Consolidated Total Maximum Daily Load (TMDL) Implementation Plan Report

Prepared for District Department of Energy and the Environment

April 26, 2022

DEPARTMENT OF ENERGY & ENVIRONMENT

GOVERNMENT OF THE DISTRICT OF COLUMBIA
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EXECUTIVE SUMMARY

The District of Columbia's Municipal Separate Storm Sewer System ("MS4") National Pollutant Discharge Elimination System ("NPDES") permit (DC0000221, U.S. EPA 2018) requires the District to update its Consolidated Total Maximum Daily Load ("TMDL") Implementation Plan ("IP"), which was developed in 2016 and is hereafter referred to as the "2016 IP." This document reflects that required update and is hereafter referred to as the "2022 IP."

As required by the MS4 permit, this 2022 IP focuses on incorporating new information into the IP and updating all required elements, including the MS4 wasteload allocation ("WLA") inventory, WLA attainment dates, and the achievement of existing programmatic milestones. This 2022 IP summarizes progress to date in implementing best management practices (BMPs) to reduce loads, and provides projections and attainment strategies to guide future implementation.

This 2022 IP builds on – and primarily continues - strategies identified and implemented during development of the 2016 IP. This 2022 IP itself is structured in a similar way to the 2016 IP, although it focuses primarily on summarizing what has been achieved in the six years since the 2016 IP and on how the TMDL implementation program will move forward into the future. Much of the fundamental information on TMDL implementation program development can be found in the 2016 IP.

Overall, this 2022 IP provides a comprehensive review of the achievements of the TMDL implementation program as documented in the 2016 IP and provides a guide for the future based on adaptive management of that program.

1. INTRODUCTION

The District of Columbia ("DC" or the "District") owns and operates a Municipal Separate Storm Sewer System ("MS4") that is designed to collect and drain stormwater. The District has an EPA-issued MS4 National Pollutant Discharge Elimination System ("NPDES") permit that gives it the authority to operate the MS4 and discharge stormwater to the Anacostia and Potomac Rivers and their local tributaries within the District.

The MS4 covers an area of 19,750 acres. As shown in Figure 1-1 on the next page, the MS4 area surrounds the combined sewer system ("CSS") area – an area of the city where stormwater is collected and drained along with sanitary sewage. Both of these sewage systems have outfalls along water bodies into which the pollutant load associated with stormwater and, in the case of the CSS, sanitary sewage is discharged. The CSS is operated by DC Water under a separate NPDES permit. Figure 1-1 shows the MS4 and CSS areas as well as the major waterbodies in the District.

The District Department of Energy and Environment ("DOEE") developed lists of impaired water bodies ("the 303(d) list") across the District during the late 1990s and early 2000s. The listing of these impaired water bodies led to development of a large number Total Maximum Daily Load ("TMDL") studies covering a variety of pollutants over all of the District's water bodies. These TMDL studies allocate the quantity of each pollutant that can be discharged without violating the District's water quality standards ("WQS"). The allocations assigned to the MS4 are called wasteload allocations ("WLAs").

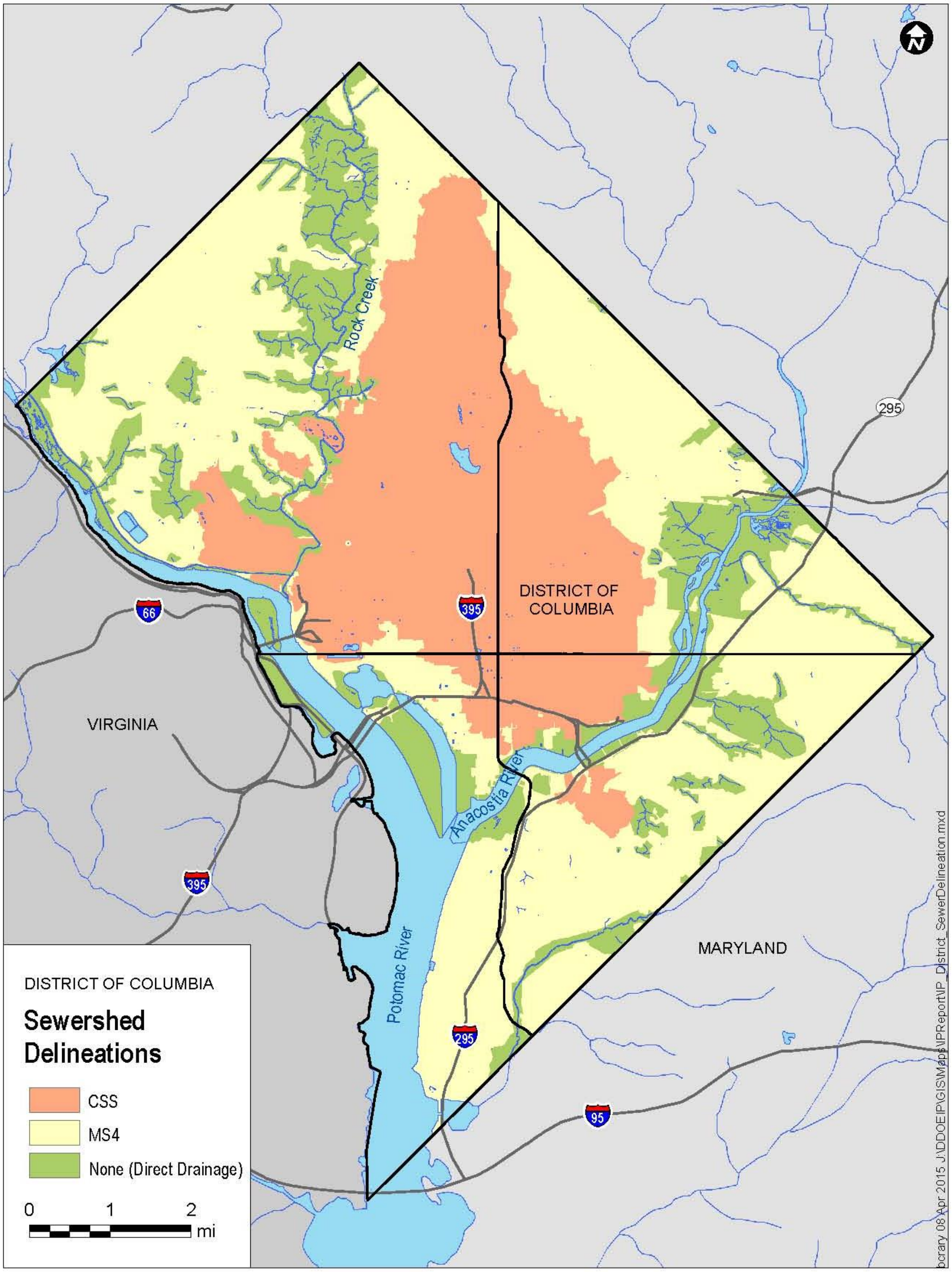

Figure 1-1: Sewershed Delineations for the District of Columbia

As part of its MS4 permit requirements under a previous (2012) permit, DOEE was required to develop a Consolidated TMDL Implementation Plan (or “IP” for short) that included strategies and a proposed timeline for achieving applicable MS4 WLAs. The original IP was published in June 2016 (DOEE, 2016a) and addressed the following permit requirements:

The Plan shall include:

1. *A specified schedule for attainment of WLAs that includes final attainment dates and, where applicable, interim milestones and numeric benchmarks.*
    a. *Numeric benchmarks will specify annual pollutant load reductions and the extent of control actions to achieve these numeric benchmarks.*
    b. *Interim milestones will be included where final attainment of applicable WLAs requires more than five years. Milestone intervals will be as frequent as possible but will in no case be greater than five (5) years.*
2. *Demonstration using modeling of how each applicable WLA will be attained using the chosen controls, by the date for ultimate attainment.*
3. *An associated narrative providing an explanation for the schedules and controls included in the Plan.*
4. *Unless and until an applicable TMDL is no longer in effect (e.g., withdrawn, reissued or the water delisted), the Plan must include the elements in 1-3 above for each TMDL as approved or established.*
5. *The current version of the Plan will be posted on the permittee's website.*

The District’s current MS4 permit (DC0000221, U.S. EPA 2018) (“2018 MS4 permit”) requires the District to update its IP. Specifically, the permit states that the focus of the IP update will be to

- Incorporate any new or revised TMDL (§2.2.5.1);
- Make appropriate adjustments to milestones if analysis indicates that initial milestones are not being met (§2.2.5.3); and
- Incorporate new information.

The 2022 updated IP (or the “2022 IP” for short) addresses these requirements.

It is important to recognize that this 2022 IP, and the process for developing it, builds on a process that was begun during the development of the 2016 IP. As such, much of the structure and components of the 2016 IP, and processes for implementation that were developed and implemented during the development of the 2016 IP. are continued in this 2022 IP. Fundamental information on the building blocks of the IP and MS4 WLAs can be found in the 2016 IP.

DOEE has also utilized the process of adaptive management to develop this 2022 IP. Lessons that have been learned over the last six years regarding effective implementation, TMDL pollutants, best management practice (“BMP”) performance, and pollutant modeling have been incorporated into the planning and projections, making the overall IP stronger.

The Consolidated TMDL IP is organized as follows:

- **Executive Summary -** The Executive Summary is added to provide an overview of content and to emphasize the key points of this 2022 IP in a concise manner.

- **Chapter 1 – Introduction -** The Introduction provides background on this 2022 IP and a forecast of sections and their composition.
- **Chapter 2 - Regulatory Requirements to Update the IP** – summarizes the specific permit requirements to develop this 2022 IP and summarizes the District's regulatory strategy for complying with TMDL implementation-related requirements.
- **Chapter 3 - Changes to the TMDL Inventory** – summarizes the current MS4 WLA inventory and changes to the inventory since the 2016 IP.
- **Chapter 4 - Updates to the Implementation Plan Modeling Tool ("IPMT") and Associated Databases** – summarizes the changes to the IPMT to improve modeling and tracking of WLA attainment.
- **Chapter 5 – Current Conditions** – summarizes the current conditions and progress made to date in terms of required load reduction. The section analyzes and summarizes BMP implementation trends and progress to date, as well as the gap between progress made and ultimate WLA attainment. This section also includes a discussion of the progress made against numeric milestones from the previous permit.
- **Chapter 6 – Implementation Plan for WLA Attainment -** describes DOEE's plans for achieving WLAs. This chapter also provides WLA attainment dates as well as an analysis of how updates to the TMDL inventory, BMP implementation, modeling inputs, and the IPMT have impacted these results. Finally, the chapter discusses how DOEE has used the adaptive management process and the implementation of key programmatic initiatives required under the current permit to accelerate the attainment of WLAs.
- **Chapter 7 – Tracking Progress** – summarizes the methods DOEE uses to track progress towards WLA attainment.
- **Chapter 8 – Public Outreach Plan** – summarizes the methods DOEE uses to communicate the IP, TMDL implementation, and load reduction progress to the public.
- **Chapter 9 – Integration with Other Watershed Plans** – describes how this 2022 IP is integrated with other watershed planning and reporting requirements in the District.
- **Chapter 10 – Funding the IP** – summarizes current funding programs and funding levels and discusses potential methods for increasing funding.

2. REGULATORY REQUIREMENTS TO UPDATE THE CONSOLIDATED TMDL IP

2.1 Requirement to Update the Consolidated TMDL IP

Section 2.2.5 of the District's 2018 MS4 permit requires the District to update its 2016 IP[1]. The 2016 IP was first published in May 2015 and was updated in August 2016. The permit states that the focus of the IP update will be to incorporate any new or revised TMDL (§2.2.5.1 – addressed in Chapter 3 of this document); make appropriate adjustments to milestones if analysis indicates that initial milestones are not being met (§2.2.5.3 – addressed in Chapter 6 of this document); and incorporate new information, including the results of studies and assessments required in this permit (addressed in Chapter 5 of this document), data on performance of stormwater control measures, improved pollutant estimates, or construction schedules, that informs refinement of benchmarks and milestones (§2.2.5.4 - addressed in Chapter 5 of this document). In addition, the 2018 MS4 permit renews previous requirements that the IP include a schedule for attainment of the WLAs (including a final date and interim milestones as necessary) (§2.2.5.1.a); a demonstration using modeling of how the WLAs will be attained (§2.2.5.1.b); and a narrative explaining schedules and controls used in the IP (§2.2.5.1.c). These requirements are addressed in Chapter 6 of this document.

2.2 Other TMDL Planning Requirements

In addition to the IP elements required by Section 2.2.5, the permit includes several other TMDL planning and implementation requirements that have been incorporated into the 2022 IP. These include:

- Using Bacterial Source Tracking to update milestones and benchmarks for implementing controls to attain *E. coli* WLAs (§2.2.2.1);
- Conducting an investigation for toxic TMDL pollutants (specifically, chlordane, heptachlor epoxide, dieldrin, dichloro-diphenyl-trichloroethane ("DDT"), dichloro-diphenyl-dichloroethylene ("DDE"), dichloro-diphenyl-dichloroethane ("DDD"), and polychlorinated biphenyls ("PCBs")) and updating milestones and benchmarks for implementing controls to attain these WLAs (§2.2.2.2);
- Developing a list of targeted watersheds and targeted implementation approaches for incorporation into the IP (§2.2.2.3);
- Evaluating the District's Stormwater Fee for its adequacy (in tandem with other financing options) in helping to achieve the water quality goals of the permit (§2.2.3);
- Evaluating the District's Stormwater Management regulations (§2.2.4) with the goal of evaluating the impact and feasibility of potential updates that could enhance implementation and load reductions; and
- Reporting on previously established milestones for acres managed, green roof implementation, tree planting, and trash removal (§1.5).

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[1] The 2016 Consolidated TMDL IP report is available for download at: https://dcstormwaterplan.org/wp-content/uploads/0_TMDL_IP_080316_Draft_updated.pdf. The appendices are available for download at: https://dcstormwaterplan.org/wp-content/uploads/TMDL_IP_Appendix_A-H.pdf.

Many of these requirements have been reported on previously in MS4 Annual Reports, documentation of technical studies, etc. The results of these studies and their impact on load reduction strategies for the IP is discussed in Chapter 6.

With respect to reporting on previously established milestones (§1.5), annual and cumulative progress towards meeting these milestones are provided in the MS4 Annual Reports starting from the beginning of the permit term[2]. For convenience, the milestone information from the MS4 Annual Reports are also presented in Chapter 5 of this 2022 IP. Chapter 6 also shows that the milestones are expected to be fully met by the end of the permit term in June 2023. However, information on progress towards these milestones is included to help evaluate the effectiveness of current implementation efforts and to help determine the need for updated or increased implementation strategies. This is covered in more detail in the discussion of adaptive management in Subsection 2.4 below.

2.3 Strategy to Meet Permit Requirements

The 2016 IP addressed all elements required by the previous MS4 permit; those elements are consistent with what is required by the 2018 MS4 permit. DOEE plans to continue using the same strategy as the foundation for making additional progress towards attaining WLAs during the next permit term (2023-2028) and beyond. DOEE will also continue to implement adaptive management to increase effectiveness.

In particular, DOEE will continue to use the Implementation Planning Modeling Tool (IPMT) for planning and tracking purposes. More information on the development of these strategies can be found in Chapter 6 (Implementation Plan: WLA Attainment) of the 2016 IP. The implementation strategies are also discussed in more detail in Chapter 6 (Implementation Plan: WLA Attainment) of this 2022 IP.

This 2022 IP continues the implementation strategies that were outlined in the 2016 IP. More information on the development of these strategies can be found in Chapter 6 (Implementation Plan: WLA Attainment) of the 2016 IP. The implementation strategies are also discussed in more detail in Chapter 6 (Implementation Plan: WLA Attainment) of this 2022 IP.

This 2022 IP also continues the strategies for tracking progress and funding that were outlined in the 2016 IP. Short updates to these components of the IP are provided in Chapter 7 (Tracking Progress) and Chapter 10 (Funding the Implementation Plan) of this document. Changes and updates to the Public Outreach Plan and to the integration of this IP with other watershed planning efforts are discussed in Chapters 8 (Public Outreach Plan) and 9 (Integration with other Watershed Planning Efforts), respectively, of this IP.

The District will also leverage the experience gained and the lessons learned during the implementation of the 2016 IP over the last several years to update this 2022 IP. A more detailed discussion of this process is included in the next subsection.

2.4 Use of Adaptive Management in Meeting Permit Requirements

An important component of meeting permit requirements for this 2022 IP is section 2.2.5.4, which requires the incorporation of new information that informs refinement of benchmarks and milestones.

[2] The 2019 MS4 Annual Report is the first Annual Report to cover the current permit term.

DOEE has implemented a process of adaptive management to meet this permit requirement. DOEE's process of adaptive management includes evaluating multiple aspects of the TMDL implementation process, including the IPMT, to ensure that this 2022 IP includes the most up-to-date information available for modeling and assessing current progress and developing forecasted WLA attainment dates. Updates to the IPMT that have been made since the 2016 IP was finalized are discussed in Chapter 4 (Updates to the Implementation Plan Modeling Tool) of this document. In addition, DOEE regularly evaluates its implementation process to identify and incorporate potential improvements. These program updates are discussed in Chapter 6 (Implementation Plan: WLA Attainment) of this document.

3. CHANGES TO TMDL INVENTORY

Since the publication of the 2016 IP (DOEE, 2016a), EPA has approved revisions to two TMDLs. DOEE has also updated its Phase 3 Watershed Implementation Plan ("WIP") for the Chesapeake Bay TMDL, which impacts load reduction requirements for that TMDL. Details on these changes are provided below:

- EPA approved the *Revised Metals Allocations and Daily Loads for Rock Creek* (DOEE, 2016b) in November 2016. This TMDL replaced the February 2004 *District of Columbia Final Total Maximum Daily Loads for Metals in Rock Creek* to incorporate revised water quality standards for copper, zinc, and mercury. It also includes daily loading expressions to comply with the court decision in *Friends of the Earth vs. the Environmental Protection Agency, 446 F.3d 140, 144* (D.C. Cir. 2006).
- EPA approved the *Total Maximum Daily Loads of Organochlorine Pesticides and Polychlorinated Biphenyls in Broad Branch, Dalecarlia Tributary, Dumbarton Oaks, Fenwick Branch, Klingle Valley Creek, Luzon Branch, Melvin Hazen Valley Branch, Normanstone Creek, Oxon Run, Piney Branch, Pinehurst Branch, Portal Branch, and Soapstone Creek in the District of Columbia* (DOEE, 2016c) in December 2016. Like the revised Rock Creek mainstem metals TMDL, this TMDL was developed to include daily loading expressions for its wasteload allocations and load allocations to address the *Friends of the Earth* decision. DOEE also incorporated additional sampling data that had been collected since the original TMDLs were approved. This TMDL replaces multiple previous TMDLs, including the February 2004 *District of Columbia Final Total Maximum Daily Loads for Organics and Metals in Broad Branch, Dumbarton Oaks, Fenwick Branch, Klingle Valley Creek, Luzon Branch, Melvin Hazen Valley Branch, Normanstone Creek, Pinehurst Branch, Piney Branch, Portal Branch, and Soapstone Creek*; the August 2004 *District of Columbia Final Total Maximum Daily Loads for Organics and Metals in Battery Kemble Creek, Foundry Branch, and Dalecarlia Tributary*; and the December 2004 *Total Maximum Daily Load for Organics, Metals and Bacteria in Oxon Run.* For the December 2004 TMDL, the bacteria loads had been previously revised in 2014.
- DOEE initially published the *District of Columbia's Phase III Watershed Implementation Plan for the Chesapeake Bay* (DOEE 2022) in August 2019 as part of the Bay Program's Midpoint Assessment. The District then amended the WIP in January 2022. The Phase 3 WIP included updated load reduction targets.

In July 2021, the District issued a draft revised TMDL for organics and metals in the Anacostia watershed entitled *Total Maximum Daily Loads for Organics and Metals in the Anacostia River Watershed*. This TMDL is intended to replace the August 2003 *Total Maximum Daily Loads for Organics and Metals in the Anacostia River, Fort Chaplin Tributary, Fort Davis Tributary, Fort Dupont Creek, Fort Stanton Tributary, Hickey Run, Nash Run, Popes Branch, Texas Avenue Tributary*, *and Watts Branch* and the September 2003 *Total Maximum Daily Loads for Organics and Metals in Kingman Lake*. However, because this TMDL has not yet been approved, it has not been incorporated into this 2022 IP.

The revisions to the TMDLs and the update of the District's Phase 3 WIP have an impact on the District's MS4 WLA inventory. These changes include:

- The addition of daily load expressions;

- Changes to some numeric expressions of existing annual MS4 WLAs; and
- The exclusion of specific pollutants/WLAs from the revised TMDL compared to the original TMDL when it was determined those pollutants or WLAs were no longer necessary to include in the revised TMDL.

Several examples of these changes and the reasons behind them are provided below:

- Many individual WLAs were removed from the updated TMDLs when samples taken in 2013 and 2014 as part of the TMDL revision process did not show exceedances of screening criteria. As stated in the revised TMDL for organics and metals in Potomac and Rock Creek tributaries:

> *TMDLs were not developed for pollutant(s)-waterbody combinations that did not exceed any numeric water quality criteria. For tributaries hydrologically connected to the Anacostia or Potomac Rivers, where there was no data other than fish tissue data from the mainstem Anacostia or Potomac Rivers, the toxic pollutant(s)-waterbody combinations were placed in Category 3(insufficient data). For waters that are not hydrologically connected to the Anacostia or Potomac River and have no evidence of a toxic pollutant present, those waters are no longer considered impaired for the specific parameter (although they remain identified as impaired based upon the District-wide fish consumption advisory).*

Individual WLAs for DDD and DDE, which had been included in the original TMDLs, were removed from the revised organics and PCBs TMDLs for the Potomac and Rock Creek tributaries because DOEE determined that WLAs for DDT were sufficient to address impairments, and that WLAs for DDD and DDE were not warranted.

3.1 Summary of MS4 WLAs

A total of 28 TMDL studies have been developed for impaired waters in the District - 15 for waterbodies in the Anacostia River watershed, six (6) for waterbodies in the Potomac River watershed, four (4) for waterbodies in the Rock Creek watershed, two (2) that encompass impaired waters in both the Anacostia River and the Potomac River watersheds, and one that includes waters in both the Potomac River and Rock Creek watersheds. (Note: This list includes both the TMDLs that have since been replaced and the TMDLs that replace them. It does not include the revised TMDL for organics and metals in the Anacostia River Watershed, because that TMDL has not yet been approved.)

Altogether, these TMDL studies provide allocations for 23 different pollutants[3] in 44 different waterbody segments. In total, the District has 439 WLAs, of which 273 are annual, 150 are daily, 16 are seasonal or monthly, and 3 are non-numeric. A summary of these TMDL studies is provided in Table 3-1 below. The table includes the name of each TMDL study; a sum of the total numeric and non-numeric MS4 WLAs in the TMDL study; a summary of the types of WLA expressions in the study (e.g., annual, daily, or seasonal WLAs); and a summary of the types of pollutants for which there are WLAs. There are also notes for each TMDL study that describe any caveats or discrepancies in the study. Finally, the total numbers of numeric and non-numeric WLAs are provided at the bottom of the table.

[3] Note that there are 23 different pollutants for which TMDLs have been completed, but only 22 pollutants for which MS4 WLAs must be achieved. This is because fecal coliform WLAs have been translated to *E. coli* for the purposes of setting MS4 WLAs.

Table 3-1: TMDL Studies and Current MS4 WLAs[1]

Major Basin	TMDL Name	Number of Numeric MS4 WLAs	Number of Non-numeric MS4 WLAs	WLA Express-ions	Metals	Organics	Nutrients	Sediment	Bacteria	Pesticides	PCBs	Other (Oil and Grease, BOD, Trash)	Notes
Anacostia	District Final Hickey Run TMDL Water Quality Management Plan to Control Oil and Grease, PCB, and Chlordane (1998)	0	3	Non-numeric narrative		X					X	X	3 narrative WLAs
Anacostia	District Final TMDL for Oil and Grease in the Anacostia River (2003)	2 (2 daily)	0	Daily								X	MS4 WLAs not provided; Decision Rationale document provides WLAs, but they include CSO and MS4 loads
Anacostia	District Draft TMDL for Biochemical Oxygen Demand in Fort Davis Tributary (2003)	0	0	N/A								X	EPA Decision Record indicates TMDL/MS4 WLA not required
Anacostia	District TMDL for Organics and Metals in the Anacostia River and Tributaries (2003)	125 (125 annual)	0	Annual	X	X				X	X		Draft revised TMDL for organics and metals in the Anacostia watershed has been completed but has not yet been approved; therefore this TMDL remains in effect

Table 3-1: TMDL Studies and Current MS4 WLAs[1]

Major Basin	TMDL Name	Number of Numeric MS4 WLAs	Number of Non-numeric MS4 WLAs	WLA Express-ions	Metals	Organics	Nutrients	Sediment	Bacteria	Pesticides	PCBs	Other (Oil and Grease, BOD, Trash)	Notes
Anacostia	District Final TMDL for Organics and Metals in Kingman Lake (2003)	13 (13 annual)	0	Annual	X	X				X			Draft revised TMDL for organics and metals in the Anacostia watershed (including Kingman Lake) has been completed but has not yet been approved; therefore, this TMDL remains in effect
Anacostia	District Final TMDL for TSS, Oil &Grease, BOD in Kingman Lake (2003)	1 (1 daily)	0	Daily				X				X	EPA Decision Record indicates TMDLs/MS4 WLAs not required for TSS, BOD
Anacostia	District Final TMDL for Total Suspended Solids in Watts Branch (2003)	4 (1 annual, 2 daily, 1 growing season)	0	Annual, Growing Season, Daily				X					
Anacostia	TMDL of Sediment/Total Suspended Solids for the Anacostia River Basin, Montgomery and Prince George's Counties, MD and the District (2007)	26 (5 annual, 8 daily, 13 growing season)	0	Annual, Growing Season, Daily				X					Includes daily and growing season daily WLAs

Table 3-1: TMDL Studies and Current MS4 WLAs[1]

Major Basin	TMDL Name	Number of Numeric MS4 WLAs	Number of Non-numeric MS4 WLAs	WLA Express-ions	Metals	Organics	Nutrients	Sediment	Bacteria	Pesticides	PCBs	Other (Oil and Grease, BOD, Trash)	Notes
Anacostia	TMDL of Nutrients/ BOD for the Anacostia River Basin, Montgomery and Prince George's Counties, MD and the District (2008)	39 (15 annual, 24 daily)	0	Annual, Daily			X					X	
Anacostia	TMDL of Trash for the Anacostia River Watershed, Montgomery and Prince George's Counties, MD and the District (2010)	4 (2 annual, 2 daily)	0	Annual, Daily								X	
Anacostia	E. coli Bacteria Allocations and Daily Loads for the Anacostia River and Tributaries (2014)	30 (10 annual; 20 daily)	0	Annual, Daily					X				Officially Appendix C of previous (2003) TMDL. Replaces 2003 fecal coliform WLAs.
Anacostia	E. coli Bacteria Allocations and Daily Loads for Kingman Lake (2014)	3 (2 daily, 1 monthly)	0	Monthly, Daily					X				Officially Appendix A of previous (2003) TMDL. Replaces 2003 fecal coliform WLAs.
Potomac	District Final TMDL for pH in the Washington Ship Channel (2004)	1 (1 annual)	0	Annual			X						TMDL indicates that no reduction in phosphorus is needed to meet MS4 WLA
Potomac	District Final TMDL for Organics in Tidal Basin and Washington Ship Channel (2004)	20 (20 annual)	0	Annual		X				X	X		

Table 3-1: TMDL Studies and Current MS4 WLAs[1]

Major Basin	TMDL Name	Number of Numeric MS4 WLAs	Number of Non-numeric MS4 WLAs	WLA Express-ions	Metals	Organics	Nutrients	Sediment	Bacteria	Pesticides	PCBs	Other (Oil and Grease, BOD, Trash)	Notes
Potomac	E. coli Bacteria Allocations and Daily Loads for the Potomac River and Tributaries (2014)	18 (6 annual, 12 daily)	0	Annual, Daily					X				Officially Appendix B of previous (2004) TMDL. Replaces 2004 fecal coliform WLAs.
Potomac	E. coli Bacteria Allocations and Daily Loads for Oxon Run (2014)	3 (1 annual, 2 daily)	0	Annual, Daily					X				Officially Appendix B of previous (2004) TMDL. Replaces 2004 fecal coliform WLAs.
Potomac	District Final TMDL for Bacteria in the Chesapeake and Ohio Canal (2014)	3 (1 annual, 2 daily)	0	Annual, Daily					X				Officially Appendix B of previous (2004) TMDL. Replaces 2004 fecal coliform WLAs.
Potomac	E. coli Bacteria Allocations and Daily Loads for the Tidal Basin and the Washington Ship Channel (2014)	6 (2 annual, 4 daily)	0	Annual, Daily					X				Officially Appendix B of previous (2004) TMDL. Replaces 2004 fecal coliform WLAs.
Potomac, Anacostia	TMDL for PCBs for Tidal Portions of the Potomac and Anacostia Rivers in District, MD, and VA (2007)	17 (7 annual, 10 daily)	0	Annual. Daily							X		
Potomac, Anacostia	Chesapeake Bay TMDL for Nitrogen, Phosphorus, and Sediment (2010)	12 (12 annual)	0	Annual			X	X					Load reduction planning targets revised 2019 and finalized 2022

Table 3-1: TMDL Studies and Current MS4 WLAs[1]

Major Basin	TMDL Name	Number of Numeric MS4 WLAs	Number of Non-numeric MS4 WLAs	WLA Express-ions	Metals	Organics	Nutrients	Sediment	Bacteria	Pesticides	PCBs	Other (Oil and Grease, BOD, Trash)	Notes
Potomac, Rock Creek	Total Maximum Daily Loads of Organochlorine Pesticides and Polychlorinated Biphenyls in Broad Branch, Dalecarlia Tributary, Dumbarton Oaks, Fenwick Branch, Klingle Valley Creek, Luzon Branch, Melvin Hazen Valley Branch, Normanstone Creek, Oxon Run, Piney Branch, Pinehurst Branch, Portal Branch, and Soapstone Creek in the District of Columbia (2016)	82 (41 annual, 41 daily)	0	Annual, Daily		X					X		Replaces 2004 Potomac Tributaries metals and organics TMDL; 2004 Oxon Run metals, organics, and bacteria TMDL (metals and organics components only); and 2004 Rock Creek tributaries metals and organics TMDL
Rock Creek	E. coli Bacteria Allocations and Daily Loads for Rock Creek (2014)	6 (2 annual, 4 daily)	0	Annual, Daily					X				Officially Appendix B of previous (2004) TMDL. Replaces 2004 fecal coliform WLAs.
Rock Creek	Revised Metals Allocations and Daily Loads for Rock Creek (2016)	24 (8 annual, 16 daily)	0	Annual	X								Officially Appendix C of previous (2004) TMDL.

Table 3-1: TMDL Studies and Current MS4 WLAs[1]														
Major Basin	TMDL Name	Number of Numeric MS4 WLAs	Number of Non-numeric MS4 WLAs	WLA Express-ions	Metals	Organics	Nutrients	Sediment	Bacteria	Pesticides	PCBs	Other (Oil and Grease, BOD, Trash)	Notes
Total		**439 (273 annual; 150 daily; 15 growing season; 1 monthly)**	3										
WLAs Not Required	3 WLAs not required (Fort Davis BOD; TSS, BOD for Kingman Lake)												

[1]Multiple TMDL studies have been replaced by revised TMDLs, and thus are not included in this list of current TMDLs. This includes fecal coliform bacteria TMDLs for the Anacostia River and its tributaries, Kingman Lake, C&O Canal, Oxon Run, the Potomac River and its tributaries, Rock Creek mainstem, and the Tidal Basin and Washington Ship Channel; metals TMDLs for the mainstem of Rock Creek; and organics and metals TMDLs for Potomac River tributaries, Oxon Run, and Rock Creek tributaries.

4. UPDATES TO THE IMPLEMENTATION PLAN MODELING TOOL ("IPMT") AND ASSOCIATED DATABASES

4.1 Introduction

A major component of the 2016 IP was the development of an Implementation Plan Modeling Tool ("IPMT") to estimate, track, and account for pollutant load generation and load reduction across the District. The IPMT, which is based on a Modified Version of the Simple Method for estimating stormwater runoff pollutant loads for urban areas, was designed to use a single, consistent modeling approach for analysis of all pollutants of interest that have MS4 WLAs. The development of this tool is explained in Chapter 4 of the 2016 IP.

DOEE's 2018 MS4 permit states that "*The Permittee shall continue to update the Consolidated TMDL Implementation Plan modeling tool and associated databases, which shall be used in development of revised plans, schedules or strategies"* (permit §2.2.1). This section describes the changes and updates to the IPMT that have been made since the 2016 IP was completed.

4.2 Model Components Assessed and Updated

The four main components of the Modified Version of the Simple Method are rainfall, runoff coefficients, drainage areas, and event mean concentrations ("EMCs"). These components are used to calculate runoff volumes and pollutant loads from entire TMDL segments as well as from individual BMP drainage areas. Of these four components, rainfall and runoff coefficients were updated using the most up-to-date information available. Drainage areas were not updated because there were no changes to the delineations of the TMDL segments. EMCs were not updated because no updated monitoring data were available at the time that this report was prepared.

In addition, the IPMT includes a BMP module that incorporates information on best management practices into the IPMT to calculate the load reductions from BMPs. BMPs were reviewed based on the most up-to-date information available, including the sediment delivery ratios for in-stream erosion and sediment/nutrient transport.

The review, assessment, and update of these components of the IPMT are described below.

4.2.1 Rainfall

Rainfall drives the generation of runoff and pollutant loads. The calculation of runoff and pollutant loads with the Modified Version of the Simple Method is typically based on annual rainfall totals. The 2016 IP used the recorded data at Ronald Reagan Washington National Airport to estimate the average annual rainfall, which was approximately 39.7 inches based on data from 1946 to 2013 but rounded up to 40.0 inches for purposes of the IPMT modeling efforts.

For this 2022 IP, the rainfall data at Ronald Reagan Washington National Airport was again evaluated to estimate the average annual rainfall. This time, data from 1946 to 2020 was extracted, and the annual average rainfall was calculated to be 40.3 inches.

Figure 4-1 below shows the annual rainfall data from 1946 to 2020. Both the 5-year rolling average and the linear trendline of the data indicate a steady increase in annual rainfall over time, particularly in the last two decades. This trend is supported by climate change literature, with annual rainfall increase projections ranging from five percent to 10 percent over the next century (EPA, 2016; EPA, 2021; UMass, 2016a; UMass, 2016b; ChesapeakeProgress, 2018; NOAA, 2017; NOAA, 2021). Based on this information, the following rainfall values will be used in the IPMT:

- Rainfall for the period from 2000 to 2020: 40 inches of annual rainfall (used to calculate current runoff and pollutant load reductions.)
- Rainfall for the future (post-2020): 42 inches and 44 inches of annual rainfall (used to calculate future attainment of WLA. Both rainfall values are used to reflect the uncertainty around the future rainfall averages, which could reasonably be expected to increase by 5 to 10 percent (or +2 to +4 inches, respectively, due to climate change). See Chapter 6 for additional information on how rainfall was used to determine future attainment of WLAs.

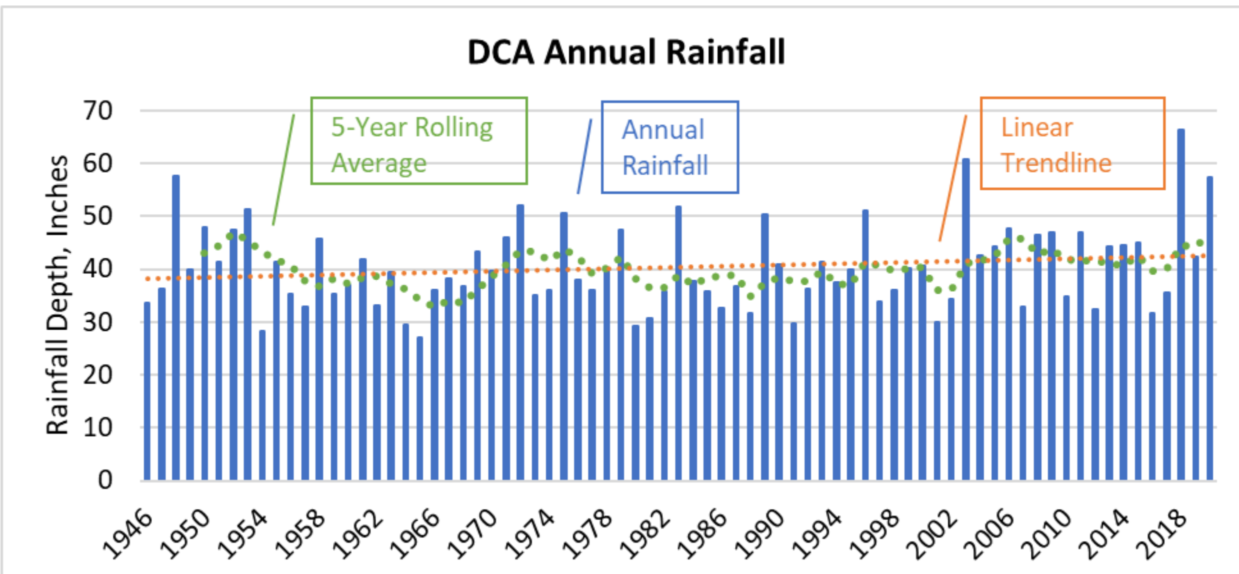

Figure 4-1: Annual Rainfall as Recorded at Ronald Reagan Washington National Airport, 1946-2020

4.2.2 Impervious Landcover and the Runoff Coefficients

The runoff coefficient, Rvc, used in the IPMT is a composite value that represents the fraction of rainfall that is converted to runoff for the area being modeled. Because the areas being modeled are comprised of different proportions of different land use types, a composite runoff coefficient is calculated to represent the combination of different land use types in the area being modeled. The reference runoff coefficients for different soil groups and land use types recommended for use in the Modified Version of the Simple Method are summarized in Table 4-1 (CWP and CSN, 2008).

Table 4-1: Reference Runoff Coefficients			
Soil Group	Impervious	Turf	Forest
HSG A Soils	0.95	0.15	0.02
HSG B Soils	0.95	0.20	0.03
HSG C Soils	0.95	0.22	0.04
HSG D Soils	0.95	0.25	0.05

Composite runoff coefficients are developed for each TMDL segment based on weighting the relative occurrence of each soil and land cover type, and the appropriate runoff coