, and in 2019 ranged from 2.50 to 2.75 at the downstream stations (Table 4-5), from 2.00 to 2.25 at the restoration stations (Table 4-6), and from 2.00 to 2.25 at the control stations (Table 4-7). The Fifteen Mile Creek site, which scored 3.00 in 2016 and attained a maximum score of 4.75 in 2017, scored 4.25 in 2019 (Table 4-8). Jones Falls scored 3.67 in 2019, which was unchanged from previous study years' BIBI scores.

BIBI scores were variable at all study sites between years, but this variation was well within what would be considered normal for benthic macroinvertebrate communities. Similar variation has been documented at other MBSS Sentinel sites and can likely be attributed to variability in biotic responses associated with precipitation and other naturally occurring factors, as well as sampling variability.

Fish data for the six study sites and the reference sites are unavailable for fiscal year 2019. Fish data will be included in the fiscal year 2020 annual report.

Table 4-1. Numbers of Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa and pollution-intolerant and tolerant benthic macroinvertebrate taxa from the downstream study reach in Little Catoctin Creek.

Reach	Downstream					
Site	201			202		
Year	2016	2017	2019	2016	2017	2019
Number of EPT taxa	7	3	3	6	1	3
Number of intolerant taxa	7	2	5	3	1	1
Number of tolerant taxa	13	8	10	15	9	11

Table 4-2. Numbers of Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa and pollution-intolerant and tolerant benthic macroinvertebrate taxa from the restoration study reach in Little Catoctin Creek.

Reach	Restoration					
Site	203			204		
Year	2016	2017	2019	2016	2017	2019
Number of EPT taxa	5	3	3	1	0	2
Number of intolerant taxa	3	1	2	2	3	2
Number of tolerant taxa	12	12	13	10	10	10

Table 4-3. Numbers of Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa and pollution-intolerant and tolerant benthic macroinvertebrate taxa from the control study reach in Little Catoctin Creek.

Reach	Control								
Site	205			206			107		
Year	2016	2017	2019	2016	2017	2019	2016	2017	2019
Number of EPT taxa	1	0	4	1	0	1	3	1	2
Number of intolerant taxa	3	1	3	2	1	1	3	2	2
Number of tolerant taxa	7	14	9	7	11	6	11	9	11

Table 4-4. Numbers of Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa and pollution-intolerant and tolerant benthic macroinvertebrate taxa from representative MBSS Sentinel sites.

Reach	Reference Sites					
Site	Fifteen Mile Creek			Jones Falls		
Year	2016	2017	2019	2016	2017	2019
Number of EPT taxa	10	24	14	13	8	10
Number of intolerant taxa	13	25	15	12	9	7
Number of tolerant taxa	2	2	2	8	7	9

Table 4-5. Benthic and fish index of biotic integrity scores from the downstream study reach in Little Catoctin Creek.

Reach	Downstream					
Site	201			202		
Year	2016	2017	2019	2016	2017	2019
BIBI	2.00	1.75	2.75	2.25	1.50	2.50
FIBI	4.33	4.00	NM1	3.33	3.67	NM1

NM1 = Not measured before end of FY19

Table 4-6. Benthic and fish index of biotic integrity scores from the restoration study reach in Little Catoctin Creek.

Reach	Restoration					
Site	203			204		
Year	2016	2017	2019	2016	2017	2019
BIBI	2.00	1.75	2.25	1.75	1.75	2.00
FIBI	3.33	3.67	NM1	3.33	3.00	NM1

NM1 = Not measured before end of FY19

Table 4-7. Benthic and fish index of biotic integrity scores from the control study reach in Little Catoctin Creek.

Reach	Control								
Site	205			206			107		
Year	2016	2017	2019	2016	2017	2019	2016	2017	2019
BIBI	1.50	1.75	2.25	1.50	1.25	1.75	2.00	1.50	2.00
FIBI	3.00	3.33	NM1	3.33	3.00	NM1	NM2	NM2	NM2

NM1 = Not measured before end of FY19

NM2 = Not measured (Only benthic macroinvertebrates sampled at this site)

Table 4-8. Benthic and fish index of biotic integrity scores from representative MBSS Sentinel sites.

	Reference Sites					
Site	Fifteen Mile Creek			Jones Falls		
Year	2016	2017	2019	2016	2017	2019
BIBI	3.00	4.75	4.25	4.00	3.67	3.67
FIBI	4.33	4.33	NM1	3.67	3.33	NM1

NM1 = Not measured before end of FY19

4.2.2 Physical Habitat Conditions

At the time, the sites were visited during the 2019 spring index period, all five unrestored sites in the Little Catoctin Creek study area exhibited damage from flooding during the 2018 extreme rain events. Crews noted “much channel alteration” due to high flows at upstream control sites, PRFR-205-X-2019 (Figure 6), PRFR-206-X-2019 (Figure 7), and PRFR-107-X-2019. Riparian buffer consisted primarily of pasture, tall grasses, and regenerating deciduous trees and shrubs. Few mature trees were observed in the riparian zone at PRFR-206-X-2019. This site was channelized for 11 meters on the left bank and three (3) meters on the right bank. Site PRFR-107-X-2019, located on the tributary to Little Catoctin Creek, exhibited minimal buffers totaling nine (9) meters between the two banks, beyond which was pasture in both riparian areas. The left bank, right bank, and bottom of the stream was channelized for five (5) meters by concrete. A cattle crossing passed through the site’s midpoint (Figure 8).

Figure 6. Photos displaying stream channel alteration occurring between 2017 and 2019, respectively, at control site PRFR-205-X

Figure 7. Photos displaying stream channel alteration occurring between 2017 and 2019, respectively, at control site PRFR-206-X.

Figure 8. Photo of the cattle crossing at tributary control site PRFR-107-X-2019.

Bank reshaping within the restoration reach had evidently occurred shortly before the sites were surveyed. Banks were largely unvegetated for more than 50 meters on each side and stabilized only with staked landscaping matting (Figure 3).

Figure 9. Photo of the restored reach PRFR-203-X.

Downstream sites, PRFR-201-X-2019 and PRFR-202-X-2019, also showed evidence of bank alteration due to flow. The 50-meter riparian buffer at PRFR-201-X-2019 was fully vegetated by forest on the left bank and by tall grass, young and regenerating deciduous trees on the right bank. Buffers at PRFR-202-X-2019 included 50 meters of forest on the left bank and 39 meters of grass and forest on the right bank, followed by cropland beyond. No channelization or buffer breaks were noted at the downstream sites.

The reference sites Jones Falls, JONE-315-S-2019, and Fifteen Mile Creek, FIMI-207-S-2019, had riparian buffers of mixed forest. The Jones Falls buffer extended more than 50 meters on each bank, and the Fifteen Mile Creek buffer extended more than 50 meters on the right bank and 43 meters on the left bank, beyond which was a paved road. The Fifteen Mile Creek site had significant new erosion on the left bank, but no unusual erosion was noted at the Jones Falls site. Neither site had any channelization nor buffer breaks.

More detailed physical habitat assessment data from the summer index period are unavailable for fiscal year 2019. Complete physical habitat assessment data will be included in the fiscal year 2020 annual report.

4.3 Next Steps

This report summarizes those data collected and finalized in fiscal year 2019 for Little Catoctin Creek. Data collected in the summer index period (June 1 – September 30), including fish and more extensive physical habitat parameters, were unavailable at the time of this report and will be added to the next annual report. Further sampling of the study and restoration reaches will be conducted in 2020.

5 Physical Monitoring

5.1 Methods

A geomorphic assessment was performed at six (6) locations; three (3) throughout the project reach, one (1) upstream of the project limits and two (2) downstream of the project limits. The initial geomorphic survey from September 2017 establishes a baseline for the pre-restoration project area. Two additional surveys were conducted in January 2018 and July/August 2018 to depict the channel morphological changes for pre-construction conditions. Left and right bank pins were established at each cross section. Cross sections P-1, P-5, and P-6 are outside of the project limits and remain intact for post-construction monitoring. Cross sections P-2, P-3, and P-4 are located within the project limits and were re-established in the first year of post-construction monitoring (June 2019). All six (6) locations will continue to be assessed for the remainder of post-construction monitoring.

For each surveyed cross section the total area, bankfull channel dimensions, water surface slope, and riffle surface material are compared. Bankfull was identified in the field in 2017 only. To compare with the following year's surveys, these cross section characteristics were adjusted based on bankfull indicators. Using this information, bankfull was either presumed at an elevation within this range above the water surface (incised channel, no bankfull indicator), or selected at a slope break/bench feature that was created at this elevation (Table 1). Starting in 2019, sections within the restoration reach (P-2 through P-4) had bankfull dimensions calculated from the top of bank. Top of bank elevation was selected at a fixed elevation in each cross-section to allow for comparison (Table 1). Cross-sectional area was calculated using the specific bankfull elevation for each section. Top of bank area was calculated using a fixed elevation around the low bank height for each section to quantify erosion (or deposition) occurring throughout the entire cross section.

Table 5-1: Bankfull and Top of Bank elevations used for calculations

Cross Section	Bankfull Elevation (ft)	Top of Bank Elevation (ft
XS 1	419.70	423.40
XS 2	413.54	413.54
XS 3	409.60	409.60
XS 4	404.43	404.43
XS 5	399.70	403.46
XS 6	397.50	400.00

The cross section, thalweg profile, and riffle pebble count data collected in September 2017, January/April 2018, July/August 2018, and June 2019 were compared to depict the bank erosion and channel morphological changes during this period. Additionally, cross section and profiles estimated from the topographical survey performed in 2015 are provided for general comparison purposes only. These data do not have the resolution of the geomorphic survey section data; therefore, caution is recommended when drawing conclusions based on this data. A brief discussion about each section is included below.

Construction of the restoration project was completed in April 2019. As of the June 2019 survey, sections 2, 3, and 4 were re-established in new locations along the restored stream channel. The cross sections and longitudinal profiles of the newly established sites are graphed separately due to disparities in locations and elevations following restoration activities.

5.2 Precipitation

Monthly precipitation data was obtained from USGS Little Catoctin gage (1636845) and NOAA's Hagerstown area gage. Data from the NOAA Hagerstown area gage, which is located approximately 25 miles north of Little Catoctin Creek, was supplemented when data was unavailable from the USGS Little Catoctin gage. Data from the USGS Little Catoctin gage was unavailable May 2018, June 2018, and from January 2019 to May 2019. For Maryland, 2018 was the wettest year on record. Additionally, 2019 is on track to be an above average precipitation year. Greater runoff and higher in-stream velocities due to large precipitation events can contribute to accelerated stream bank erosion. The annual precipitation for 2018 was 57.44 inches. Precipitation for 2019, thus far, is 22.96 inches. Figure 10 shows the yearly precipitation recorded by the gages from 2018 to 2019. The 2019 data contains analysis from January 1, 2019 through June 30, 2019.

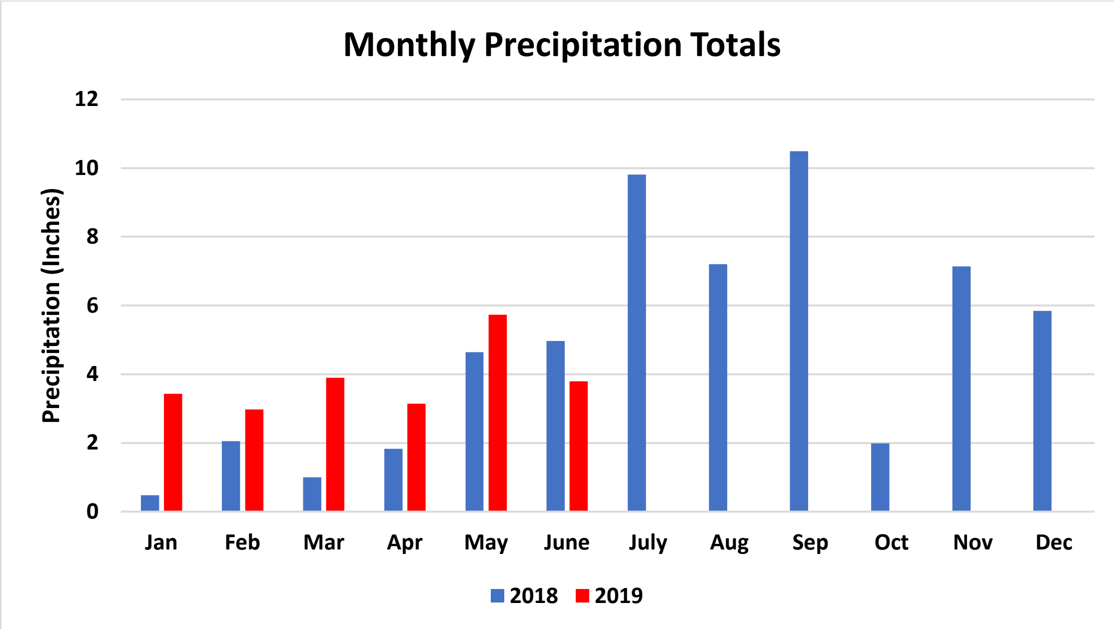

Figure 10. Monthly Precipitation Totals from January 2018 through June 2019.

5.3 Results

Geomorphic assessments results and comparisons over time are presented below for each cross section survey reach. Field survey data results can be found in Attachment B.

<u>Cross Section P-1 – Upstream Control Site</u>

Cross Section P-1 is located upstream of the restoration reach and represents a control reach. Cross section 1 is denoted as the yellow horizontal tape in Photo 1 and Photo 2. At Cross Section P-1 the left bank has eroded 1.5 feet between 2018 and 2019, while the right bank has aggraded vertically 0.4 feet (Figure 11). Between the August 2018 and June 2019 surveys, the channel thalweg experienced significant scouring that resulted in the thalweg dropping roughly 1.5 feet as the cross section is now crossing through a pool. Sediment deposition appears to shift regularly through the bottom of the channel in this reach.

Photo 1 – Section 1 Cross Section Looking Upstream – June 2019

Photo 2 - Section 1 Cross Section looking downstream – June 2019

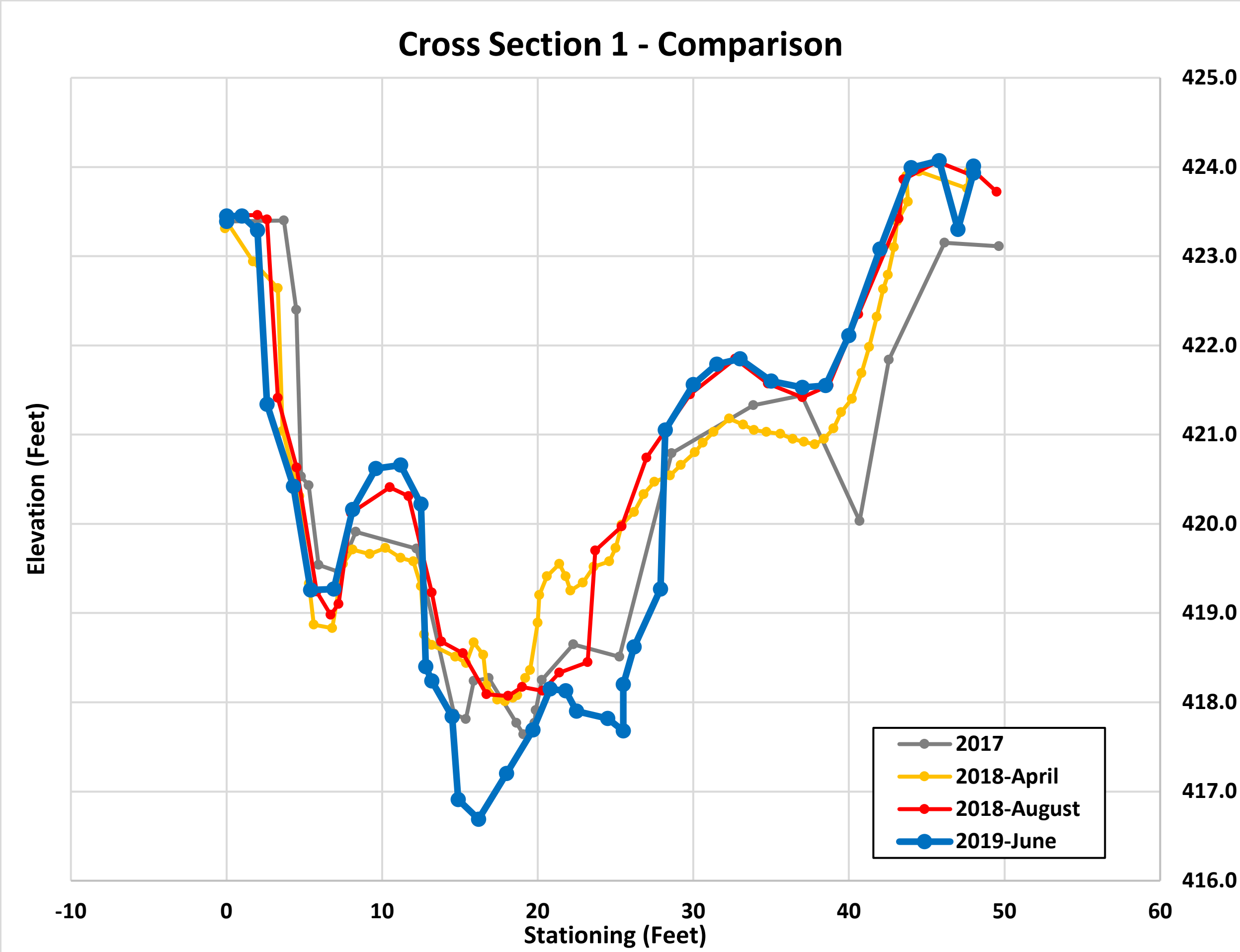

Figure 11. Cross Section P-1 Comparison (2017 to 2019)

A grade control feature appears to have formed between 2017 and April 2018 at station 1+10 (Figure 12). With the exception of a large depositional feature filling in the pool between station 0+70 and 0+90, the profile was largely unchanged between April and August of 2018. As of 2019, scour is occurring at the confluence at station 0+59 creating a large pool where the cross section is located. A mid channel bar that was observed in 2018, has now split the channel flow beginning approximately 100 feet upstream of the cross section just upstream of the start of the profile. The confluence of the split channel is approximately 15 feet upstream of the cross section at station 0+59.5. This is causing the large scour pool to form and a significant shift in the profile.

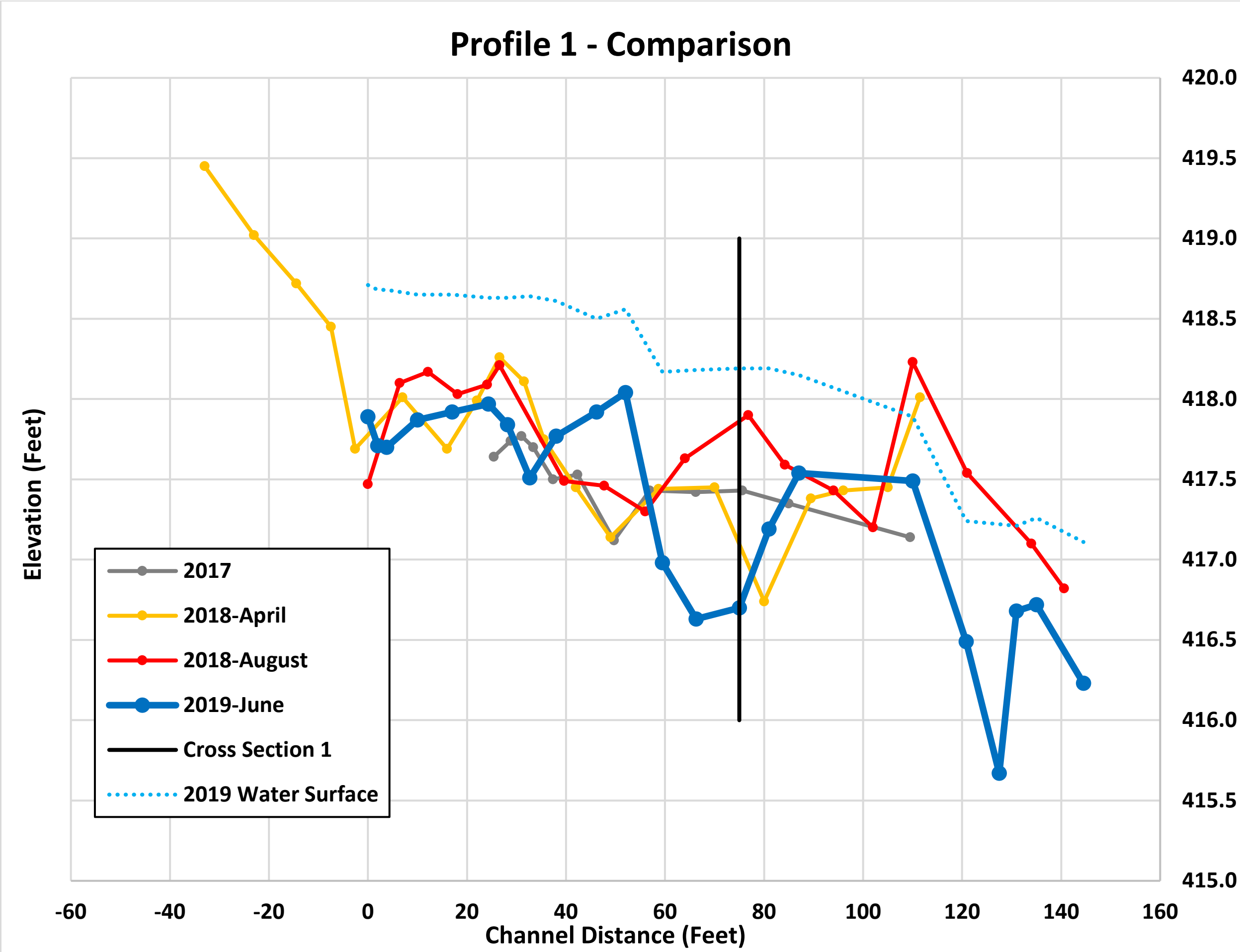

Figure 12. Profile P-1 Comparison (2017 to 2019)

The channel material appears to have coarsened between 2017 and 2018 (Figure 13), but in 2019 deposition of finer material was observed in Section 1. The D50 and D84 increased from 12.3mm (medium gravel) and 31.3mm (coarse gravel), respectively, in 2017 to 33mm (very coarse gravel) and 62mm (very coarse gravel) in 2018. As of June 2019, the D50 (18mm) decreased closer to what was observed in 2017 (12.3mm). The D84 also decreased slightly in 2019 but was still classified as very coarse gravel.

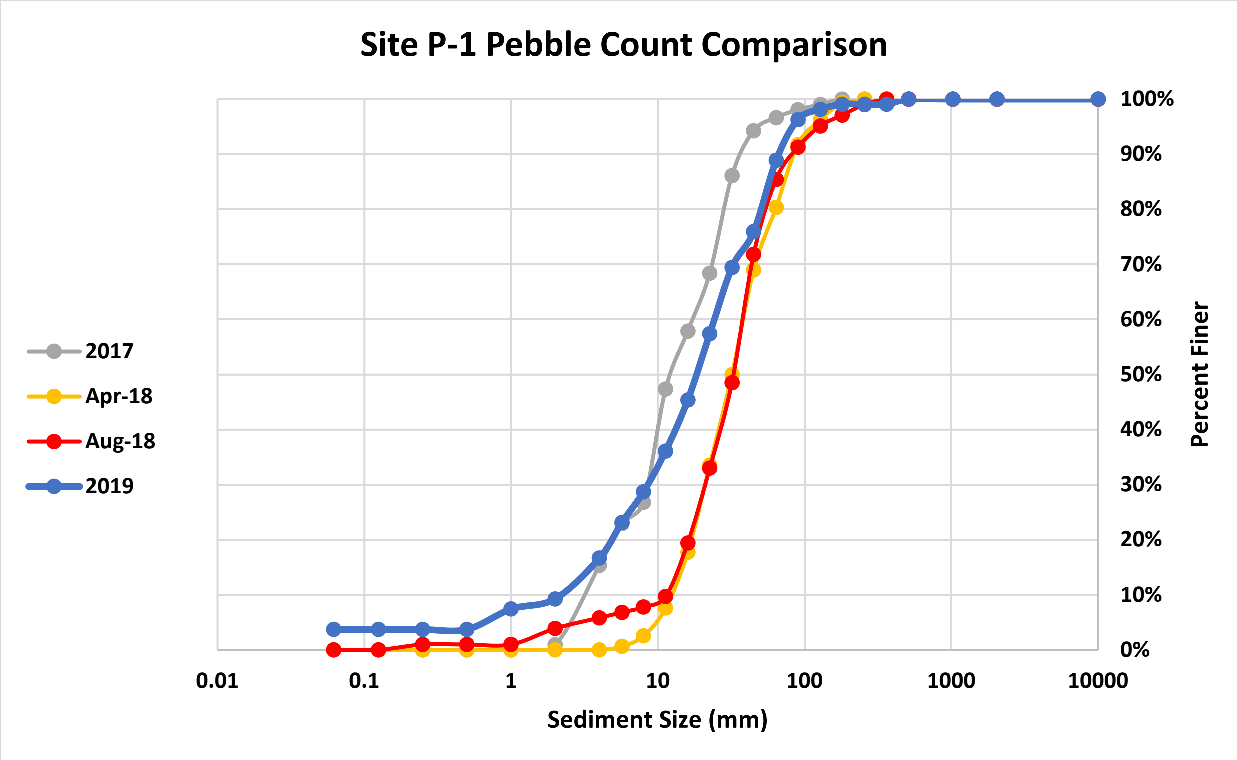

Figure 13. Section P-1 Riffle Bed Material Comparison (2017 to 2019)

Cross Section P-2 – Restoration Reach

Prior to restoration, the left bank of Cross Section P-2 had eroded approximately 4 feet (horizontally) between January and July of 2018, exposing two (2) vertical feet of the left pin. Review of the section over time indicates that the gravel deposition along the banks of the channel is regularly mobilized – the 2017 survey shows a widened channel when compared to 2015. From 2017 to 2018, bed material has aggraded along the right bank. Figure 5 shows the baseline post-construction cross section P-2 survey, which was newly established within the restoration reach in June 2019. Cross section P-2 is depicted as the yellow horizontal tape in Photo 3 and Photo 4.

Photo 3 – Cross Section P-2 – Looking upstream – June 2019

Photo 4 - Cross Section P-2 – Looking downstream – June 2019

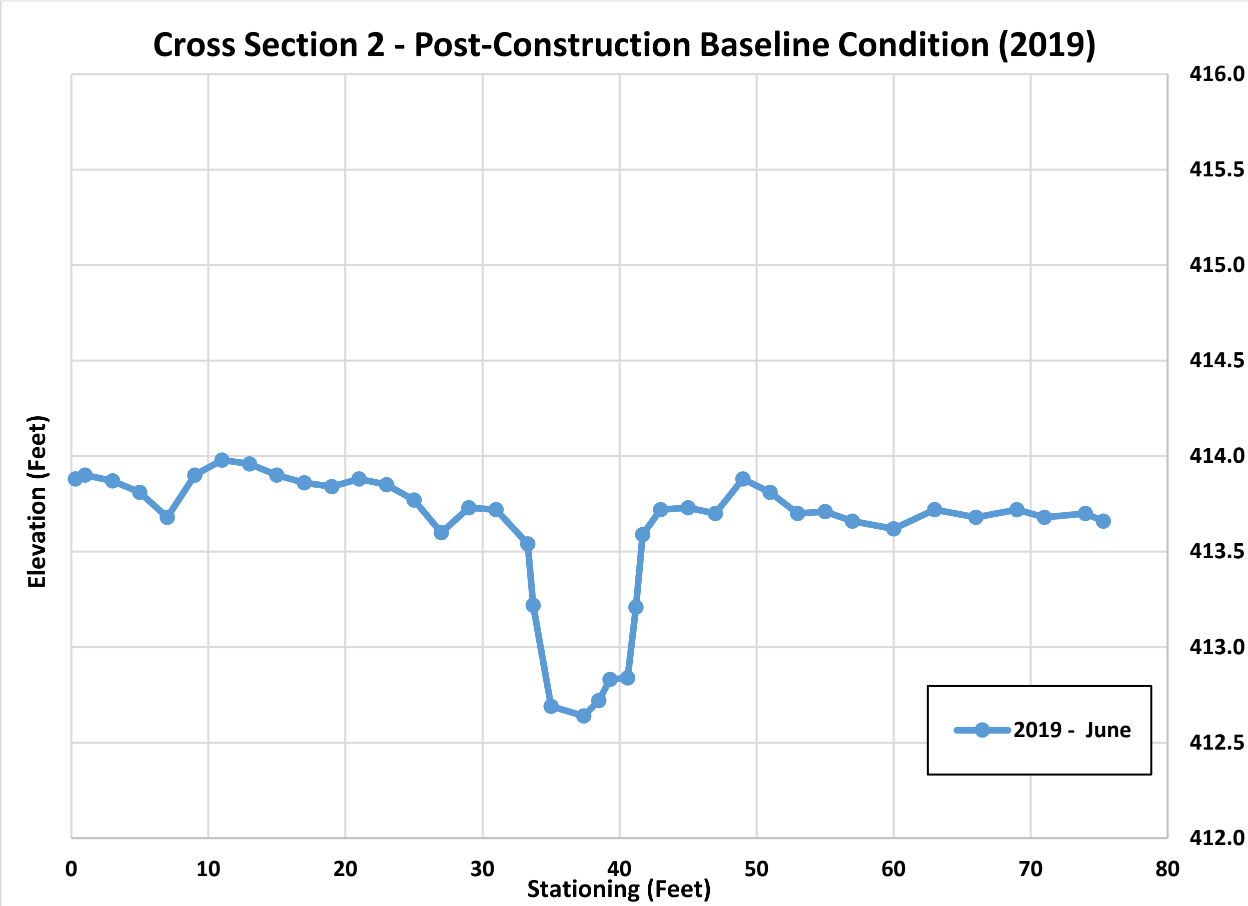

Figure 14. Cross Section P-2 – Post-construction (2019)

Throughout the profile, the pools and riffles have demonstrated adjustment of grade features in pre-restoration surveys. The overall grade had flattened from 1.154% in 2017 to 1% in 2018 when comparing the water surface slope. The grade control feature that appeared in July 2018 was the downstream end of the scour pool immediately downstream of the MD 180 bridge. The post-restoration monitoring reach has been relocated further downstream to avoid any influence of the MD 180 bridge.

Figure 15 shows the post-construction longitudinal profile baseline survey. The slope at P-2 in 2019 decreased from 1.1% during pre-construction to 0.40% in post-construction. Profile P-2 in Figure 6 is newly established within the restoration reach.

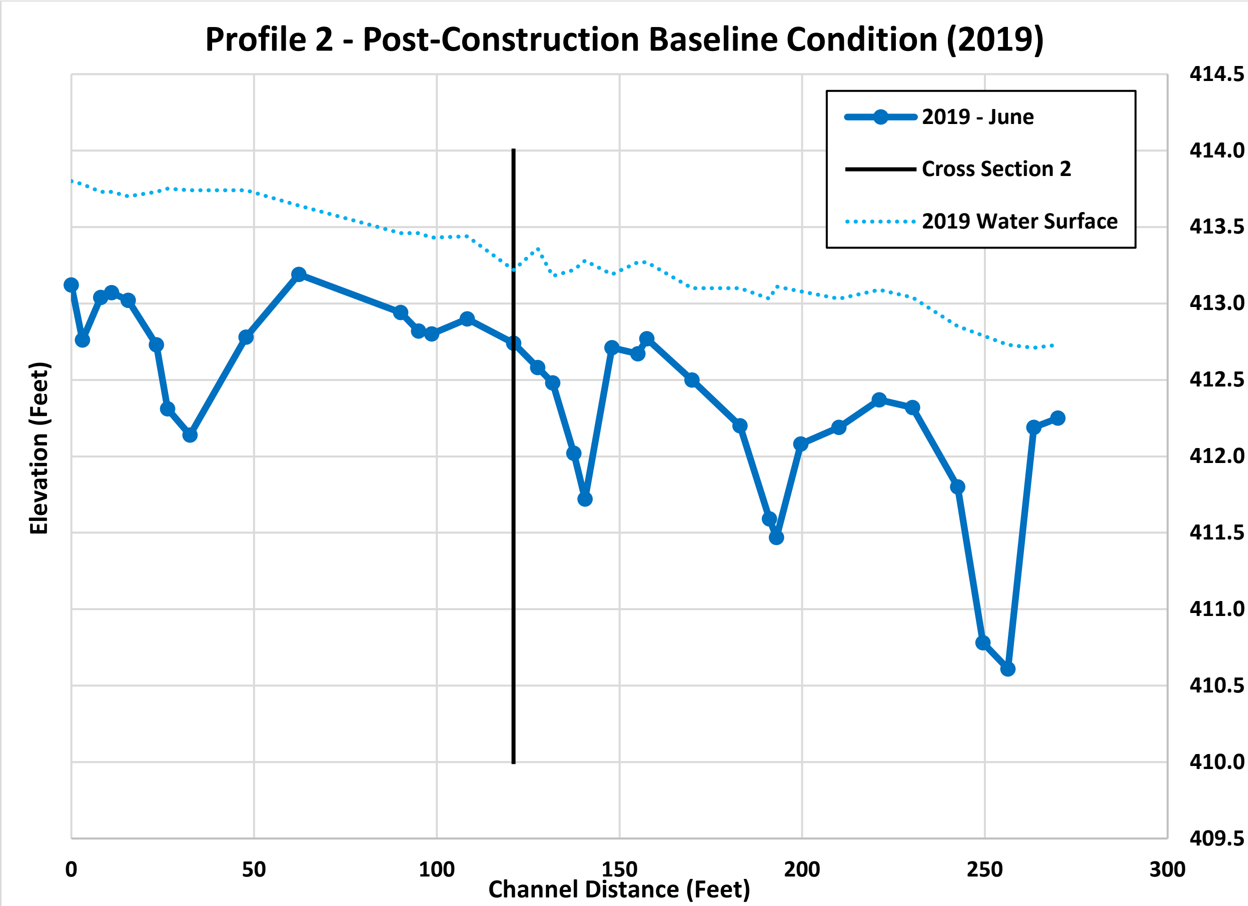

Figure 15. Profile P-2 – Post-Construction (2019)

In 2019, the D50 of the post-construction channel is 11mm (medium gravel) and the D84 is 28mm (coarse gravel) (Figure 7). Shifts in the post-construction bed material will be analyzed further in 2020.

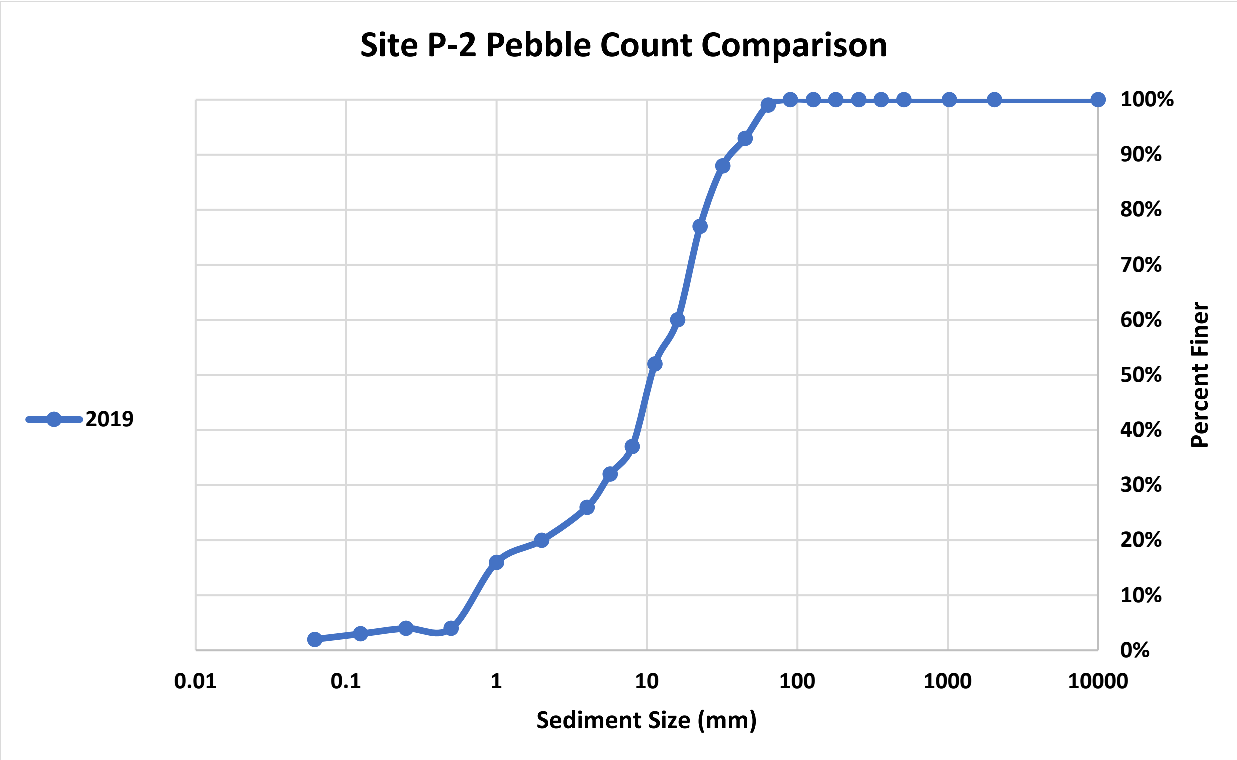

Figure 16. Section 2 Riffle Bed Material - Post-Construction (2019)

Cross Section P-3 - Restoration Reach

Pre-restoration changes from January to July of 2018 included 2-4 inches of fine sediment deposited on the right floodplain. Minor erosion and a small depositional bar at the left toe were documented during pre-restoration surveys. Figure 17 shows the baseline post-construction cross section P-3 survey that was newly established within the restoration reach in June 2019. Cross section P-3 is depicted as the yellow horizontal tape in Photo 5 and Photo 6.

Photo 5 – Cross Section P-3 – Looking downstream – June 2019

Photo 6 - Cross Section P-3 - Looking upstream – June 2019

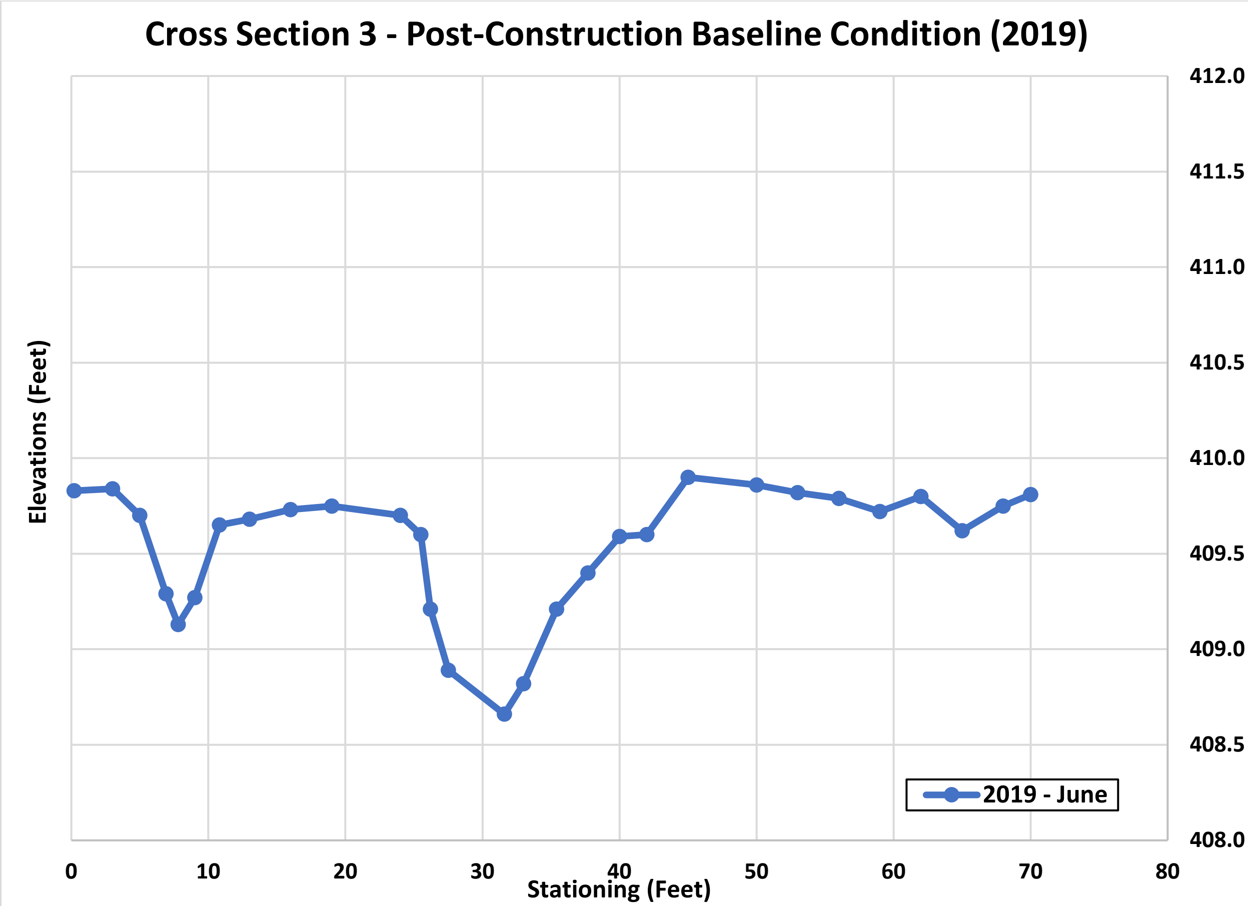

Figure 17. Cross Section P-3 - Post-Construction (2019)

The overall channel morphology was unchanged between 2017 and 2018. The pre-restoration slope for P-3 was 0.94%.

Figure 18 shows the post-construction longitudinal profile baseline survey. Analysis of shifts in post-construction bed features and slope will be analyzed in 2020 (Figure 9). This portion of the restoration reach contains three grade control structures (i.e., log sills). The post-construction channel slope is approximately 0.58%.

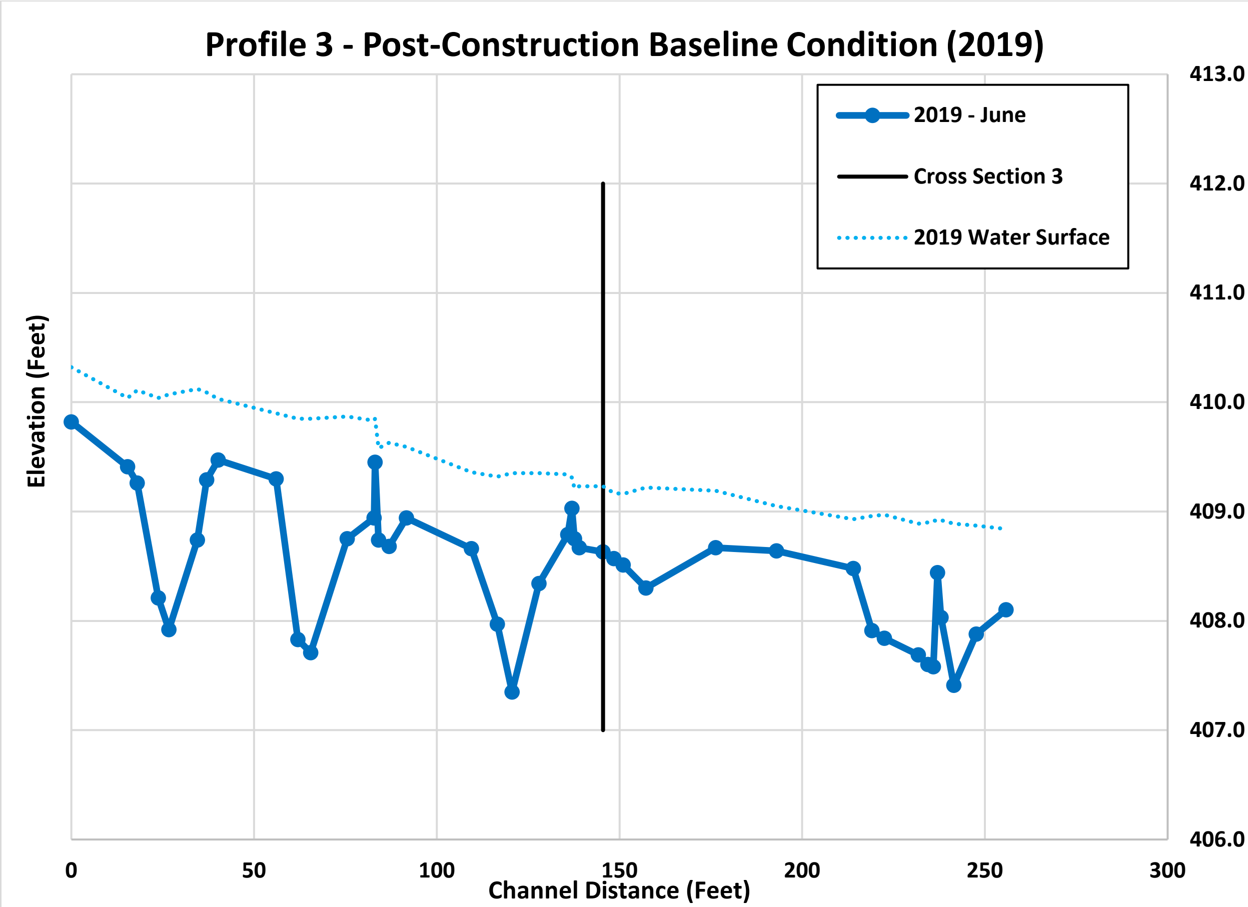

Figure 18. Profile P-3 - Post-Construction (2019)

In 2019, the D50 of the post-construction channel is 23mm (coarse gravel) and the D84 is 56mm (very coarse gravel) (Figure 19). Shifts in the post-construction bed material will be analyzed further in 2020.

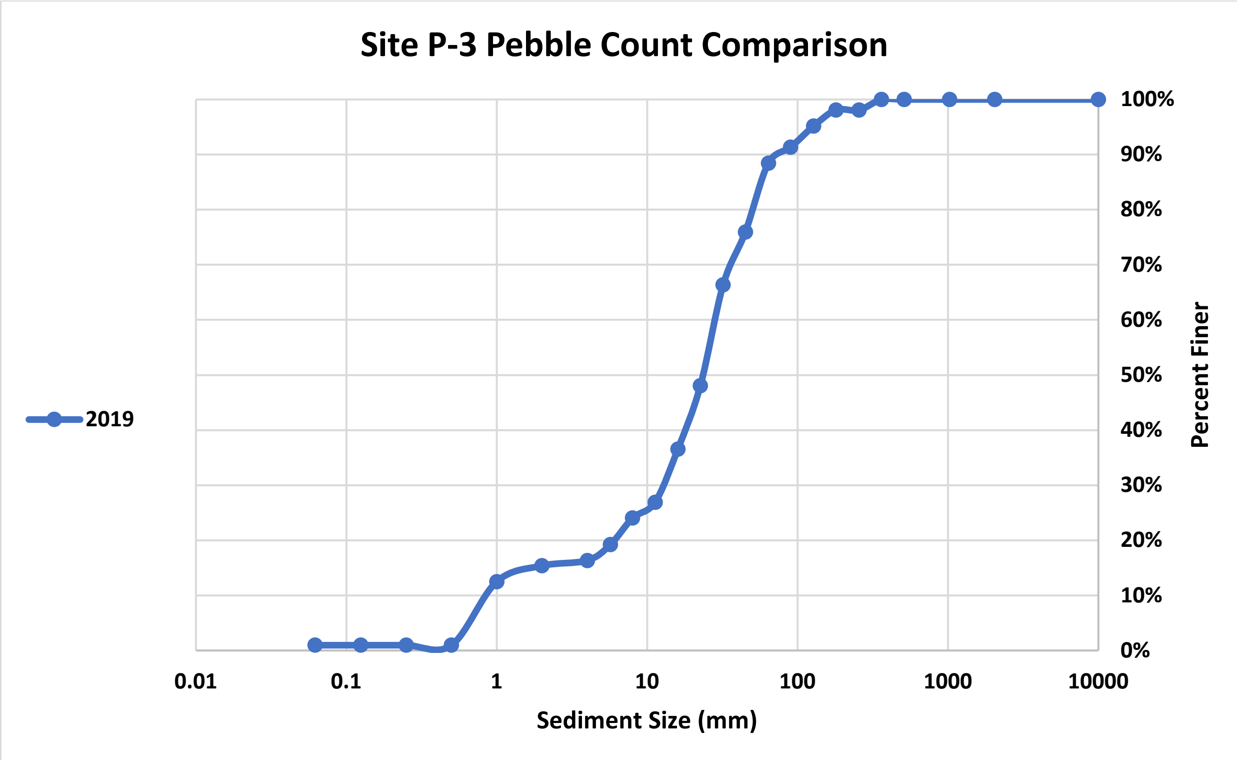

Figure 19. Section 3 Riffle Bed Material - Post-Construction (2019)

<u>Cross Section P-4 - Restoration Reach</u>

P-4 was highly unstable during the pre-construction phase. The left pin was exposed by two feet and the right bank had eroded by four feet between January and July of 2018. A large gravel bar had formed on the left bank and the entire channel had shifted over the two year monitoring period. Figure 20 shows the baseline survey of post-construction cross section P-4, which was newly established within the restoration reach in June 2019. Cross section P-4 (post-construction) is depicted as the yellow horizontal tape in Photo 7 and Photo 8.

Photo 7 – Cross Section P-4 – Looking downstream – June 2019

Photo 8 - Cross Section P-4 – Looking upstream – June 2019

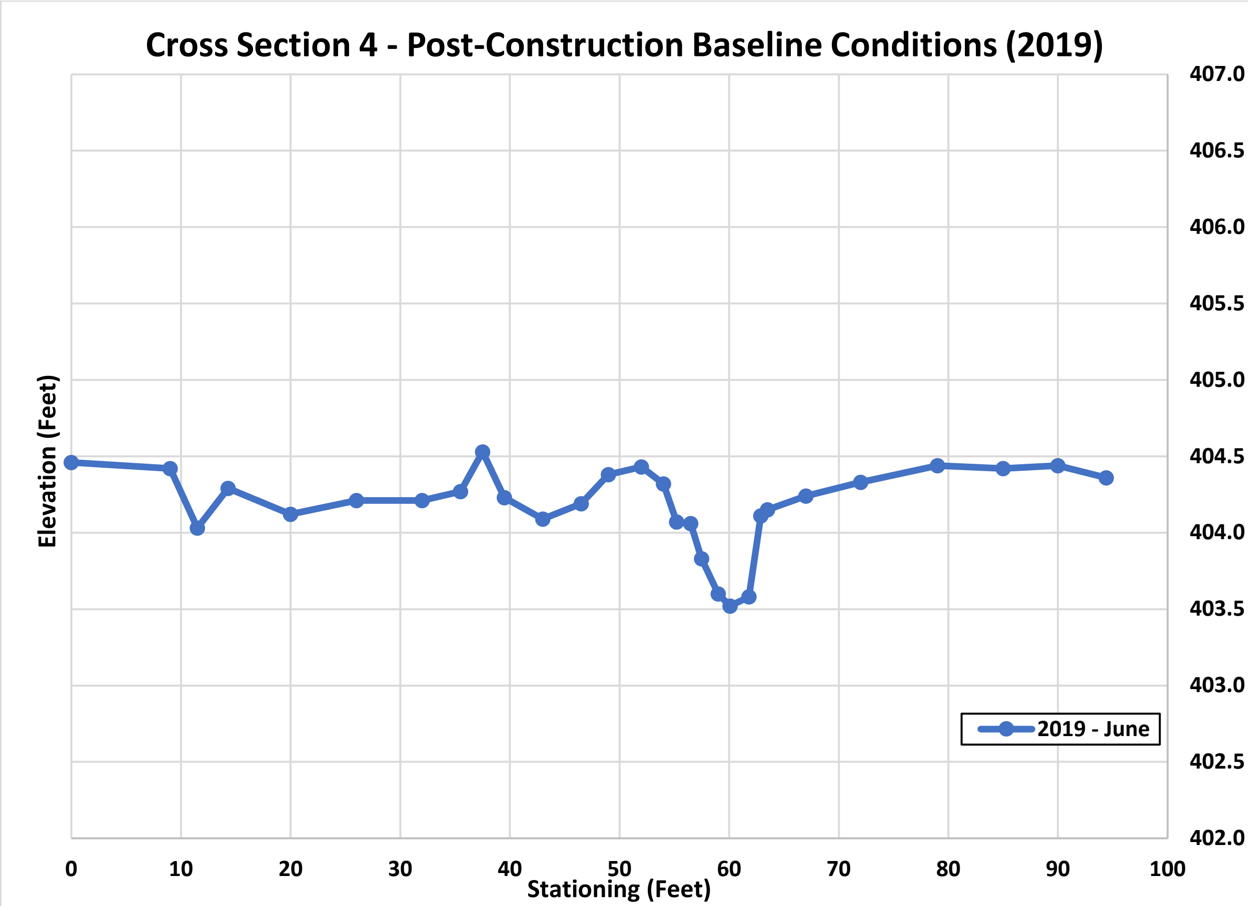

Figure 20. Cross Section P-4 – Post-Construction (2019)

The pre-construction cross section for P-4 was surveyed at a riffle in 2017, but downstream migration of the riffle resulted in the formation of a pool at the cross section location in 2018. During pre-construction, the upstream riffle migrated approximately 70 feet in the downstream direction. While the channel bed thalweg had remained at approximately the same elevation, the downstream channel had aggraded during pre-construction. The pre-construction slope for this reach in 2018 was 0.41%.

Figure 21 shows the post-construction longitudinal profile baseline survey. Analysis of shifts in post-construction bed features and slope will be analyzed in 2020. The post-restoration channel slope is 0.58%.

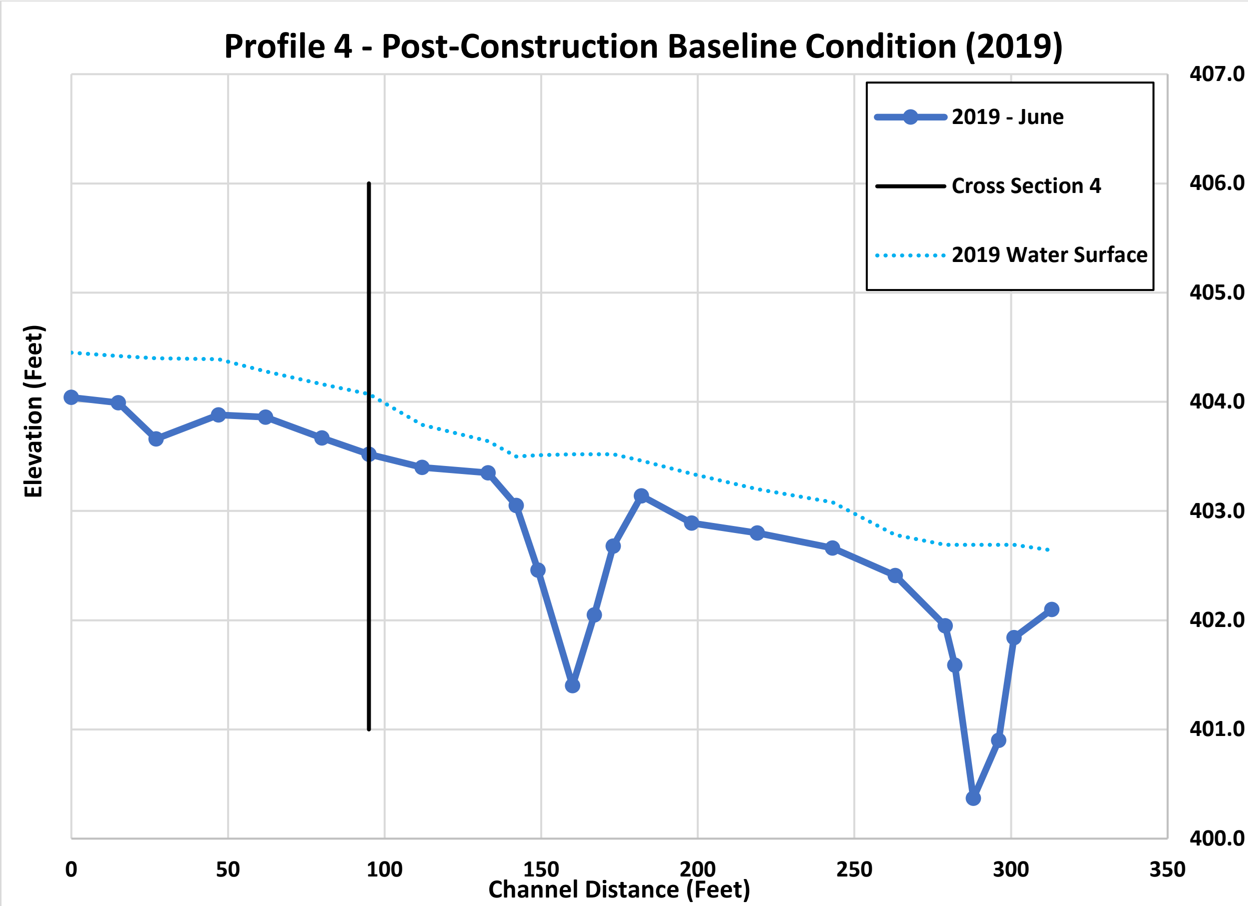

Figure 21. Profile 4 – Post-Construction (2019)

Pebble counts were performed near the riffle/run at the cross section monitoring location (Figure 13). In 2019, the D50 of the post-construction channel is 16mm (coarse gravel) and the D84 is 35mm (very coarse gravel) (Figure 13). Shifts in the post-construction bed material will be analyzed further in 2020.

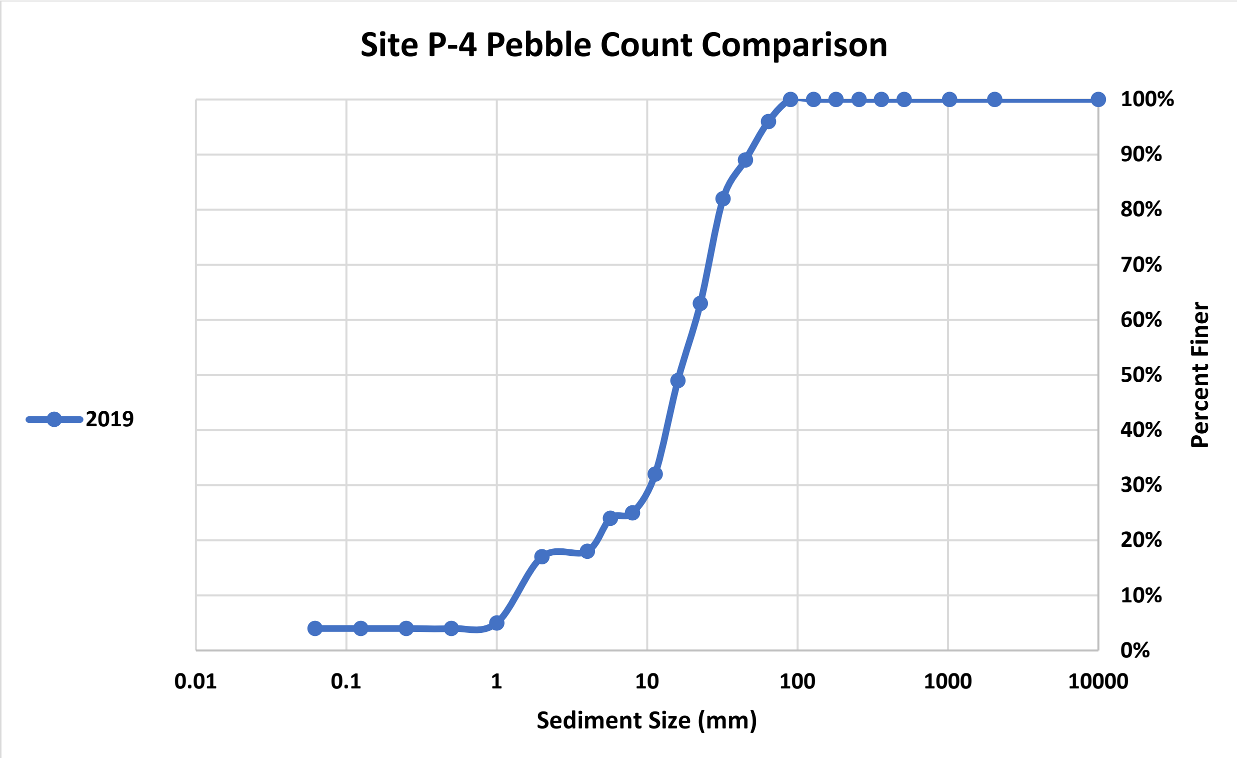

Figure 22. Section 4 Riffle Bed Material – Post-Construction (2019)

<u>Cross Section P-5 - Downstream Reach</u>

The cross section at P-5 did not change notably after stream restoration (post-construction) from Aug 2018 to June 2019. There was less than 0.5 ft. of additional bed scour near the left bank and in the center of the channel, but the thalweg elevation remained consistent. The left bank also showed additional minor erosion. Previously, the left toe scoured down approximately one foot between April 2018 and August 2018 (Figure 23), which likely occurred during the extreme flooding event in May 2018. The rest of the channel remained largely unchanged during the monitoring period, and both banks remain fully vegetated. Cross section P-5 is depicted as the yellow horizontal tape in Photo 9 and Photo 10.

Photo 9 – Cross Section P-5 – Looking downstream – June 2019

Photo 10 - Cross Section P-5 – Looking upstream – June 2019

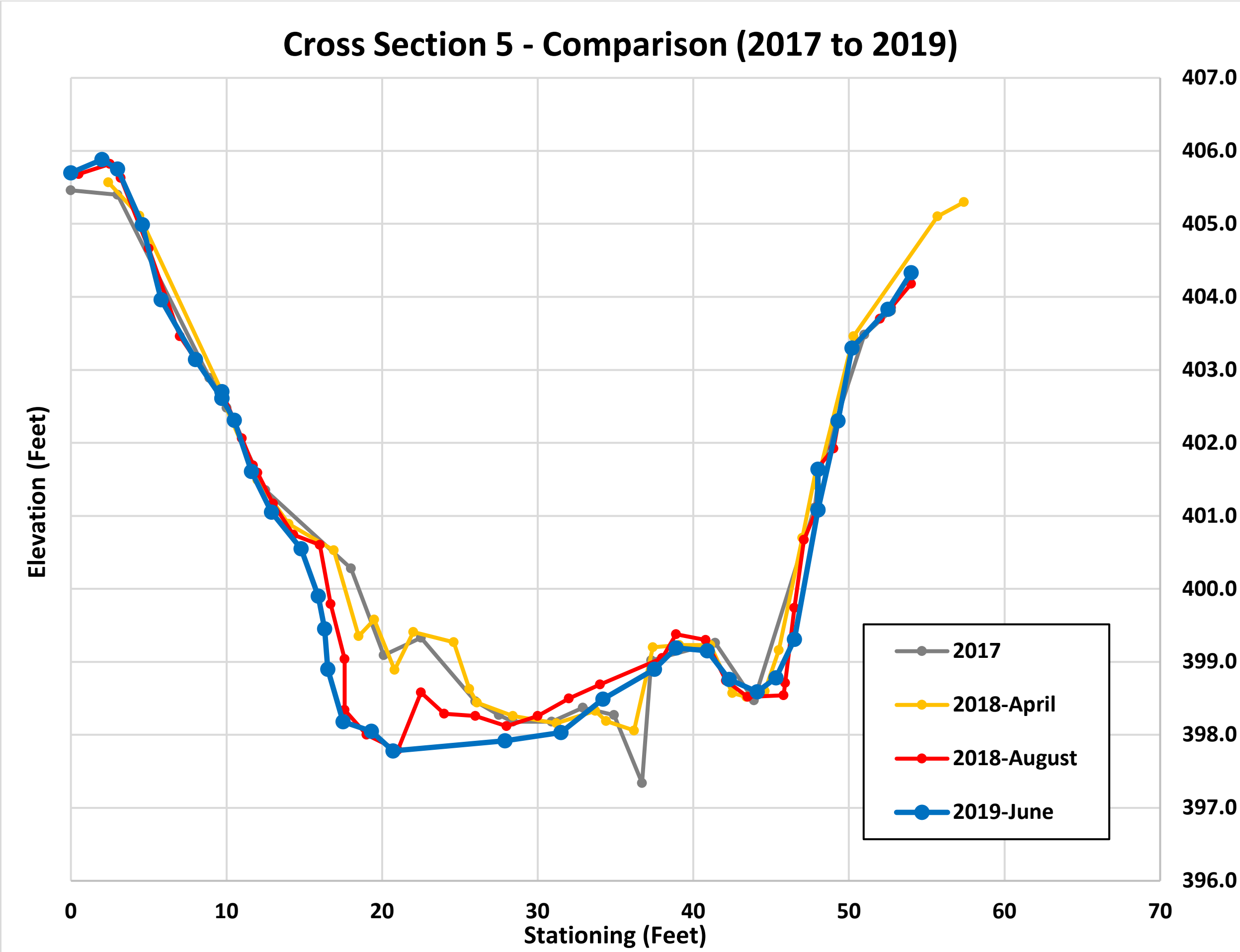

Figure 23. Cross Section P-5 Comparison (2017 to 2019)

The profile remained mostly unchanged from 2018 to 2019. The overall slope slightly increased from 0.42% in 2018 to 0.66% in 2019 due to the buildup of sediment on the upstream end of the profile. The pool depth remained consistent, and the approximate feature locations remained the same. Previously, the profile had significantly reduced in slope between April and August of 2018 (Figure 24). This is likely due in large part to the extreme storm event in May 2018, causing the riffle feature to migrate downstream, and also another major storm in August 2018, which occurred just after completion of a constructed cross vane immediately upstream. The scour pool for a constructed cross vane is immediately upstream of the profile. The area upstream of Station 0+60 received flows approaching 1800 cfs through a confined section of the floodplain, which caused further shifts in the bed profile.

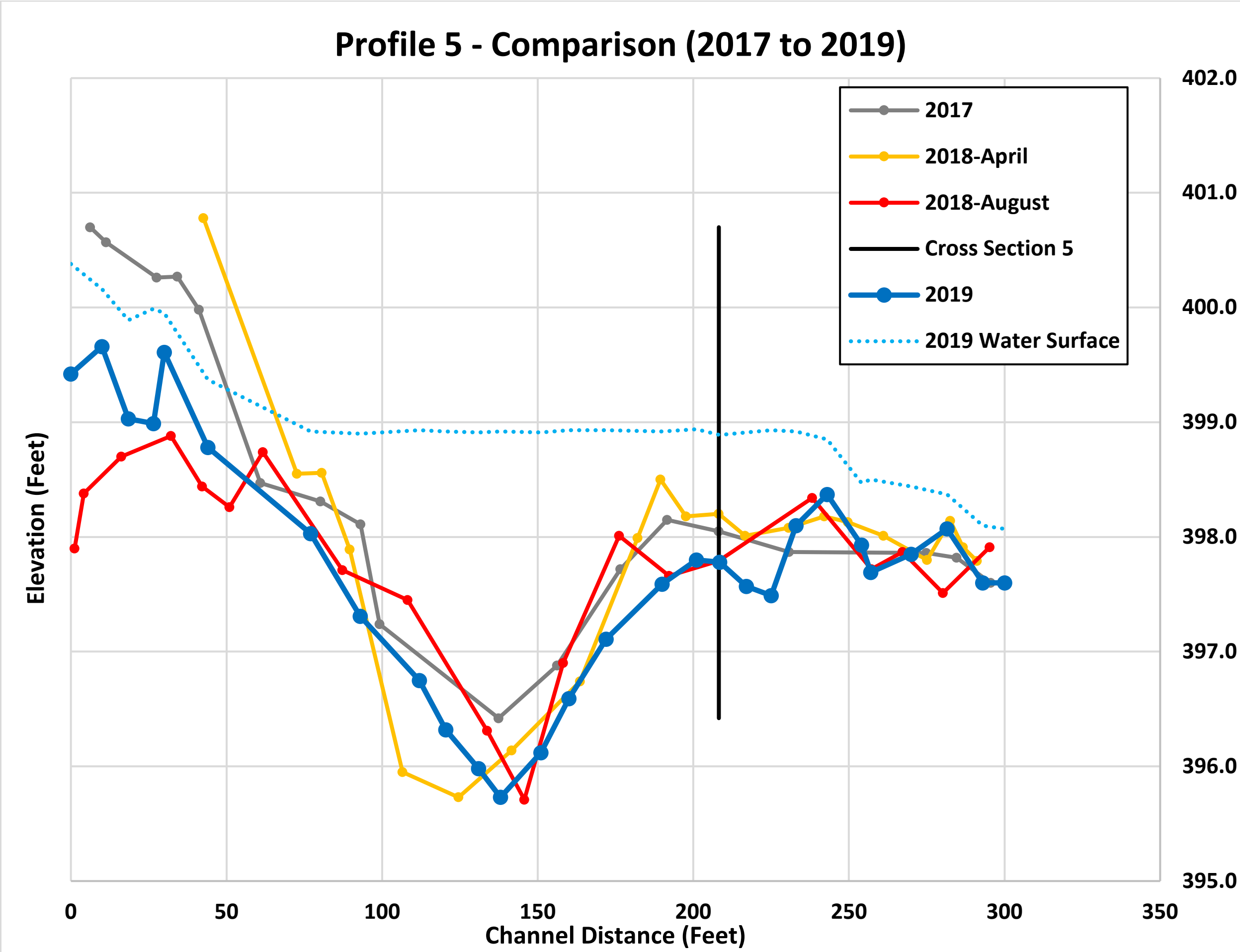

Figure 24. Profile P-5 Comparison (2017 to 2019)

The riffle material has potentially coarsened since 2017 but remains dominated by fine gravel and cobble. In 2017, the D50 and D84 was 9.1mm (medium gravel) and 28.6mm (coarse gravel), respectively. While in 2018, the D50 increased slightly to 17mm (coarse gravel) and the D84 increased substantially to 73mm (small cobble). This suggests the deposition of larger bed material in the study area of Profile 5 (Figure 25). In 2019, the trend towards coarser material continued. The D50 was 42mm, and the D84 was 110mm. This could be due to larger material washing down from the restoration site, or finer materials shifting or being washed further downstream.

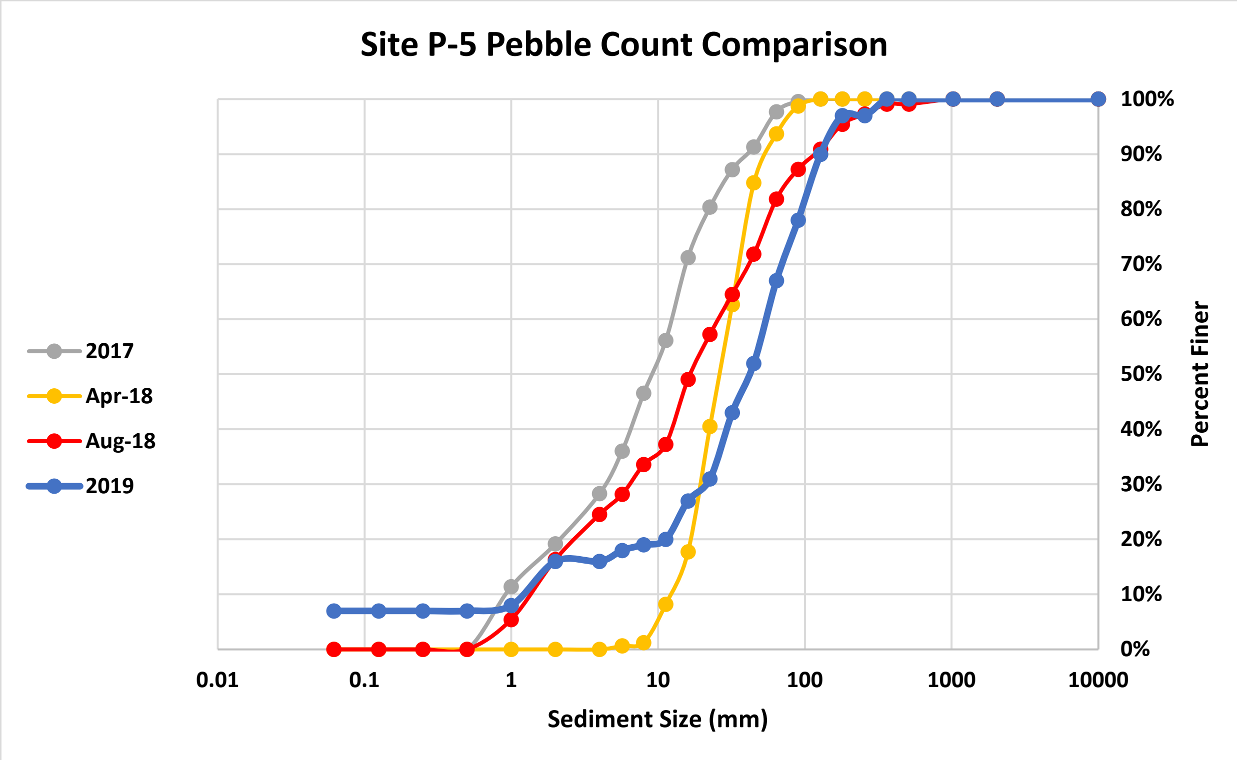

Figure 25. Section P-5 Riffle Bed Material Comparison

<u>Cross Section P-6 - Downstream Reach</u>

P-6 was established and surveyed in April 2018 and surveyed again in August 2018 and June 2019. This section has eroded significantly on the left bank where the monument pin is now exposed by 0.8 feet (Figure 26). The soil here is a loosely consolidated sand. The right bank has undercut by 3.5 feet. The entire channel bed has aggraded by approximately 4 inches across the section. It is likely that the majority of changes observed can be directly attributed to the extreme flood event that occurred in May 2018. In 2019, the left bank remained consistent and the pin was still exposed approximately 1.5 feet. The right bank showed some additional erosion, but the bank remained mostly intact and still had root protection to hold it together. Cross section P-6 is depicted as the yellow horizontal tape in Photo 11 and Photo 12.

Photo 11 – Cross Section P- 6 – Looking downstream – June 2019

Photo 12 - Cross Section P-6 – Looking at the left, eroded bank with exposed pin – June 2019

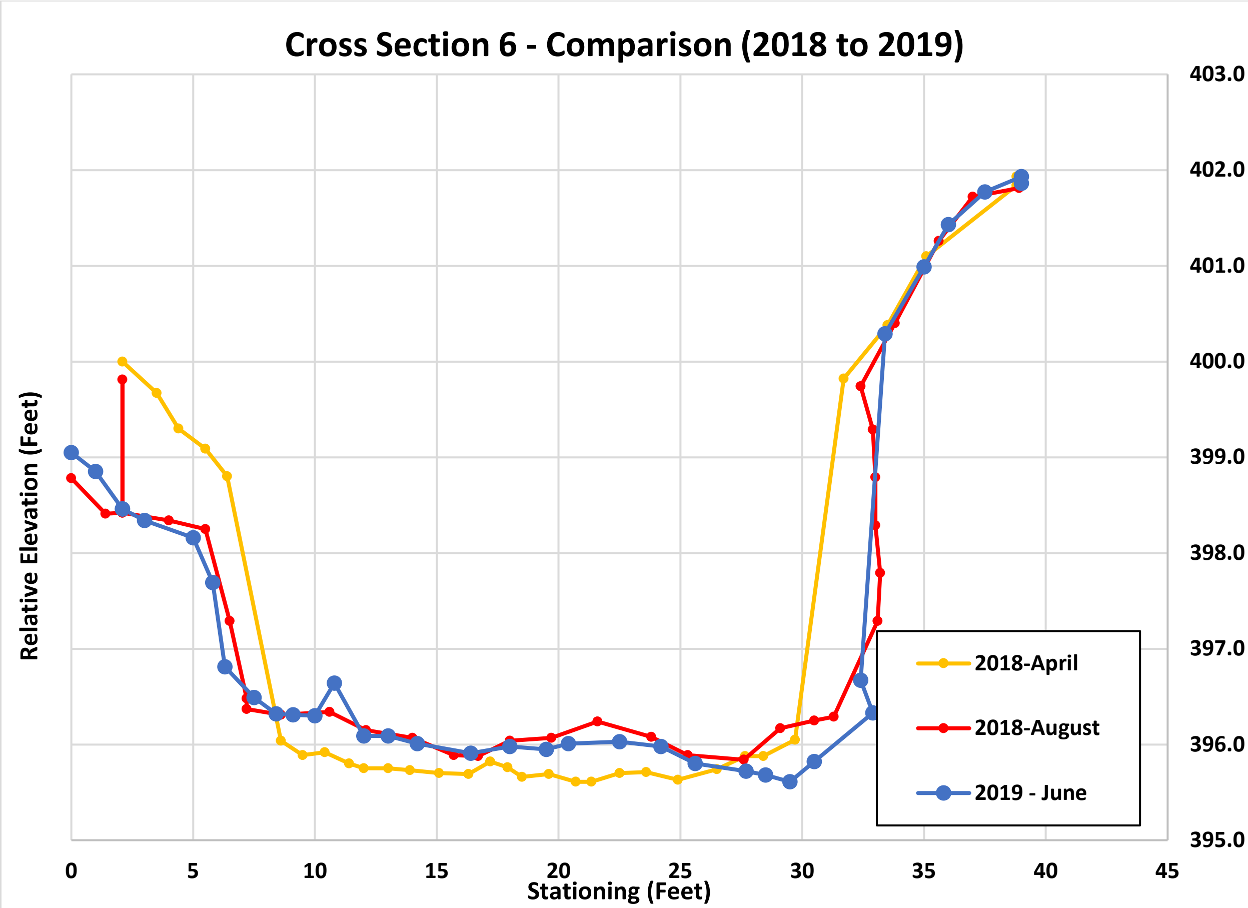

Figure 26. Cross Section P-6 Comparison (2018 to 2019). Note: Elevations are not set to known datum.

P-6 profile survey shows that the upstream pool and the lower portion of the riffle, where the cross section was surveyed, have aggraded since April 2018 (Figure 27). In 2019, the profile slope remained consistent at 0.45%, and there were no major shifts in bed features.

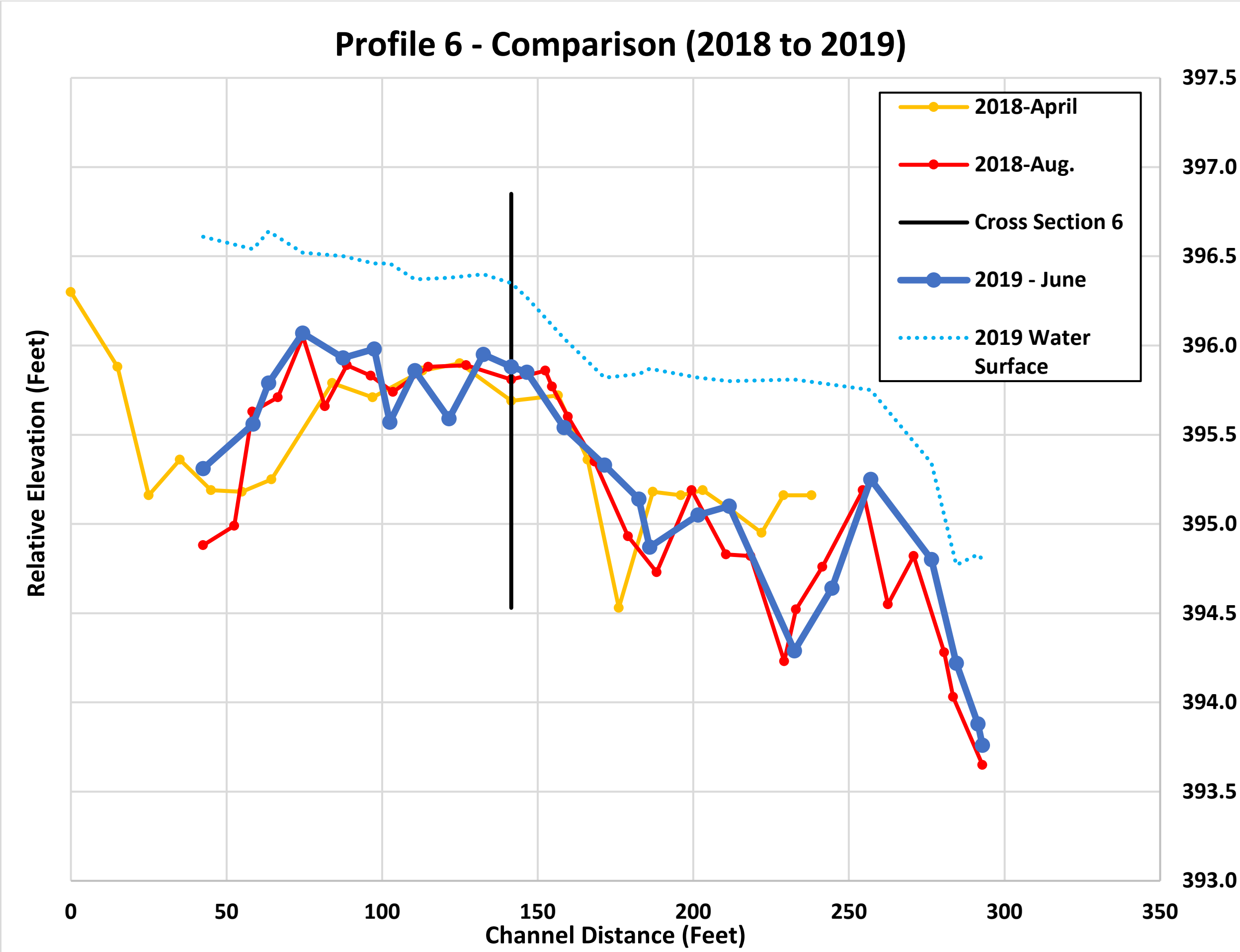

Figure 27. Profile P-6 Comparison (2018 to 2019). Note: Elevations are not set to known datum.

The riffle material is unchanged between April and August of 2018 and June of 2019. The reach maintained a D50 in the coarse gravel category and a D84 in the small cobble category, only differing by a few millimeters between the surveys (Figure 28).

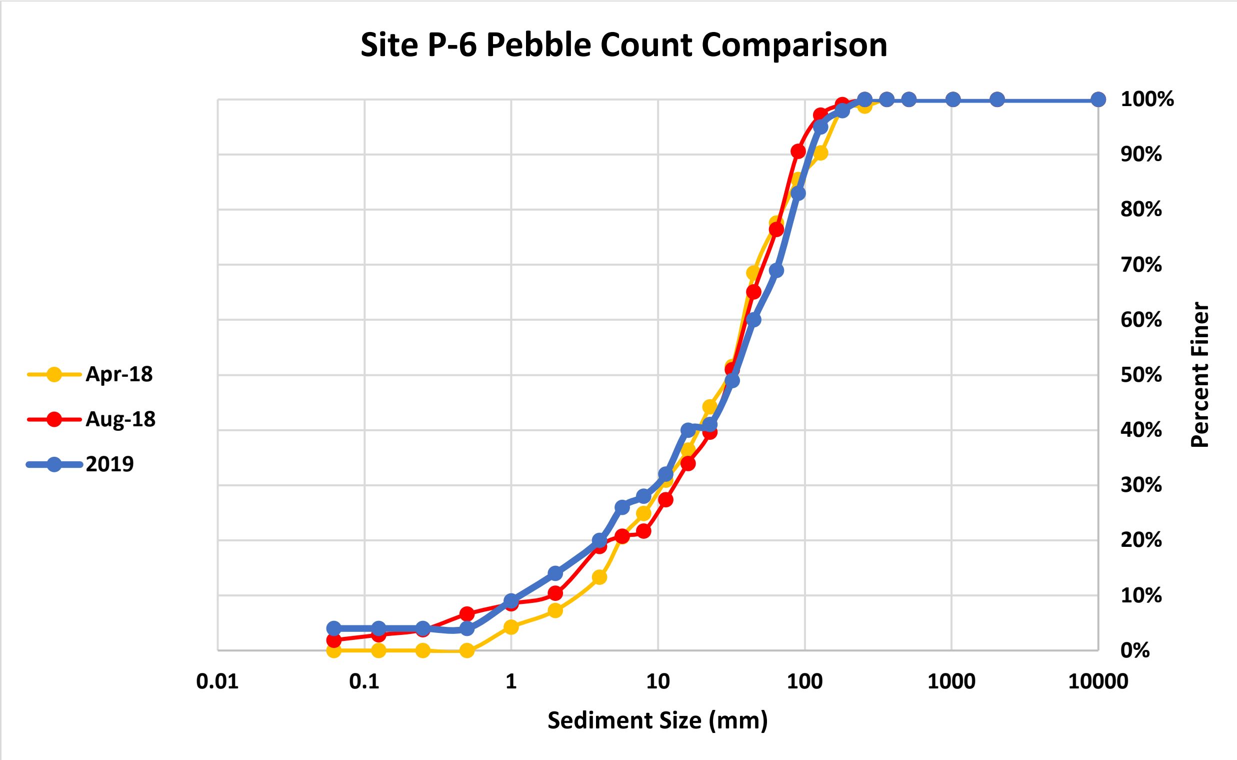

Figure 28. Section P-6 Riffle Bed Material Comparison (2018 to 2019).

5.4 Discussion

Following the pre-construction surveys, conducted from September 2017 through August 2018, there is substantial evidence that the geomorphic conditions in the monitored reaches of Little Catoctin Creek are very dynamic. With three separate geomorphic surveys conducted in the span of just one year, erosion, deposition, and general channel instability were well documented. Construction of the restoration project was completed in April 2019. Post-construction surveys of the three (3) existing and three (3) newly established sites were conducted in June 2019. A summary of the surveys both pre-and post-construction is detailed below.

Channel instability continues to increase overtime at the upstream control reach, Section P-1. At Section P-1, the channel erosion and instability will likely continue to be observed due to the absence of stream restoration. In 2019, there was minor lateral erosion near the top of the left bank of about 1.5 feet. The channel was significantly impacted by increased deposition and aggradation along the right bank where the bank aggraded vertically by 0.4 foot. This deposition has led to the decrease in bankfull cross-sectional area and top of bank area since 2017 (Table 5-2). In 2019, the majority of that deposition had eroded away leading to a 50% increase in the cross-sectional area compared to 2017. The deposition in Section 1 consists of coarse particles, like larger gravel and small cobble, that led to the increase in D50 and D84 values and associated size classes as indicated by Table 5-4. Slope decreased over the course of the three surveys, due either to the grade control structure and aggradation that occurred between 2017 and 2018, or to the difference in the lengths of the profile (Table 5-3). Between 2018 and 2019, the channel upstream of this section has become more unstable by forming a mid-channel bar/split flow. This could also have contributed to the increase in channel slope as the split flow resulted in a new thalweg location. This will likely lead to continued instability in this section. The cross section showed instability from 2018 to 2019 with additional erosion along the right bank.

Prior to restoration, sections P-2, P-3, and P-4 were considered highly unstable. During pre-construction, erosion and instability plagued sections P-2, P-3, and P-4. Decreasing cross-sectional area and top of bank area were present at P-2 and P-3. P-2 and P-3 showed increased aggradation over time. P-4 had active migration of channel features with aggradation present throughout much of the reach. The Little Catoctin stream restoration project created a better connection between the channel and floodplain. The restored channel dimensions are significantly different from pre-construction channel conditions. The restored channel has much lower bank heights. The restored bank heights range from 0.5’ to 1.0’, compared to 2.5’ to 4.0’ in height prior to restoration. The restored channel width and baseflow are smaller compared to pre-restoration conditions.

In 2019, sections P-2, P-3, and P-4 are newly established cross sections within the restoration reach and replace the pre-construction cross sections. These sites were established in June 2019, following completion of construction. In Sections P-2, P-3, and P-4, the post-construction cross sectional dimensions and profile slopes have changed significantly from pre-restoration. The evolution of the restored channel will be evaluated in 2020 post-construction monitoring. Table 5-2 summarizes the restoration cross sectional dimensions.

The Section P-5 profile shows channel features that have migrated since 2017, potentially due to two large storm events in May 2018 and August 2018 (Figure 24). The cross section was stable from the initial survey in 2017 to the second survey in April 2018 until a catastrophic storm event caused extensive scour (1 foot) and lateral erosion on the left bank (2 feet) that was documented in the August 2018 survey (Figure 23, Table 5-2). The cross-sectional area increased while the top of bank area increased by a much smaller amount which indicates most of the changes are occurring at or below the bankfull stage (Table 5-2). In 2019 the cross-sectional area continued to increase, while the maximum depth decreased. Particles in Section 5 increased as the D50 and D84 size classes changed from medium gravel and coarse gravel to very coarse gravel and medium cobble, respectively (Table 5-4). Slope in this reach decreased by half from the April 2018 survey to the August 2018 survey, likely due to restoration grading upstream of station 0+70 (Figure 24, Table 5-3). In 2019, the channel slope had increased from 2018: however, slope was still less than what was measured in 2017. As the completed restoration matures, the cross sections and profile could stabilize. Based on the 2019 survey results and minor changes to the channel in this section, the upstream restoration does not appear to have had any negative impacts on Section 5.

Section P-6 was established in 2018, and therefore only had two surveys conducted in 2018 and one in 2019. The cross-section in this reach experienced significant erosion from April 2018 to August 2018 (Figure 26). The left bank eroded about 0.8 feet and the right bank eroded 3.5 feet (Figure 26). Although, bank erosion occurred, the aggrading of the stream bed by 0.32 feet at this cross section minimized the loss in cross-sectional area (Table 5-2). The cross-sectional area stayed fairly consistent from 2018 to 2019, however the channel width increased with the erosion on the right bank that appeared to be stabilized by tree roots along the bank. Since the channel widened and aggraded, the bankfull width and width/depth ratio increased while the mean and maximum depth at bankfull stage decreased from April 2018 to August 2018. These parameters showed no change from August 2018 to June 2019 (Table 5-2). The bed material particles were stable at this reach (Table 5-4). Slope in this reach remained stable throughout the 2018 and 2019 surveys (Table 5-3). Based on the 2019 survey results and minor changes to the channel in this section, the upstream restoration does not appear to have had any negative impacts on Section 6.

Table 5-2. Cross-section dimension comparison.

Bankfull							
		Cross-Sectional Area (ft^2)	**Width (ft.)**	**Mean Depth (ft.)**	**Max Depth (ft.)**	**Width/Depth Ratio**	**Top of Bank Area (ft^2)***
XS 1	Sep 2017	19.5	16.9	1.2	2.1	14.6	143.6
	Apr 2018	13.5	19.9	0.7	1.7	29.5	137.0
	Aug 2018	15.3	13.5	1.1	1.6	11.8	123.7
	June 2019	29.7	17.9	1.7	3.0	10.8	141.7
	% Change	**+52.3**	**+5.9**	**+41.7**	**+42.9**	**+26.0**	**-1.3**
XS 2	June 2019	5.8	8.3	0.7	0.9	12.0	5.8
	% Change	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
XS 3	June 2019	7.8	16.5	0.5	0.9	35.0	7.8
	% Change	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
XS 4	June 2019	7.6	26.4	0.3	0.9	91.9	7.6
	% Change	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
XS 5	Sep 2017	26.9	26.7	1.0	2.4	26.5	160.1
	Apr 2018	26.1	28.0	0.9	1.6	30.1	159.2
	Aug 2018	35.0	29.7	1.2	2.0	25.3	169.4
	June 2019	40.3	30.8	1.3	1.9	23.5	178.1
	% Change	**+49.8**	**+15.4**	**+30.0**	**-20.8**	**-11.3**	**+11.2**
XS 6	Apr 2018	38.2	23.0	1.7	1.9	13.9	101.9
	Aug 2018	35.5	26.9	1.3	1.7	20.3	112.5
	June 2019	38.6	26.7	1.4	1.9	18.5	115.6
	% Change	**+1.1**	**+16.1**	**-17.7**	**+/-0**	**+33.1**	**+13.4**

**Top of bank area calculated from an established fixed elevation unrelated to bankfull*

Table 5-3: Profile slope comparison

Profile		Water Surface Slope %
Profile 1	Sep 2017	0.76%
	Apr 2018	0.59%
	Aug 2018	0.4%
	Jun 2019	1.1%
Profile 2	Jun 2019**	0.40%
Profile 3	Jun 2019**	0.58%
Profile 4	Jun 2019**	0.58%
Profile 5	Sep 2017	0.995%
	Apr 2018	0.94%
	Aug 2018	0.42%
	Jun 2019	0.66%
Profile 6	Apr 2018	0.45%
	Aug 2018	0.48%
	Jun 2019	0.42%

Table 5-4: Bed material particle comparison

Site		D50	Size Class	D84	Size Class
Section 1	Sep 2017	12.3	Medium gravel	31.3	Coarse gravel
	Apr 2018	32	Coarse gravel	71	Small cobble
	Aug 2018	33	Very coarse gravel	62	Very coarse gravel
	Jun 2019	18	Coarse gravel	56	Very coarse gravel
Section 2	Jun 2019**	11	Medium gravel	28	Coarse gravel
Section 3	Jun 2019**	23	Coarse gravel	56	Very coarse gravel
Section 4	Jun 2019**	16	Coarse gravel	35	Very coarse gravel
Section 5	Sep 2017	9.1	Medium gravel	28.6	Coarse gravel
	Apr 2018	26	Coarse gravel	44	Very coarse gravel
	Aug 2018	17	Coarse gravel	73	Small cobble
	Jun 2019	42	Very coarse gravel	110	Medium cobble
Section 6	Apr 2018	30	Coarse gravel	85	Small cobble
	Aug 2018	31	Coarse gravel	77	Small cobble
	Jun 2019	33	Coarse gravel	93	Medium cobble

***Sections impacted directly by restoration in 2019. The 2020 monitoring will show the change in each of the restored reaches.*

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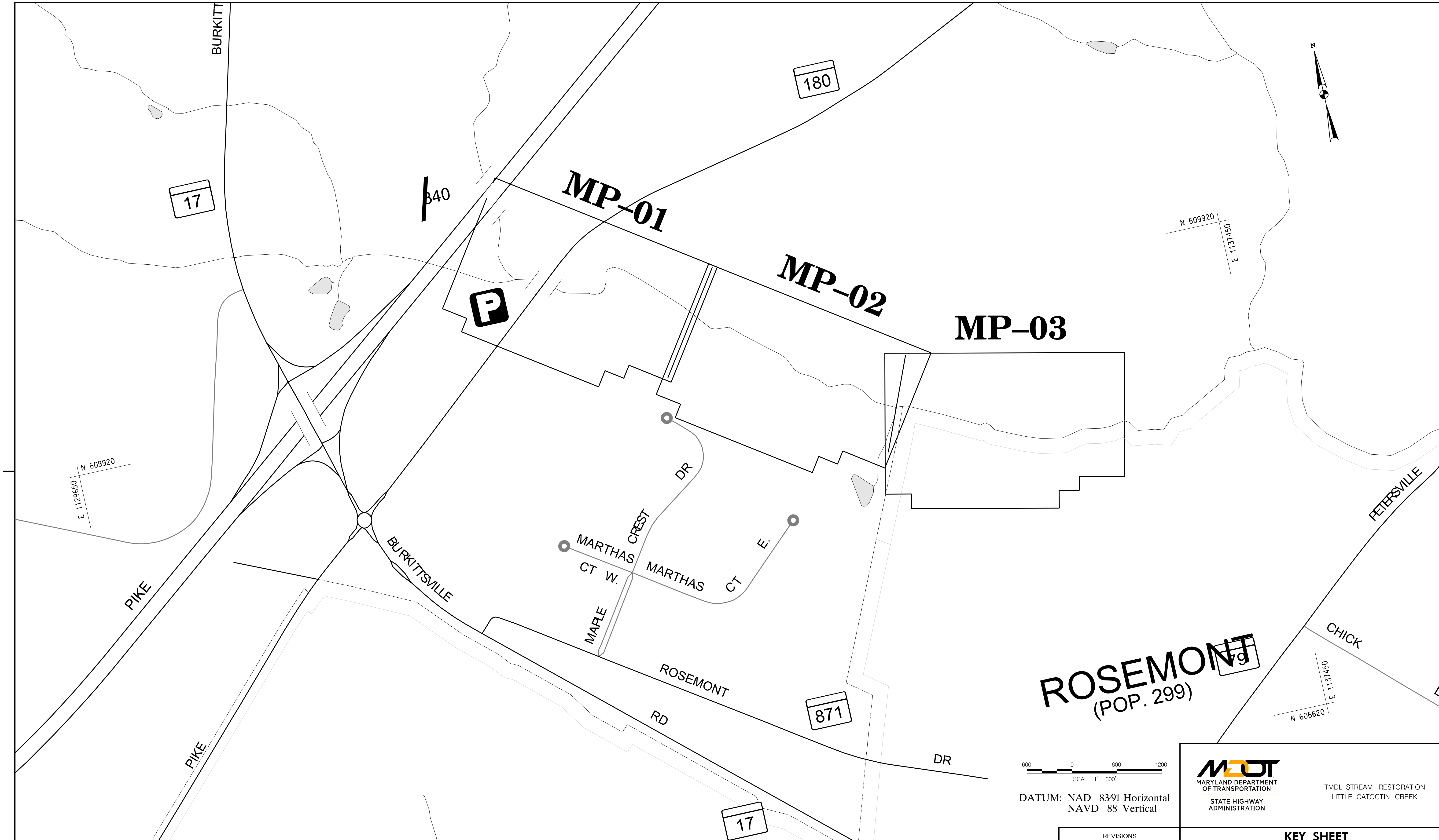
State Highway Administration (SHA), Maryland Department of Transportation. 2017. National Pollutant Discharge Elimination System Annual Report. Baltimore, Maryland.

ATTACHMENT A:
MONITORING LOCATIONS



DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

TMDL STREAM RESTORATION
LITTLE CATOCTIN CREEK

REVISIONS

KEY SHEET

SCALE 1" = 600' ADVERTISED DATE OCTOBER 2017 CONTRACT NO. AT62813

DESIGNED BY ______ COUNTY FREDERICK
DRAWN BY ______ LOGMILE ______
CHECKED BY ______
MDE/PRD ______

DRAWING NO. **KY - 01** OF **01** SHEET NO. 1 OF 4

PLOTTED: Tuesday, October 03, 2017 AT 03:39 PM
FILE: \\balsrv02\v2011\2011\11110_SHANEPA\Task41_TMDL Support\Assessmt_of_Cntrls\SR\CADD\Plans\pMP-key_MD180.dgn

BY: dblack -

Rummel, Klepper & Kahl, LLP
700 EAST PRATT STREET | BALTIMORE, MD 21202
SUITE 500 PH: (410) 728-2900
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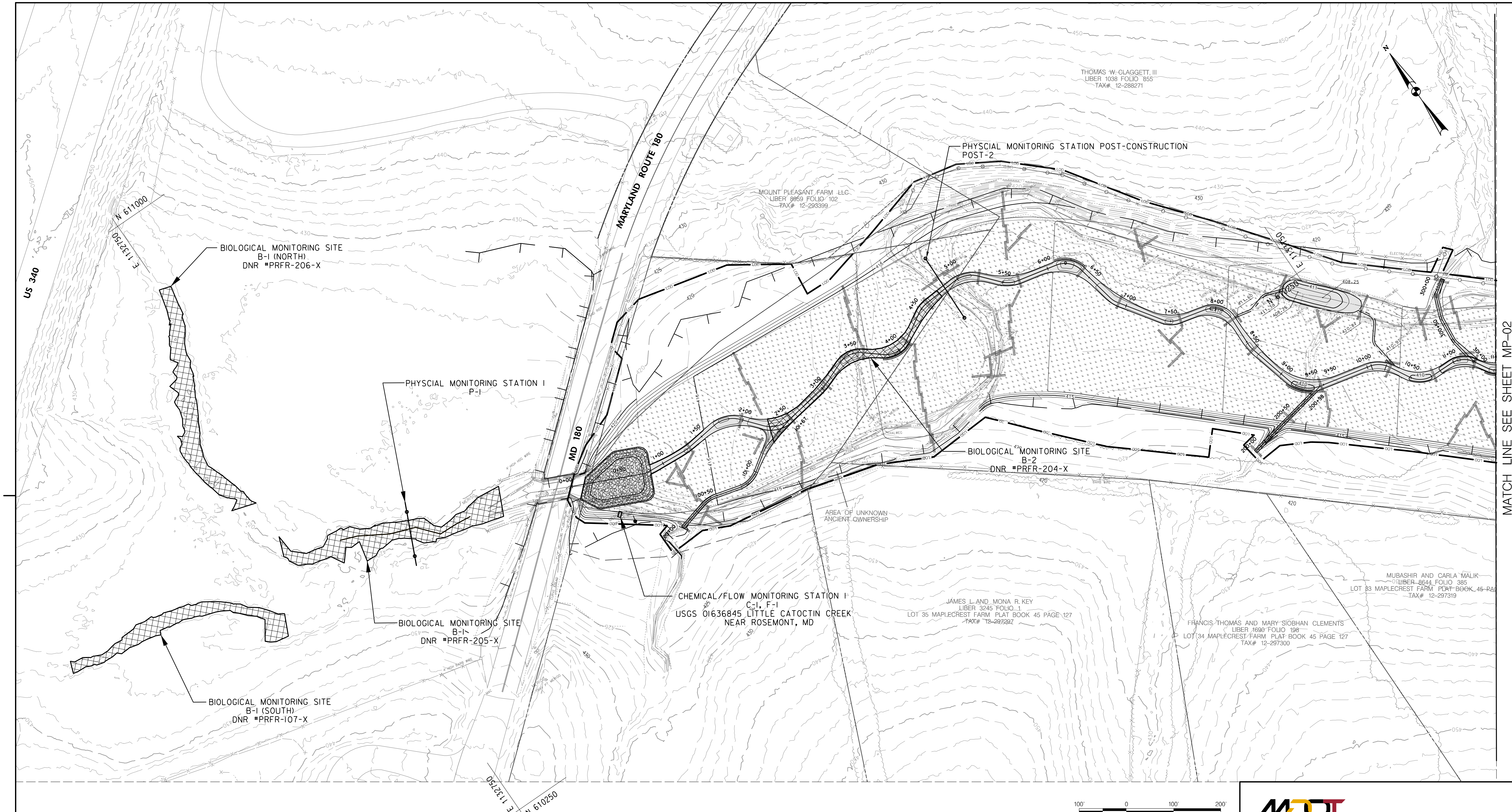


100' 0 100' 200'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

MDOT
MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

TMDL STREAM RESTORATION
LITTLE CATOCTIN CREEK

REVISIONS

MONITORING LOCATION PLAN

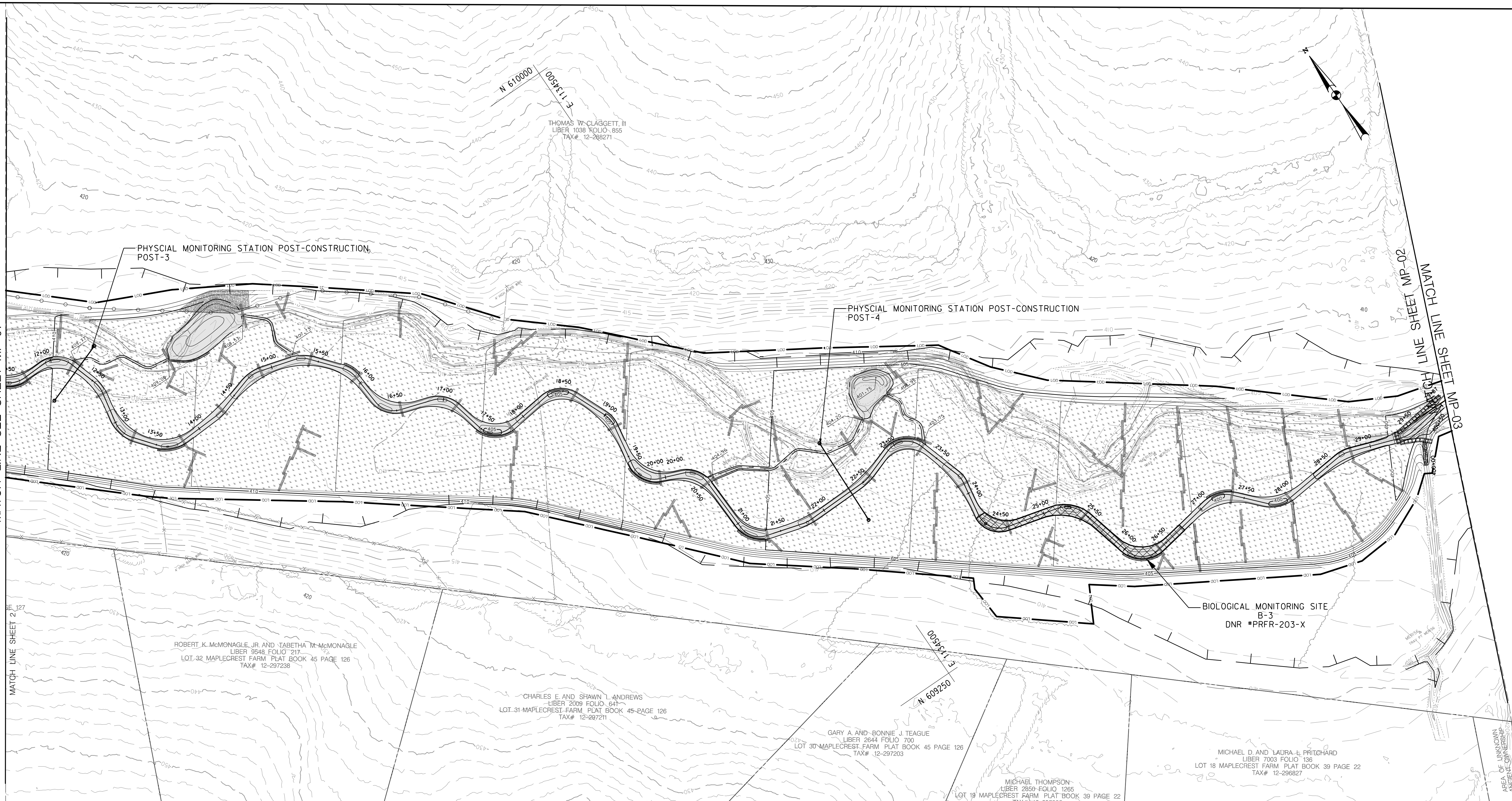
SCALE 1" = 100' ADVERTISED DATE SEPT 2019 CONTRACT NO. AT62813

DESIGNED BY ____________ COUNTY FREDERICK
DRAWN BY ____________ LOGMILE ____________
CHECKED BY ____________
MDE/PRD ____________

DRAWING NO. MP-01 OF 03 SHEET NO. 2 OF 4

PLOTTED: Tuesday, September 17, 2019 AT 11:06 AM
FILE: T:\186681 - BCS 2014-09H Enviro Design\WAT\Task 04 MS4 Monitoring - Little Catoctin\CADD\Plans\pMP-0001_MD180.dgn

BY: MoxleyK -



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SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

N 609250
E 1134000

MDOT
MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

TMDL STREAM RESTORATION
LITTLE CATOCTIN CREEK

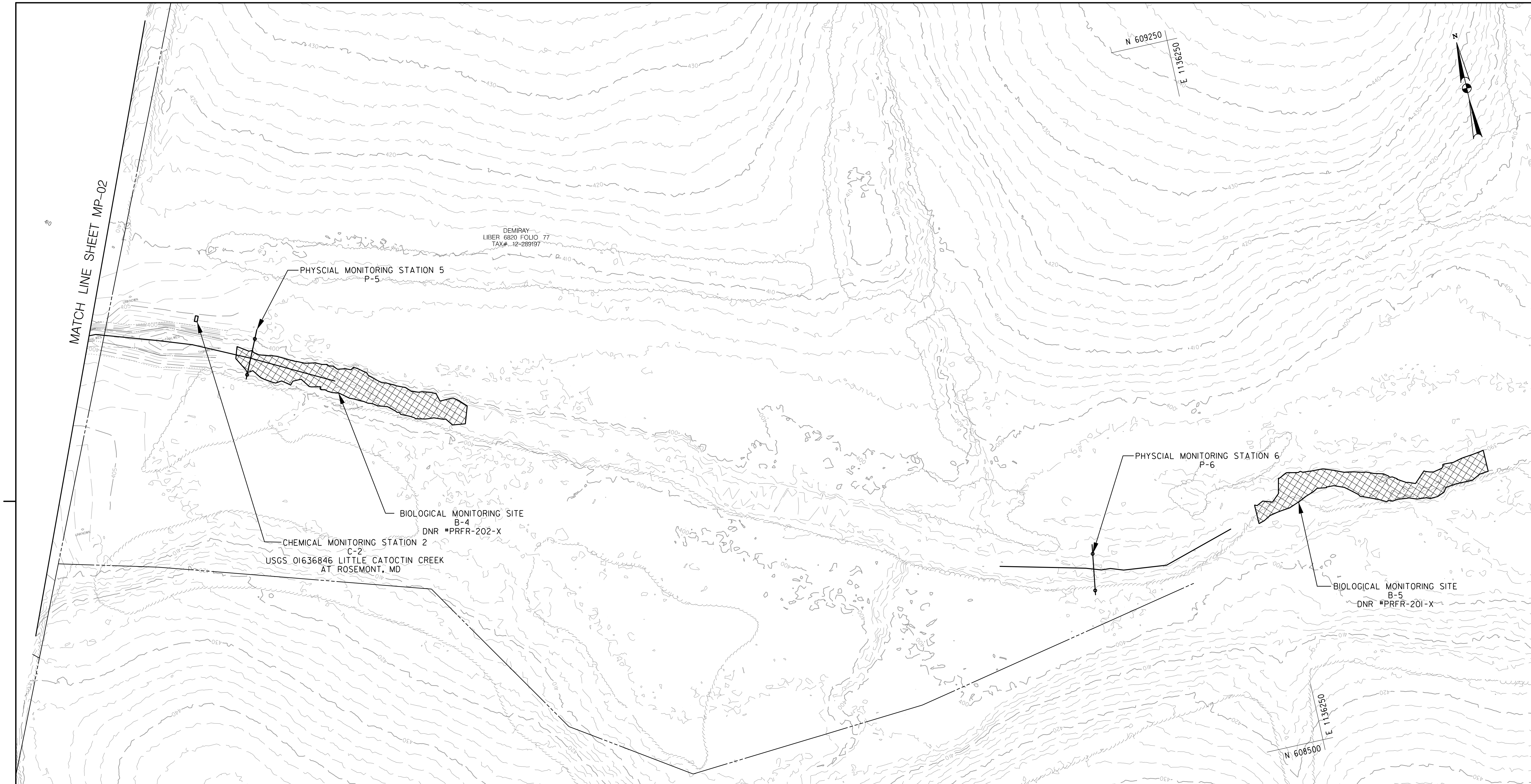
REVISIONS

MONITORING PLAN LOCATION

SCALE 1" = 100'	ADVERTISED DATE SEPT 2019	CONTRACT NO. AT62813
DESIGNED BY	COUNTY FREDERICK	
DRAWN BY	LOGMILE	
CHECKED BY		
MDE/PRD		
DRAWING NO. MP-02 OF 03	SHEET NO. 3 OF 4	

PLOTTED: Tuesday, September 17, 2019 AT 11:08 AM
FILE: T:\186681 - BCS 2014-09H Enviro Design\WAT\Task 04 MS4 Monitoring - Little Catoctin\CADD\Plans\pMP-0002_MD180.dgn

BY: MoxleyK -



100' 0 100' 200'
SCALE: 1" = 100'

DATUM: NAD 83/91 Horizontal
NAVD 88 Vertical

MDOT
MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

TMDL STREAM RESTORATION
LITTLE CATOCTIN CREEK

E 1135250
N 608500

REVISIONS

MONITORING PLAN LOCATIONS

SCALE 1" = 100' ADVERTISED DATE SEPT 2019 CONTRACT NO. AT62813

DESIGNED BY
DRAWN BY
CHECKED BY
MDE/PRD

COUNTY FREDERICK
LOGMILE

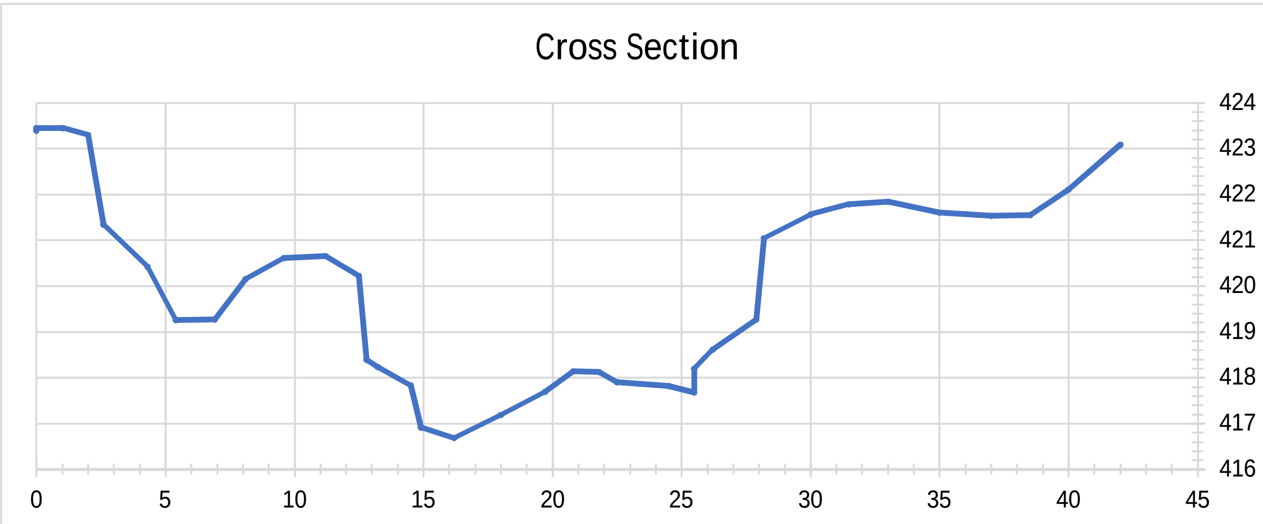
DRAWING NO. MP-03 OF 03 SHEET NO. 4 OF 4

PLOTTED: Tuesday, September 17, 2019 AT 10:24 AM
FILE: T:\186681 - BCS 2014-09H Enviro Design\WAT\Task 04 MS4 Monitoring - Little Catoctin\CADD\Plans\pMP-0003_MD18001.dgn

BY: MoxleyK -

ATTACHMENT B:
GEOMORPHIC DATA

Project: Little Catoctin Creek Monitoring
Project Number: BCS 2014-09H
Site: Section 1 - Cross Section Monitoring
Date: 6/11/2019



Benchmark Elevation: 423.39 LPIN
Height of Instrument: 429.20

Pnt Num	Survey Data: Survey Data Station (ft)	Survey Data: Survey Rod Height (ft)	Section Comparison Data: Station (ft)	Section Comparison Data: Elevation (ft)	Notes
1	0.00	5.81	0.00	423.39	LPIN
2	0.00	5.75	0.00	423.45	LPIN-gnd
3	1.00	5.75	1.00	423.45	
4	2.00	5.91	2.00	423.29	
5	2.60	7.86	2.60	421.34	
6	4.30	8.78	4.30	420.42	
7	5.40	9.94	5.40	419.26	
8	6.90	9.93	6.90	419.27	
9	8.10	9.04	8.10	420.16	
10	9.60	8.58	9.60	420.62	
11	11.20	8.54	11.20	420.66	
12	12.50	8.98	12.50	420.22	
13	12.80	10.80	12.80	418.40	L - BOB
14	13.20	10.96	13.20	418.24	LEW
15	14.50	11.36	14.50	417.84	
16	14.90	12.29	14.90	416.91	
17	16.20	12.51	16.20	416.69	TW
18	18.00	12.00	18.00	417.20	
19	19.70	11.51	19.70	417.69	
20	20.80	11.05	20.80	418.15	
21	21.80	11.07	21.80	418.13	
22	22.50	11.30	22.50	417.90	
23	24.50	11.38	24.50	417.82	

24	25.50	11.52	25.50	417.68	REOB
25	25.50	11.00	25.50	418.20	REOW
26	26.20	10.58	26.20	418.62	
27	27.90	9.93	27.90	419.27	
28	28.20	8.15	28.20	421.05	
29	30.00	7.64	30.00	421.56	
30	31.50	7.41	31.50	421.79	
31	33.00	7.35	33.00	421.85	
32	35.00	7.60	35.00	421.60	
33	37.00	7.67	37.00	421.53	
34	38.50	7.65	38.50	421.55	
35	40.00	7.09	40.00	422.11	
36	42.00	6.12	42.00	423.08	
37	44.00	5.21	44.00	423.99	
38	45.80	5.13	45.80	424.07	
39	47.00	5.90	47.00	423.30	
40	48.00	5.27	48.00	423.93	RPIN-gnd
41	48.00	5.19	48.00	424.01	RPIN

Project:	Little Catoctin Creek Monitoring
Project Number:	BCS 2014-09H
Site:	Section 1 - Profile Monitoring
Date:	6/11/2019

Benchmark Elevation	423.39
Rod Height at BM	5.81
HI from Benchmark Elev.	429.2

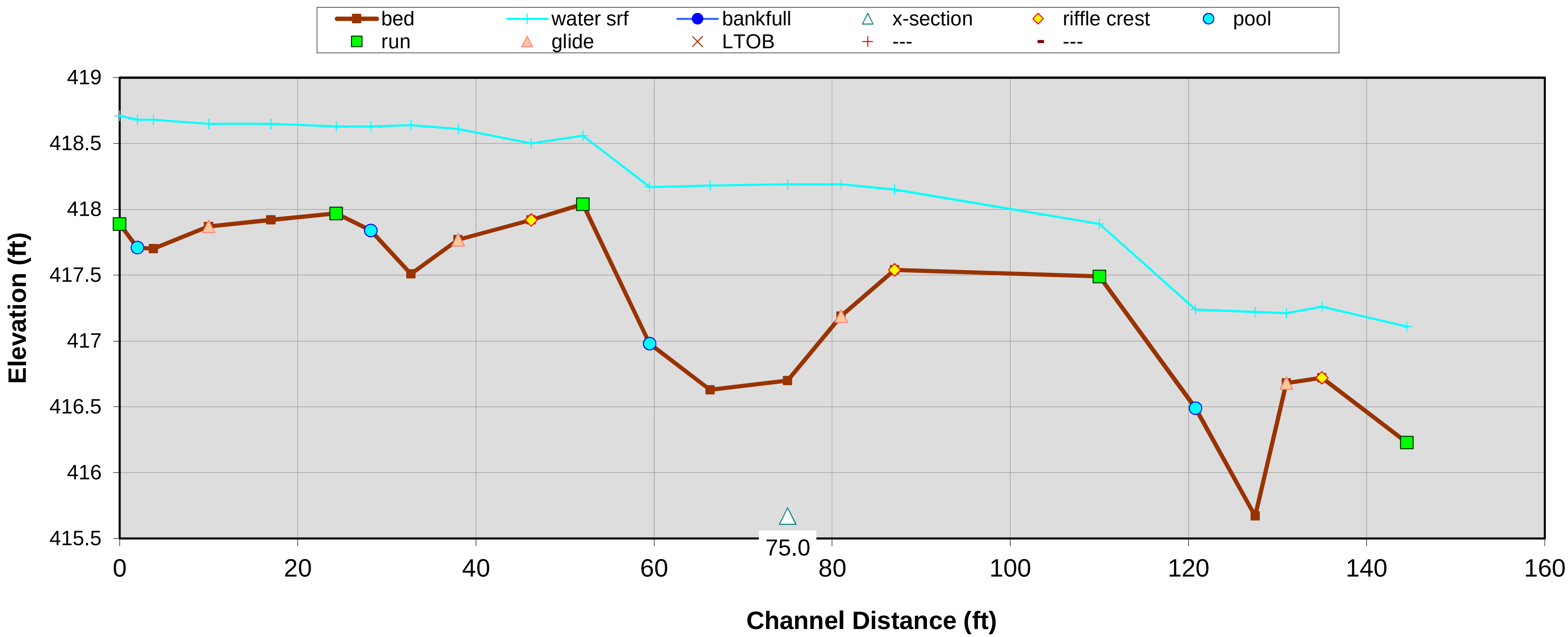
Cross Section Station	26.6
XS Station Adjustment	0
XS Crossing Processed	26.6

Slope:	1.10%		
	Survey Sta.	Adjust Sta.	WS Elev.
Start Sta.	2.00	2	418.68
End Sta.	144.50	144.5	417.11

Survey Data — Profile Comparison Data

Pnt Num	*Survey Data Station (ft)*	*Survey Rod Height (ft)*	*Water (ft)*	*Depth or Surface*	*Adjusted Station (ft)*	*Ground Elevation (ft)*	*Water Surface Elevation*	*Notes*
1	0.00	11.31	0.82	Depth	0.00	417.89	418.71	run
2	2.00	11.49	0.97	Depth	2.00	417.71	418.68	pool
3	3.80	11.50	0.98	Depth	3.80	417.70	418.68	dmax
4	10.00	11.33	0.78	Depth	10.00	417.87	418.65	glide
5	17.00	11.28	0.73	Depth	17.00	417.92	418.65	run/glide
6	24.30	11.23	0.66	Depth	24.30	417.97	418.63	run
7	28.20	11.36	0.79	Depth	28.20	417.84	418.63	pool
8	32.70	11.69	1.13	Depth	32.70	417.51	418.64	pool
9	38.00	11.43	0.84	Depth	38.00	417.77	418.61	glide
10	46.20	11.28	0.58	Depth	46.20	417.92	418.50	riffle
11	52.00	11.16	0.52	Depth	52.00	418.04	418.56	run
12	59.50	12.22	1.19	Depth	59.50	416.98	418.17	confluence
13	66.30	12.57	1.55	Depth	66.30	416.63	418.18	dmax
14	75.00	12.50	1.49	Depth	75.00	416.70	418.19	XS1
15	81.00	12.01	1.00	Depth	81.00	417.19	418.19	glide
16	87.00	11.66	0.61	Depth	87.00	417.54	418.15	riffle
17	110.00	11.71	0.40	Depth	110.00	417.49	417.89	run
18	120.80	12.71	0.75	Depth	120.80	416.49	417.24	pool
19	127.50	13.53	1.55	Depth	127.50	415.67	417.22	dmax
20	131.00	12.52	0.53	Depth	131.00	416.68	417.21	glide
21	135.00	12.48	0.54	Depth	135.00	416.72	417.26	riffle
22	144.50	12.97	0.88	Depth	144.50	416.23	417.11	end

Profile (P-1)


bed
water srf
bankfull
x-section
riffle crest
pool
run
glide
LTOB

Elevation (ft)
419
418.5
418
417.5
417
416.5
416
415.5
0
20
40
60
80
100
120
140
160
75.0
Channel Distance (ft)

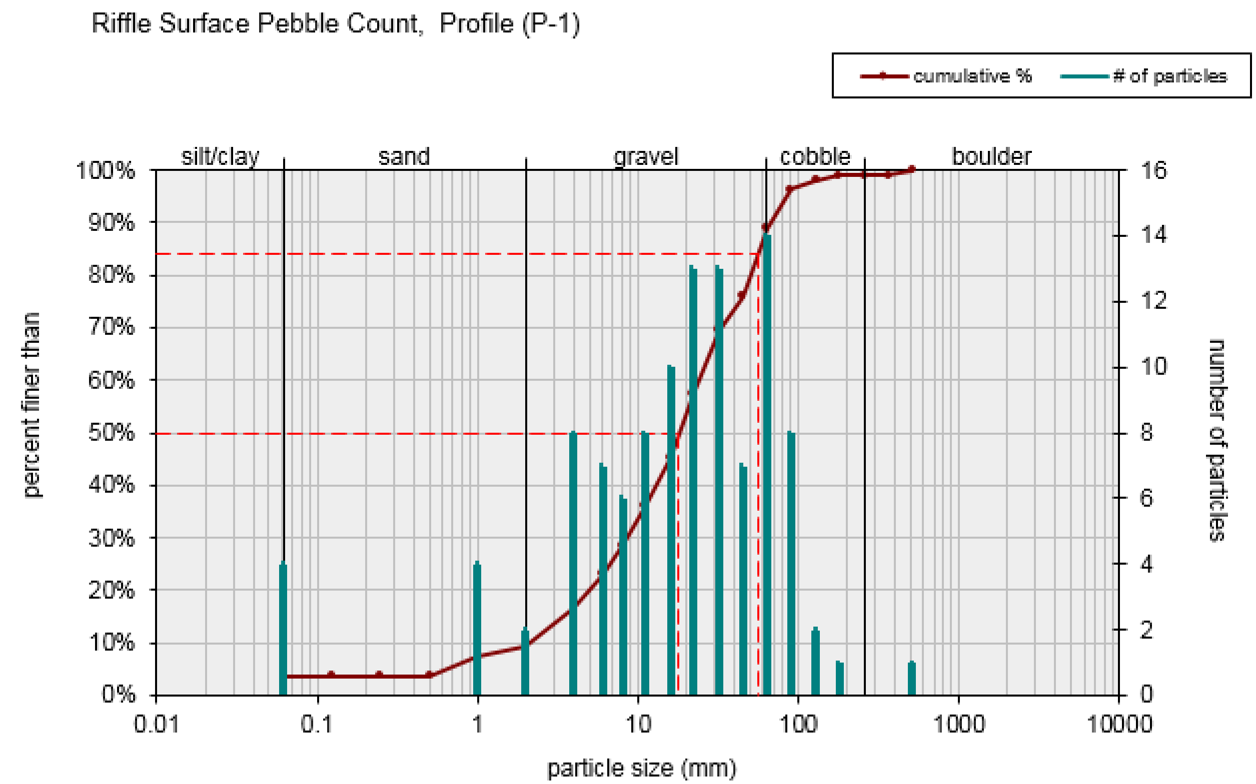
1) Individual Pebble Count

Two individual samples may be entered below. Select sample type for each.

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	4
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	
medium sand	0.25 - 0.5	
coarse sand	0.5 - 1	4
very coarse sand	1 - 2	2
very fine gravel	2 - 4	8
fine gravel	4 - 6	7
fine gravel	6 - 8	6
medium gravel	8 - 11	8
medium gravel	11 - 16	10
coarse gravel	16 - 22	13
coarse gravel	22 - 32	13
very coarse gravel	32 - 45	7
very coarse gravel	45 - 64	14
small cobble	64 - 90	8
medium cobble	90 - 128	2
large cobble	128 - 180	1
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	1
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		108
bedrock	-------------	
clay hardpan	-------------	
detritus/wood	-------------	
artificial	-------------	
total count:		108

Note:

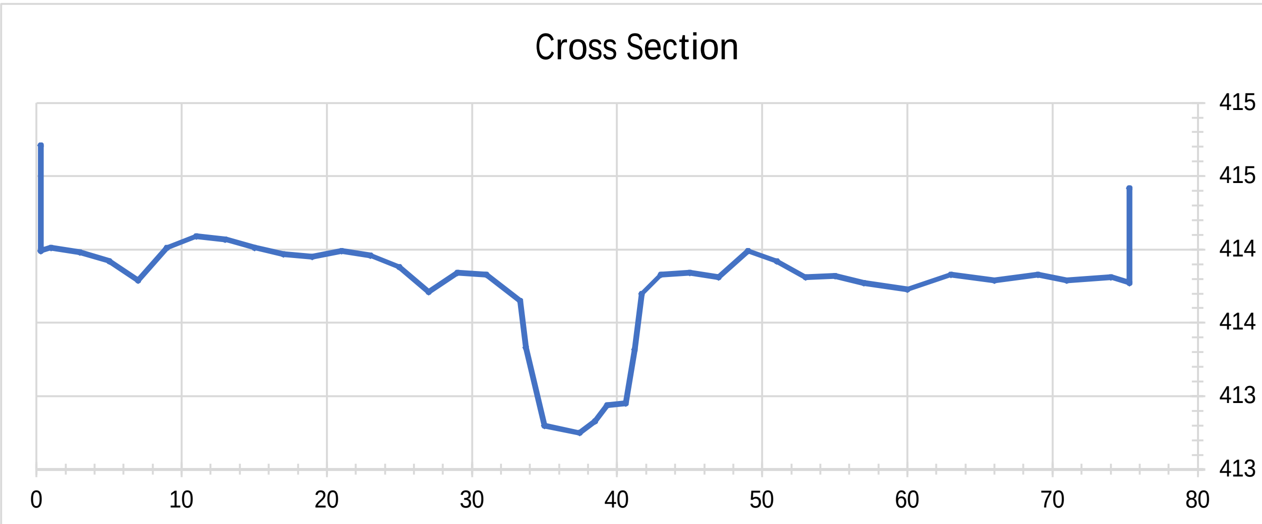


Size (mm)	
D16	3.8
D35	10
D50	18
D65	28
D84	56
D95	85

Size Distribution	
mean	14.6
dispersion	3.9
skewness	-0.08

Type	
silt/clay	4%
sand	6%
gravel	80%
cobble	10%
boulder	1%

Project: Little Catoctin Creek Monitoring
Project Number: BCS 2014-09H
Site: Section 2 - Cross Section Monitoring
Date: 6/17/2019



Benchmark Elevation: 414.42 RPIN
Height of Instrument: 418.93

	Survey Data		Section Comparison Data		
Pnt Num	Survey Data Station (ft)	Survey Rod Height (ft)	Station (ft)	Elevation (ft)	Notes
1	0.30	4.22	0.30	414.71	LPIN
2	0.30	4.94	0.30	413.99	LEP-OG
3	1.00	4.92	1.00	414.01	
4	3.00	4.95	3.00	413.98	
5	5.00	5.01	5.00	413.92	
6	7.00	5.14	7.00	413.79	
7	9.00	4.92	9.00	414.01	
8	11.00	4.84	11.00	414.09	
9	13.00	4.86	13.00	414.07	
10	15.00	4.92	15.00	414.01	
11	17.00	4.96	17.00	413.97	
12	19.00	4.98	19.00	413.95	
13	21.00	4.94	21.00	413.99	
14	23.00	4.97	23.00	413.96	
15	25.00	5.05	25.00	413.88	
16	27.00	5.22	27.00	413.71	
17	29.00	5.09	29.00	413.84	
18	31.00	5.10	31.00	413.83	
19	33.30	5.28	33.30	413.65	LTOB/BKF
20	33.70	5.60	33.70	413.33	LEW/WS
21	35.00	6.13	35.00	412.80	In channel
22	37.40	6.18	37.40	412.75	TW
23	38.50	6.10	38.50	412.83	In channel

24	39.30	5.99	39.30	412.94	
25	40.60	5.98	40.60	412.95	R- Bottom
26	41.20	5.61	41.20	413.32	REW/WS
27	41.70	5.23	41.70	413.70	RTOB/BKFL
28	43.00	5.10	43.00	413.83	RFP
29	45.00	5.09	45.00	413.84	RFP
30	47.00	5.12	47.00	413.81	RFP
31	49.00	4.94	49.00	413.99	
32	51.00	5.01	51.00	413.92	
33	53.00	5.12	53.00	413.81	
34	55.00	5.11	55.00	413.82	
35	57.00	5.16	57.00	413.77	
36	60.00	5.20	60.00	413.73	
37	63.00	5.10	63.00	413.83	
38	66.00	5.14	66.00	413.79	
39	69.00	5.10	69.00	413.83	
40	71.00	5.14	71.00	413.79	
41	74.00	5.12	74.00	413.81	
42	75.30	5.16	75.30	413.77	REP/OG
43	75.30	4.51	75.30	414.42	RPIN

Site: Section 2 - Profile Monitoring
Date: 6/17/2019

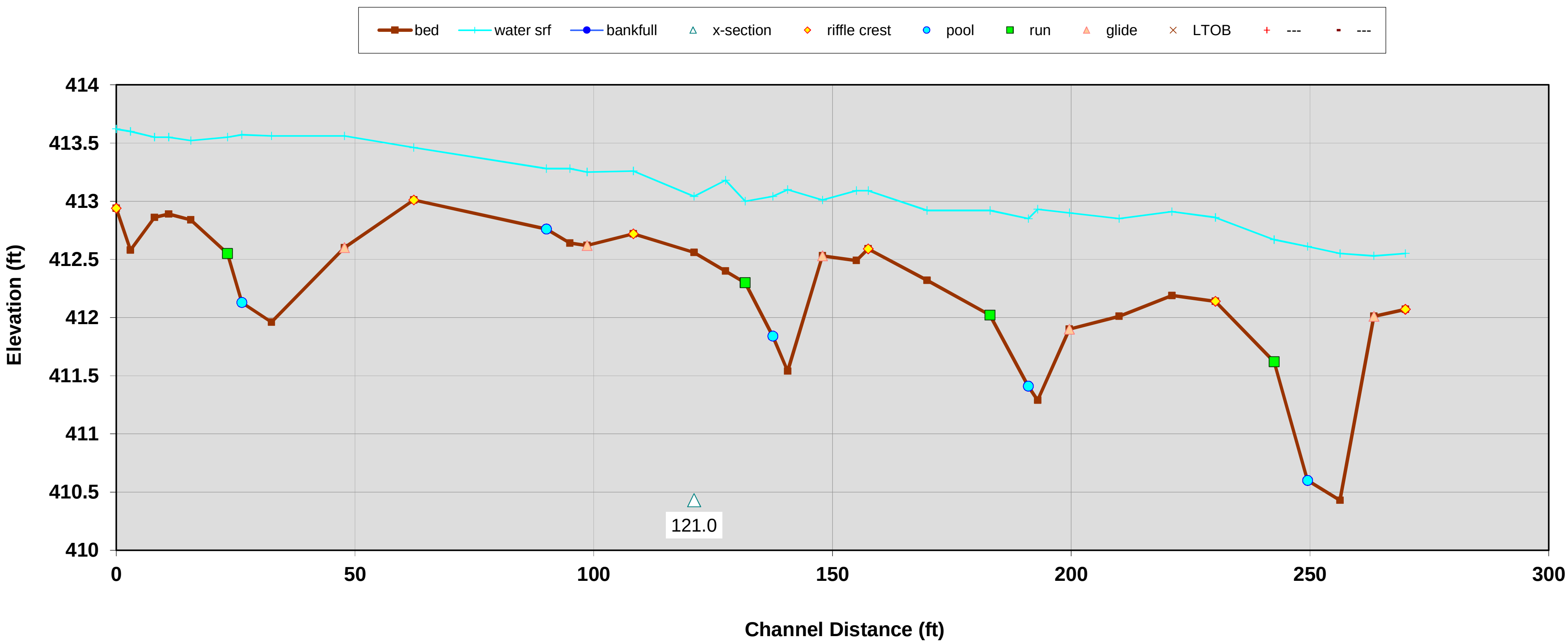
Benchmark Elevation	414.42					
Rod Height at BM	4.22					
HI from Benchmark Elev.	418.64					
Cross Section Station	121		Slope:	0.40%		
XS Station Adjustment	0			Survey Sta.	Adjust Sta.	WS Elev.
XS Crossing Processed	121	0.00	Start Sta.	3.00	3	413.6
	410.43	413.01	End Sta.	270.00	270	412.55

Survey Data — Profile Comparison Data

Pnt Num	*Survey Data Station (ft)*	*Survey Rod Height (ft)*	*Water (ft)*	*Depth or Surface*	*Adjusted Station (ft)*	*Ground Elevation (ft)*	*Water Surface Elevation*	*Notes*
1	0.00	5.70	0.68	Depth	0.00	412.94	413.62	Riffle
2	3.00	6.06	1.02	Depth	3.00	412.58	413.60	mid Riffle
3	8.00	5.78	0.69	Depth	8.00	412.86	413.55	mid Riffle
4	11.00	5.75	0.66	Depth	11.00	412.89	413.55	mid Riffle
5	15.60	5.80	0.68	Depth	15.60	412.84	413.52	mid Riffle
6	23.30	6.09	1.00	Depth	23.30	412.55	413.55	Run
7	26.30	6.51	1.44	Depth	26.30	412.13	413.57	Pool
8	32.50	6.68	1.60	Depth	32.50	411.96	413.56	Dmax
9	47.80	6.04	0.96	Depth	47.80	412.60	413.56	Glide
10	62.30	5.63	0.45	Depth	62.30	413.01	413.46	Riffle
11	90.10	5.88	0.52	Depth	90.10	412.76	413.28	Pool?
12	95.00	6.00	0.64	Depth	95.00	412.64	413.28	Dmax
13	98.60	6.02	0.63	Depth	98.60	412.62	413.25	Glide? Riffle?
14	108.30	5.92	0.54	Depth	108.30	412.72	413.26	Glide? Riffle?
15	121.00	6.08	0.48	Depth	121.00	412.56	413.04	XS-2
16	127.60	6.24	0.78	Depth	127.60	412.40	413.18	LB MBSS 0M
17	131.70	6.34	0.70	Depth	131.70	412.30	413.00	Run
18	137.50	6.80	1.20	Depth	137.50	411.84	413.04	Pool
19	140.60	7.10	1.56	Depth	140.60	411.54	413.10	Dmax
20	147.90	6.11	0.48	Depth	147.90	412.53	413.01	Glide?
21	155.00	6.15	0.60	Depth	155.00	412.49	413.09	Glide?
22	157.50	6.05	0.50	Depth	157.50	412.59	413.09	Riffle
23	169.80	6.32	0.60	Depth	169.80	412.32	412.92	mid Riffle
24	183.00	6.62	0.90	Depth	183.00	412.02	412.92	Run
25	191.00	7.23	1.44	Depth	191.00	411.41	412.85	Pool
26	193.00	7.35	1.64	Depth	193.00	411.29	412.93	Dmax
27	199.60	6.74	1.00	Depth	199.60	411.90	412.90	Glide
28	210.00	6.63	0.84	Depth	210.00	412.01	412.85	mid Glide
29	221.10	6.45	0.72	Depth	221.10	412.19	412.91	mid Riffle
30	230.20	6.50	0.72	Depth	230.20	412.14	412.86	Riffle at USGS Tile Deposition

31	242.50	7.02	1.05	Depth	242.50	411.62	412.67	Run
32	249.50	8.04	2.01	Depth	249.50	410.60	412.61	Pool
33	256.30	8.21	2.12	Depth	256.30	410.43	412.55	Dmax
34	263.40	6.63	0.52	Depth	263.40	412.01	412.53	Glide
35	270.00	6.57	0.48	Depth	270.00	412.07	412.55	Riffle

Profile P-2



bed
water srf
bankfull
x-section
riffle crest
pool
run
glide
LTOB

414
413.5
413
412.5
412
411.5
411
410.5
410
Elevation (ft)
121.0
0
50
100
150
200
250
300
Channel Distance (ft)

1) Individual Pebble Count

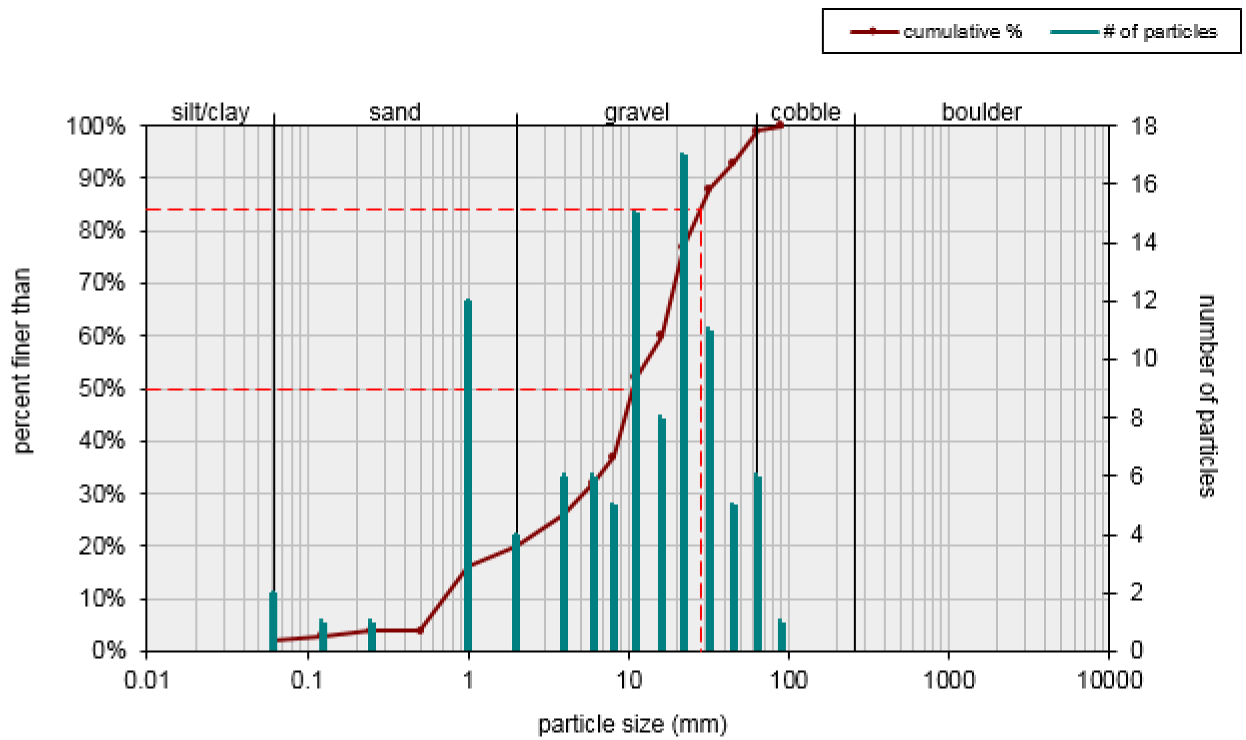
Two individual samples may be entered below. Select sample type for each.

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	2
very fine sand	0.062 - 0.125	1
fine sand	0.125 - 0.25	1
medium sand	0.25 - 0.5	
coarse sand	0.5 - 1	12
very coarse sand	1 - 2	4
very fine gravel	2 - 4	6
fine gravel	4 - 6	6
fine gravel	6 - 8	5
medium gravel	8 - 11	15
medium gravel	11 - 16	8
coarse gravel	16 - 22	17
coarse gravel	22 - 32	11
very coarse gravel	32 - 45	5
very coarse gravel	45 - 64	6
small cobble	64 - 90	1
medium cobble	90 - 128	
large cobble	128 - 180	
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
	total particle count:	100
bedrock	------------	
clay hardpan	------------	
detritus/wood	------------	
artificial	------------	
	total count:	100

Note:

Riffle Surface Pebble Count, Profile P-2

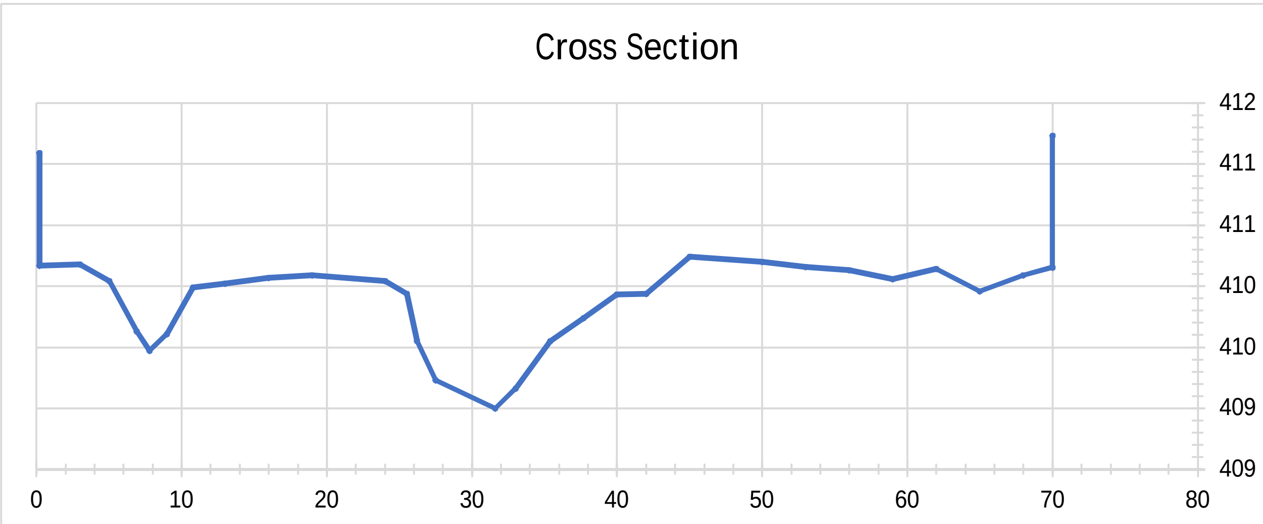


Size (mm)	
D16	1
D35	7.1
D50	11
D65	18
D84	28
D95	51

Size Distribution	
mean	5.3
dispersion	6.8
skewness	-0.26

Type	
silt/clay	2%
sand	18%
gravel	79%
cobble	1%
boulder	0%

Project: Little Catoctin Creek Monitoring
Project Number: BCS 2014-09H
Site: Section 3 - Cross Section Monitoring
Date: 6/17/2019



Benchmark Elevation: 411.09 LPIN
Height of Instrument: 415.28

	Survey Data		Section Comparison Data		
Pnt Num	Survey Data Station (ft)	Survey Rod Height (ft)	Station (ft)	Elevation (ft)	Notes
1	0.20	4.19	0.2	411.09	LPIN
2	0.20	5.11	0.2	410.17	LEP-OG
3	3.00	5.10	3	410.18	
4	5.00	5.24	5	410.04	TOB
5	6.90	5.65	6.9	409.63	LEOW
6	7.80	5.81	7.8	409.47	TW
7	9.00	5.67	9	409.61	REOW
8	10.80	5.29	10.8	409.99	TOB
9	13.00	5.26	13	410.02	FP
10	16.00	5.21	16	410.07	FP
11	19.00	5.19	19	410.09	FP
12	24.00	5.24	24	410.04	FP
13	25.50	5.34	25.5	409.94	LTOB
14	26.20	5.73	26.2	409.55	LEOW
15	27.50	6.05	27.5	409.23	
16	31.60	6.28	31.6	409.00	TW
17	33.00	6.12	33	409.16	
18	35.40	5.73	35.4	409.55	REOW
19	37.70	5.54	37.7	409.74	TOB
20	40.00	5.35	40	409.93	
21	42.00	5.34	42	409.94	
22	45.00	5.04	45	410.24	
23	50.00	5.08	50	410.20	

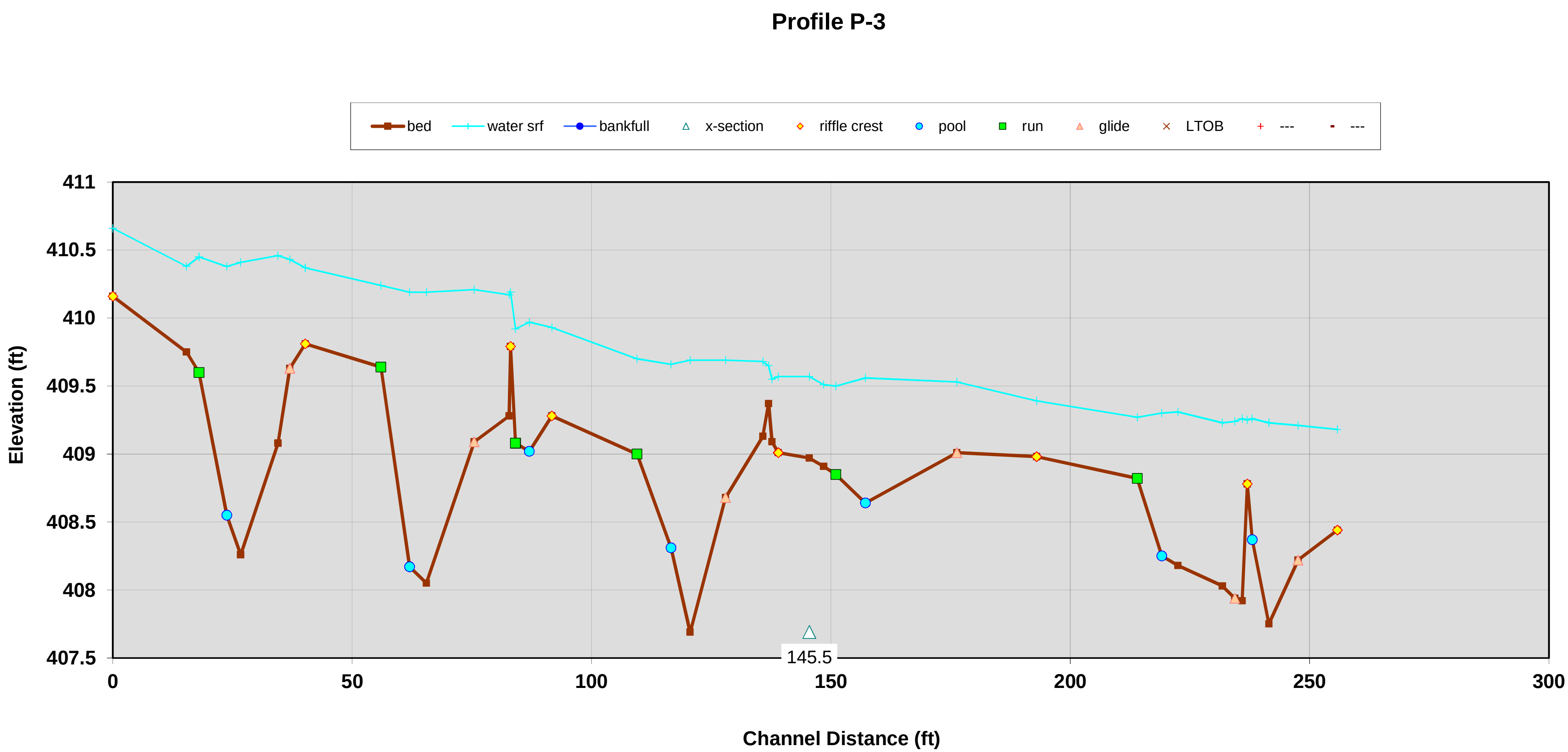
24	53.00	5.12	53	410.16	
25	56.00	5.15	56	410.13	
26	59.00	5.22	59	410.06	
27	62.00	5.14	62	410.14	
28	65.00	5.32	65	409.96	
29	68.00	5.19	68	410.09	
30	70.00	5.13	70	410.15	REOP-OG
31	70.00	4.05	70	411.23	RPIN

Project: Little Catoctin Creek Monitoring
Project Number: BCS 2014-09H
Site: Section 3 - Profile Monitoring
Date: 6/17/2019

Benchmark Elevation 411.09
Rod Height at BM 4.19
HI from Benchmark Elev. 415.28

Cross Section Station	145.5		Slope:	0.58%			
XS Station Adjustment	0			Survey Sta.	Adjust Sta.	WS Elev.
XS Crossing Processed	145.5	145.50	Start Sta.	0.00	0	410.66
	407.69	410.16	End Sta.	255.80	255.8	409.18

	Survey Data				Profile Comparison Data			
Pnt Num	*Survey Data Station (ft)*	*Survey Rod Height (ft)*	*Water (ft)*	*Depth or Surface*	*Adjusted Station (ft)*	*Ground Elevation (ft)*	*Water Surface Elevation*	*Notes*
1	0.00	5.12	0.50	Depth	0.00	410.16	410.66	Riffle
2	15.40	5.53	0.63	Depth	15.40	409.75	410.38	USGS Tile Deposition #4
3	18.00	5.68	0.85	Depth	18.00	409.60	410.45	Run
4	23.80	6.73	1.83	Depth	23.80	408.55	410.38	Pool
5	26.70	7.02	2.15	Depth	26.70	408.26	410.41	Dmax
6	34.50	6.20	1.38	Depth	34.50	409.08	410.46	Side channel confluence
7	37.00	5.65	0.80	Depth	37.00	409.63	410.43	Glide
8	40.20	5.47	0.56	Depth	40.20	409.81	410.37	Riffle
9	56.00	5.64	0.60	Depth	56.00	409.64	410.24	Run
10	62.00	7.11	2.02	Depth	62.00	408.17	410.19	Pool
11	65.50	7.23	2.14	Depth	65.50	408.05	410.19	Dmax
12	75.50	6.19	1.12	Depth	75.50	409.09	410.21	Glide
13	82.80	6.00	0.89	Depth	82.80	409.28	410.17	Back of Log
14	83.10	5.49	0.40	Depth	83.10	409.79	410.19	Top of Log
15	84.10	6.20	0.84	Depth	84.10	409.08	409.92	Front of
16	87.00	6.26	0.95	Depth	87.00	409.02	409.97	Micro-Pool
17	91.70	6.00	0.65	Depth	91.70	409.28	409.93	Riffle
18	109.50	6.28	0.70	Depth	109.50	409.00	409.70	Run
19	116.60	6.97	1.35	Depth	116.60	408.31	409.66	Pool
20	120.60	7.59	2.00	Depth	120.60	407.69	409.69	Dmax
21	128.00	6.60	1.01	Depth	128.00	408.68	409.69	Glide
22	135.80	6.15	0.55	Depth	135.80	409.13	409.68	Back of Log Drop
23	137.00	5.91	0.28	Depth	137.00	409.37	409.65	Top of Log Drop
24	137.70	6.19	0.46	Depth	137.70	409.09	409.55	Front of Log Drop
25	139.00	6.27	0.56	Depth	139.00	409.01	409.57	Riffle
26	145.50	6.31	0.60	Depth	145.50	408.97	409.57	XS 3
27	148.50	6.37	0.60	Depth	148.50	408.91	409.51	
28	151.00	6.43	0.65	Depth	151.00	408.85	409.50	Run
29	157.20	6.64	0.92	Depth	157.20	408.64	409.56	Micro-Pool
30	176.30	6.27	0.52	Depth	176.30	409.01	409.53	Glide
31	193.00	6.30	0.41	Depth	193.00	408.98	409.39	Riffle
32	214.00	6.46	0.45	Depth	214.00	408.82	409.27	Run
33	219.10	7.03	1.05	Depth	219.10	408.25	409.30	Pool
34	222.50	7.10	1.13	Depth	222.50	408.18	409.31	0.00
35	231.80	7.25	1.20	Depth	231.80	408.03	409.23	Dmax
36	234.40	7.34	1.30	Depth	234.40	407.94	409.24	Glide
37	235.90	7.36	1.34	Depth	235.90	407.92	409.26	Back of Log Drop
38	237.00	6.50	0.47	Depth	237.00	408.78	409.25	Top of Log Drop
39	238.00	6.91	0.89	Depth	238.00	408.37	409.26	Front of Log Drop
40	241.50	7.53	1.48	Depth	241.50	407.75	409.23	Dmax
41	247.60	7.06	0.99	Depth	247.60	408.22	409.21	Glide
42	255.80	6.84	0.74	Depth	255.80	408.44	409.18	Riffle



Profile P-3
bed
water srf
bankfull
x-section
riffle crest
pool
run
glide
LTOB

Elevation (ft)
411
410.5
410
409.5
409
408.5
408
407.5
0
50
100
150
200
250
300
145.5
Channel Distance (ft)

1) Individual Pebble Count

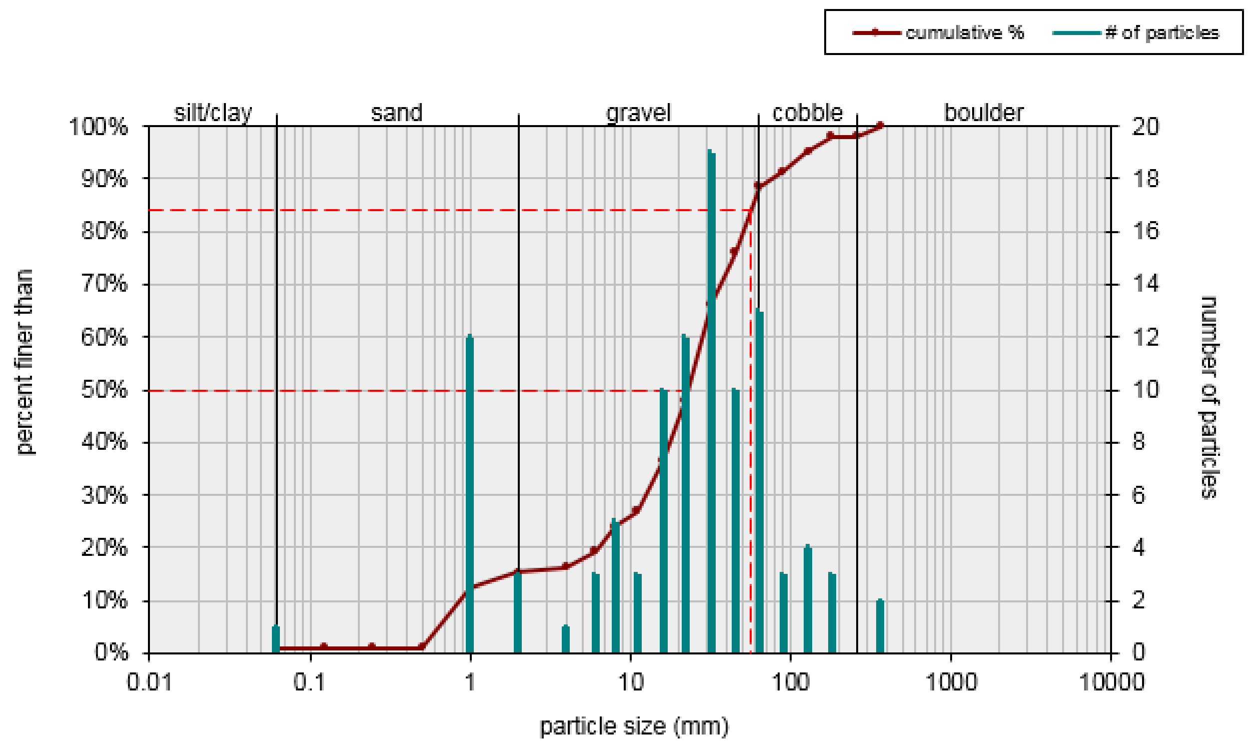
Two individual samples may be entered below. Select sample type for each.

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	1
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	
medium sand	0.25 - 0.5	
coarse sand	0.5 - 1	12
very coarse sand	1 - 2	3
very fine gravel	2 - 4	1
fine gravel	4 - 6	3
fine gravel	6 - 8	5
medium gravel	8 - 11	3
medium gravel	11 - 16	10
coarse gravel	16 - 22	12
coarse gravel	22 - 32	19
very coarse gravel	32 - 45	10
very coarse gravel	45 - 64	13
small cobble	64 - 90	3
medium cobble	90 - 128	4
large cobble	128 - 180	3
very large cobble	180 - 256	
small boulder	256 - 362	2
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
	total particle count:	104
bedrock	------------	
clay hardpan	------------	
detritus/wood	------------	
artificial	------------	
	total count:	104

Note:

Riffle Surface Pebble Count, Profile P-3

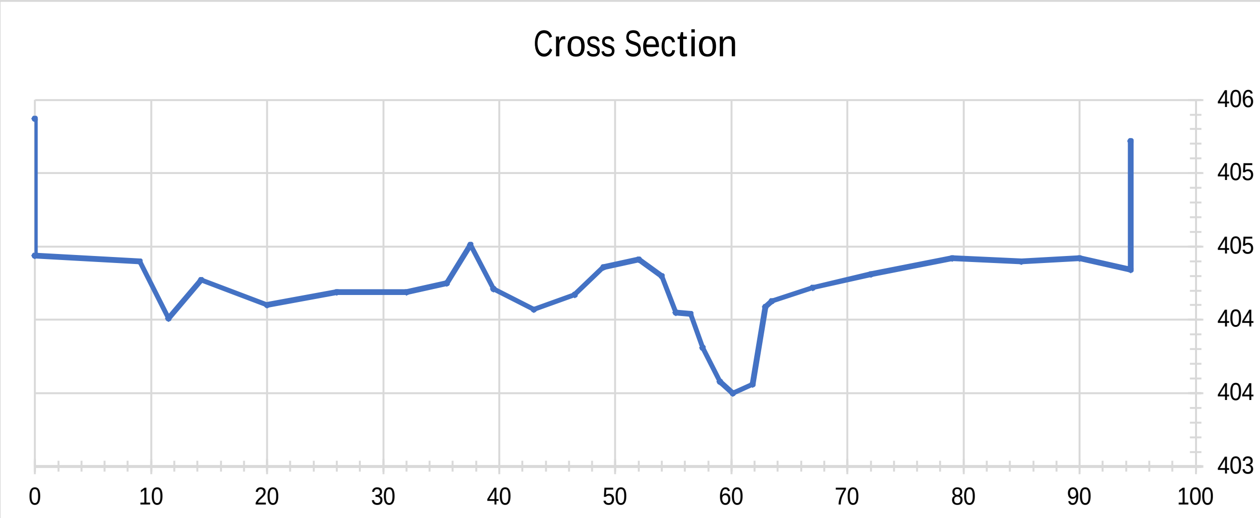


Size (mm)	
D16	3.1
D35	15
D50	23
D65	31
D84	56
D95	130

Size Distribution	
mean	13.2
dispersion	4.9
skewness	-0.22

Type	
silt/clay	1%
sand	14%
gravel	73%
cobble	10%
boulder	2%

Project: Little Catoctin Creek Monitoring
Project Number: BCS 2014-09H
Site: Section 4 - Cross Section Monitoring
Date: 6/17/2019



Benchmark Elevation: 405.37 RPIN
Height of Instrument: 409.51

	Survey Data		Section Comparison Data		
Pnt Num	Survey Data Station (ft)	Survey Rod Height (ft)	Station (ft)	Elevation (ft)	Notes
1	0.00	4.14	0	405.37	LPIN
2	0.00	5.07	0	404.44	LEP
3	9.00	5.11	9	404.40	
4	11.50	5.50	11.5	404.01	
5	14.30	5.24	14.3	404.27	
6	20.00	5.41	20	404.10	
7	26.00	5.32	26	404.19	
8	32.00	5.32	32	404.19	
9	35.50	5.26	35.5	404.25	
10	37.50	5.00	37.5	404.51	
11	39.50	5.30	39.5	404.21	
12	43.00	5.44	43	404.07	
13	46.50	5.34	46.5	404.17	
14	49.00	5.15	49	404.36	
15	52.00	5.10	52	404.41	LTOB
16	54.00	5.21	54	404.30	
17	55.20	5.46	55.2	404.05	
18	56.50	5.47	56.5	404.04	LEW
19	57.50	5.70	57.5	403.81	
20	59.00	5.93	59	403.58	
21	60.10	6.01	60.1	403.50	TW
22	61.80	5.95	61.8	403.56	
23	62.90	5.42	62.9	404.09	REW

24	63.50	5.38	63.5	404.13	RTOB
25	67.00	5.29	67	404.22	
26	72.00	5.20	72	404.31	
27	79.00	5.09	79	404.42	
28	85.00	5.11	85	404.40	
29	90.00	5.09	90	404.42	
30	94.40	5.17	94.4	404.34	REP
31	94.40	4.29	94.4	405.22	RPIN

Project: Little Catoctin Creek Monitoring
Project Number: BCS 2014-09H
Site: Section 4 - Profile Monitoring
Date: 6/17/2019

Benchmark Elevation 405.37
Rod Height at BM 4.14
HI from Benchmark Elev. 409.51

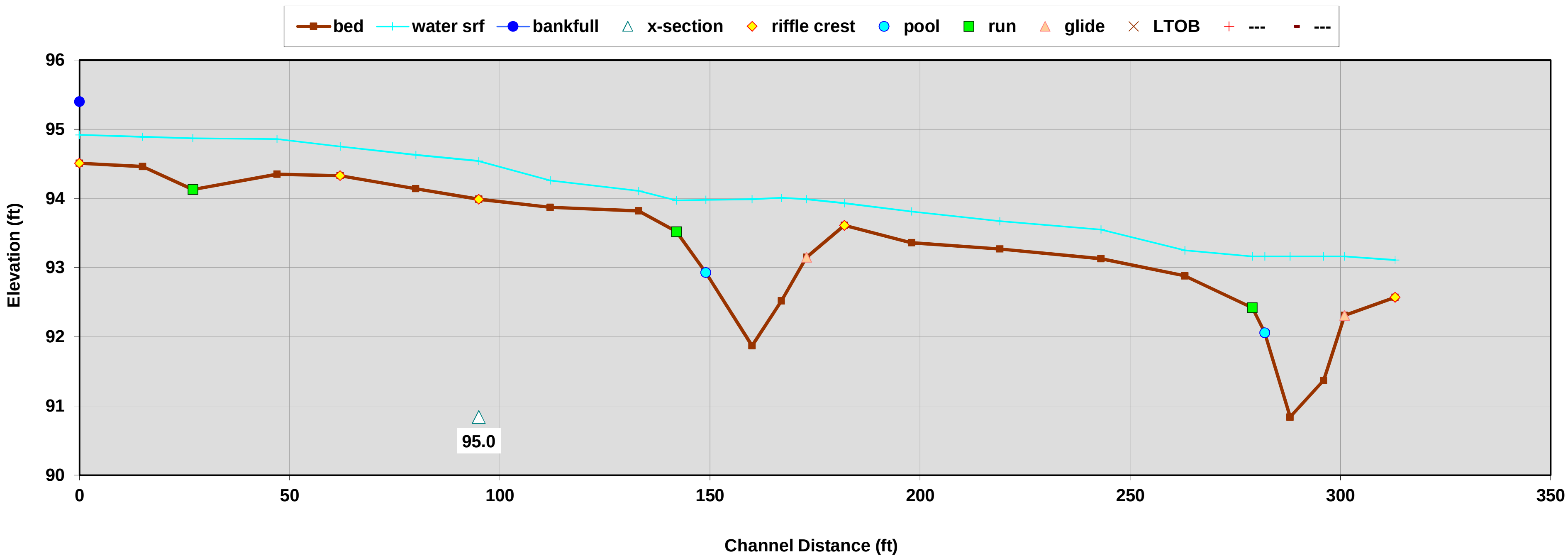
Cross Section Station 95 | Slope: 0.58%
XS Station Adjustment 0

			Survey Sta.	Adjust Sta.	WS Elev.
XS Crossing Processed 95	95.00	Start Sta.	0.00	0	404.43
400.35	404.02	End Sta.	313.00	313	402.62

Survey Data | Profile Comparison Data

Pnt Num	*Survey Data Station (ft)*	*Survey Rod Height (ft)*	*Water (ft)*	*Depth or Surface*	*Adjusted Station (ft)*	*Ground Elevation (ft)*	*Water Surface Elevation*	*Notes*
1	0.00	5.49	0.41	Depth	0.00	404.02	404.43	riffle
2	15.00	5.54	0.43	Depth	15.00	403.97	404.40	mid riffle
3	27.00	5.87	0.74	Depth	27.00	403.64	404.38	run
4	47.00	5.65	0.51	Depth	47.00	403.86	404.37	run
5	62.00	5.67	0.42	Depth	62.00	403.84	404.26	riffle
6	80.00	5.86	0.49	Depth	80.00	403.65	404.14	mid-riffle
7	95.00	6.01	0.55	Depth	95.00	403.50	404.05	XS-4 mid-
8	112.00	6.13	0.39	Depth	112.00	403.38	403.77	riffle
9	133.00	6.18	0.29	Depth	133.00	403.33	403.62	riffle
10	142.00	6.48	0.45	Depth	142.00	403.03	403.48	run
11	149.00	7.07	1.05	Depth	149.00	402.44	403.49	pool
12	160.00	8.13	2.12	Depth	160.00	401.38	403.50	max depth
13	167.00	7.48	1.47	Depth	167.00	402.03	403.50	mid pool
14	173.00	6.85	0.84	Depth	173.00	402.66	403.50	glide
15	182.00	6.39	0.32	Depth	182.00	403.12	403.44	riffle /
16	198.00	6.64	0.45	Depth	198.00	402.87	403.32	mid riffle
17	219.00	6.73	0.40	Depth	219.00	402.78	403.18	mid riffle
18	243.00	6.87	0.42	Depth	243.00	402.64	403.06	mid riffle
19	263.00	7.12	0.37	Depth	263.00	402.39	402.76	mid riffle
20	279.00	7.58	0.74	Depth	279.00	401.93	402.67	run
21	282.00	7.94	1.10	Depth	282.00	401.57	402.67	pool
22	288.00	9.16	2.32	Depth	288.00	400.35	402.67	max depth
23	296.00	8.63	1.79	Depth	296.00	400.88	402.67	mid pool
24	301.00	7.69	0.85	Depth	301.00	401.82	402.67	glide
25	313.00	7.43	0.54	Depth	313.00	402.08	402.62	riffle /lp end

Profile P-4



bed
water srf
bankfull
x-section
riffle crest
pool
run
glide
LTOB

Elevation (ft)
Channel Distance (ft)
96
95
94
93
92
91
90
0
50
100
150
200
250
300
350
95.0

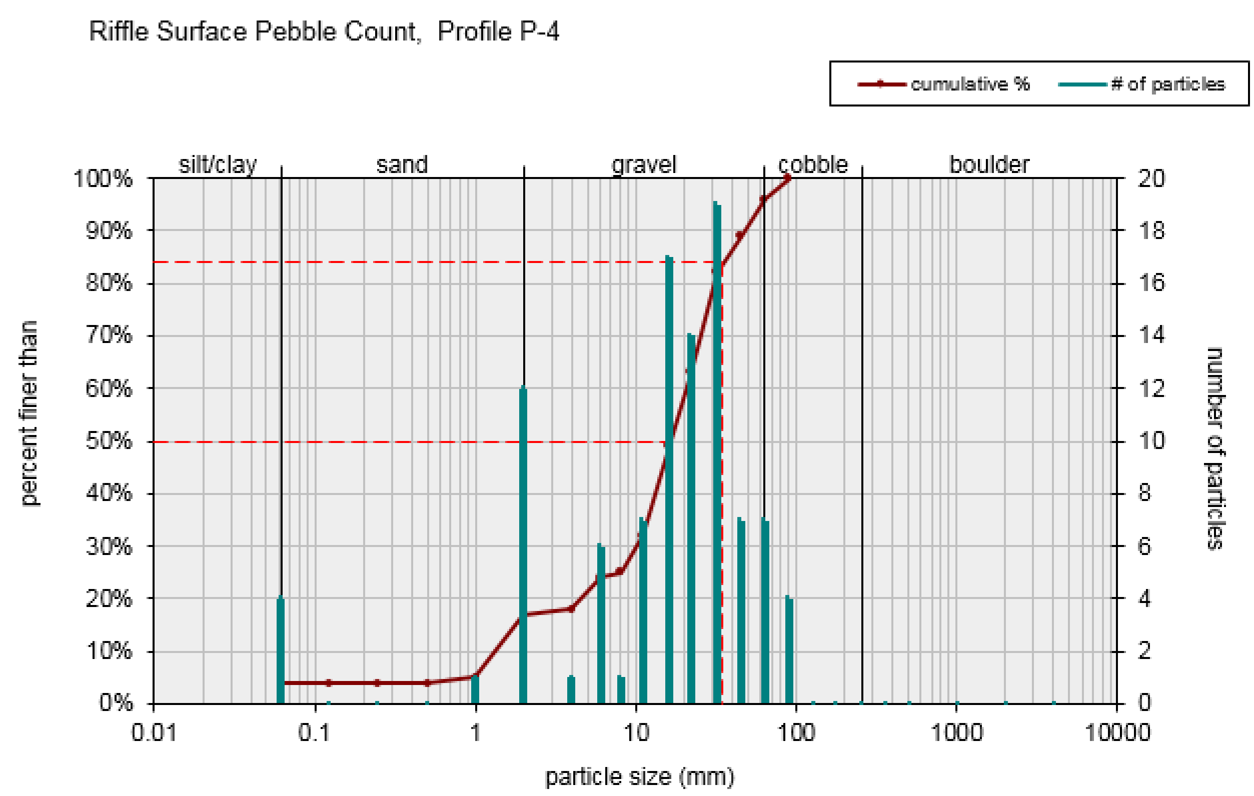
1) Individual Pebble Count

Two individual samples may be entered below. Select sample type for each.

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	4
very fine sand	0.062 - 0.125	0
fine sand	0.125 - 0.25	0
medium sand	0.25 - 0.5	0
coarse sand	0.5 - 1	1
very coarse sand	1 - 2	12
very fine gravel	2 - 4	1
fine gravel	4 - 6	6
fine gravel	6 - 8	1
medium gravel	8 - 11	7
medium gravel	11 - 16	17
coarse gravel	16 - 22	14
coarse gravel	22 - 32	19
very coarse gravel	32 - 45	7
very coarse gravel	45 - 64	7
small cobble	64 - 90	4
medium cobble	90 - 128	0
large cobble	128 - 180	0
very large cobble	180 - 256	0
small boulder	256 - 362	0
small boulder	362 - 512	0
medium boulder	512 - 1024	0
large boulder	1024 - 2048	0
very large boulder	2048 - 4096	0
total particle count:		100
bedrock	------------	
clay hardpan	------------	
detritus/wood	------------	
artificial	------------	
total count:		100

Note:

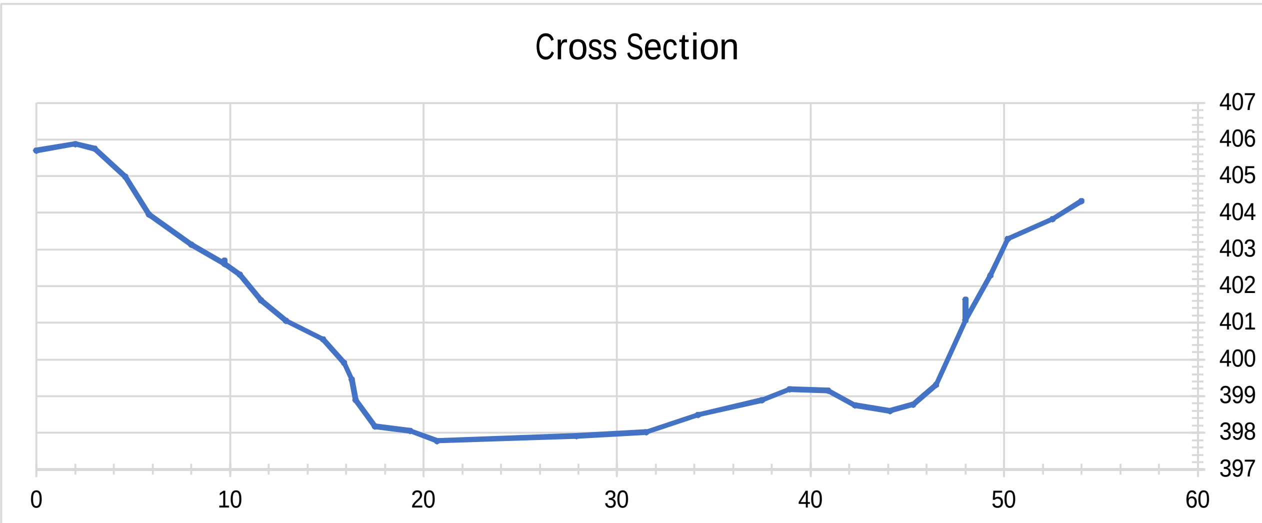


Size (mm)	
D16	1.9
D35	12
D50	16
D65	23
D84	35
D95	61

Size Distribution	
mean	8.2
dispersion	5.3
skewness	-0.26

Type	
silt/clay	4%
sand	13%
gravel	79%
cobble	4%
boulder	0%

Project: Little Catoctin Creek Monitoring
Project Number: BCS 2014-09H
Site: Section 5 - Cross Section Monitoring
Date: 6/17/2019



Benchmark Elevation: 402.70 LPIN
Height of Instrument: 407.44

	Survey Data		Section Comparison Data		
Pnt Num	Survey Data Station (ft)	Survey Rod Height (ft)	Station (ft)	Elevation (ft)	Notes
1	0.00	1.74	0	405.70	
2	2.00	1.56	2	405.88	
3	3.00	1.69	3	405.75	LTOB
4	4.60	2.45	4.6	404.99	
5	5.80	3.48	5.8	403.96	
6	8.00	4.30	8	403.14	
7	9.70	4.83	9.7	402.61	
8	9.70	4.74	9.7	402.70	LPIN
9	9.70	4.83	9.7	402.61	
10	10.50	5.13	10.5	402.31	
11	11.60	5.83	11.6	401.61	
12	12.90	6.39	12.9	401.05	
13	14.80	6.89	14.8	400.55	
14	15.90	7.54	15.9	399.90	
15	16.30	7.99	16.3	399.45	
16	16.50	8.54	16.5	398.90	LEOW
17	17.50	9.26	17.5	398.18	
18	19.30	9.39	19.3	398.05	
19	20.70	9.66	20.7	397.78	
20	27.90	9.52	27.9	397.92	
21	31.50	9.41	31.5	398.03	
22	34.20	8.95	34.2	398.49	
23	37.50	8.54	37.5	398.90	REOW

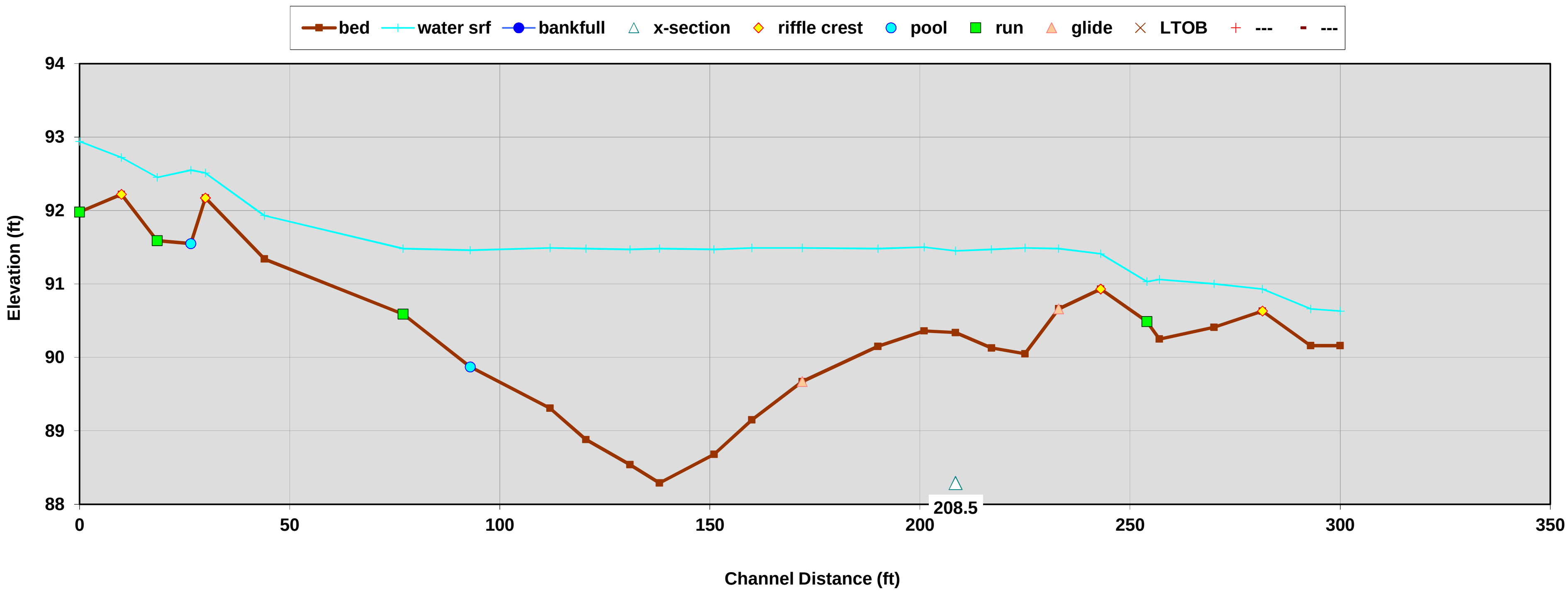
24	38.90	8.25	38.9	399.19	
25	40.90	8.29	40.9	399.15	
26	42.30	8.68	42.3	398.76	
27	44.10	8.85	44.1	398.59	
28	45.30	8.66	45.3	398.78	
29	46.50	8.13	46.5	399.31	TOB
30	48.00	6.36	48	401.08	
31	48.00	5.80	48	401.64	RPIN
32	48.00	6.36	48	401.08	
33	49.30	5.14	49.3	402.30	
34	50.20	4.14	50.2	403.30	RTOB
35	52.50	3.61	52.5	403.83	
36	54.00	3.11	54	404.33	

Project:	Little Catoctin Creek Monitoring
Project Number:	BCS 2014-09H
Site:	Section 5 - Profile Monitoring
Date:	6/17/2019

Benchmark Elevation	402.7					
Rod Height at BM	4.74					
HI from Benchmark Elev.	407.44					
Cross Section Station	208.5		Slope:	0.66%		
XS Station Adjustment	0			Survey Sta.	Adjust Sta.	WS Elev.
XS Crossing Processed	208.5	208.50	Start Sta.	0.00	0	400.38
	395.73	399.66	End Sta.	300.00	300	398.07

	Survey Data				Profile Comparison Data			
Pnt Num	*Survey Data Station (ft)*	*Survey Rod Height (ft)*	*Water (ft)*	*Depth or Surface*	*Adjusted Station (ft)*	*Ground Elevation (ft)*	*Water Surface Elevation*	*Notes*
1	0.00	8.02	0.96	Depth	0.00	399.42	400.38	
2	10.00	7.78	0.50	Depth	10.00	399.66	400.16	
3	18.50	8.41	0.86	Depth	18.50	399.03	399.89	
4	26.50	8.45	1.00	Depth	26.50	398.99	399.99	us of cascade
5	30.00	7.83	0.34	Depth	30.00	399.61	399.95	top of cascade
6	44.00	8.66	0.59	Depth	44.00	398.78	399.37	mid-riffle cascade
7	77.00	9.41	0.89	Depth	77.00	398.03	398.92	end of
8	93.00	10.13	1.59	Depth	93.00	397.31	398.90	pool
9	112.00	10.69	2.18	Depth	112.00	396.75	398.93	mid pool
10	120.50	11.12	2.60	Depth	120.50	396.32	398.92	
11	131.00	11.46	2.93	Depth	131.00	395.98	398.91	
12	138.00	11.71	3.19	Depth	138.00	395.73	398.92	max depth
13	151.00	11.32	2.79	Depth	151.00	396.12	398.91	
14	160.00	10.85	2.34	Depth	160.00	396.59	398.93	
15	172.00	10.33	1.82	Depth	172.00	397.11	398.93	glide
16	190.00	9.85	1.33	Depth	190.00	397.59	398.92	
17	201.00	9.64	1.14	Depth	201.00	397.80	398.94	
18	208.50	9.66	1.11	Depth	208.50	397.78	398.89	
19	217.00	9.87	1.34	Depth	217.00	397.57	398.91	micro pool
20	225.00	9.95	1.44	Depth	225.00	397.49	398.93	micro pool
21	233.00	9.34	0.82	Depth	233.00	398.10	398.92	glide
22	243.00	9.07	0.48	Depth	243.00	398.37	398.85	riffle
23	254.00	9.51	0.54	Depth	254.00	397.93	398.47	run
24	257.00	9.75	0.81	Depth	257.00	397.69	398.50	
25	270.00	9.59	0.59	Depth	270.00	397.85	398.44	
26	281.50	9.37	0.30	Depth	281.50	398.07	398.37	riffle
27	293.00	9.84	0.50	Depth	293.00	397.60	398.10	mid riffle
28	300.00	9.84	0.47	Depth	300.00	397.60	398.07	top of cascade

Profile P-5



bed
water srf
bankfull
x-section
riffle crest
pool
run
glide
LTOB

94
93
92
91
90
89
88
Elevation (ft)
0
50
100
150
200
250
300
350
208.5
Channel Distance (ft)

1) Individual Pebble Count

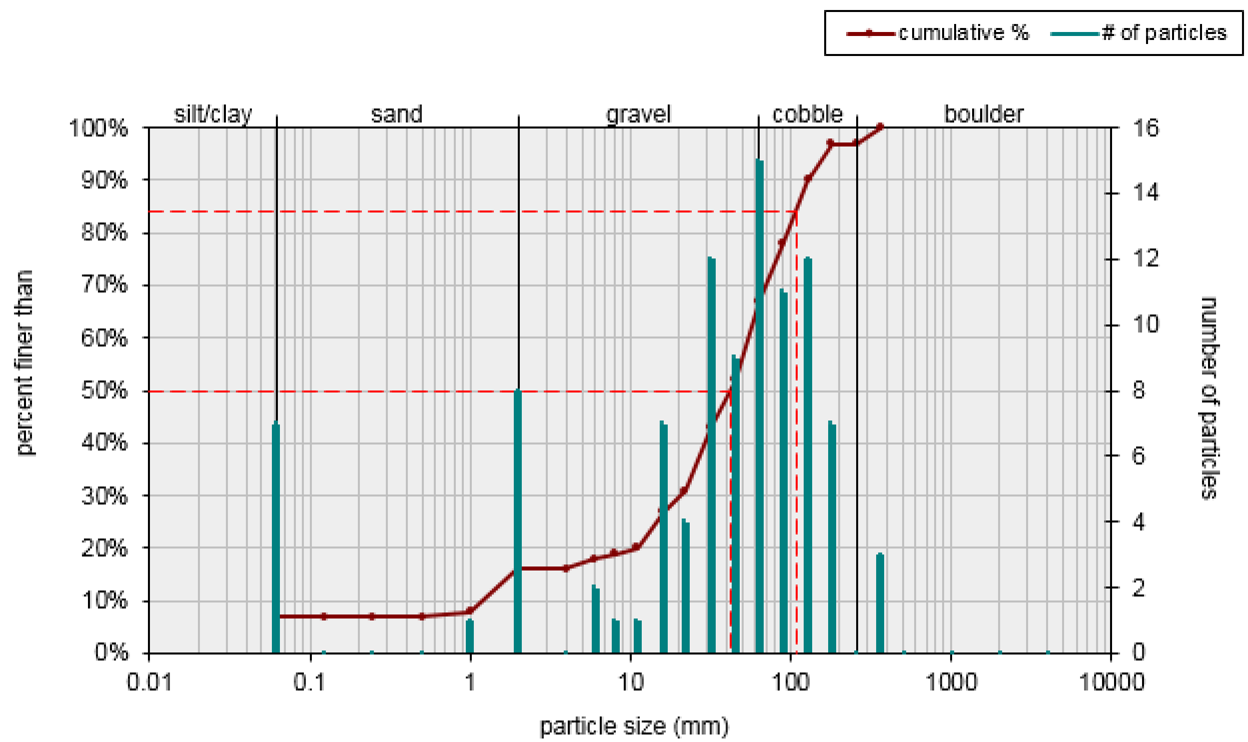
Two individual samples may be entered below. Select sample type for each.

Riffle Surface

Material	Size Range (mm)			Count
silt/clay	0	-	0.062	7
very fine sand	0.062	-	0.125	0
fine sand	0.125	-	0.25	0
medium sand	0.25	-	0.5	0
coarse sand	0.5	-	1	1
very coarse sand	1	-	2	8
very fine gravel	2	-	4	0
fine gravel	4	-	6	2
fine gravel	6	-	8	1
medium gravel	8	-	11	1
medium gravel	11	-	16	7
coarse gravel	16	-	22	4
coarse gravel	22	-	32	12
very coarse gravel	32	-	45	9
very coarse gravel	45	-	64	15
small cobble	64	-	90	11
medium cobble	90	-	128	12
large cobble	128	-	180	7
very large cobble	180	-	256	0
small boulder	256	-	362	3
small boulder	362	-	512	0
medium boulder	512	-	1024	0
large boulder	1024	-	2048	0
very large boulder	2048	-	4096	0
total particle count:				100
bedrock -------------				
clay hardpan -------------				
detritus/wood -------------				
artificial -------------				
total count:				100

Note:

Riffle Surface Pebble Count, Profile P-5

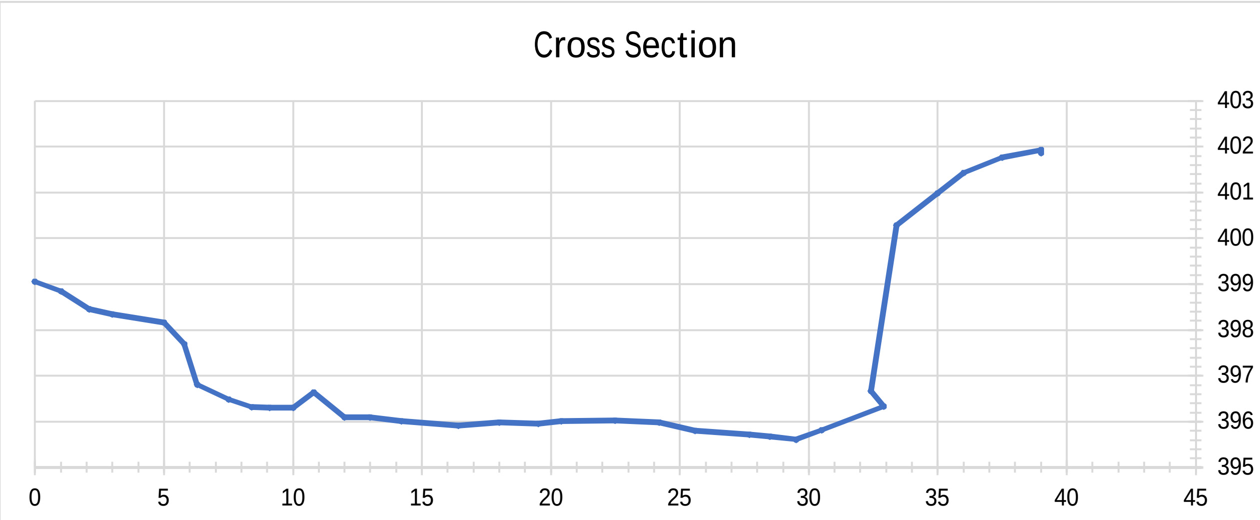


Size (mm)	
D16	4
D35	25
D50	42
D65	61
D84	110
D95	160

Size Distribution	
mean	21.0
dispersion	6.6
skewness	-0.25

Type	
silt/clay	7%
sand	9%
gravel	51%
cobble	30%
boulder	3%

Project: Little Catoctin Creek Monitoring
Project Number: BCS 2014-09H
Site: Section 6 - Cross Section Monitoring
Date: 6/11/2019



Benchmark Elevation: 401.93 RPIN
Height of Instrument: 404.37

Pnt Num	Survey Data: Survey Data Station (ft)	Survey Data: Survey Rod Height (ft)	Section Comparison Data: Station (ft)	Section Comparison Data: Elevation (ft)	Notes
1	0.00	5.32	0	399.05	
2	1.00	5.52	1	398.85	On FP
3	2.10	5.91	2.1	398.46	LEP OG
4	2.10	5.91	2.1	398.46	LPIN
5	3.00	6.03	3	398.34	On FP
6	5.00	6.21	5	398.16	LTOB
7	5.80	6.68	5.8	397.69	
8	6.30	7.56	6.3	396.81	LBOB
9	7.50	7.88	7.5	396.49	on gravel
10	8.40	8.05	8.4	396.32	on gravel
11	9.10	8.06	9.1	396.31	LEW/WS
12	10.00	8.07	10	396.30	
13	10.80	7.73	10.8	396.64	
14	12.00	8.28	12	396.09	
15	13.00	8.28	13	396.09	
16	14.20	8.36	14.2	396.01	
17	16.40	8.46	16.4	395.91	
18	18.00	8.39	18	395.98	
19	19.50	8.42	19.5	395.95	

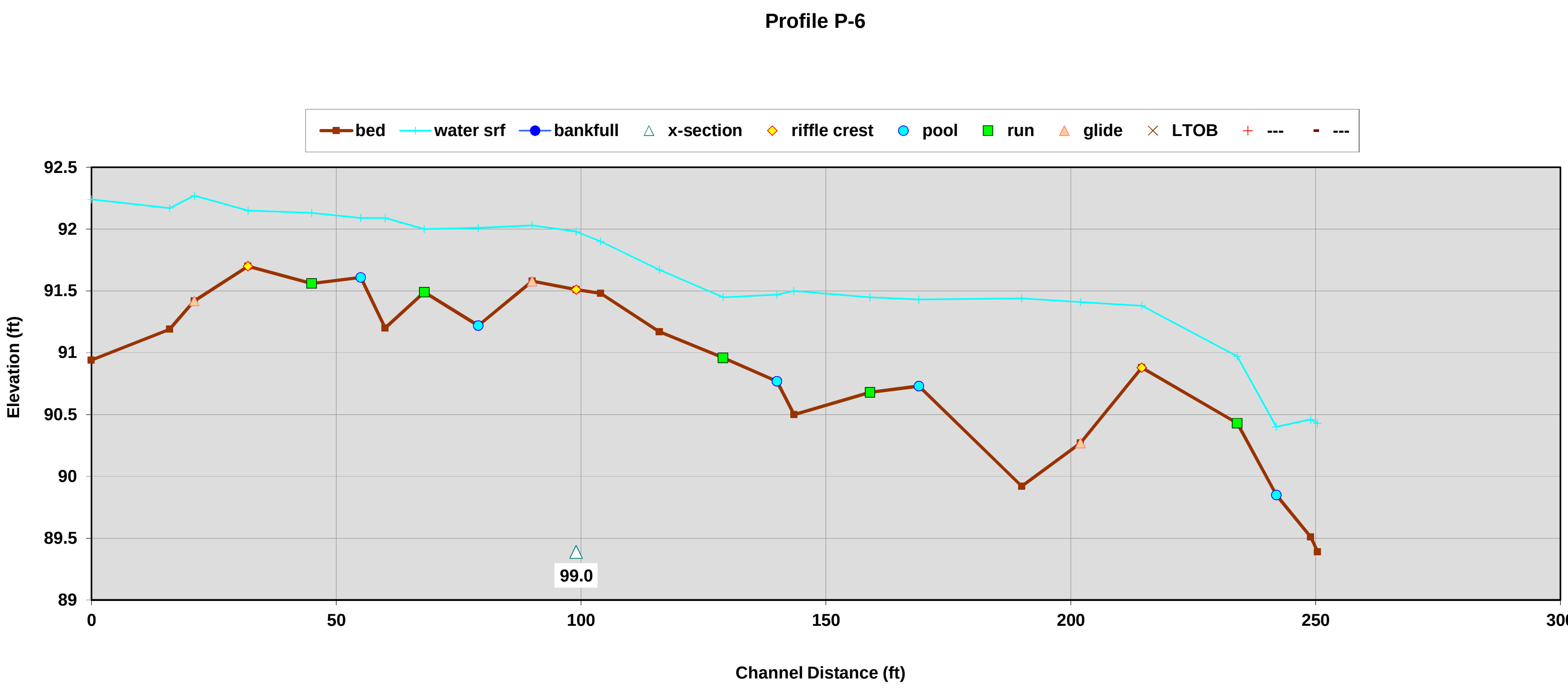
20	20.40	8.36	20.4	396.01	
21	22.50	8.34	22.5	396.03	
22	24.20	8.39	24.2	395.98	
23	25.60	8.57	25.6	395.80	
24	27.70	8.65	27.7	395.72	
25	28.50	8.69	28.5	395.68	
26	29.50	8.76	29.5	395.61	
27	30.50	8.55	30.5	395.82	
28	32.90	8.04	32.9	396.33	REW/WS
29	32.40	7.70	32.4	396.67	
30	33.40	4.08	33.4	400.29	RTOB
31	35.00	3.38	35	400.99	
32	36.00	2.94	36	401.43	
33	37.50	2.60	37.5	401.77	
34	39.00	2.44	39	401.93	rpin
35	39.00	2.51	39	401.86	grnd

Project: Little Catoctin Creek Monitoring
Project Number: BCS 2014-09H
Site: Section 6 - Profile Monitoring
Date: 6/11/2019

Benchmark Elevation	401.93					
Rod Height at BM	2.44					
HI from Benchmark Elev.	404.37					
Cross Section Station	99		Slope:	0.42%		
XS Station Adjustment	42.5			Survey Sta.	Adjust Sta.	WS Elev.
XS Crossing Processed	141.5	141.50	Start Sta.	32.00	74.5	396.52
	393.76	396.07	End Sta.	250.40	292.9	394.8

Survey Data | Profile Comparison Data

Pnt Num	Survey Data Station (ft)	Survey Rod Height (ft)	Water (ft)	Depth or Surface	Adjusted Station (ft)	Ground Elevation (ft)	Water Surface Elevation	Notes
1	0.00	9.06	1.30	Depth	42.50	395.31	396.61	Dmax
2	16.00	8.81	0.98	Depth	58.50	395.56	396.54	0.00
3	21.00	8.58	0.85	Depth	63.50	395.79	396.64	Glide
4	32.00	8.30	0.45	Depth	74.50	396.07	396.52	Riffle
5	45.00	8.44	0.57	Depth	87.50	395.93	396.50	Run
6	55.00	8.39	0.48	Depth	97.50	395.98	396.46	Micro-Pool
7	60.00	8.80	0.89	Depth	102.50	395.57	396.46	Dmax
8	68.00	8.51	0.51	Depth	110.50	395.86	396.37	Mini-Run
9	79.00	8.78	0.79	Depth	121.50	395.59	396.38	Pool, Dmax
10	90.00	8.42	0.45	Depth	132.50	395.95	396.40	Glide
11	99.00	8.49	0.47	Depth	141.50	395.88	396.35	XS 6 Riffle?
12	104.00	8.52	0.42	Depth	146.50	395.85	396.27	Riffle
13	116.00	8.83	0.50	Depth	158.50	395.54	396.04	Riffle
14	129.00	9.04	0.49	Depth	171.50	395.33	395.82	Run
15	140.00	9.23	0.70	Depth	182.50	395.14	395.84	Pool
16	143.50	9.50	1.00	Depth	186.00	394.87	395.87	Dmax
17	159.00	9.32	0.77	Depth	201.50	395.05	395.82	Run
18	169.00	9.27	0.70	Depth	211.50	395.10	395.80	Pool
19	190.00	10.08	1.52	Depth	232.50	394.29	395.81	Dmax
20	202.00	9.73	1.14	Depth	244.50	394.64	395.78	Glide
21	214.50	9.12	0.50	Depth	257.00	395.25	395.75	Riffle
22	234.00	9.57	0.54	Depth	276.50	394.80	395.34	Run
23	242.00	10.15	0.55	Depth	284.50	394.22	394.77	Pool
24	249.00	10.49	0.95	Depth	291.50	393.88	394.83	
25	250.40	10.61	1.04	Depth	292.90	393.76	394.80	Dmax



Profile P-6
bed
water srf
bankfull
x-section
riffle crest
pool
run
glide
LTOB

92.5
92
91.5
91
90.5
90
89.5
89
Elevation (ft)
99.0
0
50
100
150
200
250
300
Channel Distance (ft)

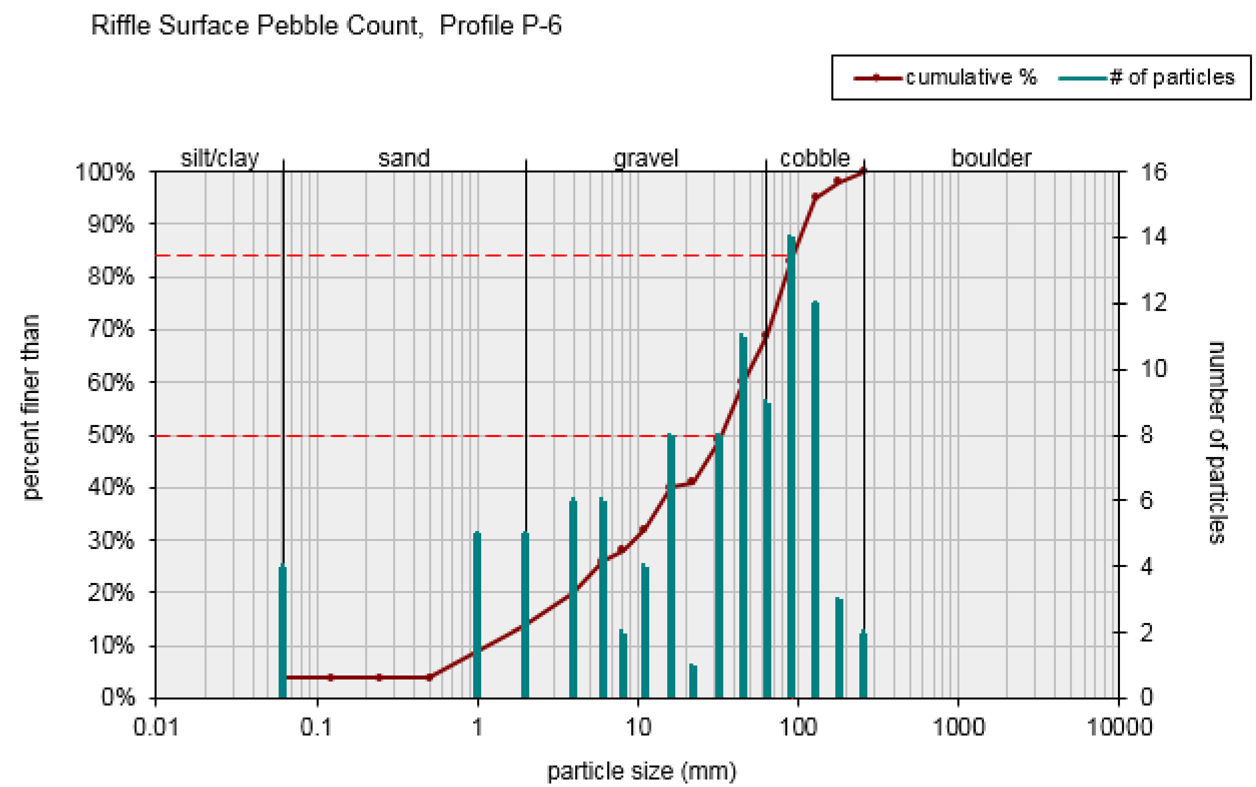
1) Individual Pebble Count

Two individual samples may be entered below. Select sample type for each.

Riffle Surface

Material	Size Range (mm)			Count
silt/clay	0	-	0.062	4
very fine sand	0.062	-	0.125	
fine sand	0.125	-	0.25	
medium sand	0.25	-	0.5	
coarse sand	0.5	-	1	5
very coarse sand	1	-	2	5
very fine gravel	2	-	4	6
fine gravel	4	-	6	6
fine gravel	6	-	8	2
medium gravel	8	-	11	4
medium gravel	11	-	16	8
coarse gravel	16	-	22	1
coarse gravel	22	-	32	8
very coarse gravel	32	-	45	11
very coarse gravel	45	-	64	9
small cobble	64	-	90	14
medium cobble	90	-	128	12
large cobble	128	-	180	3
very large cobble	180	-	256	2
small boulder	256	-	362	
small boulder	362	-	512	
medium boulder	512	-	1024	
large boulder	1024	-	2048	
very large boulder	2048	-	4096	
total particle count:				100
bedrock	-------------			
clay hardpan	-------------			
detritus/wood	-------------			
artificial	-------------			
total count:				100

Note:



Size (mm)	
D16	2.5
D35	13
D50	33
D65	55
D84	93
D95	130

Size Distribution	
mean	15.2
dispersion	8.0
skewness	-0.27

Type	
silt/clay	4%
sand	10%
gravel	55%
cobble	31%
boulder	0%

ATTACHMENT C: BENTHIC MACROINVERTEBRATE DATA

Benthic Macrovinvertebrate Metric and Index Scores

Metric	PRFR-107-X-2019	PRFR-201-X-2019	PRFR-202-X-2019	PRFR-203-X-2019	PRFR-204-X-2019	PRFR-205-X-2019	PRFR-206-X-2019
Raw Scores	**Raw Scores**						
Total Number of Taxa	21	24	27	23	20	21	13
Number of EPT Taxa	2	3	3	3	2	4	1
Number of Ephemeropter	2	3	1	2	2	3	1
Percent Intolerant Urban	12	27	34	26	22	9	16
Percent Tanytarsini	9	27	42	25	24	9	17
Percent Scrapers	1	5	9	5	1	0	0
Percent Swimmers	16	14	4	9	15	7	15
Percent Diptera	68	70	80	82	82	83	71
BIBI Scores	**BIBI Scores**						
Total Number of Taxa	3	5	5	3	3	3	1
Number of EPT Taxa	1	1	1	1	1	1	1
Number of Ephemeropter	1	3	1	1	1	3	1
Percent Intolerant Urban	1	1	1	1	1	1	1
Percent Tanytarsini	5	5	5	5	5	5	5
Percent Scrapers	1	3	3	3	1	1	1
Percent Swimmers	3	3	3	3	3	3	3
Percent Diptera	1	1	1	1	1	1	1
BIBI Score	***2.00***	***2.75***	***2.50***	***2.25***	***2.00***	***2.25***	***1.75***
Narrative Rating	***Poor***	***Poor***	***Poor***	***Poor***	***Poor***	***Poor***	***Very Poor***

Combined Highlands		Score	
Metric	**5**	**3**	**1**
Total Number of Taxa	≥24	15 - 23	<15
Number of EPT Taxa	≥14	8 - 13	<8
Number Ephemeroptera ¯	≥5	3 - 4	<3
Percent Intolerant Urban	≥80	38 - 79	<38
Percent Tanytarsini	≥4	0.1 - 3.9	<0.1
Percent Scrapers	≥13	3 - 12	<3
Percent Swimmers	≥18	3 - 17	<3
Percent Diptera	≤26	27 - 49	>50

Appendix G

Environmental Site Design (ESD) at Interstate 70 Monitoring Report

Appendix G

Environmental Site Design (ESD) at Interstate 70 Monitoring Report

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

NPDES/MS4 Assessment of Controls - Environmental Site Design for Interstate 70

Year 2 Monitoring Report – FY 2019

October 1, 2019

Prepared For:

Maryland Department of Transportation

State Highway Administration

707 N Calvert Street

Baltimore, MD 21202

Prepared by:

Straughan Environmental, Inc.

10245 Old Columbia Road

Columbia, MD 21046

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1 Executive Summary

The Maryland Department of Transportation State Highway Administration (MDOT SHA) is currently planning the installation of several stormwater infiltration features, or best management practices (BMPs), within the existing SHA right-of-way along I-70. A bioretention facility is planned for the interior of the entrance ramp, and three bioswales/two grass swales are planned for the median of I-70 near the Marriottsville Road Interchange in Ellicott City, Maryland. The bioretention facility will capture runoff from Marriottsville Road and the east bound ramp to I-70 while the bioswales and grass swales will capture runoff from a portion of the I-70 east and west bound lanes. The facilities are expected to attenuate peak discharges, limit geomorphological change, and protect channel stability during runoff events within the receiving waterway, the Little Patuxent River (LPR).

MDOT SHA has developed a monitoring plan to determine the effectiveness of these BMPs and make a conclusion about their utility for stormwater management. The monitoring plan includes continuous flow monitoring, physical monitoring of channel geomorphology, and sediment mobility assessments within the LPR. The continuous flow monitoring involves recording stream stage over time at two locations and recording flow volume and velocity over time in one location. The continuous flow monitoring before and after the installation of the BMPs will enable assessment of their ability to attenuate peak discharges. The physical monitoring includes surveys of two permanently established channel cross sections and a longitudinal profile of the monitoring reach, a portion of the LPR downstream of the outfall from the BMPs. The sediment mobility assessment includes two Wolman Pebble Count surveys at the cross sections within the monitoring reach, which are used to determine boundary and critical shear stresses within the stream. Monitoring channel geomorphology before and after the installation of the proposed BMPs will enable assessment of their ability to promote stability within the receiving channel. To capture conditions pre- and post-installation, the monitoring will be extended beyond the original four-year period outlined in the monitoring plan.

This report presents the results of monitoring from Years 1 and 2. Year 1 began on June 12, 2018 and ended on June 30, 2018 (FY2018). Year 2 began July 1, 2018 and ended on June 30, 2019 (FY2019). Continuous flow data were collected at the three flow stations during this period to characterize baseline hydrology of the monitoring reach prior to the installation of upstream BMPs. An analysis of discharge, flow volume, and temperature over the total monitoring period and during peak events revealed that runoff from the target catchment areas, as measured by Flow Station 2, has a negligible effect on the downstream receiving channel, as measured by Flow Station 3. In its baseline condition, the site appears to be minimally impacted by roadway runoff. Continued monitoring of the site throughout and post-construction of roadway expansions and installation of associated BMPs will allow an assessment of how effectively the BMPs offset impacts from the roadway expansions.

Physical monitoring was performed periodically throughout the monitoring period to characterize baseline geomorphology of the monitoring reach. Four surveys were performed during this period. The Year 1 baseline survey occurred on June 14, 2018. Two surveys were performed on July 26, 2018 and September 11, 2018 after significant rain events with the potential to alter geomorphology. The Year 2 annual survey occurred on June 20, 2019. The data were analyzed to characterize baseline conditions of the project site. Overall the monitoring reach appears to be degrading over time, becoming further incised. MDOT SHA will continue to monitor the streams response to significant storm events and to the installation of the BMPs.

2 Introduction

2.1 Project Description

The Maryland Department of Transportation State Highway Administration (MDOT SHA) is currently planning, designing, and constructing stormwater best management practices (BMPs) with the intent to improve stormwater quality. The efforts are geared towards implementing the Chesapeake Bay Total Maximum Daily Load (Bay TMDL) and Municipal Separate Storm Sewer System (MS4) impervious restoration requirements. In compliance with the MDOT SHA MS4 Phase I Permit Part IV.F, Assessment of Controls, Section 2, Stormwater Management Assessment, MDOT SHA is required to determine the effectiveness of BMPs for stream channel protection as implemented under the latest stormwater regulations.

Currently, Howard County has proposed the dualization of Marriottsville Road over Interstate 70 (I-70). The primary objective of the Howard County Marriottsville Road project is to alleviate roadway congestion. Currently, both the bridge and approaching roadways have only two lanes. Under proposed conditions, the bridge will be widened to accommodate four traffic lanes and two bike lanes. Both entrance ramps to I-70 will also be expanded to aid in controlling increased traffic. As a result, the Little Patuxent River watershed will experience an overall increase in impervious area that must be treated with stormwater management practices. The Little Patuxent River (LPR) runs parallel to Marriottsville Road and flows under I-70 through a double box culvert. Currently, stormwater runoff from I-70 and Marriottsville Road is directed to the LPR through a number of outfalls. The proposed BMPs should ensure that the LPR is not impacted by the increased impervious surface.

Howard County has proposed two bio-swales along the west side of Marriottsville Road north of the bridge and a micro-bioretention facility in the gore area north of the bridge along the east side of Marriottsville Road. MDOT SHA has proposed two grass swales and three bio-swales along I-70. and a bioretention facility in the gore area southeast of the Marriottsville Road bridge. See Figure 1 below for a map showing the location of the proposed BMPs and their drainage areas.

MDOT SHA's proposed swales along I-70 will capture runoff from I-70 before it drains to the existing inlets in the median which direct stormwater through a thirty-inch reinforced concrete pipe outfall to the LPR just downstream of the I-70 box culvert. The bioretention facility will capture runoff from Marriottsville Road and the east bound ramp of I-70 before it drains into the same outfall.

The purpose and need for the proposed BMPs is primarily reducing impacts to water quality and not necessarily controlling water quantity. The BMPs are not designed for physical rain events above one inch and, therefore, may not reduce peak discharges for storms greater than one inch. Additionally, they may have limited influence on changes in channel stability. Since the size of the watershed draining to the LPR downstream of this site is large (1,249 acres) compared to the areas treated by the proposed BMPs, MDOT SHA does not anticipate significant impacts to the channel itself through implementation of these BMPs.

Nonetheless, MDOT SHA has developed a comprehensive monitoring plan to assess the effectiveness of the BMPs to attenuate peak discharges and preserve channel stability. This report presents the baseline monitoring conditions from which future, post-construction conditions can be compared.

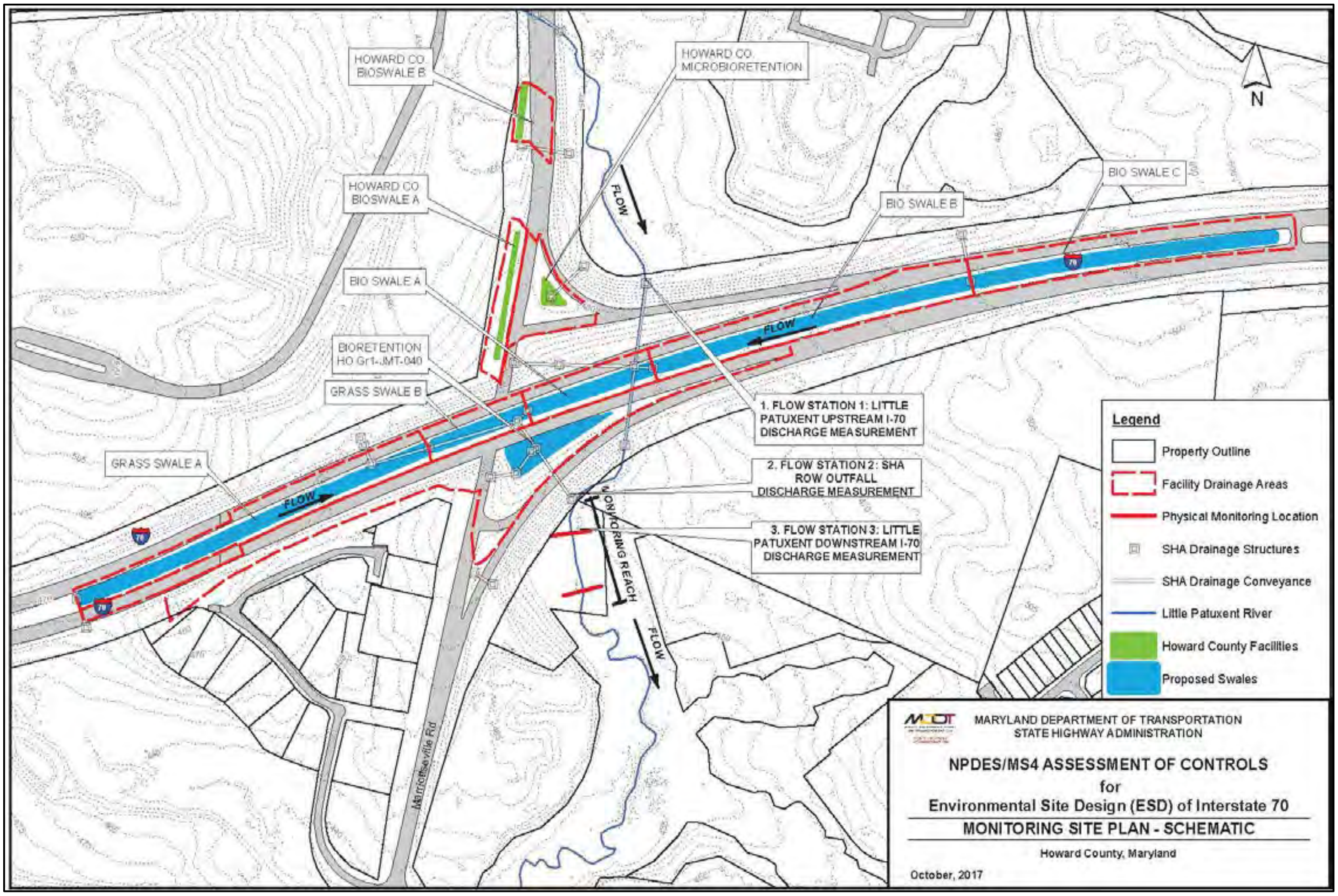

Figure 1. Location of proposed BMPs and project monitoring components (MDOT SHA, October 2017)

The primary goal of this monitoring is to answer several questions pertaining to BMP effectiveness and stream channel response, including:

- Will the peak discharge coming from controlled catchments be reduced once controls have been implemented?
- Will there be a geomorphological response by the Little Patuxent River once controls are in place?
- What are the thresholds for stream stability and do the catchment controls improve stream stability through peak discharge attenuation?
- Can a partnership with Howard County on a larger watershed monitoring plan increase the opportunity to observe a difference in discharge and channel stability?

This report presents the monitoring data collected during Year 1 (June 12, 2018, through June 30, 2018) and Year 2 (July 1, 2018, through June 30, 2019) and provides a characterization of baseline conditions. This report also presents a discussion of the baseline conditions and the ability of continued monitoring to effectively answer the proposed questions.

2.2 Site Description

The proposed BMPs and the monitoring project site are within the Little Patuxent River watershed (02131105) and the stream channel being assessed is the Little Patuxent River (LPR) main stem. The LPR is classified as surface-water use designation IV-P, *Recreational Trout Water and Public Water Supply*. Use IV-P waters allow any reasonable and lawful use if surface water is not adversely affected. Table 1 provides a summary of existing conditions for the LPR upstream watershed (MDOT SHA, October 2017). See Appendix A for the LPR watershed mapping, provided by MDOT SHA as a part of the project monitoring plan.

Land use data from 2010 were obtained from the Maryland Department of Planning (MDP) and visually verified in comparison to recent aerial imagery. In conjunction with Soil Survey Geographic Database (SSURGO) hydrologic soil group (HSG) classifications, the MDP land use categories were related to similar land use descriptions from the Natural Resource Conservation Service (NRCS) Technical Release 55 (TR55) to develop Runoff Curve Numbers (RCN) values. Soils data for the HSG were obtained from NRCS's Web Soil Survey, known as the SSURGO soils database.

Table 1. LPR Watershed Parameters

Total Drainage Area	1,248.90 Acres
	1.95 Mi^2
MDOT SHA Impervious Area	20.49 Acres
	1.64%
Total Impervious Area	110.21 Acres
	8.82%
2010 MDP RCN	74
Zoning RCN	77
Forest Cover	325.96 Acres
	26.10%

Physiographic provinces are geographic regions that are subdivided based on characteristic geomorphology. These are then subdivided into a hierarchical organization of the physiographic subdivisions of Province, Section, Region and District. The LPR watershed is entirely within the Piedmont Plateau Province, Piedmont Upland Section and the Harford Plateaus and Gorges Region. The upstream LPR watershed is entirely within the Hampstead Upland District. The geology in this district is characterized as coarse-grained quartz schists (Loch Raven Schist) and fine-to-medium grained mafic schists (Piney Run, Pleasant Grove, and Prettyboy Formations), along with lesser amounts of metagraywacke, boulder gneiss, metaconglomerate, and isolated ultramafic bodies. The Hampstead Upland District is composed of rolling to hilly uplands interrupted by steep-walled gorges. Differential weathering of adjacent, contrasting lithologies produces distinctive ridges, hills, barrens, and valleys. Streams may have short segments of narrow, steep-sided valleys. (MDOT SHA, October 2017)

3 Monitoring

3.1 Overview

Monitoring is being performed as outlined in the project monitoring plan. The objectives of the monitoring are to quantify flow from the target catchments, to quantify overall flow at the receiving downstream channel, and to characterize the geomorphology of the monitoring reach of the LPR. Two categories of monitoring are used to achieve these objectives – continuous flow monitoring and physical monitoring.

3.1.1 Continuous Flow Monitoring

Three flow monitoring stations were installed within the study area for measuring water levels and quantifying discharge (Figure 2). Flow Station 1 is located upstream of I-70 and of the other flow monitoring sites at a double box culvert that conveys the LPR under I-70. Flow Station 1 was installed to quantify the amount of flow entering the monitoring reach before the addition of flow from the target catchments. Flow Station 2 is located at the outfall of the target catchments and the proposed BMPs. Flow Station 2 was installed to quantify the amount of existing flow from the target catchments and the flow after the roadways have been widened and the BMPs have been installed. Flow Station 3 is located within the monitoring reach downstream of both I-70 and the outfall of the proposed BMPs and is representative of the receiving LPR channel. Flow Station 3 was installed downstream of Flow Station 1 and 2 to verify the estimated upstream discharges and measure the hydrologic response of the LPR to storm events. The data collected from all three stations will be used to determine the magnitude of discharge attenuation provided by the BMPs. MDOT SHA also installed a rain gauge onsite to record local rainfall amounts in order to better understand the nature of the peak discharges at the flow stations.

3.1.2 Physical Monitoring

The physical monitoring of the LPR occurs entirely within the designated monitoring reach. The purpose of this monitoring reach analysis is to estimate the sediment threshold and hydraulic parameters of the stream channel for the LPR to allow for a comparison of the anticipated motion of channel bed material with the capability of channel flows to initiate that motion. This is accomplished through sediment mobility analysis comparing critical shear stress to hydraulic parameters (boundary shear stress).

To obtain the information needed to perform the analysis, two channel cross sections and a longitudinal profile of the existing ground and water surface are periodically surveyed. Annual surveys of the cross sections and profile, along with surveys after significant rain events, will support an analysis of any erosion or aggradation of the LPR within the monitoring reach in response to pre- and post-BMP installation discharges. Wolman pebble counts are also performed during these survey events. Baseline surveys and pebble counts occur annually at the end of each monitoring year (mid-June), to capture pre- and post-BMP installation conditions over the term of the MS4 permit. The Year 1 baseline survey was performed on June 13, 2018. The Year 2 annual survey was performed on June 20, 2019. Additional surveys and pebble counts were also performed after significant storm events and/or abrupt changes to the stream channel, up to two events per monitoring year. Significant storm events are considered to be precipitation totals of greater than or equal to 1.5 inches in a 24-hour period. Two significant rain events that occurred on July 21, 2018, and September 9, 2018, were targeted for post-storm monitoring within the Year 2 monitoring cycle. MDOT SHA performed physical monitoring on July 26, 2018, and September 11, 2018, respectively.

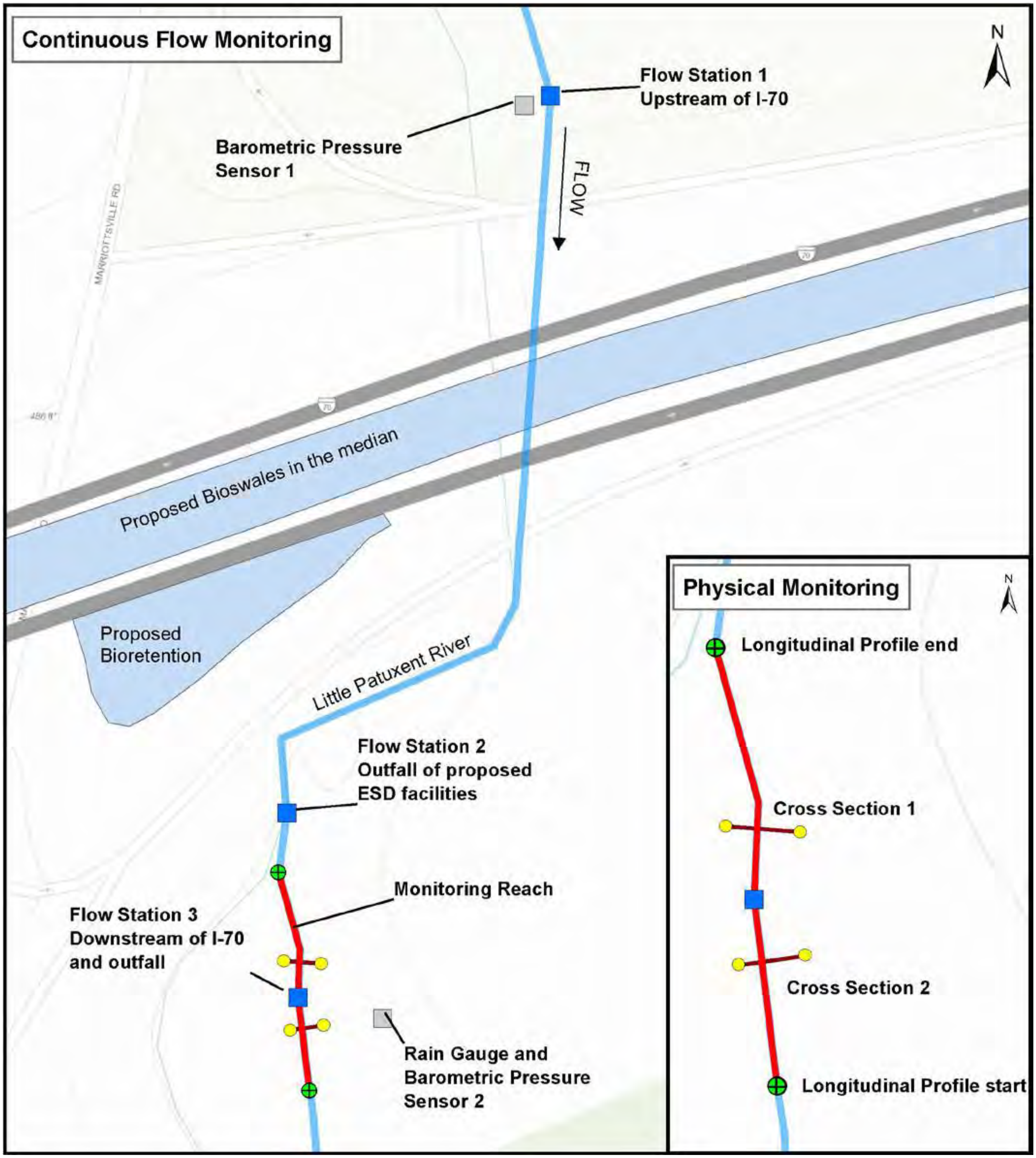

Figure 2. Continuous Flow and Physical Monitoring Locations

3.2 Methods

Detailed descriptions of calibration, quality control and data interpolation methods for the continuous monitoring can be found in Appendix I.

3.2.1 Continuous Flow and Precipitation Monitoring

Flow Stations 1 & 2: Water levels are monitored at Flow Stations 1 and 2 using paired pressure data loggers (Onset HOBO® U20L pressure data loggers). At each station, one logger is installed within the water flow to measure water pressure (water level logger) and one is installed in open air to measure barometric pressure (barometric pressure logger). The water level logger housing is made from perforated PVC, mounted to the bottom of each water conveyance structure (Figure 3). The barometric pressure logger housing is also made from perforated PVC, mounted off the ground in an upland area in the vicinity of the conveyance structures (Figure 4). The loggers were set to record data continuously at 10-minute intervals. During Year 1, water pressure data were compensated with barometric pressure data to determine water level or stage. During Year 2, MDOT SHA began to use reference water levels from manual measurements in the field instead of barometric pressure to determine stage from the water pressure data. Manual measurements of water level were taken every month.

Figure 3. Depth logger mounted at box culvert bottom upstream of I-70 (left; Flow Station 1) and at the outfall of the proposed ESDs (right; Flow Station 2)

Figure 4. Barometric pressure logger set-up

Discharge was calculated at each flow station using the stage data and stage/discharge rating curves developed for the structure at each flow station (Appendix D). For FS-1, discharge was calculated by using Manning's equation to estimate the velocity. The flow area and slope were determined from the as-builts of the box culvert (Appendix E). The roughness value, n, used in the Manning's equation was determined from the sediment mobility assessments presented in Section 4.2.3. FS-1 is located at the upstream interface of the channel and box culvert; therefore, the n value was used as the roughness coefficient instead of the box culvert material to more accurately estimate the flow in the upstream reach, which is primarily open channel with stones and weeds as opposed to the box culvert which is concrete. Stage and discharge rating curves were developed using this information. Since the monitoring equipment is located at the interface of only one of the double box culverts, an assumption was made that the flow conditions are identical for the other box culvert so that a total discharge for the entire channel could be estimated.

For FS-2, discharge was calculated by using Manning's equation to estimate the velocity. The cross-sectional area and slope were determined from the as-builts for the outfall (Appendix E). The roughness value, n, used in the Manning's equation was based on the concrete material of outfall pipe. Stage and discharge rating curves were developed using this information.

In addition to pressure, all data loggers measure temperature. Water temperature and air temperature were measured continuously at 10-minute intervals.

Flow Station 3: Instream discharge is measured at Flow Station 3 using a SonTek-IQ Standard acoustic Doppler area-velocity meter, which records velocity, area, and depth, and is capable of computing discharge and volume of total flow. The recording interval is 10 minutes. The meter was installed in the LPR receiving channel monitoring reach, secured to a mounting plate. The meter was then staked into position onto the stream bed at the thalweg, which is the lowest elevation within a stream channel cross section (Figure 5). A cross section of the meter location was surveyed prior to installation in order to provide accurate data for the internal flow calculations performed by the unit. Barometric pressure compensation is not required for these units because the IQ measures water depth acoustically with a vertical beam. These data are used to perform internal calibrations of the pressure sensor to remove atmospheric pressure, automatically compensating for barometric pressure. Stage is calculated from the measured water depth by adding the distance from the bottom of the device to the depth senor, which was determined during installation. The area-velocity meter also measures water temperature.

Figure 5. Area-velocity meter within the monitoring reach, downstream of I-70 (Flow Station 3)

Rain Gauge Station: Precipitation is recorded using an Onset HOBO® RG3 rain gauge and data logging system, which is capable of recording precipitation rates up to 5 inches per hour. The system is comprised of a tipping-bucket rain gauge, where each bucket tip is equal to 0.01 inches of rainfall, coupled with an event data logger that records the date and time of each tip. The rain gauge is mounted on a post in an unobstructed area free from canopy cover (Figure 6).

Figure 6. Rain gauge station

3.2.2 Physical Monitoring

Longitudinal Profile and Water Surface Elevations (WSEL): The monitoring reach was surveyed for Year 1 baseline survey, Year 2 annual survey and also after significant rain events to determine the elevations of the existing ground and water surface for the reach profile. The longitudinal profile starts in a pool downstream and ends in a pool upstream of the cross-section locations (Figure 2 and Figure 7). Bed elevations and water-surface elevations were recorded along the thalweg approximately every ten feet and at key feature slope breaks (i.e., riffles, runs, pools and glides). The elevations were measured using a Spectra Precision Laser level and stadia rod. The full profile was surveyed from a single set-up location.

Figure 7. Longitudinal profile

Cross Sections: Two permanently monumented cross sections were established at representative riffles within the monitoring reach (Figure 8). The cross sections are used to track channel dimensions representative of the monitoring reach. Capped rebar monuments were installed for each cross section, and the locations and elevations of each were surveyed (Table 2).

Table 2. Cross Section Monument Benchmark Data

		Latitude (feet, NAD83)	Longitude (feet, NAD83)	Elevation (feet, NAVD88)
Cross Section 1	Left Bank Monument	39.303098	-76.898270	438.30
	Right Bank Monument	39.303107	-76.898389	438.72
Cross Section 2	Left Bank Monument	39.302945	-76.898261	437.76
	Right Bank Monument	39.302933	-76.898366	437.82

The cross sections were surveyed with a Spectra Precision Laser level and stadia rod. The laser level has an accuracy of ± 1/16-inch per 100 ft. Survey pins were used to secure the survey measuring tape across the cross section channel. Both the monumented benchmarks and the pins were surveyed during the physical monitoring. Key features surveyed within the cross section include top of bank, edge of water, major slope breaks, and the thalweg.

Figure 8. Cross-section survey layout

Wolman Pebble Counts: Wolman Pebble Count surveys are performed to collect data for a sediment mobility assessment (described below). The surveys are performed at the two permanent cross section locations. The Wolman Pebble Count procedure (Wolman, 1954) requires the observer to measure random pebbles of all sizes along a cross section. Pebbles are chosen at random by using a step-toe procedure. The observer takes one step into the water perpendicular to flow and, while averting one's eyes, picks up the first pebble touching one's index finger next to one's big toe. The observer then measures the intermediate axis of the pebble. The observer takes another step across the stream, picks up and measures another pebble. This is repeated until he reaches the opposite side. In general, 100 measurements are needed in order to accurately quantify pebble distributions. Given the narrowness of the monitoring reach, this means crossing back and forth over the stream in a zig-zag pattern moving downstream from the first transect.

Sediment Mobility Assessment: The MDOT SHA monitoring plan provides the sediment mobility assessment approach and procedure for determining the stable channel threshold (MDOT SHA, October 2017), which is described in detail in the excerpt below.

> *The stable channel threshold, as defined in the project monitoring plan, is when boundary shear stress is twenty percent higher than the critical shear stress as determined from the project site's bed material. The methods used for determining boundary and critical shear stress are described below.*
>
> *A major premise of the sediment mobility analysis is that threshold conditions defined by any critical shear stress method represent a condition of very low transport rate* (Wilcock, 1988). *The*

second assumption is that statically armored riffles satisfy the conditions of near-equal mobility; that is, the largest sediments in a sediment mixture require slightly higher shear stresses than do smaller sizes. Very large particles from colluvial material or large fragments of bedrock plucked from the streambed or bank during infrequent high flows may not be mobile, although they can effectively hide or shelter other smaller particles. The largest particles (D_i) on the bars or in the sub-surface represent the maximum size present in the bedload. Methods considered in the project monitoring plan for the computation of the critical dimensionless shear stress condition for marginal transport of a specific size fraction in mixed-grain sediments (Andrews, 1995) *have the form:*

$$\tau^*_{ci} = a\,(D_1/D_2)^b$$

where τ^*_{ci} is the critical dimensionless shear stress for a very low transport rate for the specific size fraction in the matrix armor layer. This equation is used to estimate the conditions under which marginal transport will exist in the channel. An assumption is made that the minimum shear stress under bankfull conditions in the assessment riffle should be that which mobilizes the largest particles in the bedload. The variables D_1 and D_2 are representative sizes of the sediment samples. Using Andrews' 1995 equation, D_1 is equal to D_i identified below, and D_2 is the mean diameter particle size of the riffle surface using the Wolman pebble count method. Coefficient 'a' and exponent 'b' are 0.0376 and -0.994, respectively, for the equation.

The critical shear stress for marginal transport rate of the largest size fraction in the bedload corresponding to τ^*_{ci}, which relates shear stress to bedload material, is given as:

$$\tau_{ci} = \tau^*_{ci}\,(s-1)\,\gamma\,D_i$$

where τ_{ci} is the critical shear stress required to mobilize D_i, which represents the largest size fraction that is considered to be mobile, s is the specific gravity of the sediment (typically 2.65) and γ is the specific weight of water (62.4 psf). The average boundary shear stress produced by the threshold discharge over each assessment reach riffle was computed as described above.

The use of critical shear stress (τ_{ci}) and boundary shear stress (τ_b) methodologies provides a sound approach for estimating the threshold at the riffles studied. Our analysis for this monitoring plan aims to compare sediment mobility and threshold/ bankfull parameters on LPR. The methodology used for this analysis was derived by Andrews from specific bed-load data sets for streams located in the western United States and therefore may not be directly applicable to LPR. However, it provides an estimate of the expected shear stress required for mobility of coarse, mixed-grain sediments.

The energy slope (friction slope), Sf, for LPR was estimated for bankfull flow conditions based on field survey measurements. The slope is a critical parameter in determining threshold conditions. The range of slope over an assessment riffle is bound by 1) the water surface slope over just the riffle feature itself (maximum threshold slope) and 2) the water surface slope from the head of the study riffle to the head of the next riffle downstream (minimum threshold slope). Threshold conditions will typically occur somewhere between the minimum threshold slope and the maximum threshold slope. The sediment mobility analysis is used to determine the specific slope at which threshold conditions are met.

Channel roughness is caused primarily by the roughness of the channel bed. Estimates of Manning roughness coefficient, n, are based on the Limerinos relation given here as:

$$n = {R_h}^{1/6} * \frac{0.0926}{1.16 + 2LOG\frac{R\cancel{h}}{D_{84}}}$$

where R_h is the hydraulic radius (feet) and D_{84} (feet) is the particle size for which 84 percent of the particles are smaller based on the pebble count of the riffle surface (Limerinos, 1970). *As indicated by this relationship, the n value changes with flow conditions. A Wolman pebble-counting method was used to describe the surface particle size distribution over the active channel portion of the riffle surface. Particle sizes necessary for roughness estimates ($D_{84\ riffle}$) and for evaluation of the bed surface mobility ($D_{50\ riffle}$) were measured through the pebble count analysis.*

The average boundary shear stress produced by the bankfull discharge over each riffle was computed as:

$$\tau_b = \gamma R_h Sf$$

where τ_b is the cross section average boundary shear stress (in psf) over the riffle, R_h is the hydraulic radius, and Sf is the bankfull energy slope. Because the channel width-to-depth ratio was much less than 10 (bank resistance considered major at bankfull conditions) and backwater effects on the steep riffles were minor, the average boundary stress is a good approximation for the average stress on the active channel bed.

4 Year 1 and 2 Monitoring Results

This section of the report summarizes data collected during Year 1 (June 12, 2018 to June 30, 2018) and Year 2 (July 1, 2018 to June 30, 2019). Continuous flow data were collected at the three flow stations during this period to characterize baseline hydrology of the monitoring reach prior to the installation of upstream BMPs.

Physical monitoring was performed periodically throughout the monitoring period to characterize baseline geomorphology of the monitoring reach. Four surveys were performed during this period. The Year 1 baseline survey occurred on June 14, 2018. Two surveys were performed on July 26, 2018 and September 11, 2018 after significant rain events with the potential to alter geomorphology. The Year 2 annual survey occurred on June 20, 2019.

4.1 Continuous Flow Monitoring Results

4.1.1 Total Flow Volume

Total flow volume over Years 1 and 2 was analyzed and the results are presented in Table 3 below. In theory, the total volume recorded at FS-3 should exceed the combined total volume recorded at FS-1 and FS-2; however, our data suggests that there is 0.14% more volume at FS-1 and FS-2 compared to FS-3. FS-3 should exceed the combined volume at FS-1 and FS-2 because of the additional drainage inputs, as seen in Figure 1 and Appendix E.

One source of discrepancy is the monitoring equipment does not correctly characterize calculations for discharge at FS-3 during flow events when the banks are overtopped. The bank height along the monitoring reach is approximately 2.47 ft at the right bank. Once the water depth is above this height during large flow events, the discharge will flood into the floodplain. This will cause the monitoring equipment to underestimate the calculated discharge since a portion of the flow at FS-1 and FS-2 transitioned to the floodplain. Therefore, the total discharge volume will also be underestimated. This occurred 11 times out of 49 peak flow events. This does not occur for FS-1 because the box culvert has a height of 8' and the depth was never recorded above this. This means that the culvert was able to contain the entire flow volume that passed through the monitoring reach.

Another source is the margin of error in the calculation of volume at all three stations. The velocity and roughness factor from FS-1 and FS-2 are estimated using Manning's equation, while the area-velocity meter uses measured area and velocity to calculate flow. The area-velocity meter also has limitations. The meter calculates discharge by using the measured velocity and depth and applying it to the cross-sectional area within the water column that was surveyed where the meter was installed.

In order to account for the portion of total discharge not captured at FS-3, MDOT SHA determined a stage-discharge relationship at FS-3 for stages exceeding the right bank highest elevation (Appendix D). MDOT SHA assumed that the discharge at FS-3 was equivalent to discharge at the upstream monitoring station FS-1 for stages above the right bank highest elevation. Limitations of this assumption is that the relationship does not account for additional drainage between FS-1 and FS-3. Another limitation is that it does not account for any attenuation between FS-1 and FS-3. The linear relationship is from the estimated discharge at the upstream monitoring station FS-1 and the measured stage at FS-3 for that time. Since the mean velocity for stages above 2.47 feet is typically over 2 ft/sec, the lag between discharge at FS-1 and FS-3 is less than 10 minutes so using the corresponding stage at FS-3 for discharges at FS-1 is likely appropriate. Generally, the flow rate at the top of right bank elevation is between 45 to 60 ft^3/sec. Flow rates above this range are extrapolated.

MDOT SHA believes this relationship is useful for Year 1 and 2 continuous flow results but alternative relationships or approaches may be considered for the Year 3 report in order to properly characterize pre-construction conditions. To rectify the issue of FS-3 underestimating discharge in the future, MDOT SHA will expand the boundaries of the surveyed cross section to correct future measurements to be applied in Year 3 monitoring. MDOT SHA has also contacted the manufacturer, Sontek, and are exploring the potential to generate new flow rates for the previously collected data using the expanded cross-sectional area.

The recalculated total volume estimated FS-3 to have 2.18% more volume than FS-1 and FS-2, which was the expected result. The runoff from the target catchments (FS-2) contributed a relatively small amount, 1.4%, of the total flow volume received by the downstream receiving channel (FS-3) during Years 1 and 2.

Table 3. Total Flow Volume for Years 1 and 2 at all flow stations

	Total Volume* (ft^3)	**Percent of volume contributed to receiving channel (%)**
FS-1 LPR upstream	199,161,886	98.6 %
FS-2 Flow from target catchments	2,899,891	1.4 %
FS-3** LPR downstream receiving channel	206,575,254	N/A

*Total flow volume was calculated for the period of June 14, 2018 through June 30, 2019.

**Total flow volume used estimated discharges for stages greater than 2.47.

4.1.2 Peak Flow Events

The data collected during two significant rain events were analyzed and are presented below. Significant storm events are considered to be precipitation totals of more than or equal to 1.5 inches within a 24-hour period, according to the project monitoring plan. While 10 significant rain events occurred during the monitoring period, two significant rain events that were followed by physical monitoring were chosen for analysis. These events occurred on July 21, 2018 (Storm 1) and September 9, 2018 (Storm 2). The data collected during the largest discharge events at each flow station is also presented below.

4.1.2.1 Storm 1

Storm 1 occurred on July 21, 2018. The cumulative rainfall for Storm 1 was 3.8 inches over 13.8 hours. This storm event is considered to have greater than a 2-year return interval based on its intensity and precipitation depth. The storm had an average storm intensity of 0.27 in/hr with a maximum intensity of 1.64 in/hr.

Peak stage and discharge occurred at different times and varied in magnitude across the flow stations.

Table 4 provides a comparison of the results across flow stations during the storm event. Figure 9 through Figure 11 show peak discharge at each flow station.

Table 4. Response to Storm 1 at all flow stations

	Time of Peak	Peak Stage (ft)	Peak Discharge (ft^3/s)	Total Flow Volume (ft^3)	Percent of volume contributed to receiving channel (%)
FS-1 LPR upstream	23:40	2.14	274.59	1,985,740	99.97%
FS-2 Flow from target catchments	22:20	0.078	0.083	747	0.03%
FS-3* LPR downstream receiving channel	23:13	3.59	223.55	1,813,259	N/A

*FS-3 results use stage-discharge relationship for stages greater than 2.47 feet.

The runoff from the target catchments (FS-2) contributed a relatively small amount, 0.03%, of the total flow volume received by the downstream receiving channel (FS-3) during Storm 1. Peak discharge occurred slightly earlier at FS-2. This is likely due to the fact that stormwater runoff travels quickly across the impervious surface within the catchment area and also travels quickly through the outfall. The peak discharge at FS-3 is 30 minutes prior to FS-1 but this was the last valid velocity measurement for this storm event due to one of more sensors being obstructed by debris caught on the area-velocity meter.

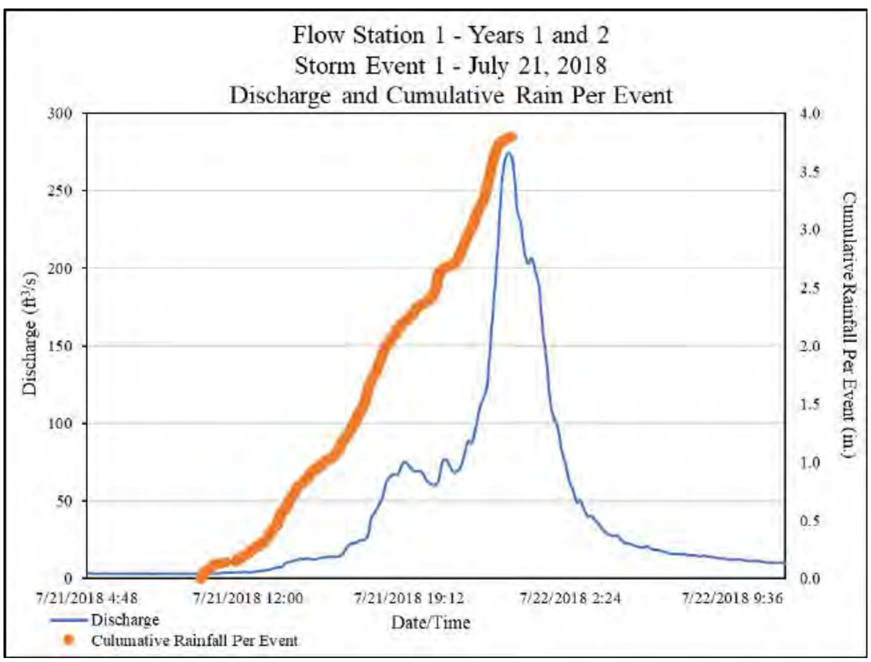

Figure 9. Discharge at FS-1 and rainfall during storm event 1 (July 21, 2018)

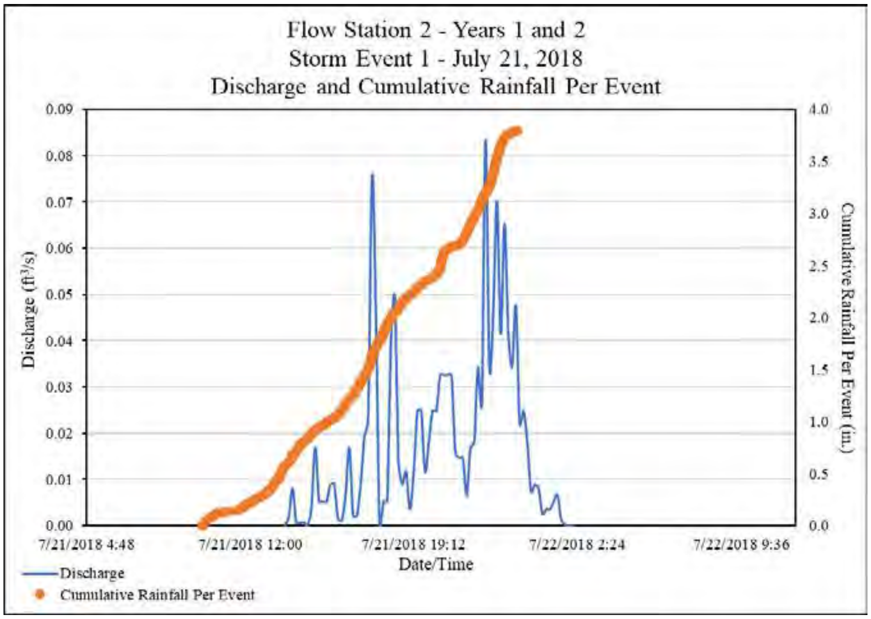

Figure 10. Discharge at FS-2 and rainfall during storm event 1 (July 21, 2018)

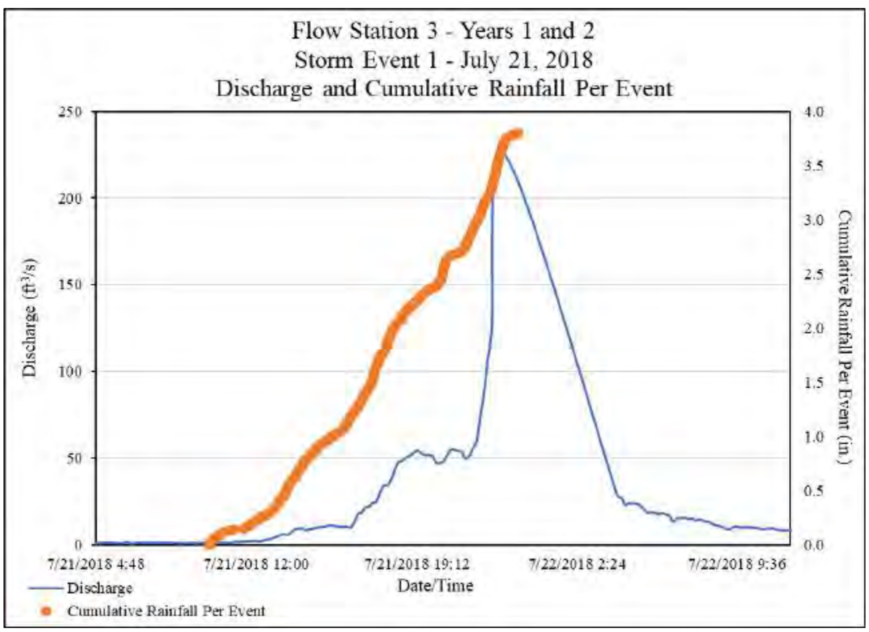

*Figure 11. Discharge at FS-3 and rainfall during storm event 1 (July 21, 2018)**

*FS-3 results use stage-discharge relationship for stages greater than 2.47 feet

4.1.2.2 Storm 2

Storm 2 occurred on September 9, 2018. The cumulative rainfall for Storm 2 was 2.1 inches over 18.3 hours. This storm event is considered to have greater than a 1-year return interval based on its intensity and precipitation depth. The storm had an average storm intensity of 0.11 in/hr with a maximum intensity of 0.75 in/hr.

Peak stage and discharge occurred at different times and varied in magnitude across the flow stations. Table 5 provides a comparison of the results across flow stations during the storm event. Figure 12 through Figure 14 demonstrate peak discharge at each flow station.

Table 5. Response to Storm 2 at all flow stations

	Time of Peak	Peak Stage (ft)	Peak Discharge (ft^3/s)	Total Flow Volume (ft^3)	Percent of volume contributed to receiving channel (%)
FS-1 LPR upstream	15:00	0.83	62.77	2,432,287	99.98 %
FS-2 Flow from target catchments	8:20	0.056	0.034	398	0.02 %
FS-3 LPR downstream receiving channel	15:44	2.32	54.89	2,554,083	N/A

The runoff from the target catchments (FS-2) contributed a relatively small amount, 0.02%, of the total flow volume received by the downstream receiving channel (FS-3) during Storm 1. Peak discharge occurred significantly earlier at FS-2. This may be due to the fact that stormwater runoff travels quickly across the impervious surface within the catchment area and also travels quickly through the outfall.

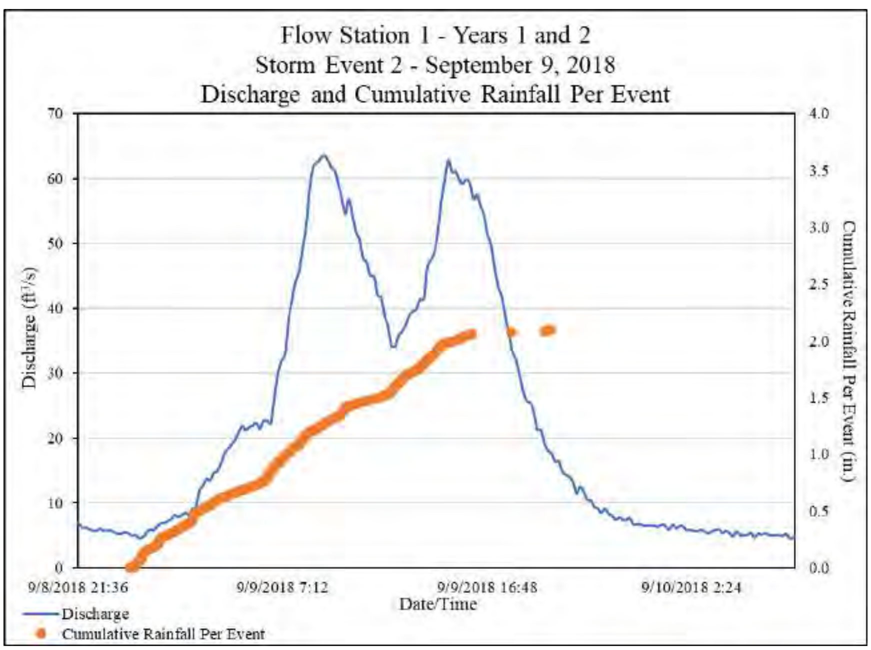

Figure 12. Discharge at FS-1 and rainfall during storm event 2 (September 9, 2018)

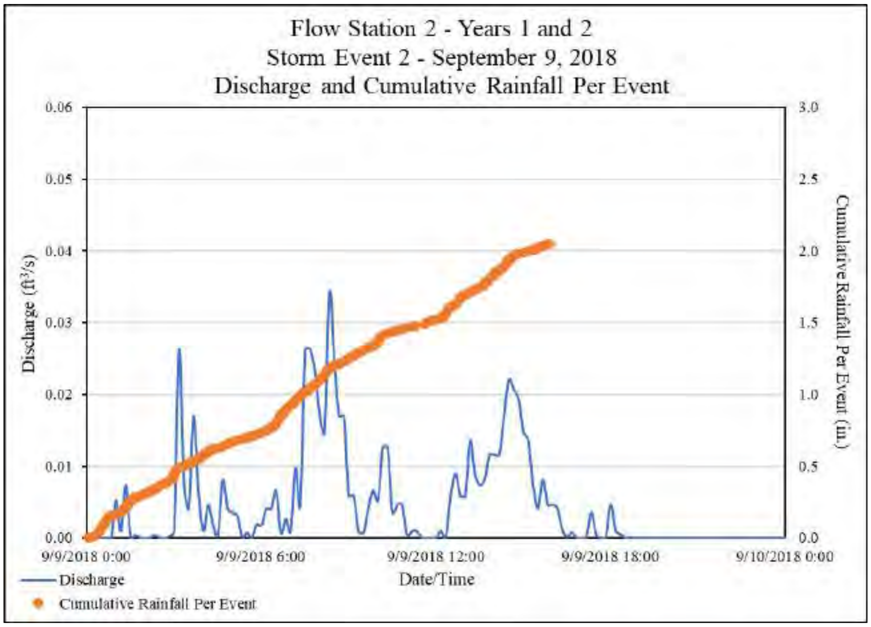

Figure 13. Discharge at FS-2 and rainfall during storm event 2 (September 9, 2018)

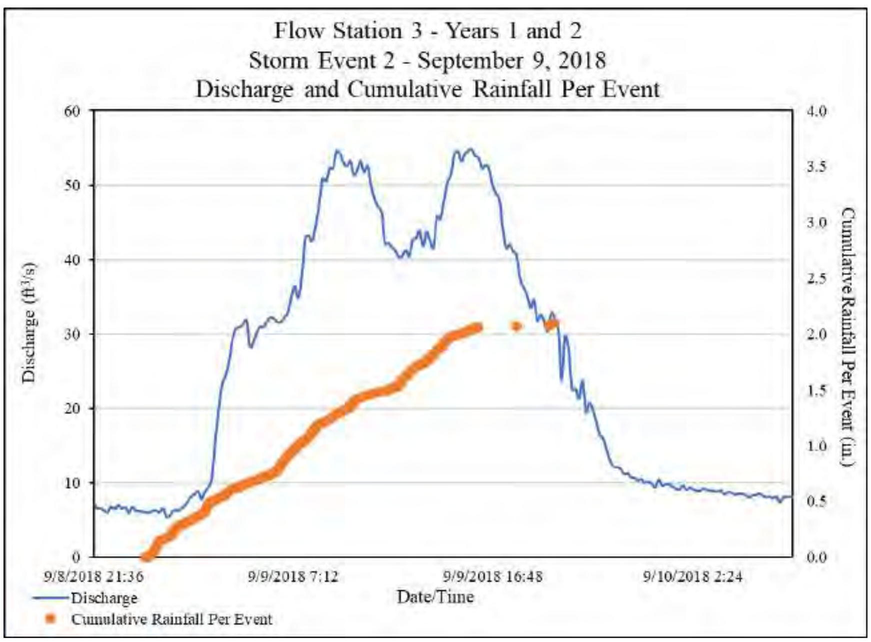

Figure 14. Discharge at FS-3 and rainfall during storm event 2 (September 9, 2018)

4.1.2.3 Largest Flow Events

FS-1: The largest peak flow event at FS-1 occurred on March 21, 2019 at 21:10. The stage was 2.78 ft and the estimated discharge was 406.43 ft^3/sec. The cumulative rainfall for FS-1 peak flow event was 2.86-inches in 23.85 hours. This storm event is considered to have greater than a 1-year return interval based on its intensity and precipitation depth. The storm had an average intensity of 0.12 in/hr. See Figure 15 below. FS-2 peak flow also occurred on March 21, 2019 at 21:10, 2.30 ft^3/sec. The estimated flow for FS-3 at this time could not be determined due to power failure for the area-velocity meter. The last recorded discharge for FS-3 on March 21, 2019 at 18:13 was 252.25 ft^3/sec. The discharge at FS-1 for that time was 231.97 ft^3/sec.

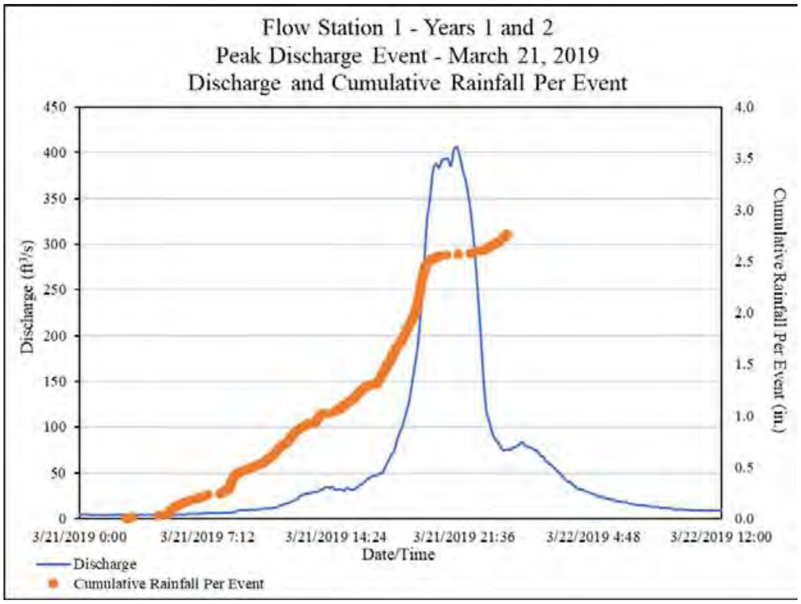

Figure 15. Discharge at FS-1 and rainfall during peak discharge event 1 (March 21, 2019)

FS-2: The largest peak flow event at FS-2 occurred on March 21, 2019 at 21:10. The stage was 0.32 ft and the discharge was 2.30 ft^3/sec. The cumulative rainfall for FS-2 peak flow event was 2.86-inches in 23.85 hours. This storm event is considered to have greater than a 1-year storm return interval based on its intensity and precipitation depth. The storm had an average storm intensity of 0.12 in/hr.. See Figure 16 below.

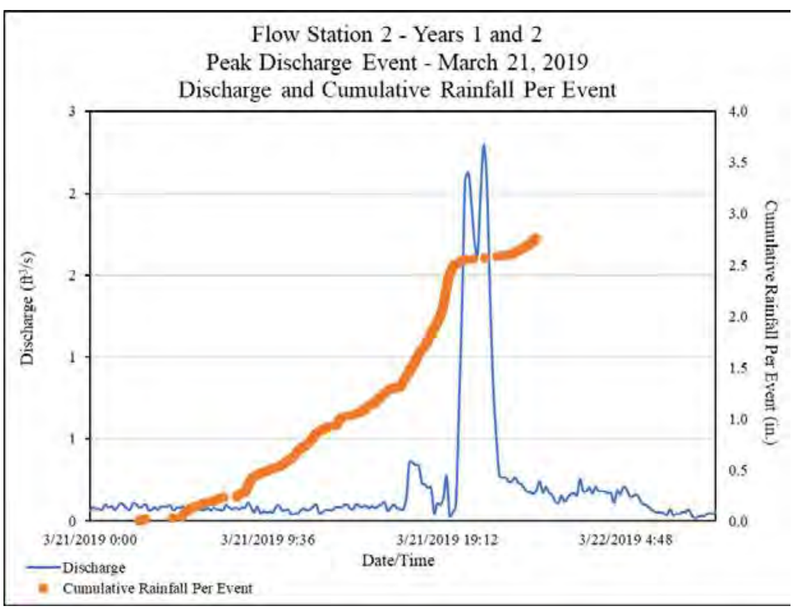

Figure 16. Discharge at FS-2 and rainfall during peak discharge event 1 (March 21, 2019)

FS-3: The largest peak flow event at FS-3 occurred on November 24, 2018 at 21:03. The stage was 3.93 ft and the estimated discharge was 277.66 ft^3/sec. The peak discharge for this storm event may have been larger but four (4) hours of data after 21:03 is unavailable due to equipment malfunction from debris jams. The cumulative rainfall for FS-3 peak flow event was 1.94-inches in 6.88 hours. This storm event is considered to have greater than a 1-year storm return interval based on its precipitation depth. The storm had a total storm intensity of 0.28 in/hr. See Figure 17 below. Discharge at FS-1 and FS-2 at this time was 313.34 and 0.031 ft^3/sec, respectively.

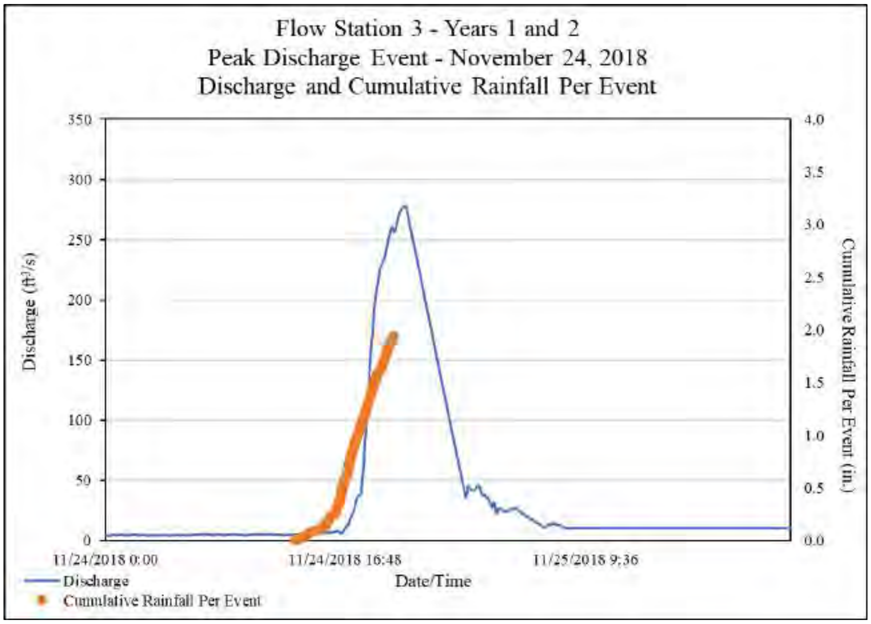

*Figure 17. Discharge at FS-3 and rainfall during peak discharge event 1 (November 24, 2018)**

*FS-3 results use stage-discharge relationship for stages greater than 2.47 feet

4.1.3 Mean Discharge

The annual mean discharge for the monitoring period was estimated to be 6.38 ft^3/sec at FS-1, 0.08 ft^3/sec at FS-2, and 5.69 ft^3/sec at FS-3. Daily mean discharge at all flow stations for Years 1 and 2 is displayed in Appendix G. Minimum, maximum and average stage and discharge values per flow station are presented in Table 6 through Table 8 below.

Table 6. Flow Station 1 Summary Statistics

	Stage (ft)	Discharge (ft^3/s)
Minimum	0.002	0.003
Maximum	2.78	406.43
Average	0.17	6.38

Table 7. Flow Station 2 Summary Statistics

	Stage (ft)	Discharge (ft^3/s)*
Minimum	0.00	0.00
Maximum	0.32	2.30
Average	0.09	0.13

*Suspect or unverifiable data not represented. See Appendix I

Table 8. Flow Station 3 Summary Statistics

	Stage (ft)	Discharge (ft^3/s)*
Minimum	0.37	0.02
Maximum	3.95	277.66
Average	1.06	5.89

*FS-3 results use stage-discharge relationship for stages greater than 2.47 feet

4.1.4 Water Temperature

The maximum daily temperatures were analyzed for the monitoring period and are presented in Table 9. Since Flow Station 2 does not always have continuous flow, temperatures were only used when there was water flowing through the outfall (i.e. the stage was above 0.00 feet). This ensures that measurements of ambient air temperatures were excluded.

High water temperature can negatively impact instream habitat. Of particular concern is habitat for adult trout. The LPR is designated as a Use IV-P stream, which means it is a Recreational Trout Water capable of holding or supporting adult trout for put-and-take fishing. The mortality temperature by brown and rainbow trout is 80 and 77 degrees Fahrenheit, respectively (Adams & et al, Rainbow trout (Oncorhynchus mykiss) Species and Conservation Assessment, 2008a) (Adams & et al, Brown Trout (Salmo trutta) Species and Conservation Assessment, 2008b). The data were analyzed to determine how often water temperatures exceeded 75 degrees, which was chosen so that temperatures approaching the mortality temperature were included in analysis. This threshold was exceeded on more than 25 days. The maximum temperature tolerated by macroinvertebrates is reported to be 86° F (Thorp, 2009), which was never observed at any flow station.

Table 9. Water Temperature Summary Statistics for Years 1 and 2

	Maximum Water Temperature (°F)	**Number of days water temperature exceeded 75°F**
FS-1 LPR upstream	78.8	26
FS-2 Flow from target catchments	80.4	9
FS-3 LPR downstream receiving channel	78.2	24

4.1.5 Precipitation

This section provides the results of the precipitation data collected from the on-site rain gauge. The figure in Appendix J shows the cumulative rainfall totals for Year 1 and 2. Table 10 provides a summary of the significant or qualifying rain events that occurred throughout the monitoring period. A significant rain event was determined to be rainfall totaling more than 1.5-inches in 24-hours, based on guidance from the monitoring plan.

The precipitation data were also analyzed to determine the return interval, based on the cumulative results of the storm. The intensity and precipitation depth during the storm were also analyzed to determine if a return interval occurred at some point during the rain event. The return interval depth and intensity frequencies were determined from the NOAA Atlas 14 Point Precipitation frequency data server (Hydrometeorological Design Studies Center, 2018). A non-qualifying event means it did not meet the criteria determined for the return interval analysis.

Table 10. Cumulative Rainfall Totals for Years 1 and 2

Rain Event Start Date	Cumulative Rainfall (in)	Total Duration (hr)	Average Storm Intensity (in/hr)	Precipitation Frequency (intensity)	Precipitation Frequency (depth)
7/5/2018	1.02	2.42	0.42	Not a Qualifying Rain Event	≥ 1 Year Storm NOAA 14 requirement occurred during storm
7/21/2018	3.8	13.83	0.27	≥ 2 Year Storm NOAA 14 requirement	≥ 2 Year Storm NOAA 14 requirement
9/9/2018	2.1	18.30	0.11	Not a Qualifying Rain Event	Significant Event with ≥ 1.5" of rainfall
9/27/2018	1.71	14.28	0.12	Not a Qualifying Rain Event	Significant Event with ≥ 1.5" of rainfall
11/15/2018	1.54	10.48	0.15	Not a Qualifying Rain Event	Significant Event with ≥ 1.5" of rainfall
11/24/2018	1.94	6.88	0.28	Not a Qualifying Rain Event	≥ 1 Year Storm NOAA 14 requirement occurred during storm
12/15/2018	2.87	26.70	0.11	≥ 1 Year Storm NOAA 14 requirement	≥ 1 Year Storm NOAA 14 requirement
3/21/2019	2.86	23.85	0.12	≥ 1 Year Storm NOAA 14 requirement	≥ 1 Year Storm NOAA 14 requirement
5/10/2019	1.29	1.47	0.88	≥ 1 Year Storm NOAA 14 requirement occurred during storm	≥ 2 Year Storm NOAA 14 requirement occurred during storm
5/30/2019	0.67	0.87	0.77	Not a Qualifying Rain Event	≥ 1 Year Storm NOAA 14 requirement occurred during storm

4.2 Physical Monitoring Results

4.2.1 Cross Sections

Cross section surveys were performed at each cross section during each of the four physical monitoring events to detect change over time. See Figure 18 and Figure 19 below for a comparison of all four cross section surveys. Left bank for the cross sections is located on the left side of the figures and vice versa for the right bank. See Appendix C for the raw data and Appendix H for full-size versions of Figure 18 and Figure 19.

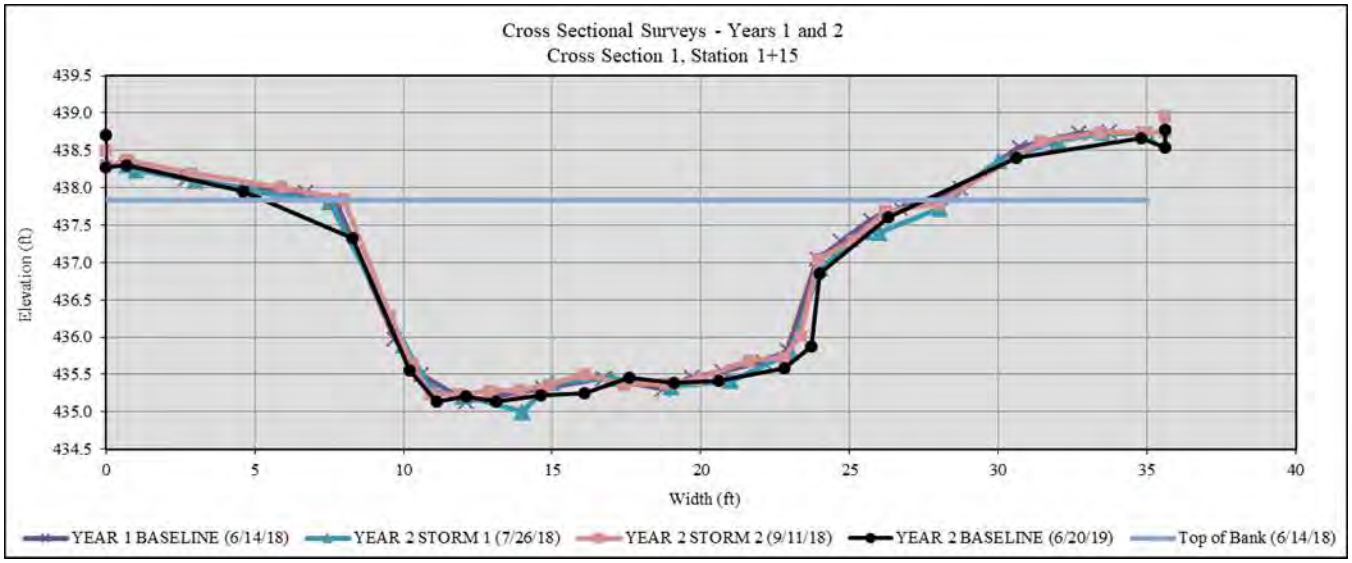

Figure 18. Cross Section 1 Survey Comparison

At Cross Section 1, the left bank has eroded vertically by about 6 inches while the right bank has eroded laterally approximately 9.5-inches between the annual surveys. Minor erosion of the riverbed can also be observed between Stations 15 and 23.

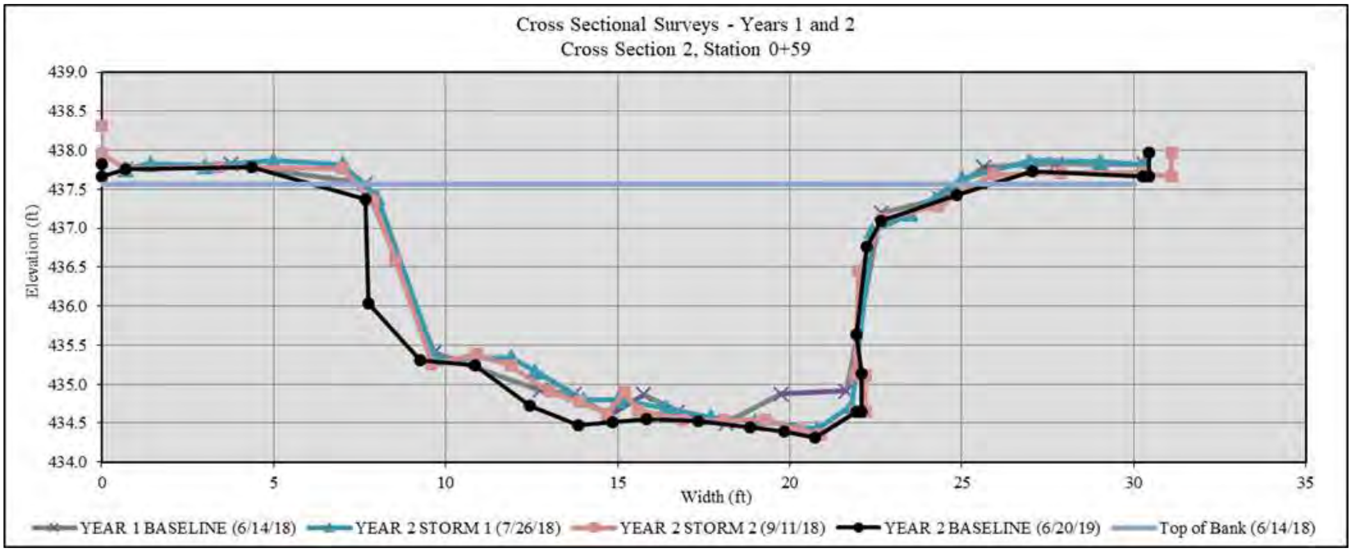

Figure 19. Cross Section 2 Survey Comparison

At Cross Section 2, the left bank has eroded laterally approximately 2 feet while the right bank has generally remained stable. However, the toe of the right bank has started to develop a 6-inch undercut. Erosion of the riverbed for Cross Section 2 can be seen from Station 11 to 22, where the elevation has decreased approximately 6-inches. The thalweg for Cross Section 2 has also migrated laterally from Station 18.75 to 20.75.

Due to actively eroding banks and poor visual indicators, it was not possible to accurately identify the bankfull elevation in the field. Instead, regression equations that estimated the bankfull cross sectional area as a function of the upstream drainage area were used (Maryland Hydrology Panel, 2010). That area was then applied to the surveyed cross sections. Drainage area and the hydro-physiographic region were used to derive the bankfull cross sectional area. The delineated drainage area was provided in the monitoring plan, and the hydro-physiographic region was determined to be the Piedmont providence in Maryland. Next, appropriate regression equations were taken from the *Maryland Stream Survey: Bankfull Discharge and Channel Characteristics of Streams in the Piedmont Hydrologic Region* (USFWS, 2002). The following equation was used to estimate the bankfull cross sectional area:

$$Cross\ Sectional\ Area = 17.42 * DA^{0.73}$$

Using this equation, the bankfull cross sectional area was estimated to be 28.36 ft^2. Using this, the surveyed cross-sectional bankfull width and mean depth were then estimated at each cross section.

An average bankfull width and depth for the reach was used to determine the bankfull elevation. Based on the results from the regression equations for bankfull width and depth, an average value of 15.65 feet for width and 1.82 feet for mean bankfull depth were used so that the computed bankfull characteristics were comparable between cross sections. The Year 1 baseline top of bank elevation for each cross section was selected as the baseline to use for comparing survey results so that geomorphic change over time can be observed. Top of bank elevations are more stable and repeatable; therefore, those elevations were used for comparisons over time. See Table 11 for a summary of the Year 1 baseline elevations.

Table 11. Bankfull and Top of Bank Elevations

Reach	Bankfull Elevation (ft)	Top of Bank Elevation (ft)
CS-1	437.00	437.83
CS-2	436.30	437.57

4.2.2 Longitudinal Profile Survey

Longitudinal profile surveys of the LPR bed and water surface were performed during each of the four physical monitoring events to detect change over time. See Figure 20 below for a comparison of all four surveys. See Appendix C for the raw data and Appendix H for a full-size version of Figure 20. The starting stations for Year 2 profiles were adjusted so that the Cross Section 2 locations are aligned for all profiles to allow for comparison between surveys. Water surface slopes between CS-1 and CS-2 are shown below, which are both riffle features.

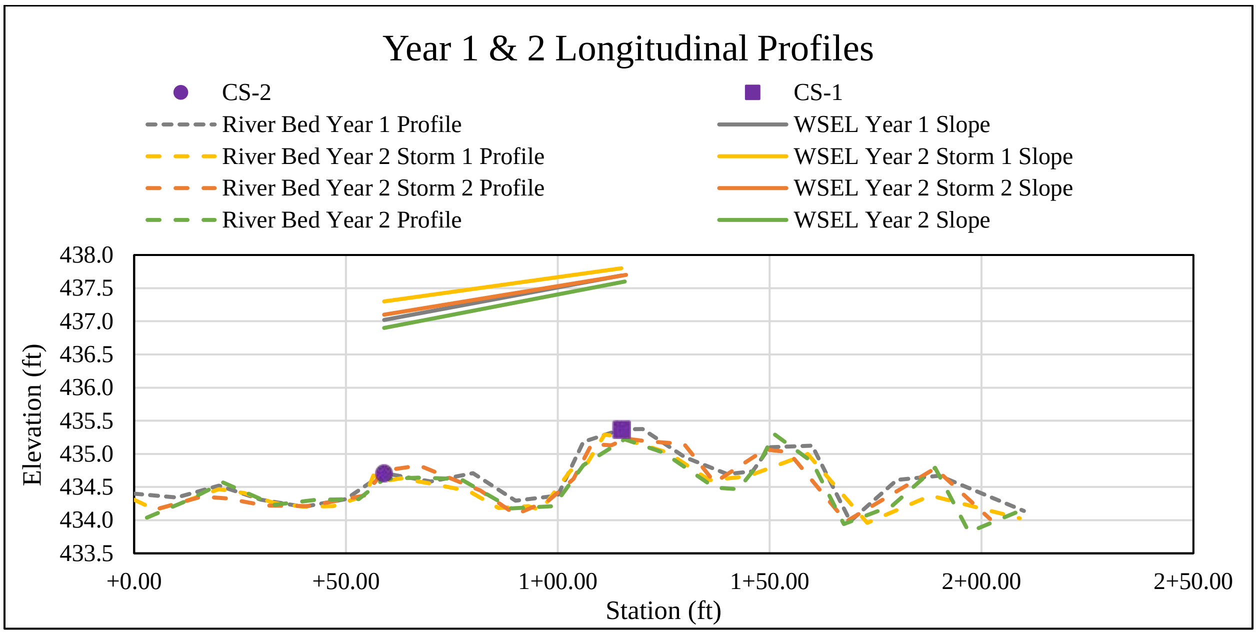

Figure 20. Year 1 & 2 Riverbed and Water Surface Elevation Profiles

Minor changes along the longitudinal profile between Year 1 and 2 annual surveys have been observed. The initial downstream pool of the profile is deeper but the riverbed between the pool and Cross Section 2 has remained stable. From Cross Section 2 to 15 feet upstream of Cross Section 1, Station 0+59 to Station 1+30, the riverbed has degraded by approximately 2-inches. The riffle at Station 1+50 and pool at Station 1+67 have overall remained stable, though some degradation and aggradation occurred between the annual surveys. The riverbed near Station 2+05 has also degraded by approximately 9.5-inches, forming a pool. It should be noted that the location of the thalweg for CS-1 only migrated vertically while CS-2 thalweg did not migrate vertically, but horizontally, as shown in the cross section figures in Section 4.2.1.

4.2.3 Sediment Mobility Assessment

Wolman pebble counts were performed at each cross section during each of the four physical monitoring events to detect change over time. See Figure 21 and Figure 22 below for a comparison of the results of all four surveys at each cross section. See Appendix C for the pebble count raw data and Appendix F for the complete results.

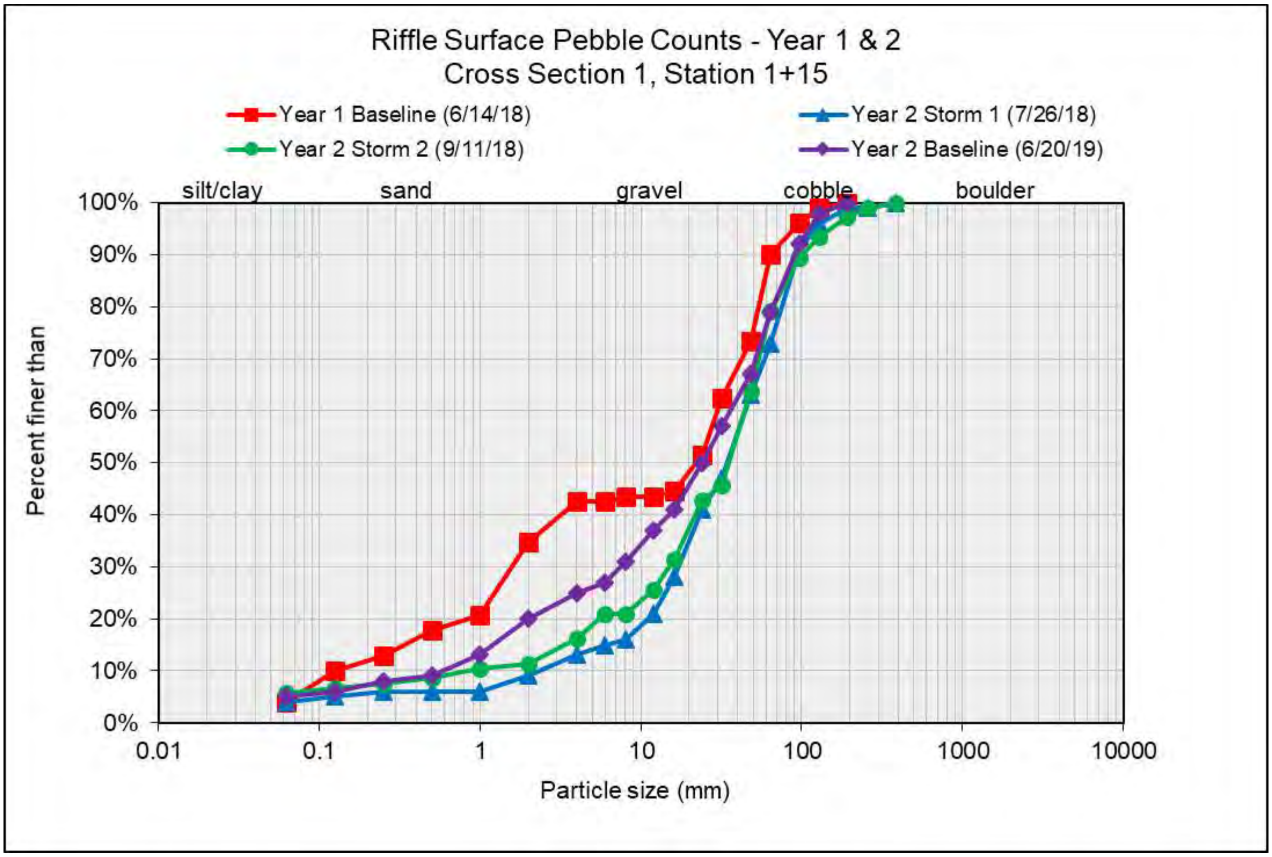

Figure 21. Cross Section 1 Bed Material Comparison

The material for Cross Section 1 has coarsened between the Year 1 and Year 2 annual surveys, with D50 increasing from 22 to 24mm and D84 increasing from 58 mm to 75 mm. Interestingly, D50 had increased to 35mm after Storms 1 and 2, but reverted back to 24mm by the Year 2 annual survey.

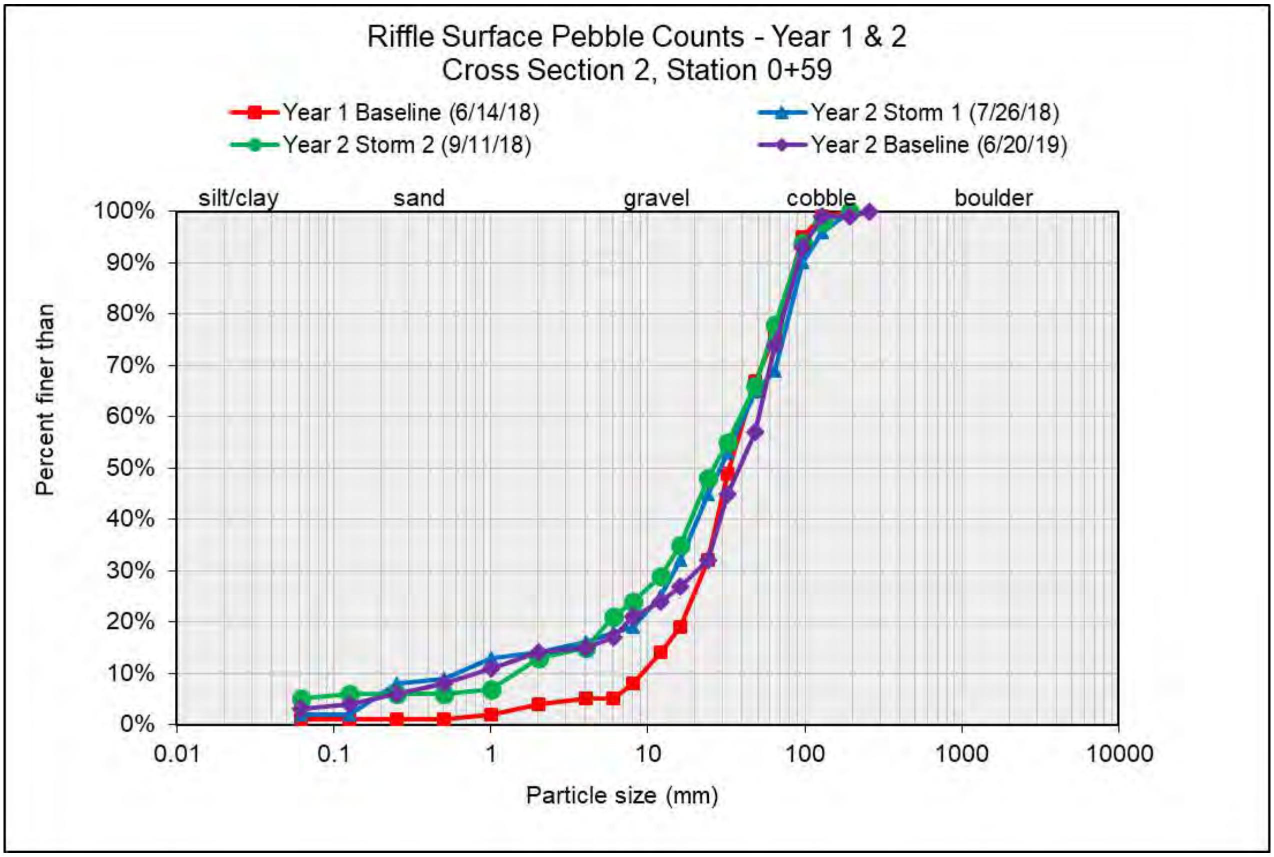

Figure 22. Cross Section 2 Bed Material Comparison

The material for Cross Section 2 has coarsened between the Year 1 and Year 2 annual surveys, with D50 increasing from 33 to 38mm and D84 increasing from 76 mm to 79mm. However, 50% of the material for this riffle section appears to be trending towards finer substrate. This can be seen by an increase in the skewness from Year 1 baseline survey to Year 2. An increase in skewness indicates an excess in finer substrate.

5 Discussion

5.1 Continuous Flow Monitoring

The monitoring reach of the LPR receives water from the LPR upstream via a box culvert that directs the LPR underneath I-70 and from roadway stormwater runoff that is conveyed through a local outfall pipe. Roadway stormwater runoff, as measured by Flow Station 2, contributed 1.4% of the total volume measured at the monitoring reach over the course of Years 1 and 2. More notably, runoff contributed from FS-2 was limited to 0.02-0.03% of peak volumes within the monitoring reach during large rain events. Currently, runoff from the target catchment areas appears to have a negligible effect on the downstream receiving channel. The installation of stormwater management facilities is expected to maintain these low contribution rates or even reduce them further by retaining stormwater and slowly releasing it over a longer period of time.

Seasonal patterns were analyzed to determine what effect they had on mean discharges. The National Weather Service's Precipitation Departure Maps for the Middle Atlantic River Forecast Center were used to determine the seasonal rain patterns for Howard County (National Weather Service, 2019). These maps compare the mean precipitation totals for the month to the 30-year mean monthly precipitation totals for Howard County. This allows for a comparison of the typical seasonal weather patterns to the weather observed at the project. Overall, the monitoring period has experienced more rain than average; 10 out of 13 months report rain departures that were greater than normal, with three (3) of those months greater than twice the normal amount. Table 12 summarizes the data from the precipitation departure maps.

Table 12. Summary of Precipitation Departure Maps

Date	Howard Co. Mean Precipitation Total (in.)	Departure from Average (in.)	% Departure from Average	FS-1 Monthly Mean Discharge	FS-2 Monthly Mean Discharge	FS-3 Monthly Mean Discharge
June-18	5.9	+2	50% greater	2.46	0.00	2.39
July-18	9.9	+5.9	148% greater	9.85	0.00	6.14
Aug.-18	5.5	+2.2	66% greater	8.99	0.00	5.39
Sept.-18	10.5	+6.4	158% greater	5.70	0.00	6.16*
Oct.-18	3.2	-0.5	13% less	4.39	0.00	4.78*
Nov.-18	7.9	+4.3	117% greater	12.89	0.05	8.93
Dec.-18	6.7	+3.2	92% greater	8.85	0.22	4.87*
Jan.-19	3.6	+0.4	13% greater	5.74	0.18	7.60*
Feb.-19	3.5	+0.6	20% greater	3.13	0.33	6.88
March-19	5.2	+1.2	30% greater	6.81	0.21	6.92*
April-19	2.2	-1.4	39% less	4.74	0.06	6.31*
May-19	6.2	+1.7	37% greater	5.14	0.04	4.58*
June-19	3.4	-0.5	12% less	2.53	0.03	1.95

**Monthly Mean Discharge missing days from the total because of equipment malfunction or data removed during quality control*

It can be seen that the highest monthly mean discharges aligned with months that had greater than average rain departures, which is expected given that rainfall contributes to an increase in stage and discharge for the watershed in the form of runoff and groundwater recharge.

For Year 1 at FS-2, the outfall was typically dry unless there was a rain event that contributed surface runoff to the inlets of the outfall where FS-2 is located. For Year 2, an increase in continuous flow during non-rain events was observed for some of the monthly mean discharges. Since the culvert typically only receives flow during or after rain events, the increase is believed to be from elevated groundwater tables, which increased in elevation from the large number of rain events during the monitoring period, seeping into the outlet pipe through cracks or exposed joints in the pipe. MDOT SHA confirmed the increase in groundwater table elevations by reviewing the closest groundwater elevation gauges. From June 2018 to June 2019, *USGS 391445076555101 HO Cd 79* and *USGS 392045076512501 BA Ea 18* stations groundwater table increased 5.44 ft and 1.53 ft, respectively. The maximum increase from the USGS stations between that time range was 8.40 ft. It should be noted that while the culvert only received inflow from the highway inlets, the inlets along the highway receive water from the surrounding area.

Since the purpose of this study is to assess the impact that the proposed BMPs may have on the downstream monitoring reach, the peak water temperatures from FS-2 were analyzed and compared to FS-1 and FS-3's corresponding temperature values.

Table 13 below lists the peak temperatures on dates when water temperature at FS-2 exceeded 75° F and the corresponding peak temperatures at FS-1 and FS-3. In theory, if roadway runoff was affecting water temperatures within the downstream receiving channel, the water temperature measured at FS-3 would exceed that at FS-1 due to contributions of hot water from FS-2; however, this is not the case at the project site. While the water at FS-2 is significantly hotter than the water within the LPR, the volumes of water conveyed through FS-2 are small enough that they do not not appear to have an effect on LPR water temperature. In fact, the water temperature of the LPR at FS-3 is cooler than FS-1 by the time it reaches FS-3, despite additions of hot water from FS-2. The water may cool after it passes FS-1 and as it passes through the box culvert, which is located underground. Given these results, it may be difficult to detect improvements in water temperature of the LPR downstream after installation of the BMPs. Pre- and post-installation monitoring can, however, track the water temperature at FS-3 over time to determine if the frequency of days where temperatures exceed 75° F is reduced after the installation of the BMPs.

Table 13. Comparison of Peak Temperatures on dates when FS-2 exceeded 75° F

Date	Time	FS-1 Water Temperature (° F)	FS-2 Water Temperature (° F)	FS-3 Water Temperature (° F)
7/5/18	13:20	74.3	80.4	73.7
7/16/18	17:40	76.7	79.9	76.7
7/22/18	17:10	71.0	75.8	71.2
7/23/18	17:30	73.9	77.2	73.8
7/24/18	12:40	71.9	75.8	72.0
7/25/18	19:00	73.2	75.5	73.3
8/1/18	22:50	73.9	75.7	73.8
8/3/18	19:20	75.0	77.2	74.5
9/7/18	18:30	73.6	76.0	73.5

5.2 Physical Monitoring

Top of bank cross-sectional area and bankfull dimensions were calculated for CS-1 and CS-2. See Table 14 for a summary of the results. CS-1 saw an overall increase in bankfull and top of bank cross sectional area, 7.29% and 7.11% respectively. While showing an overall increase in bankfull and top of bank cross sectional area, the geometry fluctuated over the course of the monitoring period. After Storm 1, which had a 2-year return interval, CS-1 saw an increase in cross-sectional area. The riverbed slope and D50 also increased, as seen in the longitudinal profile summary (Table 15) and the bed material particle comparison (Table 16). This seems to have helped migrate material in the reach, which had a change of bed material at CS-2 from very coarse gravel to coarse gravel. The riverbed elevation at CS-2 remained relatively stable; however, most of the surveyed reach had a much lower bed elevation when compared to the Year 1 profile.

For Storm 2, which had less than a 1-year return interval, CS-1 saw a decrease in cross-sectional area. The riverbed slope also decreased, but the D50 remained stable. While this storm was significant, it did not have the same magnitude as Storm 1 and appears to have had no overall erosional effect on the reach, which instead seems to have aggregated and stabilized since the Storm 1 event. Deposition of material can be seen throughout the reach when comparing the Storm 1 and Storm 2 profiles. The D50 for CS-2 was slightly reduced.

For the Year 2 annual survey, an increase in cross-sectional area, riverbed slope, and D50 was observed at CS-1 compared to Year 2 Storm 2. A total of seven (7) significant storm events, with five (5) having larger than a 1-year return interval, occurred between Storm 2 and Year 2 annual survey. This had an erosional effect on the reach by steepening the channel and migrating riverbed material downstream. This was also shown in the profile, where the riverbed elevation decreased four (4) inches at the start of the riffle directly upstream of CS-1. The stream seems to continue to move towards stabilizing itself after each large event, but these large peak flows are causing the stream to degrade overtime, reducing access to the floodplain.

This will cause the channel to evolve through several shifts in morphology until it is able to achieve a quasi-stable form.

CS-2 saw an overall increase in top of bank and bankfull cross-sectional area and an increase in overall bank height as the streambed elevation decreased. This was a steady increase throughout the monitoring period. While there is a large increase in cross-sectional area between Year 2 Storm 2 and Year 2 annual, as noted above, there have been several significant storms during the months between surveys. CS-2 experienced degradation for the Year 2 Storm 2, while CS-1 encountered aggradation. Comparing the two surveys, the increase is from an approximate 0.1 ft elevation decrease at the riverbed and undercutting that occurred on the right bank.

The monitoring plan states that the channel is considered stable if the boundary shear stress is 20% greater than the critical shear stress. Table 17 below summarizes this information. The boundary shear stress calculated using the methods discussed in Section 3.2.2 is at least 35% greater than the critical shear stress, indicating that particles become mobile more frequently, indicating channel instability. These results, combined with the stream geomorphology results, suggest that monitoring reach will continue to degrade.

Table 14. Cross Section comparison

		Bankfull					Top of Bank Area (ft^2)*
		Cross Sectional Area (ft^2)	**Width (ft)**	**Mean Depth (ft)**	**Max Depth (ft)**	**Width/Depth Ratio**	
CS-1	Baseline (6/14/18)	21.98	15.27	1.44	1.86	10.61	36.22
	Storm 1 (7/26/18)	22.66	15.67	1.45	2.00	10.84	37.68
	% Change from Baseline	3.09%	2.63%	0.45%	7.36%	2.17%	4.01%
	Storm 2 (9/11/18)	21.74	15.09	1.44	1.77	10.47	35.94
	% Change from Baseline	-1.07%	-1.20%	0.13%	-4.98%	-1.32%	-0.78%
	Year 2 Annual (6/20/19)	23.58	15.81	1.49	1.87	10.60	38.80
	% Change from Baseline	7.29%	3.52%	3.64%	0.38%	-0.12%	7.11%
CS-2	Baseline (6/14/18)	18.06	13.43	1.34	1.80	9.99	36.73
	Storm 1 (7/26/18)	18.53	13.32	1.39	1.88	9.57	37.09
	% Change from Baseline	2.56%	-0.85%	3.44%	4.36%	-4.15%	0.99%
	Storm 2 (9/11/18)	19.43	13.21	1.47	1.94	8.98	38.22
	% Change from Baseline	7.57%	-1.65%	9.37%	8.15%	-10.08%	4.06%
	Year 2 Annual (6/20/19)	22.00	14.39	1.53	1.99	9.42	41.63
	% Change from Baseline	21.78%	7.16%	13.64%	10.65%	-5.70%	13.34%

*Top of bank area calculated from an established fixed elevation unrelated to bankfull

Table 15. Baseline Riverbed and Water Surface Elevation Slopes for the Monitoring Reach

	Riverbed Slope	**Water Surface Slope**
Year 1 Baseline	1.18%	1.20%
Storm 1	1.27%	0.93%
Storm 2	0.84%	1.05%
Year 2 Annual	1.06%	1.23%

Table 16. Bed Material Particle Size Comparison (mm)

Site		**D50**	**Size Class**	**D84**	**Size Class**
CS-1	Baseline (6/14/18)	22	Coarse gravel	58	Very coarse gravel
	Storm 1 (7/26/18)	35	Very coarse gravel	82	Small cobble
	Storm 2 (9/11/18)	35	Very coarse gravel	78	Small cobble
	Year 2 Annual (6/20/19)	24	Coarse gravel	75	Small cobble
CS-2	Baseline (6/14/18)	33	Very coarse gravel	76	Small cobble
	Storm 1 (7/26/18)	29	Coarse gravel	85	Small cobble
	Storm 2 (9/11/18)	26	Coarse gravel	75	Small cobble
	Year 2 Annual (6/20/19)	38	Very coarse gravel	79	Small cobble

Table 17. Percent Boundary Shear Stress Greater Than Critical Shear Stress

	Cross Section 1	**Cross Section 2**	**Overall Monitoring Reach**
Year 1 Baseline	71%	53%	62%
Storm 1	58%	62%	60%
Storm 2	35%	47%	38%
Year 2 Annual	66%	44%	55%

In addition to shear stress calculation, the Wolman pebble-count results were used to determine the channel roughness factor. As mentioned in the FS-1 results section, the roughness factor *n* is used to convey characteristics about the wetted portion (bottom and sides) of the channel. See Table 18 for the results of this calculation for Cross Section 1, Cross Section 2, and the overall monitoring reach. Ultimately, the average of the overall reach results (0.037) was used for Flow Station 1 roughness coefficient because this is assumed to represent the typical conditions of the LPR. See Appendix F for the calculations of channel roughness.

Table 18. Channel roughness results

	Cross Section 1	**Cross Section 2**	**Overall Monitoring Reach**
Baseline Channel Roughness (n)	0.034	0.038	0.036
Storm 1 Channel Roughness (n)	0.038	0.039	0.039
Storm 2 Channel Roughness (n)	0.038	0.038	0.037
Year 2 Annual Channel Roughness (n)	0.037	0.038	0.037

5.3 Riparian Observations

Since the riparian zone is affected by channel conditions, it is important to observe changes in the riparian zone over time. The riparian zone is forested with dense ground cover by herbaceous plants. Despite being densely vegetated, the riverbanks are eroding from the high energy within the stream channel. This is demonstrated by the exposed roots along the channel banks (Figure 23 through Figure 26).

Figure 23. Vegetated top of banks with exposed roots along monitoring reach on July 26, 2018

Figure 24. Exposed roots on left bank at Cross Section 1 on December 5, 2018

Figure 25. Exposed roots on left bank at Cross Section 1 on June 20, 2019

Figure 26. Vegetated top of banks with exposed roots along Cross Section 2 reach on June 20, 2019

5.4 Anomalies and Lessons Learned

Monthly data download field protocols were adjusted during the monitoring period to correct equipment malfunctions that occurred. One adjusted protocol was made for Flow Station 3. During a monthly visit to the site on December 3, 2018, the area-velocity meter was downloaded but somewhere during the process was reset to idle mode. This caused a month-long gap in the data for the flow station. To reduce the chances of this in the future, MDOT SHA finishes downloading the data and then waits for another data point to be shown on the area-velocity meter real-time flow display. This ensures that the equipment is still logging once the data has been downloaded. Another issue at this station was caused by power failures. A marine battery was deployed at the site as a long-term power source for the area-velocity meter. After the first power failure, the voltage when the area-velocity meter died, 8.22 V, was used as a guide to alert MDOT SHA when the battery will likely need to be replaced. The voltage of the battery was noted during monthly site visits so that when the voltage got near 9 V, the battery would be replaced. However, on March 21, 2018 another power failure occurred at 10.86 V. This became the new minimum voltage requirement. The battery was exchanged for a charged battery on April 16, 2019 but failed shortly after the site visit. MDOT SHA believes this was due to a faulty battery. The faulty battery was disposed of and replaced with a new one. To reduce the likelihood of this in the future, MDOT SHA uses a multimeter to check battery voltages while being recharged in the office for signs of reduced resiliency.

An issue arose during barometric compensation of Flow Station 1 water depth in Year 2 monitoring. Field measurements were not being reflected accurately when estimating sensor depth from the pressure recorded in the depth logger. HOBO technical support was contacted to help determine the cause. It was concluded that it may have occurred from a clogged sensor in the depth logger from sediment, or possibly the distance of the barometer from Flow Station 1. HOBO recommended another barometer be installed closer to the site and using a reference water level each month will increase accuracy. An additional barometer was installed adjacent to the box culvert at Flow Station 1 and a new method of barometric compensation using the recorded field measurements was used for Flow Station 1 and 2.

Year 2 of the monitoring period saw a significant amount of rain throughout the year. The 30-year average annual rainfall for the project is 44.57 inches (NACSE, 2018). Howard County experienced an average of 73.7 inches during Year 2 of the monitoring period (National Weather Service, 2019). This could potentially make comparisons of future monitoring periods difficult. Future comparisons may be difficult because the abnormal frequency and magnitude of the storm events from Year 2 may not be comparable to the future monitoring periods (post-construction period) storm events and the LPR's geomorphological response. These weather factors are beyond what can be controlled by the monitoring project.

A limitation of the area-velocity meter (AVM) at FS-3 was discovered during the analysis of Year 2 data. The limitation is that the AVM will underestimate discharge when it exceeds the top-of-bank elevation and the flow becomes dispersed on the floodplain. To account for this during Year 3 monitoring, MDOT SHA is recommending that the cross section at the AVM be re-surveyed and extended to the limits of the floodplain. This will provide the AVM with a more accurate cross-sectional area needed to estimate discharges outside of the channel boundaries. MDOT SHA is also coordinating with Sontek to ascertain what manipulation of the previously collected data the AVM software can perform to help characterize ultimate pre-construction conditions.

5.5 Key Project Questions

The primary goal of the monitoring study is to answer several questions pertaining to ESD controls and stream channel response. The questions are as follows:

1. Will the peak discharge coming from controlled catchments be reduced once controls have been implemented?
2. Will there be geomorphological response to the LPR once controls are in place?
3. What are the thresholds for stream stability, and do the catchment controls improve stream stability through peak discharge attenuation?
4. Can a partnership with Howard County on a larger watershed monitoring plan increase the opportunity to observe a difference in discharge and channel stability?

The project is currently in its second year of monitoring, and the data collected has been used to establish a baseline for the LPR stream characteristics. Since the proposed ESD controls have not been installed, these questions cannot currently be answered or analyzed. MDOT SHA will continue to monitor the physical characteristics of the LPR and record the data necessary to discuss these questions at a later stage of the project.

6 Conclusion

Years 1 and 2 of pre-construction monitoring included data collected from June 12, 2018 to June 30, 2019. The data were analyzed to characterize baseline conditions of the project site and to form a basis upon which to answer the questions from the monitoring plan and to provide insight into the effectiveness of stormwater management practices for stream channel protection.

Continuous flow data were collected at the three flow stations during this period to characterize baseline hydrology of the monitoring reach prior to the installation of upstream BMPs. An analysis of discharge, flow volume, and temperature over the total monitoring period and during peak events revealed that runoff from the target catchment areas, as measured by Flow Station 2, has a negligible effect on the downstream receiving channel, as measured by Flow Station 3. In its baseline condition, the site appears to be minimally impacted by roadway runoff. Continued monitoring of the site throughpost-construction of roadway expansions and installation of associated BMPs will allow an assessment of how effectively the BMPs offset impacts from the roadway expansions.

Physical monitoring was performed periodically throughout the monitoring period to characterize baseline geomorphology of the monitoring reach. Four surveys were performed during this period. The Year 1 baseline survey occurred on June 14, 2018. Two surveys were performed on July 26, 2018 and September 11, 2018 after significant rain events with the potential to alter geomorphology. The Year 2 annual survey occurred on June 20, 2019. Overall the monitoring reach appears to be degrading over time, becoming further incised. However, the rate of channel degradation observed may be skewed by the excessive rainfall, and subsequent runoff, experienced throughout 2018. MDOT SHA will continue to monitor stream response to significant storm events and to the installation of the BMPs.

7 References

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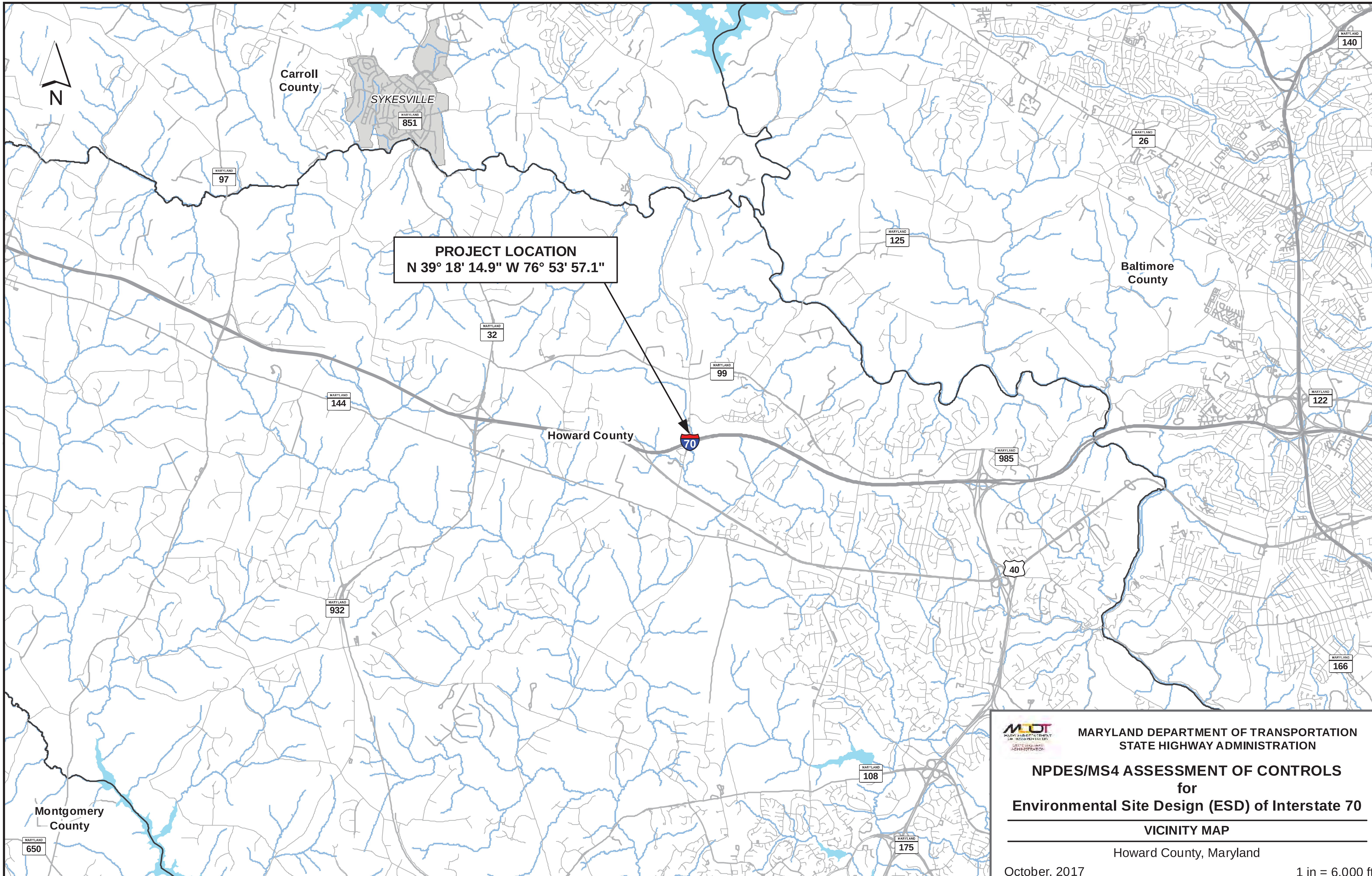
Appendix A

Little Patuxent River Project Mapping



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

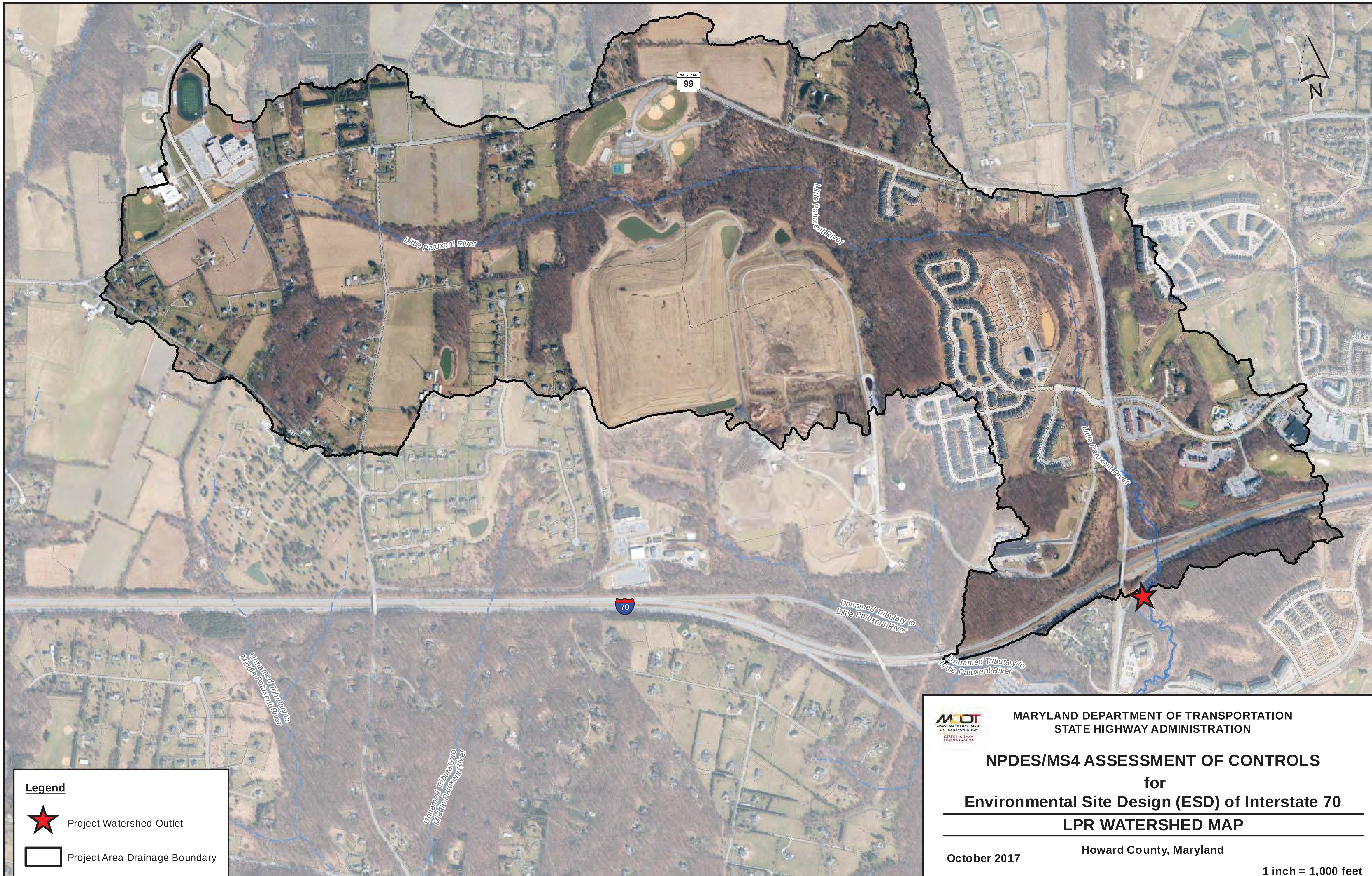
NPDES/MS4 ASSESSMENT OF CONTROLS
for
Environmental Site Design (ESD) of Interstate 70

VICINITY MAP

Howard County, Maryland

October, 2017

1 in = 6,000 ft



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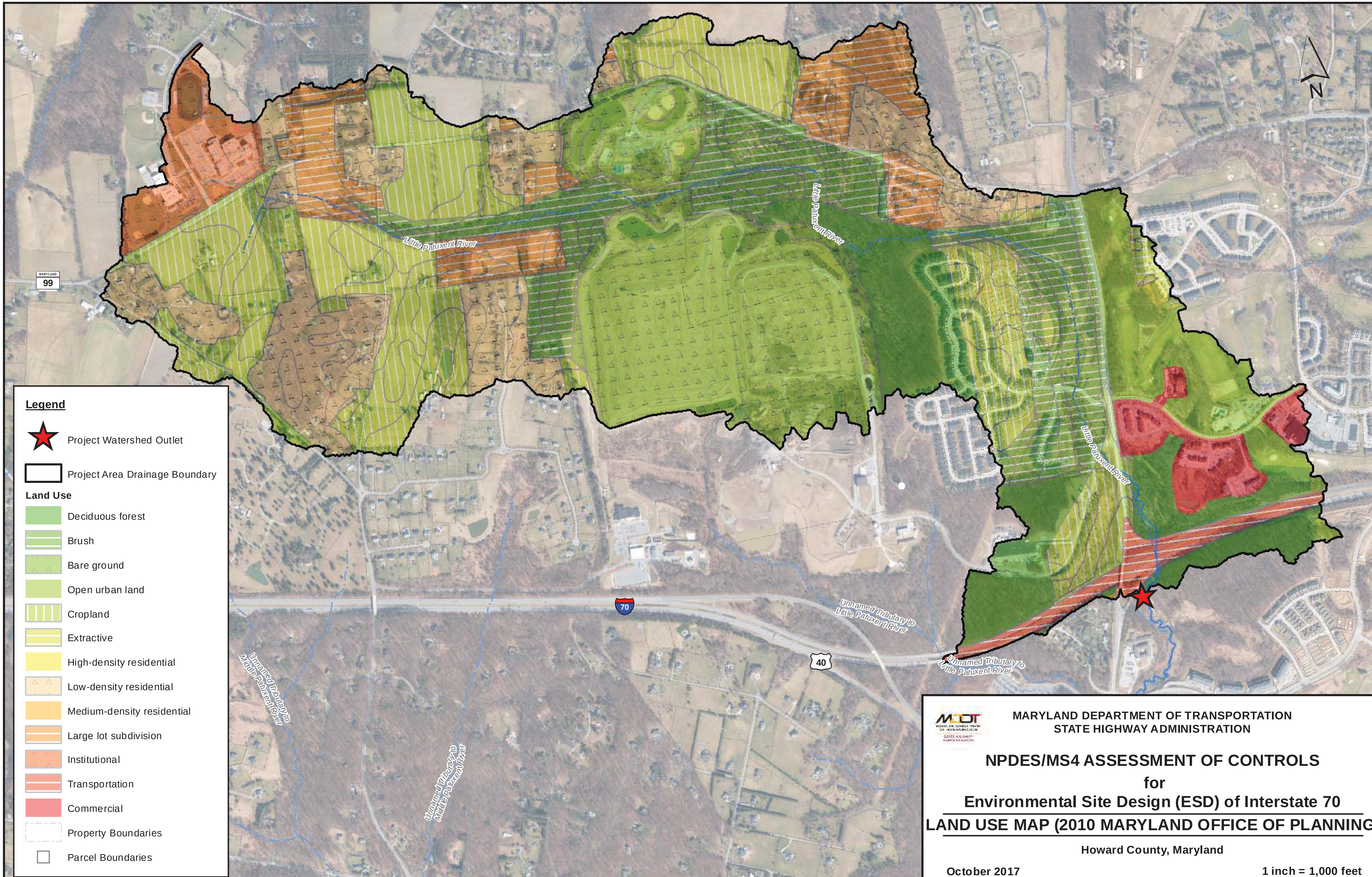
LPR WATERSHED MAP

Howard County, Maryland

October 2017

1 inch = 1,000 feet



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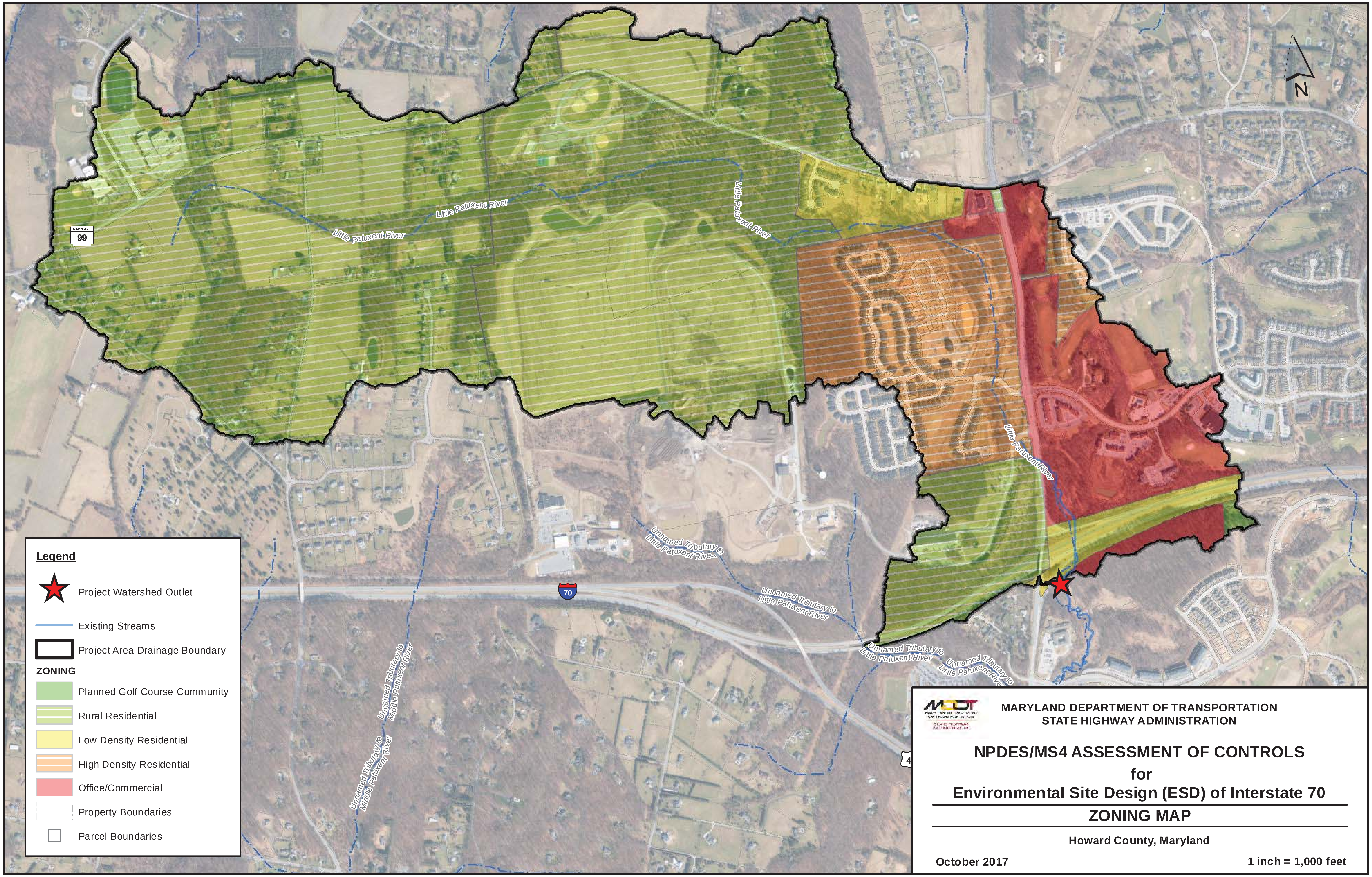
STATE HIGHWAY ADMINISTRATION

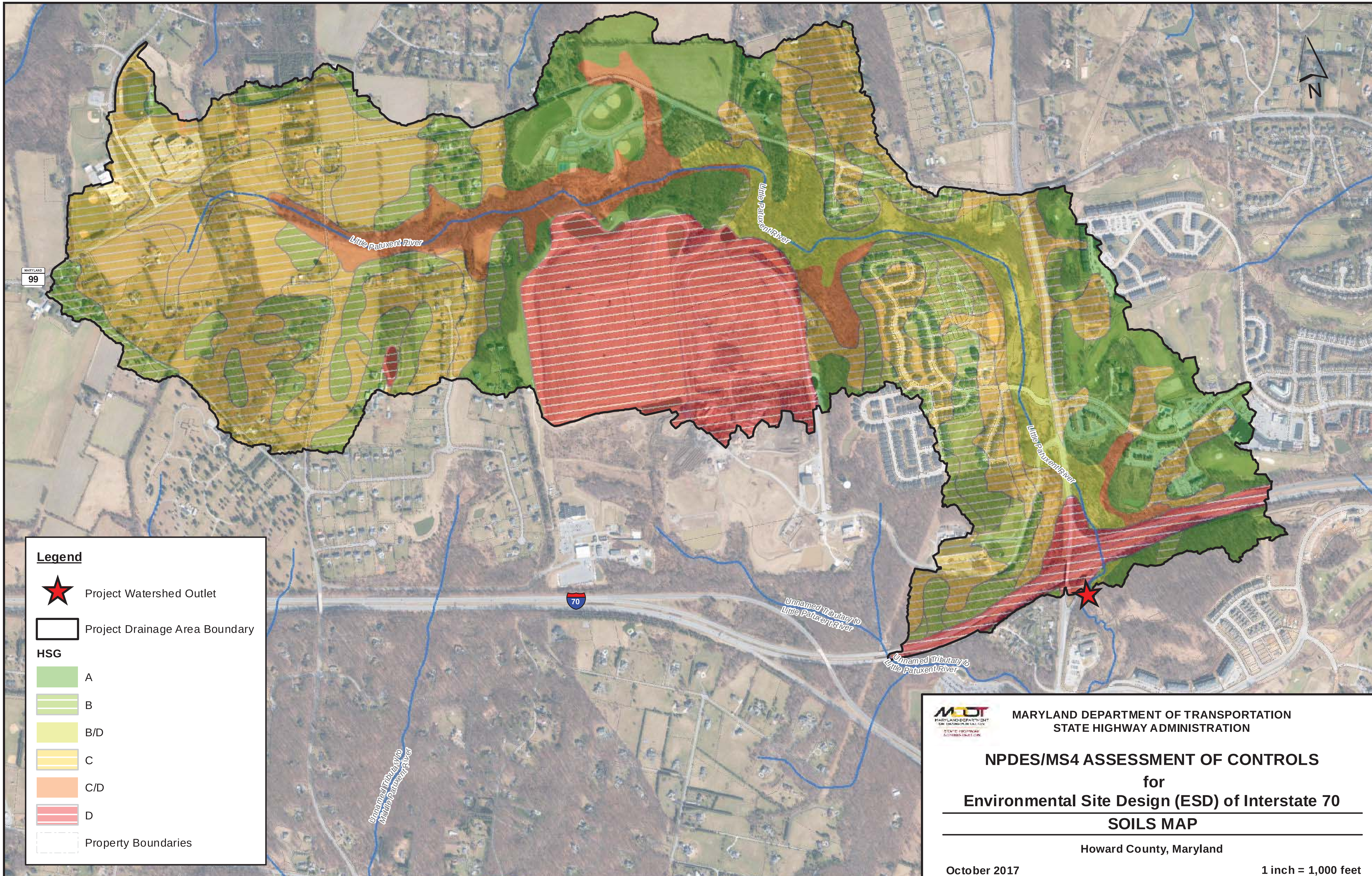
NPDES/MS4 ASSESSMENT OF CONTROLS
for
Environmental Site Design (ESD) of Interstate 70

LAND USE MAP (2010 MARYLAND OFFICE OF PLANNING)

Howard County, Maryland

October 2017 | 1 inch = 1,000 feet


N
Little Patuxent River
Little Patuxent River
Little Patuxent River
Little Patuxent River
Unnamed Tributary to Little Patuxent River
Unnamed Tributary to Little Patuxent River
Unnamed Tributary to Little Patuxent River
Unnamed Tributary to Little Patuxent River
Unnamed Tributary to Middle Patuxent River
Unnamed Tributary to Middle Patuxent River
MARYLAND 99
70
Legend
Project Watershed Outlet
Existing Streams
Project Area Drainage Boundary
ZONING
Planned Golf Course Community
Rural Residential
Low Density Residential
High Density Residential
Office/Commercial
Property Boundaries
Parcel Boundaries
MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
NPDES/MS4 ASSESSMENT OF CONTROLS
for
Environmental Site Design (ESD) of Interstate 70
ZONING MAP
Howard County, Maryland
October 2017
1 inch = 1,000 feet



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

NPDES/MS4 ASSESSMENT OF CONTROLS
for
Environmental Site Design (ESD) of Interstate 70

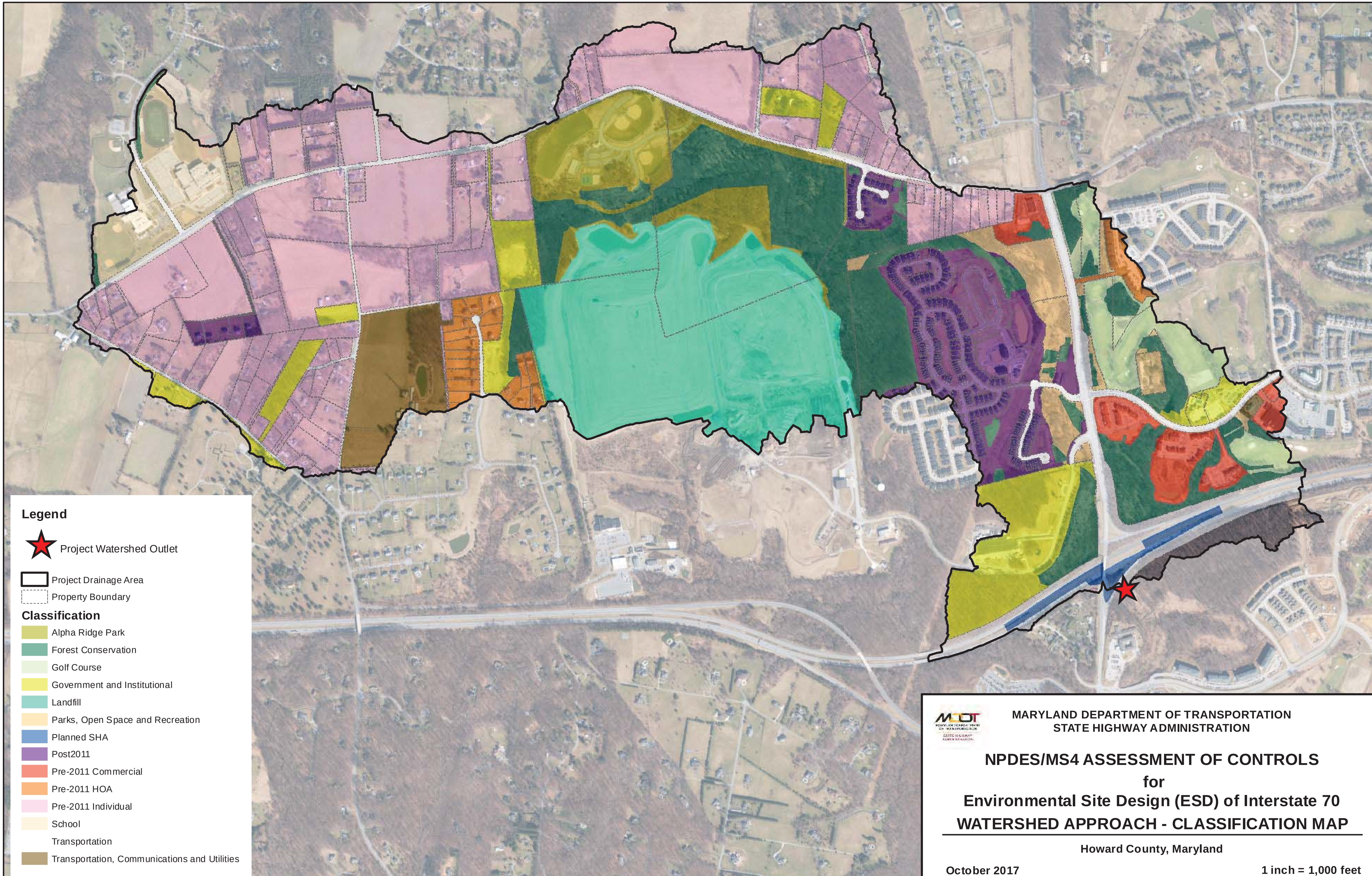
SOILS MAP

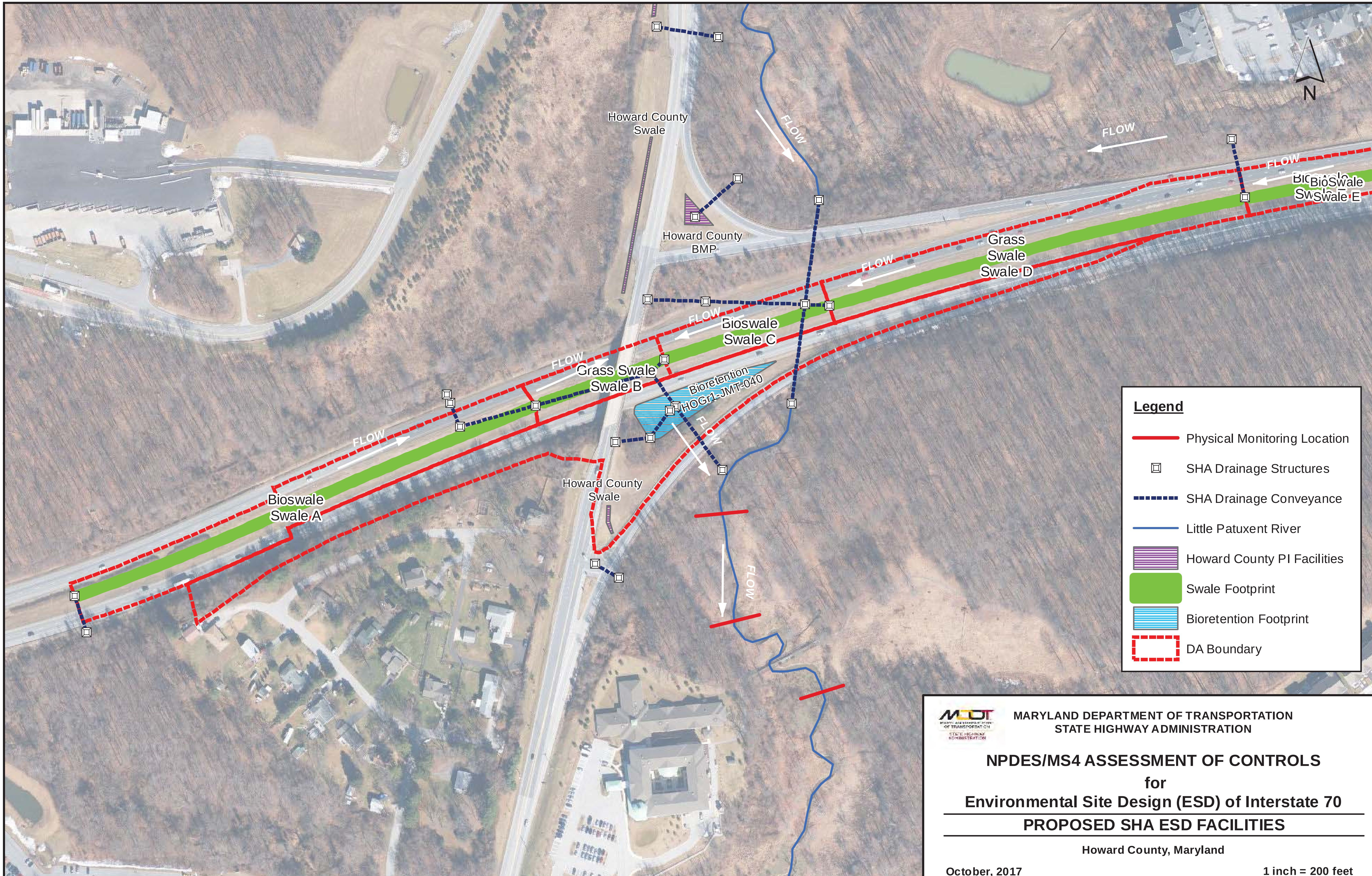
Howard County, Maryland

October 2017

1 inch = 1,000 feet

N
70
40
Legend
Project Watershed Outlet
Existing Grass Swales
SHA Tree Plantings
Active Maintenance Contract
Project Drainage Area Boundary
SHA
State Highway
Maryland Department of Transportation
MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
NPDES / MS4 ASSESSMENT OF CONTROLS
for
Environmental Site Design (ESD) of Interstate 70
SHA TMDL EFFORTS
Howard County, Maryland
August 31, 2016
1 inch = 650 feet


Legend
Project Watershed Outlet
Project Drainage Area
Property Boundary
Classification
Alpha Ridge Park
Forest Conservation
Golf Course
Government and Institutional
Landfill
Parks, Open Space and Recreation
Planned SHA
Post2011
Pre-2011 Commercial
Pre-2011 HOA
Pre-2011 Individual
School
Transportation
Transportation, Communications and Utilities
MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
NPDES/MS4 ASSESSMENT OF CONTROLS
for
Environmental Site Design (ESD) of Interstate 70
WATERSHED APPROACH - CLASSIFICATION MAP
Howard County, Maryland
October 2017
1 inch = 1,000 feet



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

NPDES/MS4 ASSESSMENT OF CONTROLS
for
Environmental Site Design (ESD) of Interstate 70

PROPOSED SHA ESD FACILITIES

Howard County, Maryland

October, 2017 | 1 inch = 200 feet

Appendix B

Photo Log

Photograph 1. 7/18/2018: Downstream of Flow Station 1, looking upstream. Monthly download.

Photograph 2. 7/18/2018: Upstream of Flow Station 1, looking downstream. Monthly download.

Photograph 3. 7/18/2018: Flow Station 2, monthly download.

Photograph 4. 7/18/2018: Flow Station 3, monthly download.

Photograph 5. 7/26/2018: Longitudinal profile for Year 2 Storm 1, looking downstream from right bank

Photograph 6. 7/26/2018: Upstream extent of longitudinal profile for Year 2 Storm 1

Photograph 7. 7/26/2018: Longitudinal profile for Year 2 Storm 1, looking upstream from right bank

Photograph 8. 7/26/2018: Downstream extent of longitudinal profile for Year 2 Storm 1

Photograph 9. 7/26/2018: Longitudinal profile for Year 2 Storm 1, at Cross Section 2

Photograph 10. 7/26/2018: Longitudinal profile for Year 2 Storm 1, slightly downstream of Cross Section 1

Photograph 11. 7/26/2018: Longitudinal profile for Year 2 Storm 1, looking downstream to Cross Section 2

Photograph 12. 7/26/2018: Longitudinal profile for Year 2 Storm 1, looking upstream to Cross Section 1

Photograph 13. 7/26/2018: Longitudinal profile for Year 2 Storm 1, looking downstream from Cross Section 2

Photograph 14. 7/26/2018: Longitudinal profile for Year 2 Storm 1, looking upstream from Cross Section 2

Photograph 15. 7/26/2018: Downstream extent of longitudinal profile for Year 2 Storm 1

Photograph 16. 8/29/2018: Flow Station 1, monthly download

Photograph 17. 8/29/2018: Sediment being cleaned out of Flow Station 1 housing

Photograph 18. 8/29/2018: Sediment being cleaned out of Flow Station 1 housing

Photograph 19. 8/29/2018: Flow Station 1 reset after maintenance

Photograph 20. 8/29/2018: Flow Station 1 reset after maintenance

Photograph 21. 8/29/2018: Flow Station 2, monthly download. Before maintenance.

Photograph 22. 8/29/2018: Flow Station 3, monthly download. Flow display before download

Photograph 23. 8/29/2018: Flow Station 3, monthly download. Area-velocity meter

Photograph 24. 8/29/2018: Barometer and rain gauge location, monthly download. Before maintenance.

Photograph 25. 8/29/2018: Barometer and rain gauge location, monthly download. After maintenance.

Photograph 26. 9/11/2018: Longitudinal profile for Year 2 Storm 2. Looking downstream to Cross Section 1

Photograph 27. 9/11/2018: Longitudinal profile for Year 2 Storm 2. Looking downstream to Cross Section 1

Photograph 28. 9/11/2018: Longitudinal profile for Year 2 Storm 2. Looking downstream from Cross Section 1

Photograph 29. 9/11/2018: Longitudinal profile for Year 2 Storm 2. Looking downstream to Cross Section 2

Photograph 30. 9/11/2018: Longitudinal profile for Year 2 Storm 2. Looking upstream to Cross Section 1

Photograph 31. 9/11/2018: Longitudinal profile for Year 2 Storm 2. Downstream extent of profile

Photograph 32. 9/11/2018: Cross Section 1 Survey for Year 2 Storm 2, looking at left bank (LB)

Photograph 33. 9/11/2018: Cross Section 1 Survey for Year 2 Storm 2, looking to right bank (RB)

Photograph 34. 9/11/2018: Cross Section 1 Survey for Year 2 Storm 2, RB

Photograph 35. 9/11/2018: Cross Section 1 Survey for Year 2 Storm 2, looking at LB

Photograph 36. 9/11/2018: Cross Section 1 Survey for Year 2 Storm 2, looking downstream

Photograph 37. 9/11/2018: Cross Section 1 Survey for Year 2 Storm 2, looking to RB

Photograph 38. 9/11/2018: Cross Section 1 Survey for Year 2 Storm 2, looking upstream

Photograph 39. 9/11/2018: Cross Section 2 Survey for Year 2 Storm 2, looking to LB

Photograph 40. 9/11/2018: Cross Section 2 Survey for Year 2 Storm 2, looking to LB

Photograph 41. 9/11/2018: Cross Section 2 Survey for Year 2 Storm 2, looking downstream

Photograph 42. 9/11/2018: Cross Section 2 Survey for Year 2 Storm 2, looking to RB

Photograph 43. 9/11/2018: Cross Section 2 Survey for Year 2 Storm 2, looking upstream

Photograph 44. 9/11/2018: Data download at Flow Station 3

Photograph 45. 9/11/2018: Barometer and rain gauge, data download

Photograph 46. 9/11/2018: Flow Station 1, before maintenance

Photograph 47. 9/11/2018: Flow Station 1, after maintenance

Photograph 48. 10/08/2018: Flow Station 3, monthly download. Before maintenance

Photograph 49. 10/08/2018: Flow Station 3, monthly download. Before maintenance

Photograph 50. 10/08/2018: Flow Station 3, monthly download. Before maintenance

Photograph 51. 10/08/2018: Flow Station 2, monthly download. Before maintenance

Photograph 52. 10/08/2018: Barometer and rain gauge, monthly download. Before maintenance

Photograph 53. 10/08/2018: Flow Station 1, monthly download. Before maintenance

Photograph 54. 11/01/2018: Barometer, monthly download

Photograph 55. 11/01/2018: Flow Station 1 with collected debris, monthly download before maintenance

Photograph 56. 11/01/2018: Flow Station 2, monthly download before maintenance

Photograph 57. 11/01/2018: Flow Station 3 with collected debris, monthly download before maintenance

Photograph 58. 11/01/2018: Rain gauge with collected debris, monthly download before maintenance

Photograph 59. 12/05/2018: Flow Station 2 with collected debris, monthly download before maintenance

Photograph 60. 12/05/2018: Barometer, monthly download before maintenance

Photograph 61. 12/05/2018: Rain gauge with collected debris, monthly download before maintenance

Photograph 62. 12/05/2018: Rain gauge tipper with collected ice, monthly download before maintenance

Photograph 63. 12/05/2018: Flow Station 3 with collected debris, monthly download before maintenance

Photograph 64. 12/05/2018: Exposed roots along monitoring reach

Photograph 65. 12/05/2018: Flow Station 1 with collected debris, monthly download before maintenance

Photograph 66. 12/05/2018: Debris jam at box culvert for Flow Station 1

Photograph 67. 12/05/2018: Debris jam at box culvert for Flow Station 1

Photograph 68. 12/14/2018: After clearing of debris jam at box culvert for Flow Station 1

Photograph 69. 03/15/2019: Flow Station 2 before and after monthly maintenance

Photograph 70. 03/15/2019: Flow Station 3 before and after monthly maintenance

Photograph 71. 04/16/2019: Flow Station 1 before monthly maintenance

Photograph 72. 04/16/2019: Flow Station 2 before monthly maintenance

Photograph 73. 04/16/2019: Flow Station 3 before monthly maintenance – connection cord pulled downstream by leaf litter (left) and velocity meter completely covered in debris (right)

Photograph 74. 05/10/19: Monthly download - rain gauge and downstream barometer

Photograph 75. 05/10/19: Monthly download - Flow Station 1

Photograph 76. 05/10/19: Monthly download - Flow Station 2

Photograph 77. Monthly download - Flow Station 3

Photograph 78. 06/20/19: Year 2 Baseline Physical Monitoring Survey – Longitudinal Profile, facing upstream from Station 0

Photograph 79. 06/20/19: Year 2 Baseline Physical Monitoring Survey – Longitudinal Profile, facing right bank at Station 0

Photograph 80. 06/20/19: Year 2 Baseline Physical Monitoring Survey – Longitudinal Profile, facing left bank at Station 0

Photograph 81. 06/20/19: Year 2 Baseline Physical Monitoring Survey – Longitudinal Profile, facing upstream from Station 70

Photograph 82. 06/20/19: Year 2 Baseline Physical Monitoring Survey – Longitudinal Profile, facing downstream from Station 70

Photograph 83. 06/20/19: Year 2 Baseline Physical Monitoring Survey – Longitudinal Profile, facing upstream from Station 162

Photograph 84. 06/20/19: Year 2 Baseline Physical Monitoring Survey – Longitudinal Profile, facing downstream from Station 162

Photograph 85. 06/20/19: Year 2 Baseline Physical Monitoring Survey – Cross Section 1, facing upstream

Photograph 86. 06/20/19: Year 2 Baseline Physical Monitoring Survey – Cross Section 1, facing downstream

Photograph 87. 06/20/19: Year 2 Baseline Physical Monitoring Survey – Cross Section 1, facing left bank

Photograph 88. 06/20/19: Year 2 Baseline Physical Monitoring Survey – Cross Section 1, facing right bank

Photograph 89. 06/20/19: Year 2 Baseline Physical Monitoring Survey – Cross Section 2, facing upstream

Photograph 90. 06/20/19: Year 2 Baseline Physical Monitoring Survey – Cross Section 2, facing downstream

Photograph 91. 06/20/19: Year 2 Baseline Physical Monitoring Survey – Cross Section 2, facing left bank

Photograph 92. 06/20/19: Year 2 Baseline Physical Monitoring Survey – Cross Section 2, facing right bank

Photograph 93. 07/01/19: Year 2 Monthly Download and Maintenance – Flow Station 1

Photograph 94. 07/01/19: Year 2 Monthly Download and Maintenance – Flow Station 2

Photograph 95. 07/01/19: Year 2 Monthly Download and Maintenance – Flow Station 3

Appendix C

Geomorphic Data

Year 2 - Storm 1

Physical Monitoring

07/26/18

MARYLAND STREAM STUDY
LONGITUDINAL PROFILE

STREAM:								DATE: 7/26/16			CREW: JB / MD			
USGS #			ALL MEASUREMENTS IN FEET UNLESS OTHERWISE NOTED.											
FWS #			REFERENCE POINT ELEVATION AND DESCRIPTION:											

Identifier	Backsight	Height of Instrument	Station	Bed Surface Foresight	Bed Surface Elevation	Water Surface Foresight	Water Surface Elevation	Bankfull Foresight	Bankfull Elevation	Top of Bank Foresight	Top of Bank Elevation	Other Foresight	Other Elevation	
		100in	—											
pool			0	9.37		8.54								
run			6	9.52		8.55								
run			13	9.395		8.52								
run			21	9.21		8.50								
run			27	9.27		8.45								
run			34	9.42		8.41								
run			41	9.48		8.44								
run			48	9.47		8.42								
riffle			55.5	9.31		8.39								
riffle			57.5	9.005		8.34								
riffle (CS2)			60	9.09		8.38								(XS 2)
riffle			64	9.05		8.31								
glide			72	9.14		8.26								
glide ~~glide pool~~			80	9.24		8.225								
~~glide~~ pool			87	9.495		8.20								
pool			94	9.47		8.23								
run			97	9.53		8.21								
riffle			104	8.93		8.24								
riffle			108	8.71		8.11								
riffle			112	8.29		7.94								
riffle			116	8.405		7.84								(XS 1)
glide			127	8.66		7.75								
pool			136.8	9.075		7.69								
pool			145.7	9.02		7.68								
glide			~~153~~ 160	8.69		7.61								
pool			174	9.72		7.62								
pool			189	9.31		7.60								
pool			210	9.65		7.58								
LBMON	XS 1			5.38										
RBMON														

MARYLAND STREAM STUDY

CROSS SECTION us XS

STREAM	DATE 7/26/13 10:50
USGS #	CREW JB/AD
FWS #	

Begin on left, facing downstream (all measurements are in feet unless otherwise noted)

NOTE	DIST.	ELEV. / DEPTH	NOTE	DIST.	ELEV. / DEPTH
LP@grnd@LB	0.0	5.86			
LP	0.0	5.70			
LB MON	.7	5.8			
	1.0	5.97			
	3.0	6.02			
	5.0	6.18			
TOB LB	7.5	6.33			
EW	10.0	8.27			
AC	11.0	8.90	WS	11.0	8.37
AC	12.0	8.97	WS	12.0	8.45
AC	14.0	8.65	WS	14.0	8.44
AC	15.0	8.81	WS	15.0	8.43
AC	17.0	8.77	WS	17.0	8.45
AC	19.0	8.89	WS	19.0	8.39
AC	21.0	8.93	WS	21.0	8.40
EW	23.0	8.47			
	24.0	7.34			
TOB RB	25.5	6.86			
	26.0	6.88			
	28.0	6.57			
	30.0	5.95			
	32.0	5.69			
	33.5	5.60			
RB MON	35.0	5.62			
RP	36.2	5.57			
RP@grnd@RB	36.2	5.73			

STATION OR DISTANCE FROM GAGE	
DIRECTION FROM GAGE	

NOTATIONS

NOTE	ABBREV
Left	L
Right	R
Pin	P
Edge of Water	EW
Water Surface	WS
Active Channel	AC
Scour Line	SL
Bankfull	BF
Top of Bank	TOB
Monument	MON
HI	66.25"

ENTRENCHMENT

FLOODPRONE WIDTH	
BANKFULL WIDTH	
ENTRENCHMENT	

GPS Coordinates

Left Monument	
Latitude	
Longitude	
Error	
Right Monument	
Latitude	
Longitude	
Error	
Instrument (Prop.#)	

MARYLAND STREAM STUDY

CROSS SECTION

STREAM	DATE 7/26/16 11:30
USGS #	CREW JB/MD
FWS #	

Begin on left, facing downstream (all measurements are in feet unless otherwise noted)

NOTE	DIST.	ELEV. / DEPTH	NOTE	DIST.	ELEV. / DEPTH
LP grnd @ LB	0	~~5.46~~	5.47		
LP	0	5.33			
LB MON	0.7	5.48			
	1.4	5.42			
	3.0	5.46			
	5.0	5.41			
TOB LB	7.0	5.47			
	8.0	5.90			
BAR	9.7	7.48			
Scr	11.9	7.99			
EW	12.6	8.17	WS	12.6	0
~~AC~~	~~13.0~~				
AC	14.0	8.55	WS	14.0	8.22
AC	15.0	8.56	WS	15.0	8.20
AC	16.4	8.67	WS	16.4	8.15
AC	17.7	8.80	WS	17.7	8.18
AC, Thlwg	19.0	8.86	WS	19.0	8.03
	~~20.7~~				
AC, Thlwg	20.8	8.98	WS	20.8	9.11
EW	21.8	8.64	WS	21.8	8.11
TOB RB	22.4	6.46			
	23.5	6.24			
	25.0	5.80			
	27.0	5.54			
	29.0	5.62			
RB MON	30.3	5.66			
RP	31.3	5.52			
Grd RP	31.3	5.70			

STATION OR DISTANCE FROM GAGE

DIRECTION FROM GAGE

NOTATIONS

NOTE	ABBREV
Left	L
Right	R
Pin	P
Edge of Water	EW
Water Surface	WS
Active Channel	AC
Scour Line	SL
Bankfull	BF
Top of Bank	TOB
Monument	MON
HI	66.25"

ENTRENCHMENT

FLOODPRONE WIDTH

BANKFULL WIDTH

ENTRENCHMENT

GPS Coordinates

Left Monument

Latitude

Longitude

Error

Right Monument

Latitude

Longitude

Error

Instrument (Prop.#)

MARYLAND STREAM STUDY XS #1
REACH AVERAGE PEBBLE COUNT

STREAM		DATE	7/26/18
USGS #		CREW	JB + MD
FWS #			

PARTICLE TALLY COUNTS BY TRANSECT

FEET	PARTICLE	MILLIMETERS		1	2	3	4	5	6	7	8	9	10	TOT#	ITEM%	%CUM
	Silt/Clay	< .062	S/C	||||												
	Very Fine	.062 - .125	S	|												
	Fine	.125 - .25	A	|												
	Medium	.25 - .50	N													
	Coarse	.50 - 1.0	D													
	Vry Coarse	1.0 - 2	S	|||												
	Very Fine	2 - 4		||||												
	Fine	4 - 6	G	||												
	Fine	6 - 8	R	|												
	Medium	8 - 12	A	|||||												
	Medium	12 - 16	V	|||||||												
	Coarse	16 - 24	E	|||||||||	||||||											
	Coarse	24 - 32	L	||||||												
	Vry Coarse	32 - 48	S	||||||||	|||||||||	||										
	Vry Coarse	48 - 64		||||||||	|||											
0.21-0.31	Small	64 - 96	C	|||||||||||	|||||||||	|										
0.31-0.42	Small	96 - 128	O	||||||												
0.42-0.63	Large	128 - 192	B	|||												
0.63-0.84	Large	192 - 256	L													
0.84-1.26	Small	256 - 384	B	|												
1.26-1.68	Small	384 - 512	L													
1.68-3.36	Medium	512 - 1024	D													
3.36-6.72	Lrg	1024 - 2048	R													
6.72-13.43	Vry Lrg	2048-4096														
	Bedrock	>4096	BDRK													
CHANNEL WIDTH AT TRANSECT																

	LENGTH	PROPORTION	NO. UNITS	SAMPLED
REACH				
POOL				
RIFFLE				
RUN				

TRANSECT	FEATURE	LENGTH	LOCATION	COUNT
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Cross Section 2

XS #2

MARYLAND STREAM STUDY
REACH AVERAGE PEBBLE COUNT

STREAM		**DATE**	7/26/15
USGS #		**CREW**	JB / MD
FWS #			

PARTICLE TALLY COUNTS BY TRANSECT

FEET	PARTICLE	MILLIMETERS		1	2	3	4	5	6	7	8	9	10	TOT#	ITEM%	%CUM
	Silt/Clay	< .062	S/C													
	Very Fine	.062 - .125	S													
	Fine	.125 - .25	A													
	Medium	.25 - .50	N													
	Coarse	.50 - 1.0	D													
	Vry Coarse	1.0 - 2	S													
	Very Fine	2 - 4														
	Fine	4 - 6	G													
	Fine	6 - 8	R													
	Medium	8 - 12	A													
	Medium	12 - 16	V													
	Coarse	16 - 24	E													
	Coarse	24 - 32	L													
	Vry Coarse	32 - 48	S													
	Vry Coarse	48 - 64														
0.21-0.31	Small	64 - 96	C													
0.31-0.42	Small	96 - 128	O													
0.42-0.63	Large	128 - 192	B													
0.63-0.84	Large	192 - 256	L													
0.84-1.26	Small	256 - 384	B													
1.26-1.68	Small	384 - 512	L													
1.68-3.36	Medium	512 - 1024	D													
3.36-6.72	Lrg	1024 - 2048	R													
6.72-13.43	Vry Lrg	2048-4096														
	Bedrock	>4096	BDRK													
	CHANNEL WIDTH AT TRANSECT															

	LENGTH	PROPORTION	NO. UNITS	SAMPLED	TRANSECT	FEATURE	LENGTH	LOCATION	COUNT
REACH					1				
POOL					2				
RIFFLE					3				
RUN					4				
					5				
					6				
					7				
					8				
					9				
					10				

Year 2 - Storm 2

Physical Monitoring

09/11/18

MARYLAND STREAM STUDY
LONGITUDINAL PROFILE

STREAM: Little Patuxent River - Monitoring Reach							DATE: 09/11/2018				CREW: T. Bishop, J. Jahn				
USGS #			ALL MEASUREMENTS IN FEET UNLESS OTHERWISE NOTED.												
FWS #			REFERENCE POINT ELEVATION AND DESCRIPTION:												
Identifier	Backsight	Height of Instrument	Station	Bed Surface Foresight	Bed Surface Elevation	Water Surface Foresight	Water Surface Elevation	Bankfull Foresight	Bankfull Elevation	Top of Bank Foresight	Top of Bank Elevation	water depth (in) ~~Other Foresight~~	Other Elevation		
		5.65													
MON-LB	5.66														
MON-RB	5.295														
pool			0	9.77								8.75			
glide	tail of glide		10	9.595								6.875			
glide	head		16	9.62								7.25			
pool			24.7	9.73								7.75			
run	tail		35	9.74								8.625			
run	head		48.3	9.58								7.0			
riffle	CS-2		53.0	9.2								3.6875			
head of riffle /	tail of glide		61.3	9.125								4.56			
glide	head of glide		75.7	9.5								10.19			
pool	FS-3		84	9.865								15.6			
run	tail of run		91.9	9.65								10.94			
run	head of run		97.7	9.33								7.75			
riffle			102	8.8		8.65						1.75			
riffle			106.6	8.82								6.0			
riffle	CS-1		110.1	8.72								5.5			
glide	tail		114.9	8.76								6.25			
glide	head		123.8	8.8								7.0			
pool			131	9.38								14.28			
glide	tail		142.9	8.885								8.88			
glide	head		148.4	8.92								9.5			
pool			162	9.97								22.2			
pool			192.3	9.58								17.64			
pool			183	9.17								12.6			
pool			196	9.93								21.96			

CROSS SECTION #1

MARYLAND STREAM STUDY

CROSS SECTION

STREAM Little Patuxent River	DATE 09/11/2018
USGS #	CREW J. Bishop, J. Jahn
FWS #	

Begin on left, facing downstream (all measurements are in feet unless otherwise noted)

NOTE	DIST.	ELEV. / DEPTH	NOTE	DIST.	ELEV. / DEPTH
LP	0.0	5.54			
GRD @ LP	0.0	5.735			
LB-MON	0.8	5.67			
LB	3.0	5.84			
LB	6.0	6.03			
LB-TOB	9.1	6.18	photo #7		
LB-Shelf	9.65	7.76			
LB-EW	10.4	8.40			
AC / BOB	11.0	8.80			
AC	12.0	8.805			
AC	13.0	8.955			
AC	14.0	8.75			
AC	15.0	8.67			
AC	16.2	8.53			
AC	17.5	8.67			
AC / Thalweg	18.9	8.66			
AC	20.0	8.60			
AC	21.7	8.35			
RB-EW / BOB	22.9	8.31			
RB-shelf	~~23.5~~	8.02	23.45 station		
RB-TOB	24.05	6.995	photo #8+9		
RB	25.2	6.75			
RB	26.3	6.35			
RB	28.1	6.245			
RB	31.5	~~5.405~~	5.415		
RB	33.5	5.30			
RB-MON	35.0	5.295			
GRD @ RP	35.7	5.29			
RP	35.7	5.08			

STATION OR DISTANCE FROM GAGE	
DIRECTION FROM GAGE	

NOTATIONS

NOTE	ABBREV
Left	L
Right	R
Pin	P
Edge of Water	EW
Water Surface	WS
Active Channel	AC
Scour Line	SL
Bankfull	BF
Top of Bank	TOB
Monument	MON
Ground	GRD
Left Bank	LB
Right Bank	RB
Bottom of Bank	BOB

ENTRENCHMENT

FLOODPRONE WIDTH	
BANKFULL WIDTH	
ENTRENCHMENT	

GPS Coordinates

Left Monument	
Latitude	
Longitude	
Error	
Right Monument	
Latitude	
Longitude	
Error	

Instrument (Prop.#)

instrument height = 5.65 ft

CROSS SECTION #2

MARYLAND STREAM STUDY

CROSS SECTION

STREAM Little Patuxent River	DATE 09/11/18
USGS #	CREW J. Bishop, J. Jahn
FWS #	

Begin on left, facing downstream (all measurements are in feet unless otherwise noted)

NOTE	DIST.	ELEV. / DEPTH	NOTE	DIST.	ELEV. / DEPTH
LP	0.00	5.975			
GRD @ LP	0.00	5.616			
LB - MON	0.8	6.175			
LB	3.5	6.15			
LB - TOB	7.1	6.17	photo # 14		
LB	8.0	6.58			
LB	8.65	7.345			
LB - BOB	9.7	8.68			
Gravel Bar - LB	11.0	8.55			
Gravel Bar - LB	12.0	8.70	Station 12.0		
EW - LB	13.1	9.03			
AC	14.0	9.16			
AC	14.8	9.315			
AC	15.3	9.04			
AC	15.7	9.27			
AC	17.0	9.395			
AC	18.2	9.40			
AC	19.4	9.395			
AC / Thalweg	20.4	9.53			
AC / Thalweg	21.0	9.58			
EW / BOB - RB	22.0	9.29			
RB -	22.1	7.49			
RB - TOB	22.8	6.815			
RB	24.4	6.65			
RB	26.0	6.25			
RB	28.0	6.23			
RB - MON	30.4	6.22			
Grd @ RP	31.7	6.275			
RP	31.2	5.97			

STATION OR DISTANCE FROM GAGE	
DIRECTION FROM GAGE	

NOTATIONS

NOTE	ABBREV
Left	L
Right	R
Pin	P
Edge of Water	EW
Water Surface	WS
Active Channel	AC
Scour Line	SL
Bankfull	BF
Top of Bank	TOB
Monument	MON
GRD	ground
LB	Left Bank
RB	Right Bank
BOB	Bottom of Bank

ENTRENCHMENT	
FLOODPRONE WIDTH	
BANKFULL WIDTH	
ENTRENCHMENT	

GPS Coordinates	
Left Monument	
Latitude	
Longitude	
Error	
Right Monument	
Latitude	
Longitude	
Error	

Instrument (Prop.#)

instrument height = 5.65 ft

undercut RB 0.47 ft off BOB
0.30 ft deep

Total Tally: 卌 卌 卌 卌 卌
卌 卌 卌 卌 卌
卌 卌 卌 卌 卌
卌 卌 卌 卌 卌

MARYLAND STREAM STUDY
REACH AVERAGE PEBBLE COUNT

CROSS SECTION #1

STREAM	Little Patuxent River		DATE	09/11/2018
USGS #			CREW	J. Bishop, J. John
FWS #		PARTICLE TALLY COUNTS BY TRANSECT		

FEET	PARTICLE	MILLIMETERS												TOT#	ITEM%	%CUM
	Silt/Clay	< .062	S/C	卌	|											
	Very Fine	.062 - .125	S	|												
	Fine	.125 - .25	A	|												
	Medium	.25 - .50	N	|												
	Coarse	.50 - 1.0	D	||												
	Vry Coarse	1.0 - 2	S	|												
	Very Fine	2 - 4		卌												
	Fine	4 - 6	G	卌												
	Fine	6 - 8	R													
	Medium	8 - 12	A	卌												
	Medium	12 - 16	V	卌	|											
	Coarse	16 - 24	E	卌	卌	||										
	Coarse	24 - 32	L	||||												
	Vry Coarse	32 - 48	S	卌	卌	卌	||||									
	Vry Coarse	48 - 64		卌	卌	卌	|									
0.21-0.31	Small	64 - 96	C	卌	卌	|										
0.31-0.42	Small	96 - 128	O	||||												
0.42-0.63	Large	128 - 192	B	||||												
0.63-0.84	Large	192 - 256	L	||												
0.84-1.26	Small	256 - 384	B	|												
1.26-1.68	Small	384 - 512	L													
1.68-3.36	Medium	512 - 1024	D													
3.36-6.72	Lrg	1024 - 2048	R													
6.72-13.43	Vry Lrg	2048-4096														
	Bedrock	>4096	BDRK													
CHANNEL WIDTH AT TRANSECT																

	LENGTH			
REACH		PROPORTION	NO. UNITS	SAMPLED
POOL				
RIFFLE				
RUN				

TRANSECT	FEATURE	LENGTH	LOCATION	COUNT
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

MARYLAND STREAM STUDY
REACH AVERAGE PEBBLE COUNT CROSS SECTION #2

STREAM	Little Patuxent River	DATE	09/11/2018
USGS #		CREW	J. Bishop, J. John
FWS #		PARTICLE TALLY COUNTS BY TRANSECT	

FEET	PARTICLE	MILLIMETERS		1	2	3	4	5	6	7	8	9	10	TOT#	ITEM%	%CUM
	Silt/Clay	< .062	S/C													
	Very Fine	.062 - .125	S													
	Fine	.125 - .25	A													
	Medium	.25 - .50	N													
	Coarse	.50 - 1.0	D													
	Vry Coarse	1.0 - 2	S													
	Very Fine	2 - 4														
	Fine	4 - 6	G													
	Fine	6 - 8	R													
	Medium	8 - 12	A													
	Medium	12 - 16	V													
	Coarse	16 - 24	E													
	Coarse	24 - 32	L													
	Vry Coarse	32 - 48	S													
	Vry Coarse	48 - 64														
0.21-0.31	Small	64 - 96	C													
0.31-0.42	Small	96 - 128	O													
0.42-0.63	Large	128 - 192	B													
0.63-0.84	Large	192 - 256	L													
0.84-1.26	Small	256 - 384	B													
1.26-1.68	Small	384 - 512	L													
1.68-3.36	Medium	512 - 1024	D													
3.36-6.72	Lrg	1024 - 2048	R													
6.72-13.43	Vry Lrg	2048-4096														
	Bedrock	>4096	BDRK													
	CHANNEL WIDTH AT TRANSECT															

	LENGTH	PROPORTION	NO. UNITS	SAMPLED
REACH				
POOL				
RIFFLE				
RUN				

TRANSECT	FEATURE	LENGTH	LOCATION	COUNT
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Year 2 - Baseline

Physical Monitoring

06/20/19

MARYLAND STREAM STUDY
LONGITUDINAL PROFILE

STREAM: Little [illegible] River		DATE: 06/20/19	CREW: J Bishop [illegible] J. Kim
USGS #	ALL MEASUREMENTS IN FEET UNLESS OTHERWISE NOTED.		
FWS #	REFERENCE POINT ELEVATION AND DESCRIPTION:		

Identifier	LB [illegible] Backsight	Height of Instrument	Station	Bed Surface Foresight	Bed Surface Elevation	Water Surface Foresight	Water Surface Elevation	Bankfull Foresight	Bankfull Elevation	Top of Bank Foresight	Top of Bank Elevation	Other Foresight	Other Elevation
	5.74	5.54											
pool			0.00	10.0			0.72						
run			10.0	9.73			0.45						
riffle			18	9.47			0.24						
run			30	9.81			0.59						
run			40	9.73			0.52						
run			50	9.72			0.59						
riffle		X-section 2 →	56	9.42		9.16							
glide			64	9.40			0.45						
glide			74	9.42			0.52						
pool		XS-3 →	86	9.86			0.96						
run			96	9.83		8.92							
riffle			103	9.21		8.81							
riffle		x-section 1 →	112.8	8.82		7.47							
glide			122	9.02			0.64						
pool			134	9.55			1.20						
pool			137.6	9.57			1.19						
run			144.6	9.17			0.78						
riffle			148	8.74		8.38							
glide			157	9.16			0.80						
pool			164.5	10.10			1.80						
pool			176	9.82			1.53						
glide			186	9.25			0.95						
pool			194	10.22			1.92						
pool			206	9.90			1.60						

MARYLAND STREAM STUDY

CROSS SECTION # 1 (US)

STREAM Little Patuxent	DATE 06/20/2019
USGS #	CREW J. Bishop J. [illegible] J. Jahn
FWS #	

Begin on left, facing downstream (all measurements are in feet unless otherwise noted)

Stream Bed NOTE	DIST.	ELEV. / DEPTH	Water Surface NOTE	DIST.	ELEV. / DEPTH
LB TOP	Ø	5.35			
LB GRND [illegible]	Ø	5.77			
LB MIN	.1	5.75			
LB	4.0	6.10			
LB TOB	7.7	6.72			
LB EOW	9.6	8.56			
Thalweg	10.5	~~8.92~~	8.72		8.31
AC 1	11.5	8.84			.37
AC	12.5	8.91			.41
AC	14.0	8.63			.32
AC	15.5	8.86			.31
AC	17.0	8.59			.13
AC	18.5	8.67			.22
AC	20.0	8.64			.21
RB EOW	21.2	8.47			
RB [illegible]	23.1	8.18			
RB TOB	23.4	7.20			
RB	25.7	6.45			
RB	30.7	5.65			
RB MIN 34.2	~~35.0~~	5.38			
GRND [illegible] RT	35.0	5.41			
TOP RT	35.0	5.29			

STATION OR DISTANCE FROM GAGE

DIRECTION FROM GAGE

NOTATIONS	
NOTE	**ABBREV**
Left	L
Right	R
Pin	P
Edge of Water	EW
Water Surface	WS
Active Channel	AC
Scour Line	SL
Bankfull	BF
Top of Bank	TOB
Monument	MON
Water Depth	WD
Thalweg	Th
HI = 5.54	

ENTRENCHMENT

FLOODPRONE WIDTH

BANKFULL WIDTH

ENTRENCHMENT

GPS Coordinates

Left Monument

Latitude

Longitude

Error

Right Monument

Latitude

Longitude

Error

Instrument (Prop.#)

MARYLAND STREAM STUDY

CROSS SECTION #2 (DS)

STREAM Little Patuxent	DATE 05/28/2015
USGS #	CREW J. Bishop J. Kim
FWS #	J. Jahn

Begin on left, facing downstream (all measurements are in feet unless otherwise noted)

NOTE	DIST.	ELEV. / DEPTH	NOTE	DIST.	ELEV. / DEPTH
Top LB	0.0	6.15			
LB Ground adj. pin	0.0	6.31			
LB Mon.	3.35	6.21			
LB	4.0	6.19			
LB TOB	7.3	6.60			
LB Shelf	7.4	7.93			
LB BOB	8.9	8.66			
Point bar	10.5	8.73			
LB EDW	12.1	9.25			
AC	13.5	9.50			9.22
AC	14.5	9.46			9.24
AC	15.5	9.42			9.20
AC	17	9.44			9.22
AC	18.5	9.52			9.21
AC	19.5	9.57			9.23
Thalweg	20.4	9.66			9.22
RB EDW	21.6	9.33			9.22
RB Undercut	21.75	9.30			
RB Undercut	21.75	8.83			
RB Undercut	21.6	8.33			
RB TOB	21.9	7.20			
RB TOB	22.3	6.97			
RB	24.5	6.54			
RB	26.7	6.24			
RB Mon	29.9	6.31			
RB Ground adj. pin	30.1	6.31			
TOP RB	30.1	6.0			

STATION OR DISTANCE FROM GAGE	
DIRECTION FROM GAGE	

NOTATIONS

NOTE	ABBREV
Left	L
Right	R
Pin	P
Edge of Water	EW
Water Surface	WS
Active Channel	AC
Scour Line	SL
Bankfull	BF
Top of Bank	TOB
Monument	MON
Water Depth	WD
Thalweg	Th

HI = 5.54

ENTRENCHMENT

FLOODPRONE WIDTH	
BANKFULL WIDTH	
ENTRENCHMENT	

GPS Coordinates

Left Monument	
Latitude	
Longitude	
Error	
Right Monument	
Latitude	
Longitude	
Error	

Instrument (Prop.#)

MARYLAND STREAM STUDY
REACH AVERAGE PEBBLE COUNT

STREAM		**DATE**	
USGS #		**CREW**	
FWS #			

PARTICLE TALLY COUNTS BY TRANSECT

FEET	PARTICLE	MILLIMETERS		1	2	3	4	5	6	7	8	9	10	TOT#	ITEM%	%CUM
	Silt/Clay	< .062	S/C													
	Very Fine	.062 - .125	S													
	Fine	.125 - .25	A													
	Medium	.25 - .50	N													
	Coarse	.50 - 1.0	D													
	Vry Coarse	1.0 - 2	S													
	Very Fine	2 - 4														
	Fine	4 - 6	G													
	Fine	6 - 8	R													
	Medium	8 - 12	A													
	Medium	12 - 16	V													
	Coarse	16 - 24	E													
	Coarse	24 - 32	L													
	Vry Coarse	32 - 48	S													
	Vry Coarse	48 - 64														
0.21-0.31	Small	64 - 96	C													
0.31-0.42	Small	96 - 128	O													
0.42-0.63	Large	128 - 192	B													
0.63-0.84	Large	192 - 256	L													
0.84-1.26	Small	256 - 384	B													
1.26-1.68	Small	384 - 512	L													
1.68-3.36	Medium	512 - 1024	D													
3.36-6.72	Lrg	1024 - 2048	R													
6.72-13.43	Vry Lrg	2048-4096														
	Bedrock	>4096	BDRK													
	CHANNEL WIDTH AT TRANSECT															

	LENGTH	PROPORTION	NO. UNITS	SAMPLED
REACH				
POOL				
RIFFLE				
RUN				

TRANSECT	FEATURE	LENGTH	LOCATION	COUNT
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

MARYLAND STREAM STUDY
REACH AVERAGE PEBBLE COUNT

STREAM			DATE	
USGS #			CREW	
FWS #				

PARTICLE TALLY COUNTS BY TRANSECT

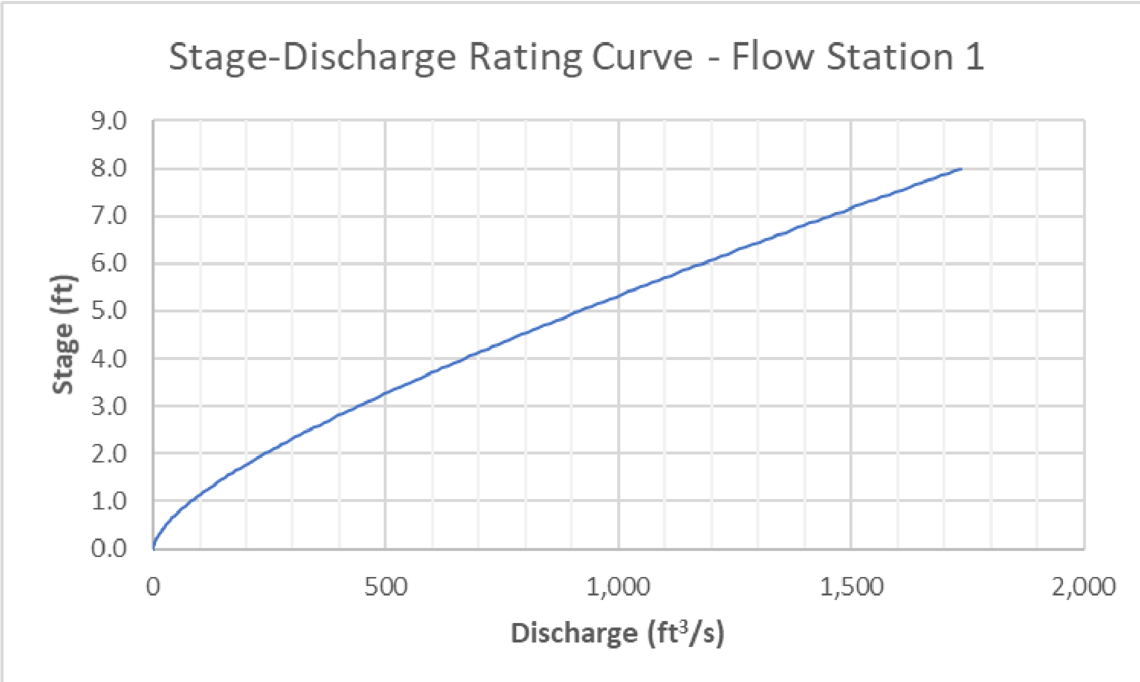
FEET	PARTICLE	MILLIMETERS		1	2	3	4	5	6	7	8	9	10	TOT#	ITEM%	%CUM
	Silt/Clay	< .062	S/C	|||												
	Very Fine	.062 - .125	S	|												
	Fine	.125 - .25	A	||												
	Medium	.25 - .50	N	||												
	Coarse	.50 - 1.0	D	|||												
	Vry Coarse	1.0 - 2	S	||||												
	Very Fine	2 - 4		|												
	Fine	4 - 6	G	||												
	Fine	6 - 8	R	||||												
	Medium	8 - 12	A	|||												
	Medium	12 - 16	V	|||												
	Coarse	16 - 24	E	~~||||~~												
	Coarse	24 - 32	L	||||	~~||||~~	|||										
	Vry Coarse	32 - 48	S	~~||||~~	~~||||~~	||										
	Vry Coarse	48 - 64		||||	~~||||~~	~~||||~~	||									
0.21-0.31	Small	64 - 96	C	||||	~~||||~~	~~||||~~	||||									
0.31-0.42	Small	96 - 128	O	||||	|											
0.42-0.63	Large	128 - 192	B													
0.63-0.84	Large	192 - 256	L	|												
0.84-1.26	Small	256 - 384	B													
1.26-1.68	Small	384 - 512	L													
1.68-3.36	Medium	512 - 1024	D													
3.36-6.72	Lrg	1024 - 2048	R													
6.72-13.43	Vry Lrg	2048-4096														
	Bedrock	>4096	BDRK													
CHANNEL WIDTH AT TRANSECT																

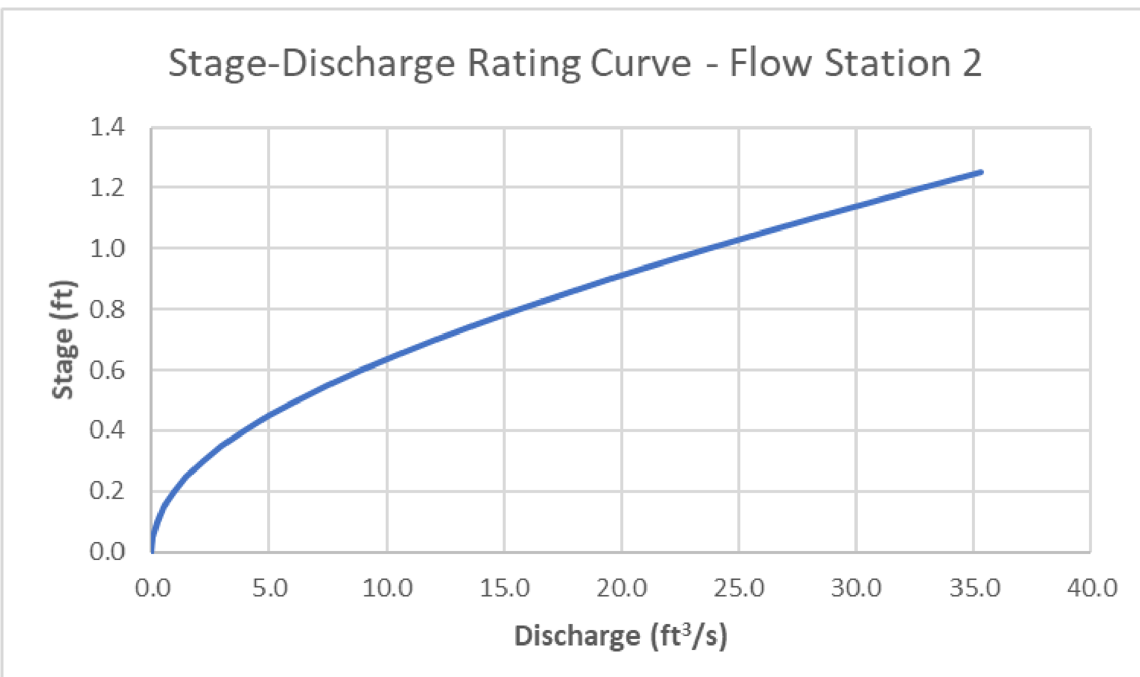
	LENGTH	PROPORTION	NO. UNITS	SAMPLED
REACH				
POOL				
RIFFLE				
RUN				

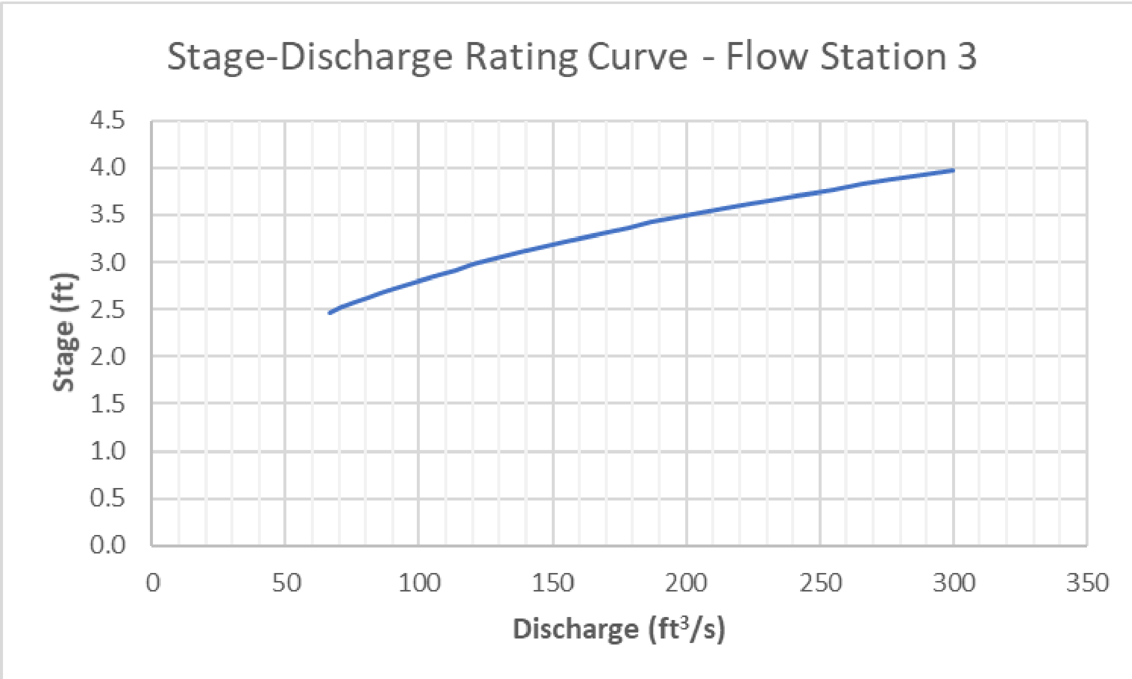
TRANSECT	FEATURE	LENGTH	LOCATION	COUNT
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Appendix D

Stage-Discharge Relationships


Stage-Discharge Rating Curve - Flow Station 1
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Stage (ft)
0
500
1,000
1,500
2,000
Discharge (ft³/s)


Stage-Discharge Rating Curve - Flow Station 2
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Stage (ft)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
Discharge (ft³/s)

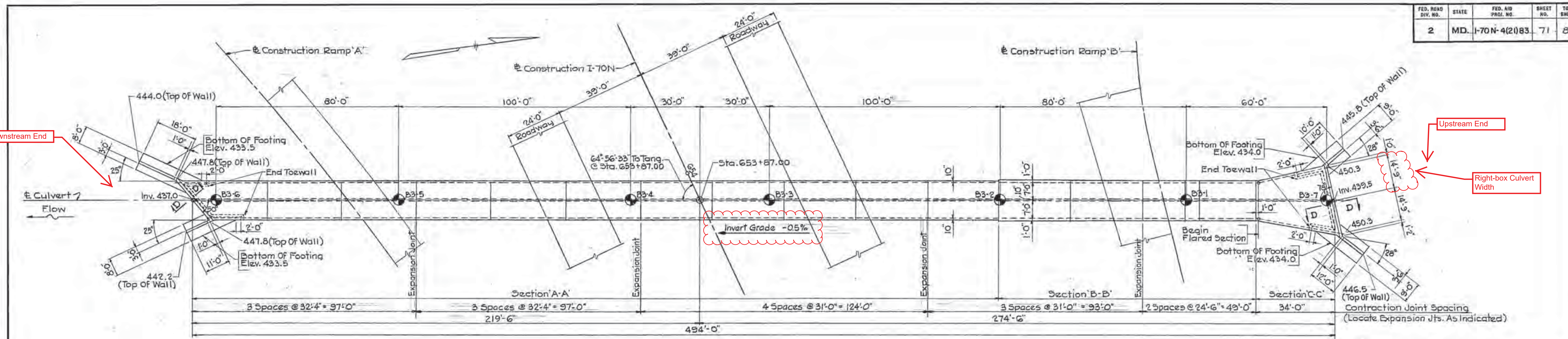


Stage-Discharge Rating Curve - Flow Station 3
Stage (ft)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
50
100
150
200
250
300
350
Discharge (ft³/s)

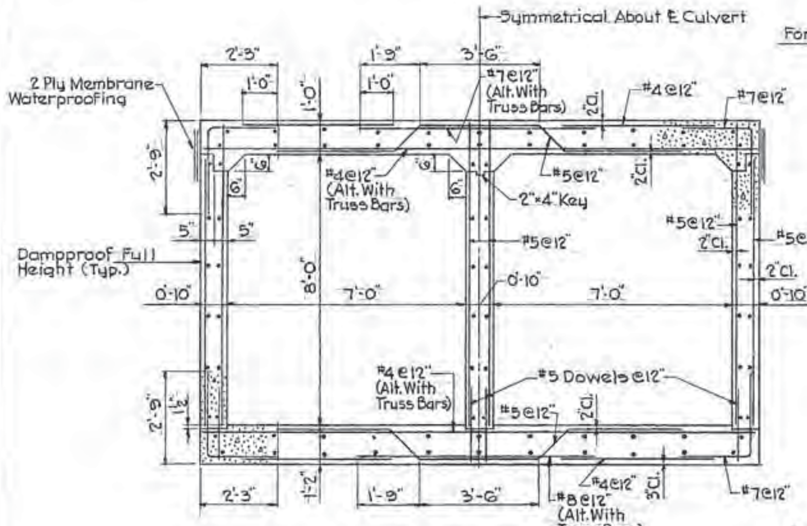
Appendix E

Flow Station As-Builts

FED. ROAD DIV. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
2	MD.	I-70N-4(21)83	71	85

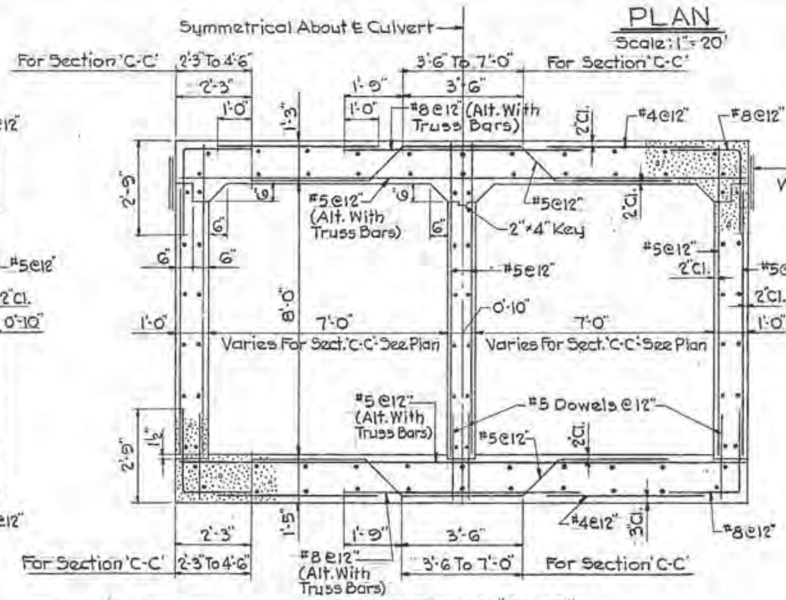


PLAN
Scale: 1" = 20'

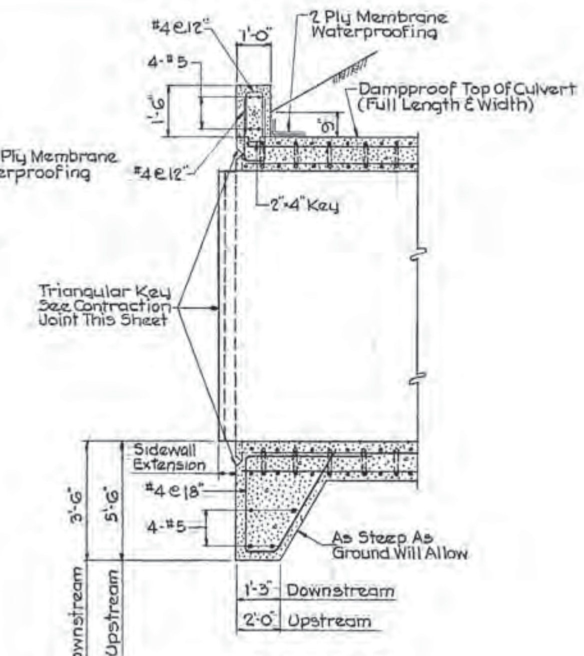


SECTION 'A-A'
Scale: 3/8" = 1'-0"

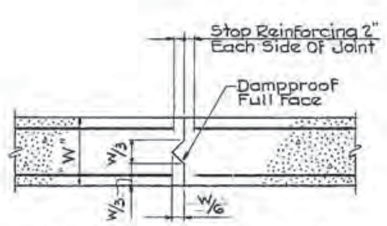
Note:
All Longitudinal Reinforcement To Be #4 Spaced As Shown For Section 'A-A' & Section 'B-B' And #4 Spaced At 18" Max. For Section 'C-C'.



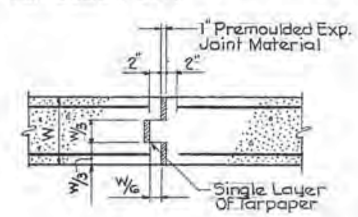
SECTION 'B-B'
SECTION 'C-C' (Similar Except As Noted)
Scale: 3/8" = 1'-0"



SECTION 'D-D'
Scale: 3/8" = 1'-0"



CONTRACTION JOINT



EXPANSION JOINT

FLOW STATION 1 AS-BUILTS

ESTIMATED QUANTITIES			
ITEM No.	ITEM	UNIT	QUANTITY
303	Selected Backfill Using #6 Aggregate	C.Y.	130
304	Selected Backfill Using CR-6 Or Type 2 Sub-Base	C.Y.	130
401	Class #3 Excavation For Structures	C.Y.	3,200
~~446~~	Contingent Concrete For Box Culvert	C.Y.	5
428	Class C Concrete Subfoundation	C.Y.	5
431	Double 7.0 Ft. x 8.0 Ft. Reinf. Concrete Box Culv. At Sta. 653+	—	L.S.

GENERAL NOTES

SPECIFICATIONS: A.A.S.H.O. Standard Specifications For Highway Bridges, Dated 1961; And A.A.S.H.O. Interim Specifications, Dated 1961, 1962, 1963 And 1964 For Design. Maryland S.R.C. Specifications, Dated January 1962, Addenda And Errata Thereto; And "Special Provisions" For Materials And Construction.

LOADING: HS 20-44

CONCRETE: Class "A-1" f'c = 3,000 p.s.i., Class "C" f'c = 1,500 p.s.i. All Exposed Edges Shall Be Chamfered 3/4" x 3/4".

REINFORCING BARS: Reinforcing Steel Shall Be Deformed Bars Of Intermediate Grade. Allowable Design Stress 20,000 p.s.i. Splices And Embedment Shall Be 24 Diameters Unless Otherwise Noted.

BORINGS: Borings Are Numbered And Indicated Thus ⊕ For Boring Logs See Sheet No. 72

SELECTED BACKFILL: Selected Backfill To Be Placed For Entire Length Of Culvert To Depth As Directed By The Engineer To Suit Field Conditions.

Maximum Design Foundation Pressure = 1.0 Tons/Sq. Ft.

HYDRAULIC DATA
- DRAINAGE AREA = 1.8 SQ. MI. = 1152 ACRES
- STORMWATER DISCHARGE c. f. s. = 1350
- TIDAL FLOW c. f. s. =
- TOTAL MAXIMUM DISCHARGE c. f. s. = 1350
- MAXIMUM FLOW DEPTH AT H. W. FEET = 9.75
- OPENING BY TALBOT
- OPENING TO H.W. SQ. FT. = 224 $\square'$
- VELOCITY AT OUTLET FT. PER SEC. = 14.0

EXISTING STRUCTURE
- TYPE
- WATERWAY
- UNDERCLEARANCE
- DATE BUILT
- OWNERSHIP
- DISPOSITION
- REMARKS

UTILITIES
- STORM SEWERS
- SANITARY SEWERS
- WATER MAINS
- GAS MAINS
- ELECTRIC WIRES { OVERHEAD / UNDERGROUND
- OTHER

TRAFFIC DATA
- TRAFFIC COUNT = ______ DATE ______
- DESIGN SPEED = ______ m. p. h.

DATUM

REVISIONS

STATE OF MARYLAND
STATE ROADS COMMISSION
BALTIMORE, MD.
INTERSTATE ROUTE 70N
DOUBLE 7'-0" x 8'-0" BOX CULVERT
AT STA. 653+87
PLAN & SECTIONS

SCALE As Shown DATE April 11, 1966 CONTRACT H0-305-5-742

MADE BY W.F.H.
TRACED BY W.F.H.
CHECKED BY E.P.R.

CHIEF, BUREAU OF BRIDGES
5/16/66

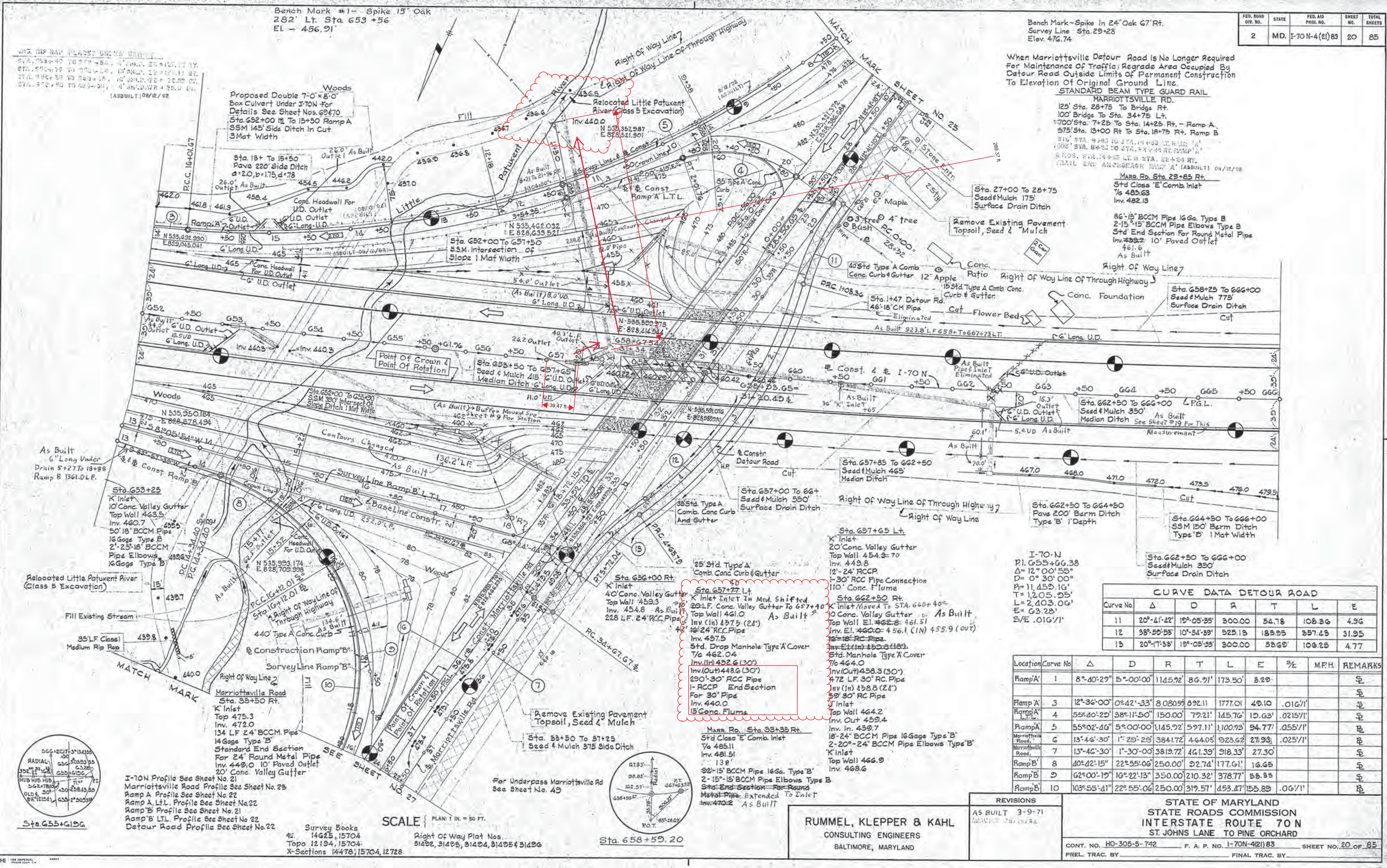
SHEET NO. 71 OF 85

INDEXED

BRIDGE No. 13128X0 Survey Book No.

File No. 2 Pocket No. 13 Folder No. 4

FLOW STATION 2 AS-BUILTS



CURVE DATA DETOUR ROAD						
Curve No	Δ	D	R	T	L	E
11	20°-41'-42"	19°-05'-55"	300.00	54.78	108.36	4.96
12	38°-59'-53"	10°-54'-39"	525.13	185.95	357.43	31.95
13	20°-17'-33"	19°-05'-55'	300.00	53.69'	106.25	4.77

Location	Curve No	Δ	D	R	T	L	E	S/E	M.P.H.	REMARKS
Ramp 'A'	1	8°-40'-29"	5°-00'-00"	1145.92'	86.91'	173.50'	3.29			S.P.
										S.P.
Ramp 'A'	3	12°-36'-00"	0°42'-33"	8,080.59	892.11	1777.01	49.10	.016'/1'		S.P.
Ramp 'A' L.T.L.	4	55°-40'-29'	38°-11'-50"	150.00'	79.21'	145.76'	19.63'	.0215'/1'		S.P.
Ramp 'A'	5	55°02'-46"	5°00'-00"	1,145.92'	597.11'	1,100.93'	94.77'	.055'/1'		B.
Marriottsville Road.	6	13°-46'-30'	1°-29'-29'	3841.72'	464.05	923.62'	27.93	.025'/1'		B.
Marriottsville Road.	7	13°-46'-30"	1°-30'-00'	3819.72'	461.39'	918.33'	27.30'			S.P.
Ramp 'B'	8	40°-42'-15"	22°55'-06"	250.00'	92.74'	177.61'	16.65			S.P.
Ramp 'B'	9	62°00'-19"	16°-22'-13"	350.00'	210.32'	378.77'	58.35			S.P.
Ramp 'B'	10	103°-55'-41"	22°-55'-06	250.00'	319.57'	453.47'	155.89	.06'/1'		B.

FED. ROAD DIV. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
2	MD.	I-70N-4(21)83	20	85

REVISIONS
AS BUILT 3-9-71

RUMMEL, KLEPPER & KAHL
CONSULTING ENGINEERS
BALTIMORE, MARYLAND

STATE OF MARYLAND
STATE ROADS COMMISSION
INTERSTATE ROUTE 70 N
ST. JOHNS LANE TO PINE ORCHARD

CONT. NO. HO-305-5-742 F. A. P. NO. I-70N-4(21)83 SHEET NO. 20 OF 85
PREL. TRAC. BY FINAL TRAC. BY

Appendix F

Sediment Mobility Assessment Calculations

Cross Section 1 - Year 1 Baseline (6/14/18)

Critical Dimensionless Shear Stress

$$\tau^*_{ci} = a * (D_1/D_2)^b$$

D_1 = Largest size fraction considered mobile = D_i = D_{95}	89
D_2 = D_{50} bed matieral	22
a = constant	0.0376
b = constant	-0.994
τ^*_{ci}	0.009373

Critical Shear Stress, psf

$$\tau_{ci} = \tau^*_{ci} * (s-1) * \gamma * D_i$$

τ^*_{ci} = Critical Dimensionless Shear Stress	0.009372648
s = specific gravity for sediment	2.65
γ = specific weight of water, psf	62.4
D_i = Largest size fraction considered mobile = D_i, ft	0.2920
τ_{ci} (psf)	0.2818

Average Boundary Shear Stress, psf

$$\tau_b = \gamma * Rh * S_f$$

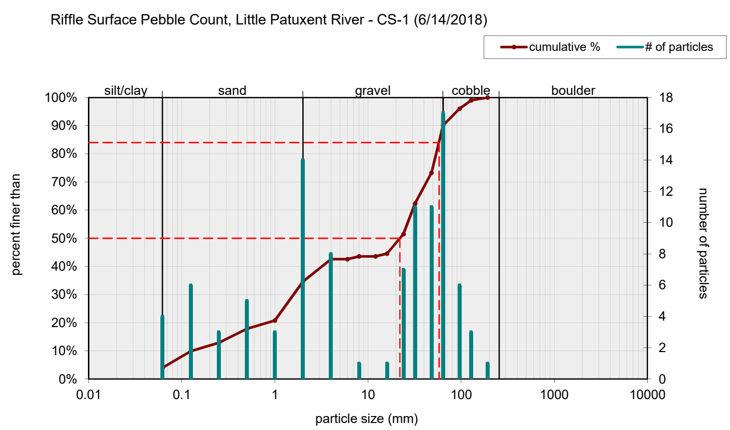
γ = specific weight of water, psf	62.4
R_h = Bankfull Hydraulic Radius, ft	1.55
S_f = Bankfull energy slope, ft/ft	0.0118
τ_b , psf	1.1413

Channel Roughness

$$n = R_h^{1/6} * \frac{0.0926}{1.16 + 2LOG\frac{R_h}{D_{84}}}$$

R_h = Bankfull Hydraulic Radius, ft	1.55
D_{84} = Particle size larger than 84% other particles, ft	0.1903
n	0.033

Cross Section 1 Hydraulic Radius	
Flow Area	28.36
Wetted Perimeter	18.27
Rh	1.55



Cross Section 2 - Year 1 Baseline (6/14/18)

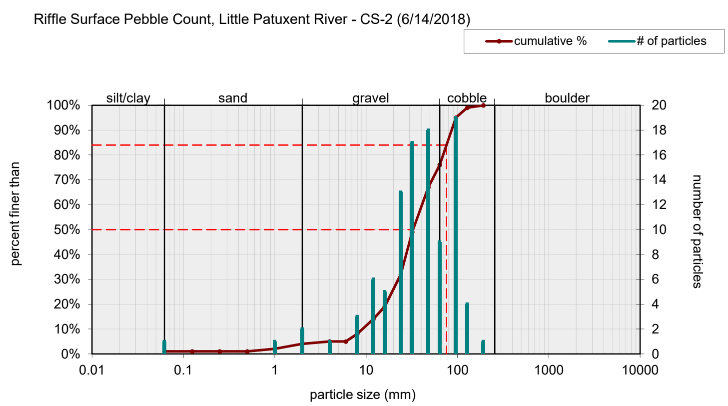
Critical Dimensionless Shear Stress	
$\tau^*_{ci} = a * (D_1/D_2)^b$	
D_1 = Largest size fraction considered mobile = D_i = D_{95}	96
D_2 = D_{50} bed matieral	33
a = constant	0.0376
b = constant	-0.994
τ^*_{ci}	0.01301

Critical Shear Stress, psf	
$\tau_{ci} = \tau^*_{ci} * (s-1) * \gamma * D_i$	
τ^*_{ci} = Critical Dimensionless Shear Stress	0.01301
s = specific gravity for sediment	2.65
γ = specific weight of water, psf	62.4
D_1 = Largest size fraction considered mobile = D_i, ft	0.3150
τ_{ci} (psf)	0.4218

Average Boundary Shear Stress, psf	
$\tau_b = \gamma * Rh * S_f$	
γ = specific weight of water, psf	62.4
R_h = Bankfull Hydraulic Radius, ft	1.69
S_f = Bankfull energy slope, ft/ft	0.0118
τ_b, psf	1.2444

Channel Roughness	
$n = R_h^{1/6} * \frac{0.0926}{1.16 + 2LOG\frac{R_h}{D_{84}}}$	
R_h = Bankfull Hydraulic Radius, ft	1.69
D_{84} = Particle size larger than 84% other particles, ft	0.2493
n	0.036

Cross Section 2 Hydraulic Radius	
Flow Area	28.36
Wetted Perimeter	16.73
Rh	1.70



Overall Monitoring Reach - Year 1 Baseline (6/14/18)

Critical Dimensionless Shear Stress

$$\tau^*_{ci} = a * (D_1/D_2)^b$$

D_1 = Largest size fraction considered mobile = D_i = D_{95}	94
D_2 = D_{50} bed matieral	28
a = constant	0.0376
b = constant	-0.994
τ^*_{ci}	0.01128

Critical Shear Stress, psf

$$\tau_{ci} = \tau^*_{ci} * (s-1) * \gamma * D_i$$

τ^*_{ci} = Critical Dimensionless Shear Stress	0.01128
s = specific gravity for sediment	2.65
γ = specific weight of water, psf	62.4
D_1 = Largest size fraction considered mobile = D_i , ft	0.3084
τ_{ci} (psf)	0.3582

Average Boundary Shear Stress, psf

$$\tau_b = \gamma * Rh * S_f$$

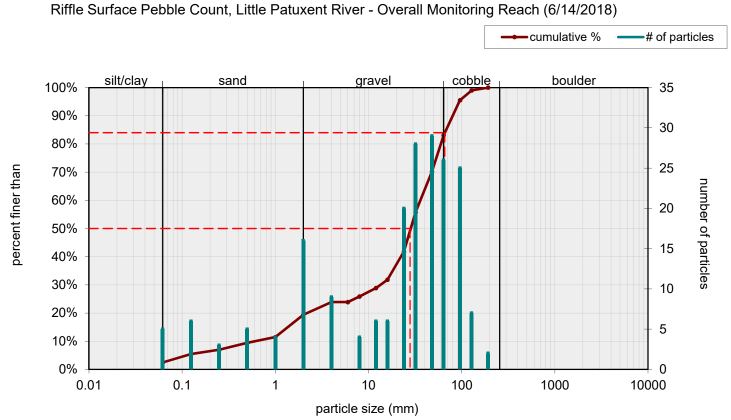
γ = specific weight of water, psf	62.4
R_h = Bankfull Hydraulic Radius, ft (average of CS-1 & CS-2	1.62
S_f = Bankfull energy slope, ft/ft	0.0118
τ_b , psf	1.1928

Channel Roughness

$$n = R_h^{1/6} * \frac{0.0926}{1.16 + 2LOG\frac{R_h}{D_{84}}}$$

R_h = Bankfull Hydraulic Radius, ft	1.62
D_{84} = Particle size larger than 84% other particles, ft	0.2165
n	0.035

Riffle Surface Pebble Count, Little Patuxent River - Overall Monitoring Reach (6/14/2018)



Cross Section 1 - Year 2 Storm 1 (7/26/18)

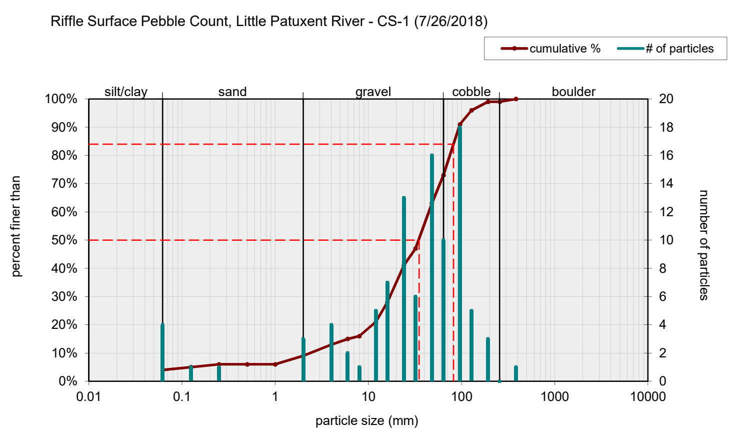
Critical Dimensionless Shear Stress	
$\tau^*_{ci} = a * (D_1/D_2)^b$	
D_1 = Largest size fraction considered mobile = D_i = D_{95}	120
D_2 = D_{50} bed matieral	35
a = constant	0.0376
b = constant	-0.994
τ^*_{ci}	0.011048

Critical Shear Stress, psf	
$\tau_{ci} = \tau^*_{ci} * (s-1) * \gamma * D_i$	
τ^*_{ci} = Critical Dimensionless Shear Stress	0.011048042
s = specific gravity for sediment	2.65
γ = specific weight of water, psf	62.4
D_1 = Largest size fraction considered mobile = D_i, ft	0.3937
τ_{ci} (psf)	0.4478

Average Boundary Shear Stress, psf	
$\tau_b = \gamma * Rh * S_f$	
γ = specific weight of water, psf	62.4
R_h = Bankfull Hydraulic Radius, ft	1.51
S_f = Bankfull energy slope, ft/ft	0.0127
τ_b, psf	1.1966

Channel Roughness	
$n = R_h^{1/6} * \frac{0.0926}{1.16 + 2LOG\frac{R_h}{D_{84}}}$	
R_h = Bankfull Hydraulic Radius, ft	1.51
D_{84} = Particle size larger than 84% other particles, ft	0.2690
n	0.037

Cross Section 1 Hydraulic Radius	
Flow Area	28.36
Wetted Perimeter	18.75
Rh	1.51



Cross Section 2 - Year 2 Storm 1 (7/26/18)

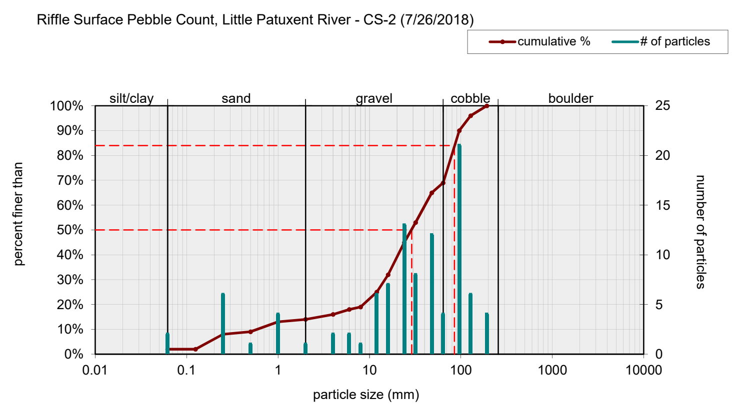
Critical Dimensionless Shear Stress	
$\tau^*_{ci} = a * (D_1/D_2)^b$	
D_1 = Largest size fraction considered mobile = D_i = D_{95}	120
D_2 = D_{50} bed matieral	29
a = constant	0.0376
b = constant	-0.994
τ^*_{ci}	0.00916

Critical Shear Stress, psf	
$\tau_{ci} = \tau^*_{ci} * (s-1) * \gamma * D_i$	
τ^*_{ci} = Critical Dimensionless Shear Stress	0.00916
s = specific gravity for sediment	2.65
γ = specific weight of water, psf	62.4
D_1 = Largest size fraction considered mobile = D_i, ft	0.3937
τ_{ci} (psf)	0.3715

Average Boundary Shear Stress, psf	
$\tau_b = \gamma * Rh * S_f$	
γ = specific weight of water, psf	62.4
R_h = Bankfull Hydraulic Radius, ft	1.66
S_f = Bankfull energy slope, ft/ft	0.0127
τ_b, psf	1.3155

Channel Roughness	
$n = R_h^{1/6} * \frac{0.0926}{1.16 + 2LOG\frac{R_h}{D_{84}}}$	
R_h = Bankfull Hydraulic Radius, ft	1.66
D_{84} = Particle size larger than 84% other particles, ft	0.2789
n	0.037

Cross Section 2 Hydraulic Radius	
Flow Area	28.36
Wetted Perimeter	17.13
Rh	1.66



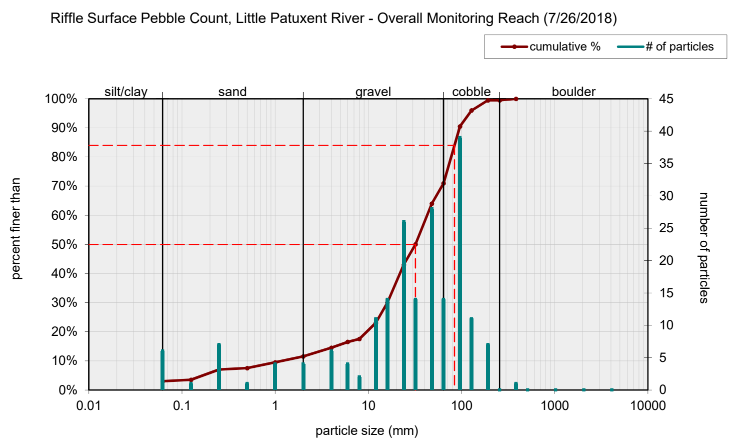
Overall Monitoring Reach - Year 2 Storm 1 (7/26/18)

Critical Dimensionless Shear Stress	
$\tau^*_{ci} = a * (D_1/D_2)^b$	
D_1 = Largest size fraction considered mobile = D_i = D_{95}	120
D_2 = D_{50} bed matieral	32
a = constant	0.0376
b = constant	-0.994
τ^*_{ci}	0.01011

Critical Shear Stress, psf	
$\tau_{ci} = \tau^*_{ci} * (s-1) * \gamma * D_i$	
τ^*_{ci} = Critical Dimensionless Shear Stress	0.01011
s = specific gravity for sediment	2.65
γ = specific weight of water, psf	62.4
D_i = Largest size fraction considered mobile = D_i, ft	0.3937
τ_{ci} (psf)	0.4097

Average Boundary Shear Stress, psf	
$\tau_b = \gamma * Rh * S_f$	
γ = specific weight of water, psf	62.4
R_h = Bankfull Hydraulic Radius, ft (average of CS-1 & CS-2	1.585
S_f = Bankfull energy slope, ft/ft	0.0127
τ_b, psf	1.2561

Channel Roughness	
$n = R_h^{1/6} * \frac{0.0926}{1.16 + 2LOG\frac{R_h}{D_{84}}}$	
R_h = Bankfull Hydraulic Radius, ft	1.585
D_{84} = Particle size larger than 84% other particles, ft	0.2756
n	0.037



Cross Section 1 - Year 2 Storm 2 (9/11/18)

Critical Dimensionless Shear Stress	
$\tau^*_{ci} = a * (D_1/D_2)^b$	
D_1 = Largest size fraction considered mobile = D_i = D_{95}	150
D_2 = D_{50} bed matieral	35
a = constant	0.0376
b = constant	-0.994
τ^*_{ci}	0.008850

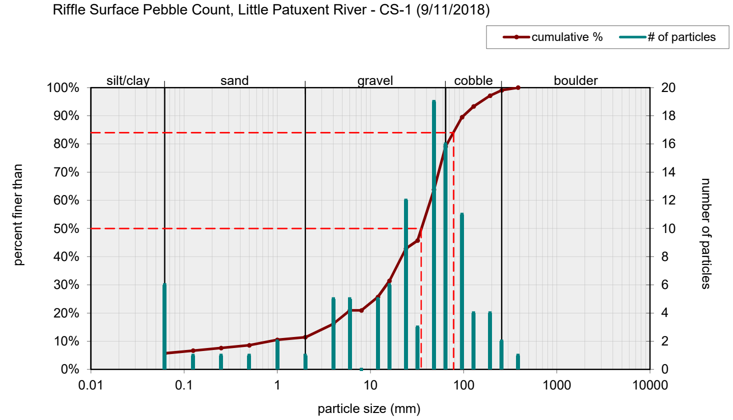
Critical Shear Stress, psf	
$\tau_{ci} = \tau^*_{ci} * (s-1) * \gamma * D_i$	
τ^*_{ci} = Critical Dimensionless Shear Stress	0.008850275
s = specific gravity for sediment	2.65
γ = specific weight of water, psf	62.4
D_i = Largest size fraction considered mobile = D_i, ft	0.4921
τ_{ci} (psf)	0.4484

Average Boundary Shear Stress, psf	
$\tau_b = \gamma * Rh * S_f$	
γ = specific weight of water, psf	62.4
R_h = Bankfull Hydraulic Radius, ft	1.52
S_f = Bankfull energy slope, ft/ft	0.0084
τ_b, psf	0.7967

Channel Roughness	
$n = R_h^{1/6} * \frac{0.0926}{1.16 + 2LOG\frac{R_h}{D_{84}}}$	
R_h = Bankfull Hydraulic Radius, ft	1.52
D_{84} = Particle size larger than 84% other particles, ft	0.2559
n	0.037

Cross Section 1 Hydraulic Radius	
Flow Area	28.36
Wetted Perimeter	18.61
Rh	1.52

Riffle Surface Pebble Count, Little Patuxent River - CS-1 (9/11/2018)



Cross Section 2 - Year 2 Storm 2 (9/11/18)

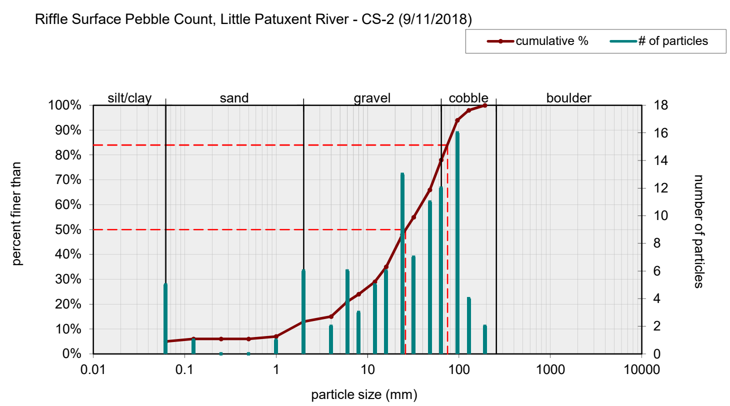
Critical Dimensionless Shear Stress	
$\tau^*_{ci} = a * (D_1/D_2)^b$	
D_1 = Largest size fraction considered mobile = D_i = D_{95}	100
D_2 = D_{50} bed matieral	26
a = constant	0.0376
b = constant	-0.994
τ^*_{ci}	0.00986

Critical Shear Stress, psf	
$\tau_{ci} = \tau^*_{ci} * (s-1) * \gamma * D_i$	
τ^*_{ci} = Critical Dimensionless Shear Stress	0.00986
s = specific gravity for sediment	2.65
γ = specific weight of water, psf	62.4
D_i = Largest size fraction considered mobile = D_i, ft	0.3281
τ_{ci} (psf)	0.3329

Average Boundary Shear Stress, psf	
$\tau_b = \gamma * Rh * S_f$	
γ = specific weight of water, psf	62.4
R_h = Bankfull Hydraulic Radius, ft	1.58
S_f = Bankfull energy slope, ft/ft	0.0084
τ_b, psf	0.8282

Channel Roughness	
$n = R_h^{1/6} * \frac{0.0926}{1.16 + 2LOG\frac{R_h}{D_{84}}}$	
R_h = Bankfull Hydraulic Radius, ft	1.58
D_{84} = Particle size larger than 84% other particles, ft	0.2461
n	0.036

Cross Section 2 Hydraulic Radius	
Flow Area	28.36
Wetted Perimeter	17.92
Rh	1.58



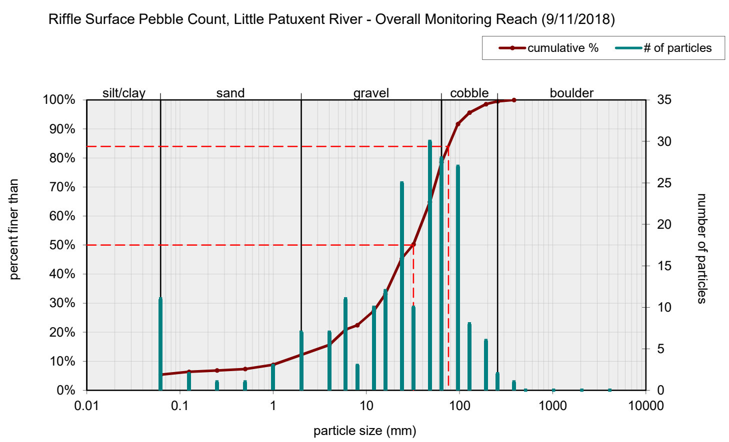
Overall Monitoring Reach - Year 2 Storm 2 (9/11/18)

Critical Dimensionless Shear Stress	
$\tau^*_{ci} = a * (D_1/D_2)^b$	
D_1 = Largest size fraction considered mobile = D_i = D_{95}	120
D_2 = D_{50} bed matieral	32
a = constant	0.0376
b = constant	-0.994
τ^*_{ci}	0.01011

Critical Shear Stress, psf	
$\tau_{ci} = \tau^*_{ci} * (s-1) * \gamma * D_i$	
τ^*_{ci} = Critical Dimensionless Shear Stress	0.01011
s = specific gravity for sediment	2.65
γ = specific weight of water, psf	62.4
D_i = Largest size fraction considered mobile = D_i , ft	0.3937
τ_{ci} (psf)	0.4097

Average Boundary Shear Stress, psf	
$\tau_b = \gamma * Rh * S_f$	
γ = specific weight of water, psf	62.4
R_h = Bankfull Hydraulic Radius, ft (average of CS-1 & CS-2	1.55
S_f = Bankfull energy slope, ft/ft	0.0084
τ_b , psf	0.8124

Channel Roughness	
$n = R_h^{1/6} * \frac{0.0926}{1.16 + 2LOG\frac{R_h}{D_{84}}}$	
R_h = Bankfull Hydraulic Radius, ft	1.55
D_{84} = Particle size larger than 84% other particles, ft	0.2493
n	0.036



Cross Section 1 - Year 2 Baseline (6/20/19)

Critical Dimensionless Shear Stress	
$\tau^*_{ci} = a * (D_1/D_2)^b$	
D_1 = Largest size fraction considered mobile = D_i = D_{95}	110
D_2 = D_{50} bed matieral	24
a = constant	0.0376
b = constant	-0.994
τ^*_{ci}	0.008279

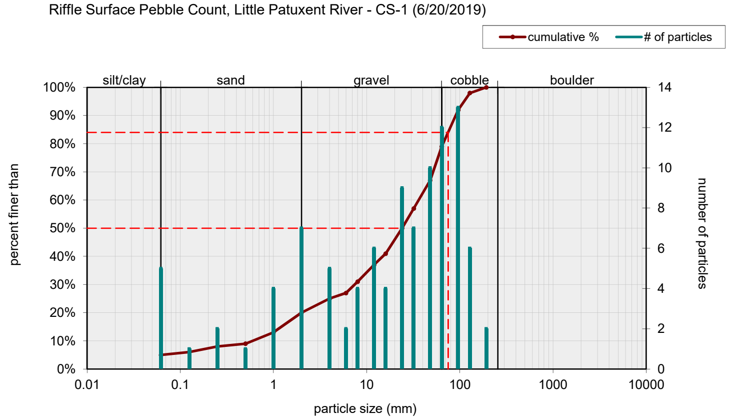
Critical Shear Stress, psf	
$\tau_{ci} = \tau^*_{ci} * (s-1) * \gamma * D_i$	
τ^*_{ci} = Critical Dimensionless Shear Stress	0.008278916
s = specific gravity for sediment	2.65
γ = specific weight of water, psf	62.4
D_1 = Largest size fraction considered mobile = D_i, ft	0.3609
τ_{ci} (psf)	0.3076

Average Boundary Shear Stress, psf	
$\tau_b = \gamma * Rh * S_f$	
γ = specific weight of water, psf	62.4
R_h = Bankfull Hydraulic Radius, ft	1.5
S_f = Bankfull energy slope, ft/ft	0.0106
τ_b, psf	0.9922

Channel Roughness	
n= $R_h^{1/6} * \frac{0.0926}{1.16+2LOG\frac{R_h}{D_{84}}}$	
R_h = Bankfull Hydraulic Radius, ft	1.5
D_{84} = Particle size larger than 84% other particles, ft	0.2461
n	0.036

Cross Section 1 Hydraulic Radius	
Flow Area	28.36
Wetted Perimeter	18.92
Rh	1.50

Riffle Surface Pebble Count, Little Patuxent River - CS-1 (6/20/2019)



Cross Section 2 - Year 2 Baseline (6/20/18)

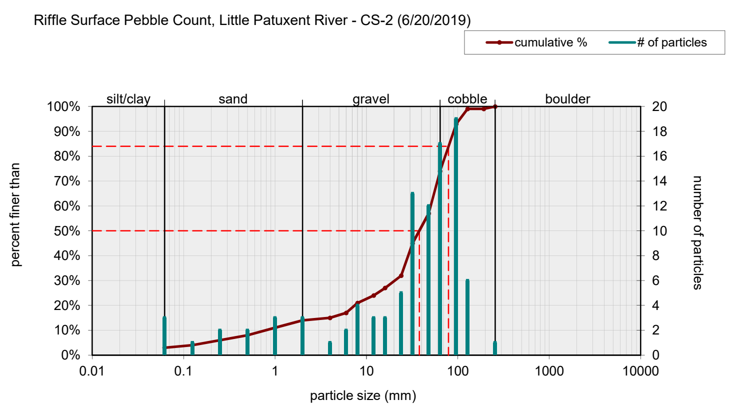
Critical Dimensionless Shear Stress	
$\tau^*_{ci} = a * (D_1/D_2)^b$	
D_1 = Largest size fraction considered mobile = D_i = D_{95}	110
D_2 = D_{50} bed matieral	38
a = constant	0.0376
b = constant	-0.994
τ^*_{ci}	0.01307

Critical Shear Stress, psf	
$\tau_{ci} = \tau^*_{ci} * (s-1) * \gamma * D_i$	
τ^*_{ci} = Critical Dimensionless Shear Stress	0.01307
s = specific gravity for sediment	2.65
γ = specific weight of water, psf	62.4
D_i = Largest size fraction considered mobile = D_i, ft	0.3609
τ_{ci} (psf)	0.4857

Average Boundary Shear Stress, psf	
$\tau_b = \gamma * Rh * S_f$	
γ = specific weight of water, psf	62.4
R_h = Bankfull Hydraulic Radius, ft	1.605
S_f = Bankfull energy slope, ft/ft	0.0106
τ_b, psf	1.0616

Channel Roughness	
$n = R_h^{1/6} * \frac{0.0926}{1.16 + 2LOG\frac{R_h}{D_{84}}}$	
R_h = Bankfull Hydraulic Radius, ft	1.605
D_{84} = Particle size larger than 84% other particles, ft	0.2592
n	0.037

Cross Section 2 Hydraulic Radius	
Flow Area	28.36
Wetted Perimeter	17.67
Rh	1.60



Overall Monitoring Reach - Year 2 Baseline (6/20/19)

Critical Dimensionless Shear Stress

$$\tau^*_{ci} = a * (D_1/D_2)^b$$

D_1 = Largest size fraction considered mobile = D_i = D_{95}	110
D_2 = D_{50} bed matieral	31
a = constant	0.0376
b = constant	-0.994
τ^*_{ci}	0.01068

Critical Shear Stress, psf

$$\tau_{ci} = \tau^*_{ci} * (s-1) * \gamma * D_i$$

τ^*_{ci} = Critical Dimensionless Shear Stress	0.01068
s = specific gravity for sediment	2.65
γ = specific weight of water, psf	62.4
D_1 = Largest size fraction considered mobile = D_i, ft	0.3609
τ_{ci} (psf)	0.3967

Average Boundary Shear Stress, psf

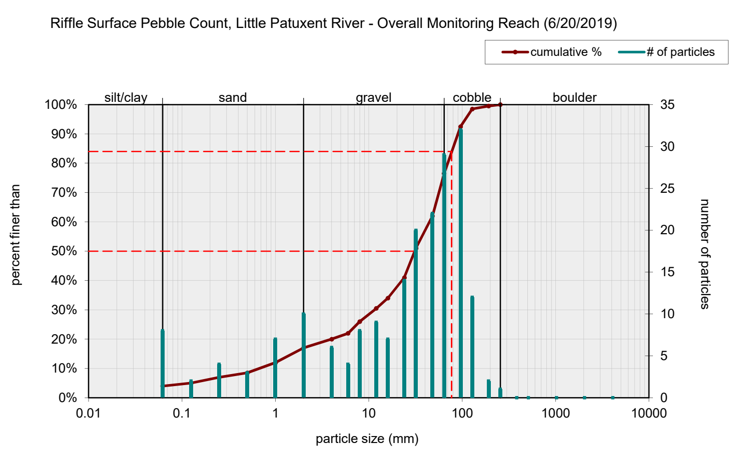
$$\tau_b = \gamma * Rh * S_f$$

γ = specific weight of water, psf	62.4
R_h = Bankfull Hydraulic Radius, ft (average of CS-1 & CS-2	1.5525
S_f = Bankfull energy slope, ft/ft	0.0106
τ_b, psf	1.0269

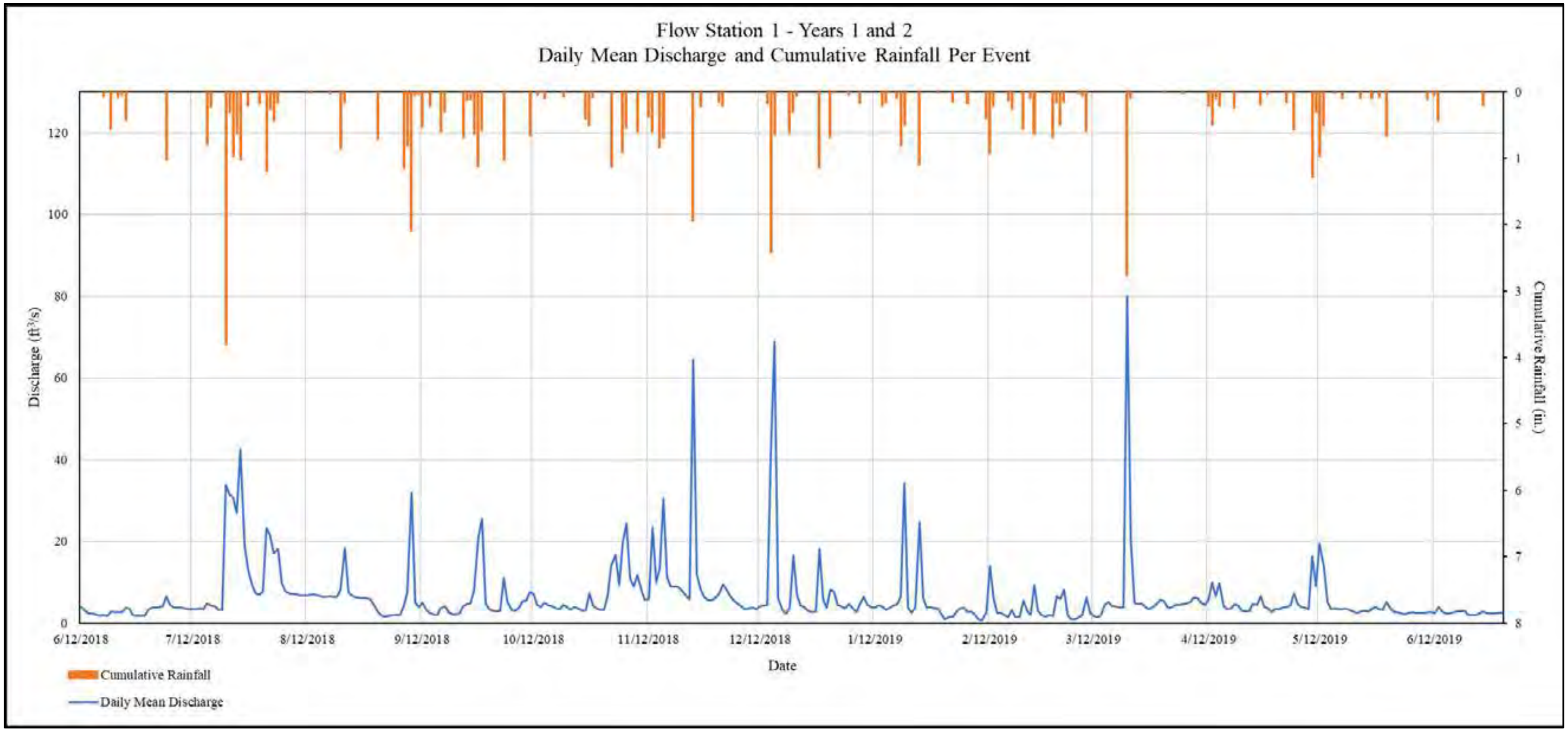
Channel Roughness

$$n = R_h^{1/6} * \frac{0.0926}{1.16 + 2LOG\frac{R_h}{D_{84}}}$$

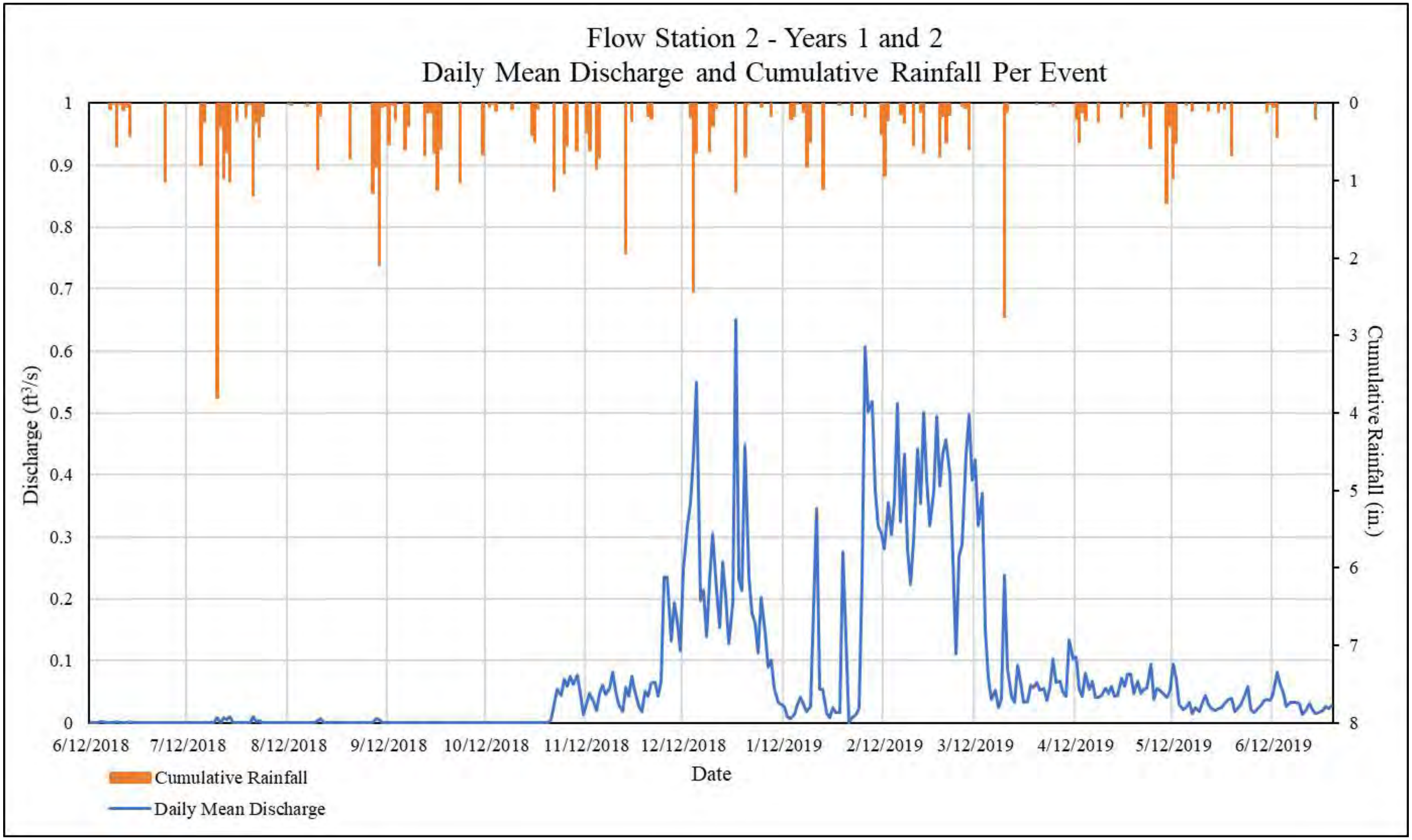
R_h = Bankfull Hydraulic Radius, ft	1.5525
D_{84} = Particle size larger than 84% other particles, ft	0.2526
n	0.036



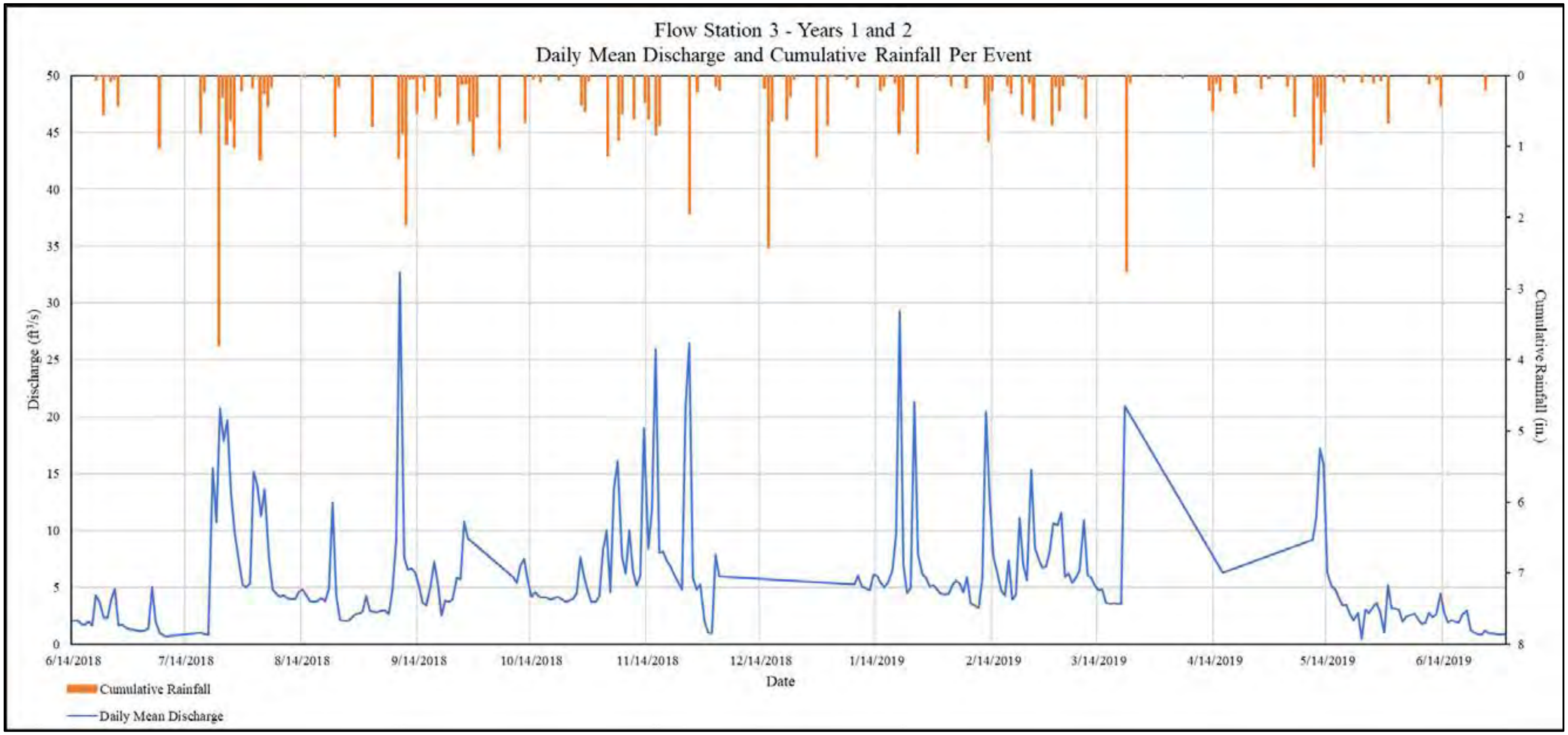
Appendix G
Daily Mean Discharge



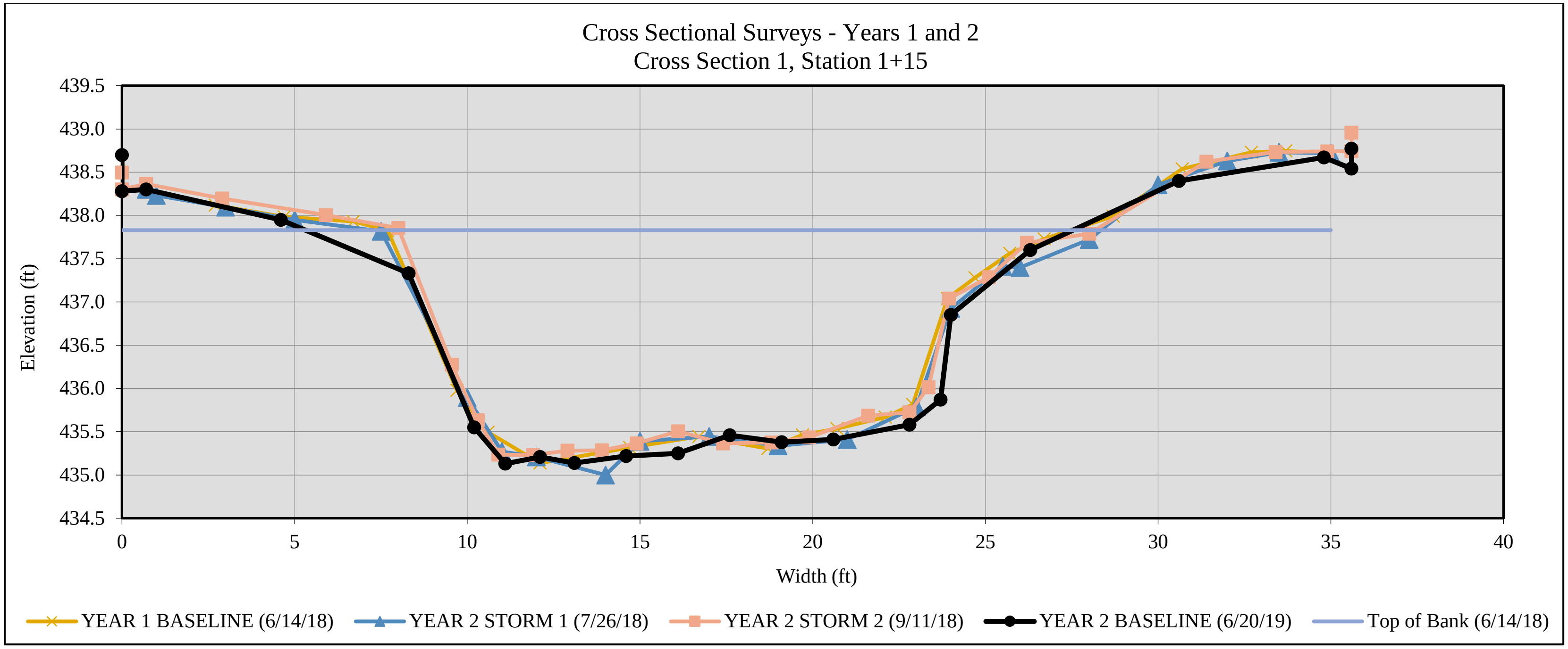
Flow Station 1 - Years 1 and 2
Daily Mean Discharge and Cumulative Rainfall Per Event
Discharge (ft³/s)
Cumulative Rainfall (in.)
Date
0
20
40
60
80
100
120
1
2
3
4
5
6
7
8
6/12/2018
7/12/2018
8/12/2018
9/12/2018
10/12/2018
11/12/2018
12/12/2018
1/12/2019
2/12/2019
3/12/2019
4/12/2019
5/12/2019
6/12/2019
Cumulative Rainfall
Daily Mean Discharge



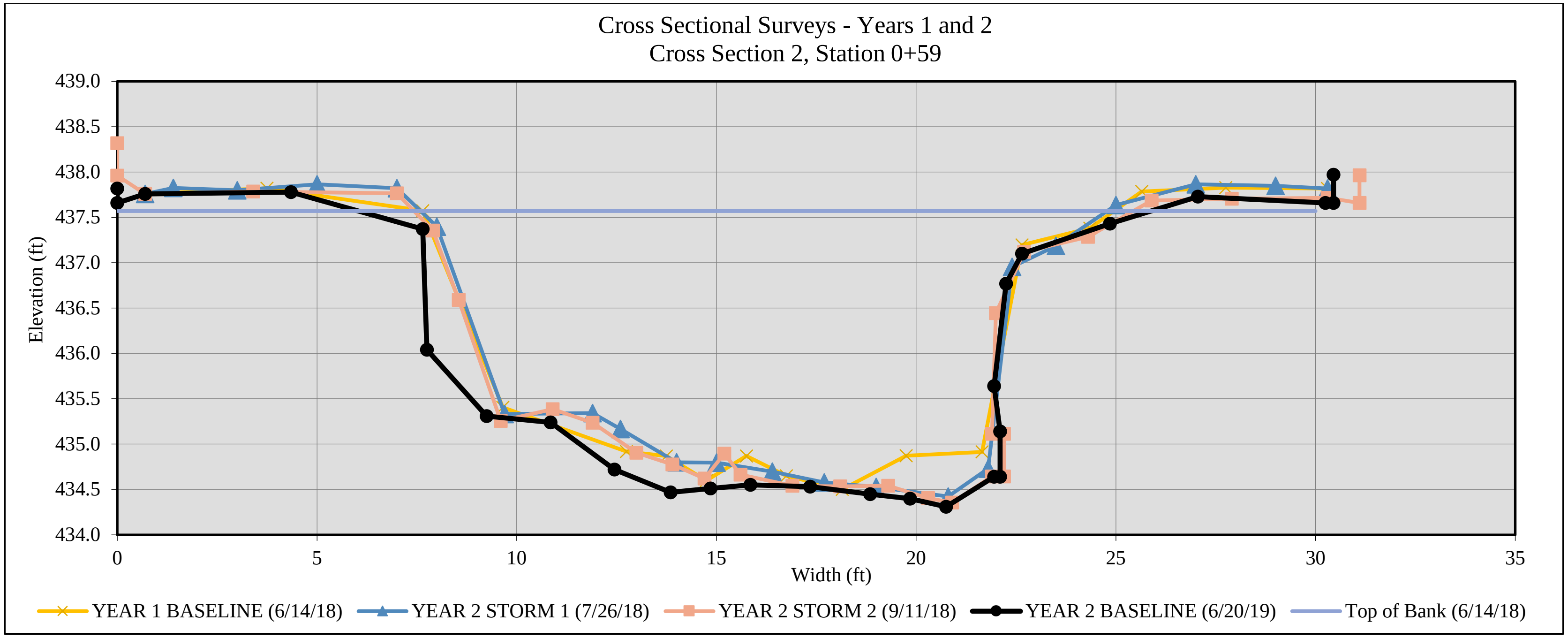
Flow Station 2 - Years 1 and 2
Daily Mean Discharge and Cumulative Rainfall Per Event
Discharge (ft³/s)
Cumulative Rainfall (in.)
Date
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1
2
3
4
5
6
7
8
6/12/2018
7/12/2018
8/12/2018
9/12/2018
10/12/2018
11/12/2018
12/12/2018
1/12/2019
2/12/2019
3/12/2019
4/12/2019
5/12/2019
6/12/2019
Cumulative Rainfall
Daily Mean Discharge


Flow Station 3 - Years 1 and 2
Daily Mean Discharge and Cumulative Rainfall Per Event
Discharge (ft³/s)
Cumulative Rainfall (in.)
Date
0
5
10
15
20
25
30
35
40
45
50
0
1
2
3
4
5
6
7
8
6/14/2018
7/14/2018
8/14/2018
9/14/2018
10/14/2018
11/14/2018
12/14/2018
1/14/2019
2/14/2019
3/14/2019
4/14/2019
5/14/2019
6/14/2019
Cumulative Rainfall
Daily Mean Discharge

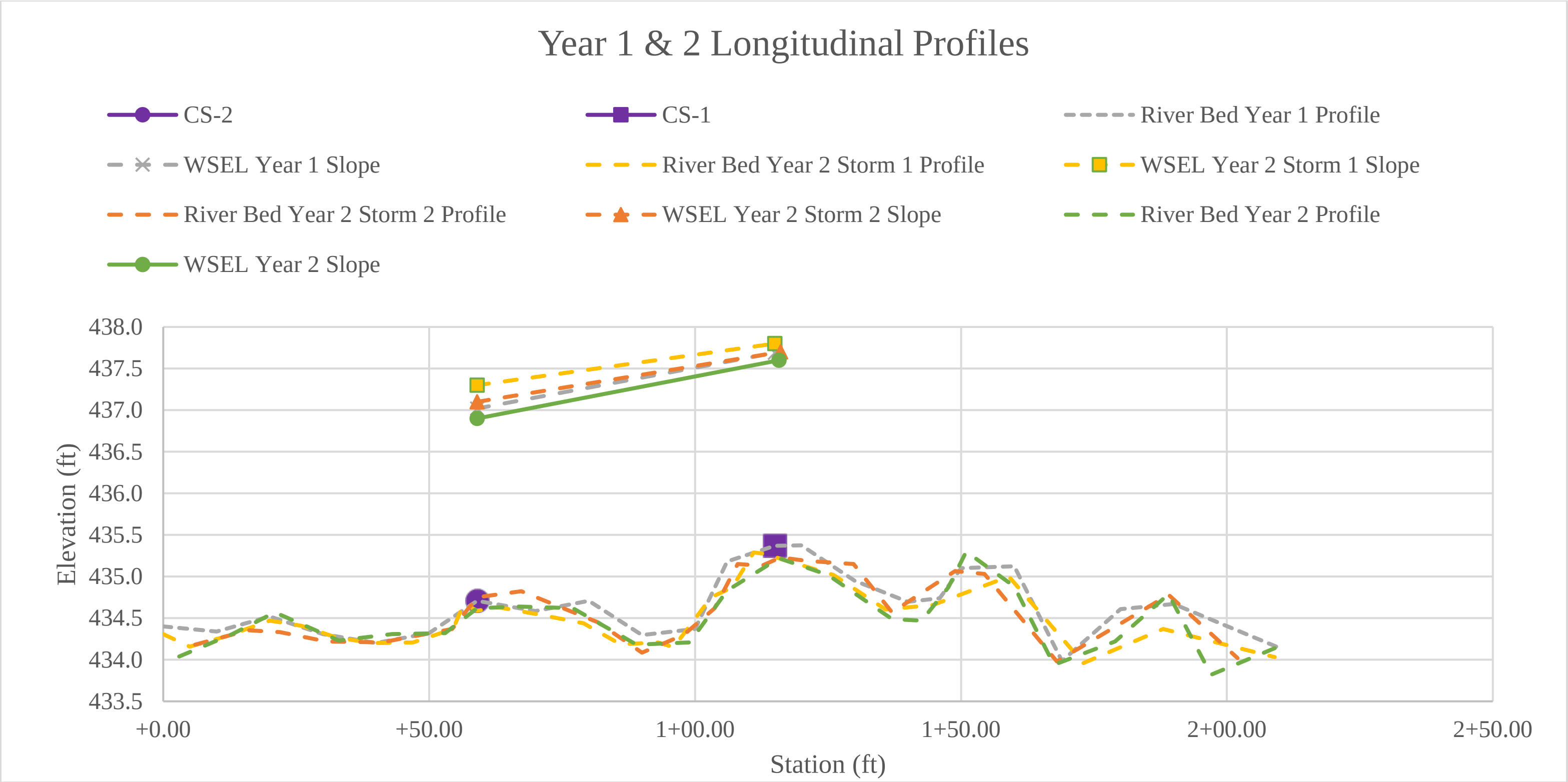
Appendix H
Physical Monitoring
Figures



Cross Sectional Surveys - Years 1 and 2
Cross Section 1, Station 1+15
Elevation (ft)
439.5
439.0
438.5
438.0
437.5
437.0
436.5
436.0
435.5
435.0
434.5
0
5
10
15
20
25
30
35
40
Width (ft)
YEAR 1 BASELINE (6/14/18)
YEAR 2 STORM 1 (7/26/18)
YEAR 2 STORM 2 (9/11/18)
YEAR 2 BASELINE (6/20/19)
Top of Bank (6/14/18)



Cross Sectional Surveys - Years 1 and 2
Cross Section 2, Station 0+59
Elevation (ft)
439.0
438.5
438.0
437.5
437.0
436.5
436.0
435.5
435.0
434.5
434.0
0
5
10
15
20
25
30
35
Width (ft)
YEAR 1 BASELINE (6/14/18)
YEAR 2 STORM 1 (7/26/18)
YEAR 2 STORM 2 (9/11/18)
YEAR 2 BASELINE (6/20/19)
Top of Bank (6/14/18)


Year 1 & 2 Longitudinal Profiles
CS-2
CS-1
River Bed Year 1 Profile
WSEL Year 1 Slope
River Bed Year 2 Storm 1 Profile
WSEL Year 2 Storm 1 Slope
River Bed Year 2 Storm 2 Profile
WSEL Year 2 Storm 2 Slope
River Bed Year 2 Profile
WSEL Year 2 Slope
Elevation (ft)
438.0
437.5
437.0
436.5
436.0
435.5
435.0
434.5
434.0
433.5
+0.00
+50.00
1+00.00
1+50.00
2+00.00
2+50.00
Station (ft)

Appendix I
Calibration,
Quality Control
and Interpolations

Continuous Flow

Calibration: Calibration was performed on June 21, 2018, for Flow Station 3 after the area-velocity meter was installed as part of the initial calibration of the field equipment. There was a discrepancy between the recorded field measurement of 11.25-inches at 11:15AM and the reported stage of 13.2 inches at 11:16AM. The system configuration was reviewed for the source of the error. Final calibration for the area-velocity meter occurred on June 27, 2018. The parameter adjusted for calibration was the difference in height of where the depth readings are taken and the bottom of the area-velocity meter and mounting plate. This affects what the area-velocity meter computes as stage for LPR. After correcting the system calculation for stage, the recorded value of stage was 0.856 feet at 10:24AM on June 27, 2018. Comparing this value to the measured field measurement of 0.854 feet at 10:33AM confirms that the correction correctly calibrated the instrument. The corrected parameter is measurable, so this difference could be applied to the uncalibrated stage measurements to give a reasonable estimate of the actual stage measurement. This corrected stage measurement did have an effect on the flow and total flow volume computed by the instrument, so these parameters were also corrected. A simple field test was performed on June 21, 2018, to determine if the velocity values were reasonable. A piece of paper was placed in the stream and was timed as it traveled along a measured distance. Two tests at two different intervals—25 feet and 10 feet—were performed. The estimated velocity of the water yielded an average value of 1.19 ft/sec. This value was compared to the area-velocity beam that was closest to the path the paper traveled along the stream. This was chosen because the average velocity calculated by the area-velocity meter uses four separate beams that cover the entire cross sections and different depths. The chosen beam is directed towards the water surface on the left side of the channel. The average value recorded during the test was 1.17 ft/sec which is comparable to the average value calculated from the field tests.

At Flow Station 2, during Years 1 and 2, there were several periods during which there was no water within the pipe. During these periods, the pressure measured by the logger was so low that, after compensation for barometric pressure, the values for stage were negative. When analyzing the data, all negative values were entered as 0.00 feet. Values below 0.00 feet should be considered as no flow at the outfall. MDOT SHA also needed to increase the stage for this station by 0.156-inches to account for the thickness of the PVC pipe logger housing. This correction is only applied during flow events so that the correction does not account for depth when no water is in the outfall.

Quality Control: Quality control was performed for the continuous flow monitoring equipment each month after downloading data. This was performed to ensure that the data collected was complete, representative, comparable, and of known quality. The data was plotted as needed and verified through visual inspection. The data from all logging devices were also inspected for accuracy. Data anomalies that occurred from equipment handling during monthly data download, low battery, clogged sensors, or malfunctioning equipment were documented and removed from analysis. The majority of data anomalies were relatively short period of times, 24 hours or less. Data anomalies that caused gaps longer than this are discussed below. Field measurements of water depth during monthly site visits were compared to the monitoring equipment logs to ensure the accuracy of the results. During Year 2, these measurements were also used to calibrate the water level data at Flow Station 1 & 2, as noted in the Section 3.2.1. Since a reference water level was used for Flow Station 1 and 2, the field measurements reflect the measured depth for that time. Since Flow Station 3 self-adjusts for barometric pressure so a reference water level was not used during barometric compensation. The differences between field measurements and data points used for analysis at Flow Station 3 had a maximum difference of less than one inch. The largest differences occurred when comparing the stage values. Stage is not a measured parameter but calculated based on the depth sensor and the distance from the bottom of the meter to the depth sensor. This distance was measured when the meter was installed and is a static value. The differences are believed to be due to the fact that the stage directly beneath the area-velocity meter cannot be measured due to the area-velocity meter itself. Therefore, stage measurements were taken adjacent to the meter. Since the stream bottom will slightly vary from the stream bottom at the area-velocity meter, this is likely the difference in the field and equipment stage measurements. The comparison of water depth for Flow Station 3 is less variable, with the maximum difference in measurements being 0.5 inches and the average as 0.2 inches. This would have an average potential difference of 0.75% on the calculated flow. This difference is likely due to the inaccuracy of field measurements, where the turbulence of the stream flow causes exact water depth measurements to be difficult. The turbulence of the water will cause the water line along the measuring device to slightly fluctuate up and down when it obstructs the flow. The differences between the field measurements and the equipment logged values is negligible and all data is believed to be representative of the site conditions.

Two peak stage and discharge events at Flow Station 2 were removed from analysis. These events occurred on January 21, 2019 and January 31, 2019. MDOT SHA removed these events because they were not supported by local rainfall data and appear to be anomalous. The events could have been from an ice build-up, based on the time of year they occurred.

Quality control was performed on the rain gauge when it was installed. The rain gauge in Figure 1 shows data recorded on June 20, 2018. Using the raw data file containing tip timestamps and known amount of rain per tip (.01”), cumulative rainfall (primary axis) and intensity (secondary axis) were calculated.

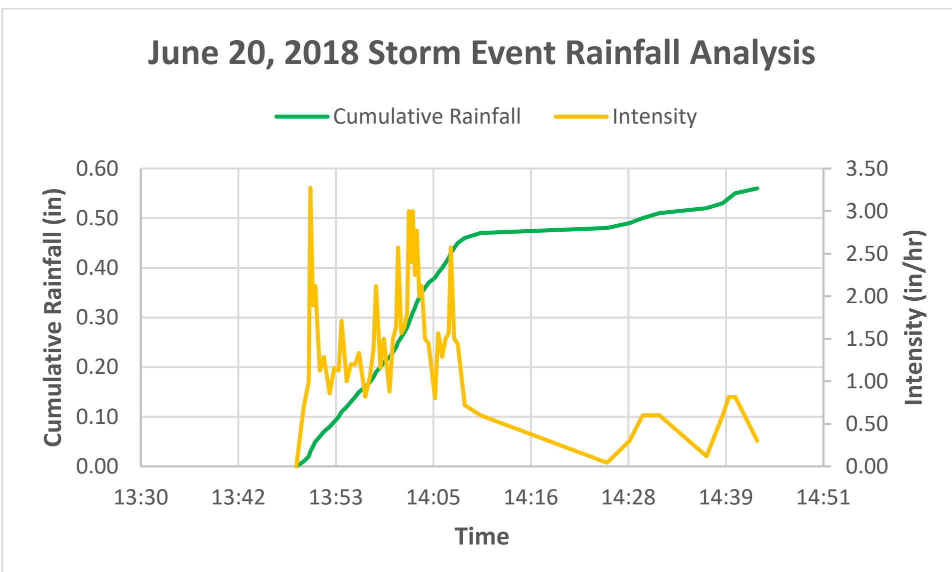


Figure 1. June 20, 2018 storm event rainfall analysis

To determine the validity of the results, MDOT SHA compared this rain event to a near-by independent rain gauge. The closest rain gauge with readily available data is the Thompson Drive (KMDELLIC68) weather station from Weather Underground (https://www.wunderground.com/personal-weather-station/dashboard?ID=KMDELLIC68). The rain gauge is approximately 1.20 miles west of the project rain gauge and is considered comparable due to its proximity. Figure 2 shows the cumulative rainfall recorded by the Weather Underground rain gauge and the project rain gauge from the rain event on June 20, 2018.

The lag between the events is explained by the difference in rain gauge locations. The difference between cumulative rainfall results is minimal and probably due to the path of the storm.

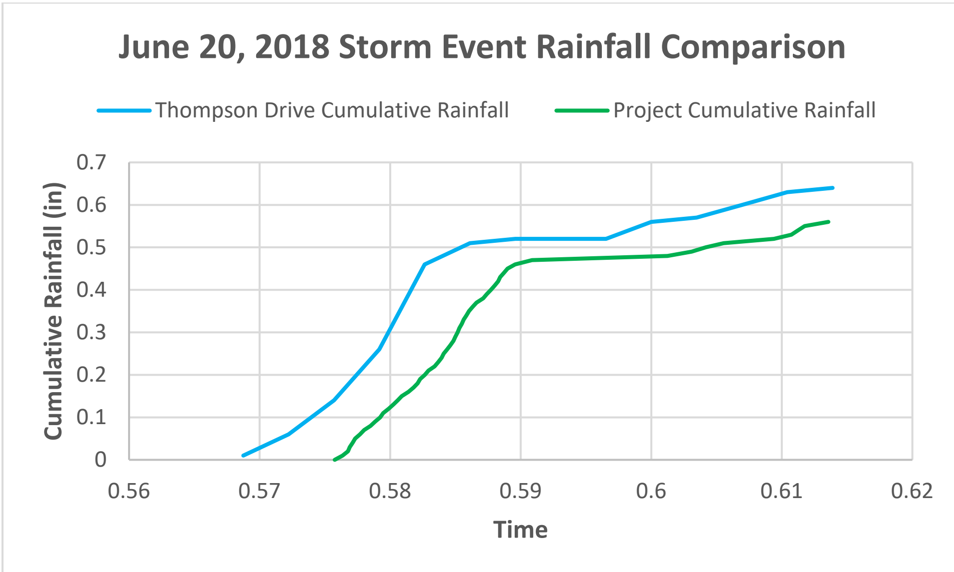


Figure 2. June 20, 2018 storm event rainfall comparison

Quality control of the recorded water temperature values was performed on July 18, 2018. A YSI Professional Plus water quality instrument was used for a field measurement while on-site at Flow Station 3. The field measurement at 10:11 AM yielded a value of 20.3 degrees Celsius or 68.5 degrees Fahrenheit. Comparing this to the recorded value of 68.9 degrees Fahrenheit at 9:54 AM for Flow Station 3, the equipment is believed to be operating correctly. Furthermore, the parallel values recorded between Flow Station 1 and 3 also confirm that the temperature is being measured accurately. The difference in Flow Station 2 water temperature when compared to Flow Station 1 and Flow Station 3 is likely due to the fact that the water from Flow Station 2 is runoff from I-70. This runoff travels across dark-colored impervious surfaces, which has the ability to retain heat and therefore transfer this energy to the water as it travels across its surface. See Figure 3 below for a comparison of water temperatures during Year 1 monitoring.

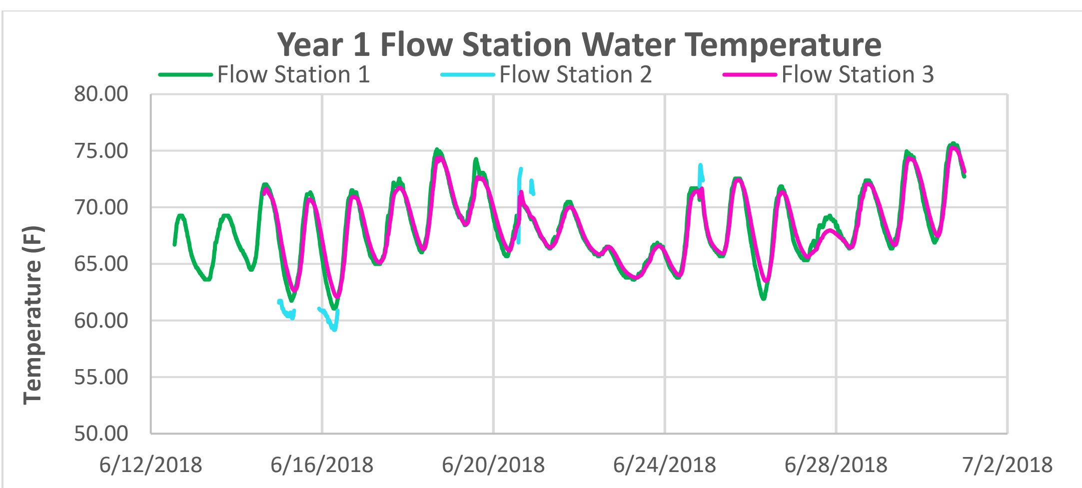


Figure 3. Year 1 Flow Station Water Temperature

Data interpolation: Data interpolation for the flow stations was performed to fill in gaps in the collected data due to equipment malfunction and data removed due to irregularities so that total discharge volume for the monitoring period could be calculated. Most of the time periods for which interpolation was used are relatively short, between 10 minutes and 24 hours. For these instances, the last recorded discharge value was applied to the period of time missing to estimate the total flow volume. Flow Station 3 was the only continuous flow monitoring station where interpolations greater than 24-hours occurred. Total discharge volume was estimated for these periods by averaging the daily mean discharge recorded at Flow Station 1 and applying the value to the gap in discharges for Flow Station 3. By using the average daily mean discharge at Flow Station 1 for that time period, a more accurate estimate of the flow conditions was used when interpolating. Flow Station 1 was chosen because it is the only other flow station on site with discharge data for those time periods. The alternative would be to use the last known data point at Flow Station 3, but that would not account for the change in discharge during the time gap. Table 1 provides a breakdown of when data interpolation was performed for periods exceeding 24-hours at Flow Station 3.

Table 1. Flow Station 3 Total Discharge Volume Interpolation Summary

Start Date of Interpolation	Start Time of Interpolation	End Date of Interpolation	End Time of Interpolation	Reason Interpolation Needed	Discharge Value Used in Interpolation
7/11/2018	3:24	7/18/2018	11:23	Debris wedged under velocity meter caused it to exceed tilt values	3.78
9/27/2018	21:24	10/9/2018	15:43	Power failure - low battery and firmware malfunction	7.31
11/11/2018	16:23	11/12/2018	20:13	System Error - errant data values due to debris jams	5.77
11/25/2018	8:13	11/26/2018	16:43	System Error - errant data values due to debris jams	10.16
12/3/2018	8:13	1/8/2019	10:13	Equipment malfunction - defaulted back to idle mode after monthly download	7.92
1/10/2019	16:33	1/12/2019	11:53	System Error - errant data values due to debris jams	4.06
3/21/2019	18:13	4/16/2019	11:10	Power failure - low battery	8.54
4/16/2019	11:40	5/10/2019	11:08	Power failure - faulty battery	4.49
6/12/2019	0:58	6/13/2019	3:48	System Error - errant data values due to debris jams	3.15

Physical Monitoring

Quality Control: Survey 1 or Year 1 baseline survey was performed on June 13, 2018. During quality control checks of the cross-sectional data, an error was discovered based on the difference in calculated elevations of the monuments when compared to the GPS survey results. After examination of the survey results, it was concluded that the laser level used during Survey 1 was not self-leveling due to an incorrect setting. The data from the survey was analyzed to determine corrective actions. A correction function for the data was calculated using two assumptions. The first assumption is that the error for the right bank monument is zero. For Survey 1, the laser level was set-up along the right bank of the LPR. This would indicate that the error from the surveyed data points would increase linearly as the survey progressed further from the laser level. The second assumption was that the elevations calculated for the monuments is accurate. Using these assumptions, the difference between the survey left bank elevation and the GPS elevation was calculated. A linear function representing the survey error across the cross section was determined and used to correct the survey data points collected in the field.

To validate the results of this correction to Survey 1, another survey of the cross sections, Survey 2, was performed on August 7, 2018, using the proper self-leveling settings for the laser level. Results of Survey 2 compared to the benchmark elevations at Cross Section 1 were within .04 feet of each other, while Cross Section 2 was within 0.12 feet. A real-time kinematic GPS unit was used to survey the elevations of the benchmarks. Depending on the exact GPS unit used and the distance to the base station, an accuracy of 0.15 feet can be expected. Since the survey results are within this range, it is believed that the results from the survey are reasonable.

Survey 2 results were then overlaid with the Survey 1 to see how they compared. The top of bank elevations were determined to have minimal elevation differences while some change can be seen along the stream bottom, which is to be expected for an active stream where the riverbed material is dynamic. Based on these results and the accuracy to be expected from this type of physical monitoring, the corrected data from Survey 1 is believed to be acceptable and was used as the Year 1 baseline survey for the project.

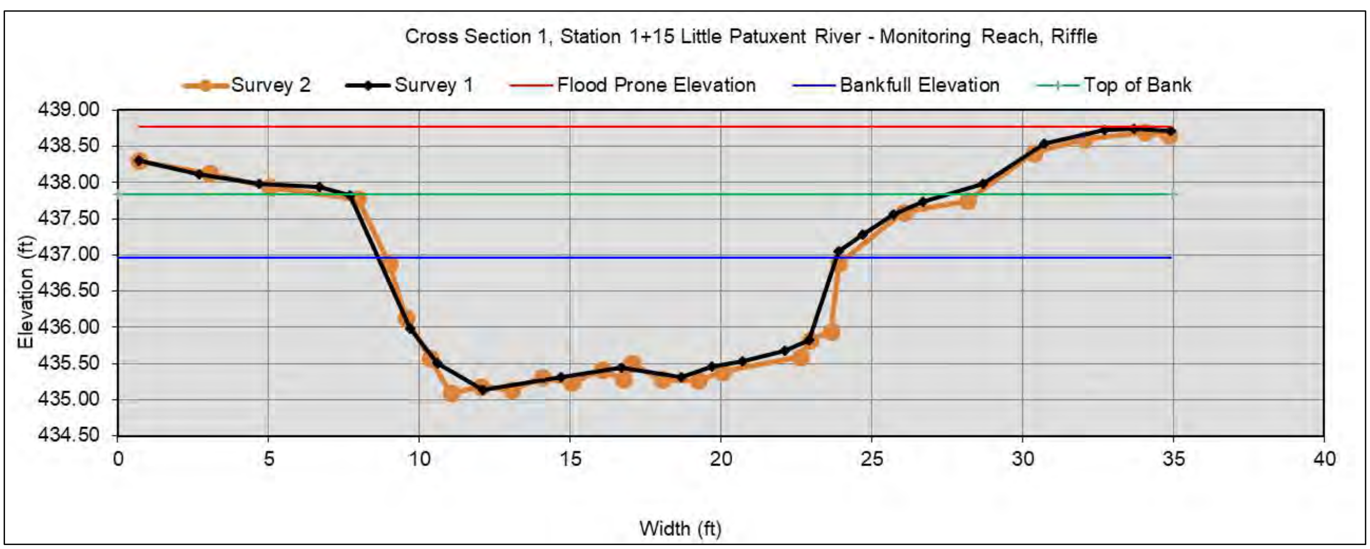


Figure 4. Survey 1 and 2 comparison at Cross Section 1

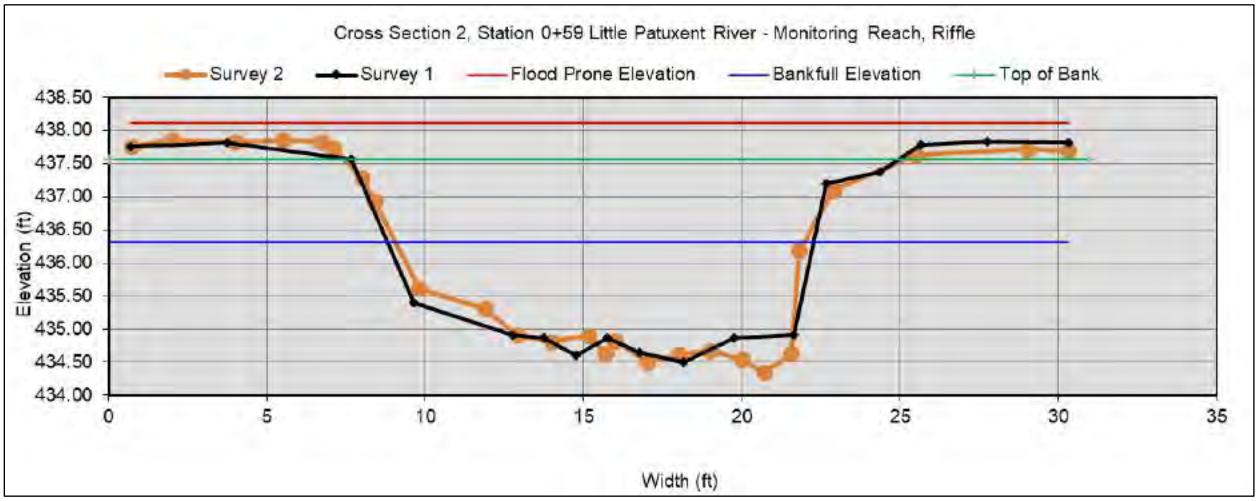
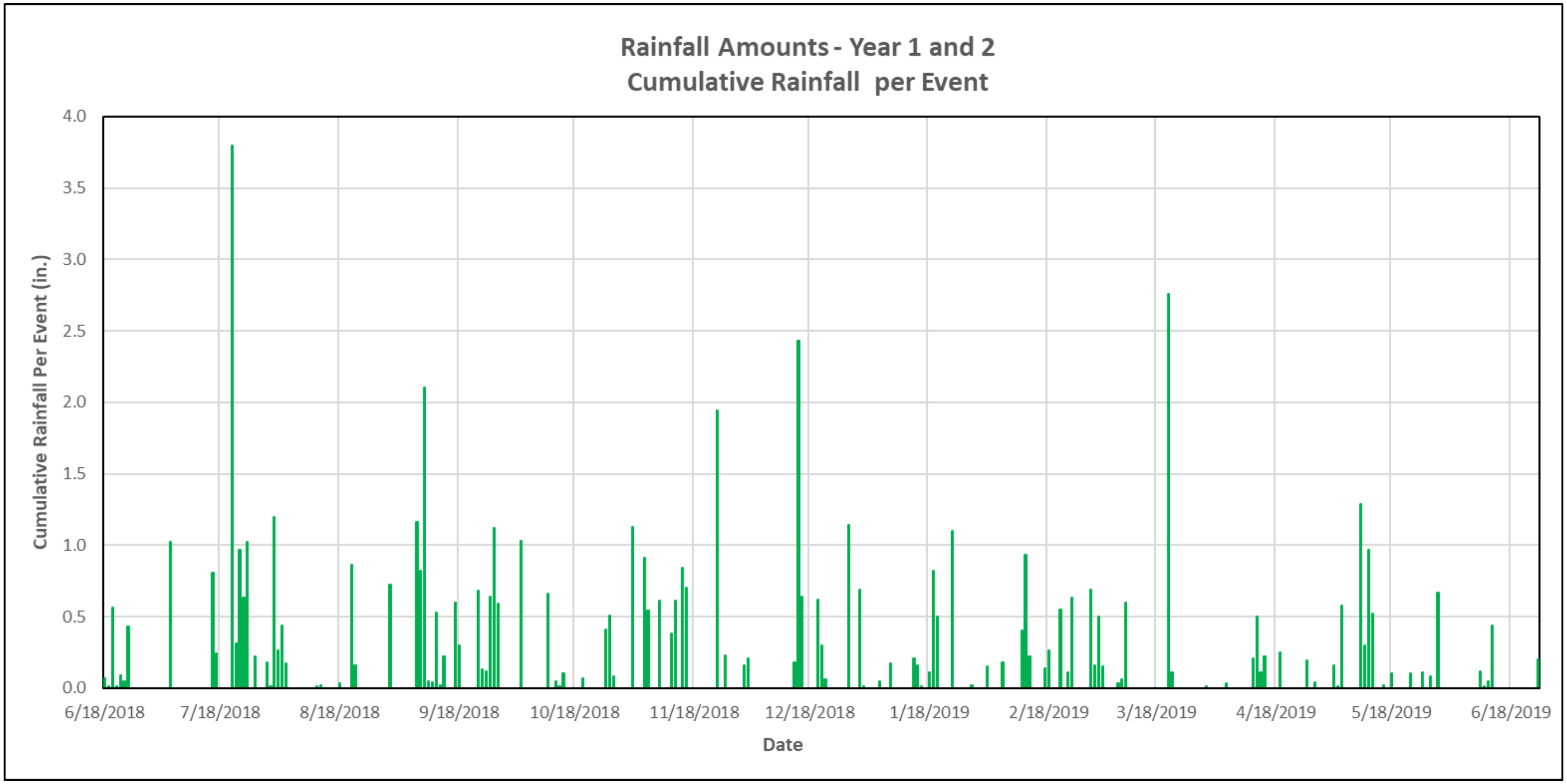


Figure 5. Survey 1 and 2 comparison at Cross Section 2

Appendix J

Cumulative Rainfall per Rain Event over Years 1 and 2



Cumulative rainfall per rain event for Years 1 and 2

Appendix H

Geospatial Database and Data Dictionary

Appendix H

Appendix H

Geospatial Database and Data Dictionary

MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

Appendix H
MDOT SHA Annual Report
GIS Database Submittal Data Dictionary

A Introduction

The NPDES Annual Report database submittal includes three ESRI geodatabases. MDOT SHA has provided the following geodatabases for submittal with the 2019 NPDES Annual Report:

Table H-1: MDOT SHA Geodatabases

Filename	Description	Specifications
MDOT_SHA_MDE_2019_geodatabase.mdb	MDE geodatabase for the FY2019 NPDES Annual Report (personal geodatabase)	Detailed *National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4), Geodatabase Design and User's Guide*, Version 1.1 published in April 2015
MDOT_SHA_NPDES_2019_geodatabase.gdb	SWM Infrastructure and Impervious Accounting datasets (file geodatabase)	Detailed in the *SHA's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit, Part IV.C,* which was provided to SHA on October 9, 2015
MDOT_SHA_Supplemental_2019_geodatabase.gdb	Commercial Industrial layer for MDOT SHA	Miscellaneous guidance document and MDE guidance identifying and determining the supplemental datasets

This database dictionary for the submittal incorporates a summary of modifications to the 2019 MDE geodatabase framework as well as a description of entities and attributes for the MDOT SHA NPDES 2019 geodatabase. Supplemental information for each layer is provided, as necessary, to detail the lineage of the datasets.

B File Formats

The 2019 Annual Report submittal geodatabases are exported from the enterprise SDE geodatabase environment into an ESRI geodatabase compatible with ArcGIS 10.3+.

C Contents

Within the "Databases" folder on the CD deliverable, the following ESRI geodatabases may be found:

- **MDOT_SHA_NPDES_2019_geodatabase.gdb**

- **MDOT_SHA_MDE_2019_geodatabase.mdb**
- **MDOT_SHA_Supplemental_2019_geodatabase.gdb**

D Data Projection

The MDE and Supplemental geodatabase submittals have been re-projected from SHA's standard projection into the required projection for MDE, specifically NAD_1983_StatePlane_Maryland _FIPS_1900_Meters. The data within the geodatabases are developed in the following original spatial projection: NAD_1983_StatePlane_Maryland _FIPS_1900_Feet.

E 2019 SHA NPDES Geodatabase (MDOT_SHA_NPDES_2019_geodatabase.gdb)

The geodatabase contains two core feature classes containing the spatial data relating to stormwater structures and conveyances. Each feature class is related through defined relationship classes to a set of tables that further describe the structure or conveyance. Additionally, the impervious surface layer is provided here as a feature class. The contents of the MDOT_SHA_NPDES_2019_geodatabase.gdb are detailed below in Table H-2.

Table H-2: MDOT SHA NPDES Geodatabase Contents

DATABASE SPATIAL LAYERS	TYPE	DESCRIPTION
STRUCTURES	Feature Class	Point feature class that stores the spatial representation and tabular information pertaining to storm water structures (i.e., inlets, manholes, outfalls, control structures). Information includes structure type, feature status, major outfall (T/F), and other overlay attributes such as watershed.
CONVEYANCE	Feature Class	Line feature class that stores the spatial representation and tabular information pertaining to storm water conveyance (i.e., pipe and ditch). Information includes conveyance type, feature status, invert elevations, and other overlay attributes such as watershed.
DATABASE TABLES	**TYPE**	**DESCRIPTION**
END_HEADWALL	Table	Contains the outfall and open upstream structures for a storm drain system, such as endsections, projection pipes, headwall, and endwalls. Information includes the type and material of the end structure.
INLET	Table	Contains the inlet features within the storm drain systems. Information includes the type and material of the inlet, the top of grate, and the length for COG and COS type inlets.
MANHOLE_CONN	Table	Contains the manhole and other connection features within the storm drain system. Information includes the material and top of manhole lid, when applicable.
DATABASE TABLES	**TYPE**	**DESCRIPTION**
PUMPSTN	Table	Contains the pump stations within the storm drain system. Information includes the station name, install date, number of pumps, and maximum capacity for the station.
SWMRISER	Table	Contains the storm water BMP control structure, such as box risers and pipe barrel risers. Information includes the material, if a trash rack exists, riser type, and the stage storage elevation.
WEIR	Table	Contains the weirs and emergency spillways related to storm water BMP storage controls. Information includes the material, if a trash rack exists, and the stage storage elevation.
DITCH	Table	Contains the ditch features within the storm drain conveyance. Information included includes ditch material and dimensions.
PIPES	Table	Contains the pipe features within the storm drain conveyance. Information includes the type, length, and dimension of the pipe.

F 2019 MDOT SHA Supplemental Geodatabase (MDOT_SHA_Supplemental_2019_geodatabase.gdb)

The geodatabase contains supplemental data provided to MDE, as follows:

MDOT_SHA_FY19_Commercial_Industrial

The MDOT SHA commercial and industrial layer

MDE should refer to the June 30, 2018 Baseline Revised Submittal for the Impervious Surface accounting layer and Right-of-Way layer geodatabase.

G 2019 SHA MDE Geodatabase

(MDOT_SHA_MDE_2019_geodatabase.mdb)

The geodatabase framework was altered in the following manner for the 2019 submission per MDE's request:

IMPL_COST – changed from short to long integer on all feature classes and tables where this attribute was present in the geodatabase.

H BMP / Structure System Numbering Convention

The BMP system numbering methodology applies a unique seven-digit identification number to each asset. The first two (2) digits indicate the county where the system is located. Table H-3 lists the county code numbers for Maryland. For county codes that begin with a zero (ex. Baltimore County 03), the leading zero is not dropped from any naming convention. The remaining five (5) digits represent the unique system number. For example, 130140 is system 140 located in Howard County (County Code 13).

Table H-3: Maryland County Codes

Code	Abbreviation	County Name	Code	Abbreviation	County Name
01	AL	Allegany	13	HO	Howard
02	AA	Anne Arundel	14	KE	Kent
03	BA	Baltimore	15	MO	Montgomery
04	CA	Calvert	16	PG	Prince Georges
05	CO	Caroline	17	QA	Queen Anne's
06	CL	Carroll	18	SM	St. Mary's
07	CE	Cecil	19	SO	Somerset
08	CH	Charles	20	TA	Talbot
09	DO	Dorchester	21	WA	Washington
10	FR	Frederick	22	WI	Wicomico
11	GA	Garrett	23	WO	Worcester
12	HA	Harford	24	BC	Baltimore City
			99	SW	Statewide

The individual drainage structures located within a system receive a unique three (3) digit identification number. For example, 1300140.007 is the seventh (.007) structure in the 140th drainage system in Howard County.

Numbering begins with the most downstream structure, usually the outfall, which is assigned the structure number of .001. Structures are then numbered as the system is traced upstream. For initial data collection or adding new systems, the most downstream structure in any system should be numbered .001. This is convention only, and structures may be numbered out of sequence in the existing geodatabase. Each system that flows into a BMP is a separate system. The control structure and outfall for a stormwater BMP also starts a new system. Figures H-1 and H-2 (on the following page) show examples of system, structure, and BMP numbering.

Figure H-1: System No. Ex. 1

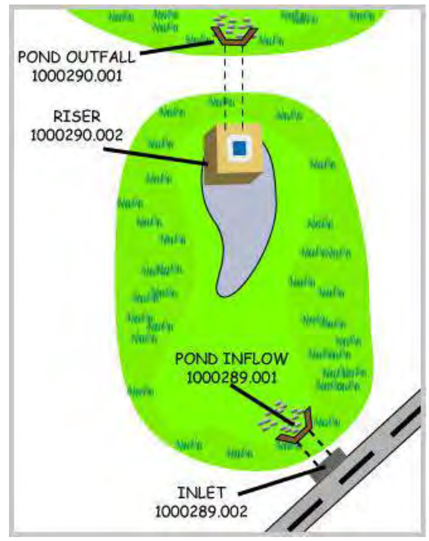


Figure H-2: System No. Ex. 2

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION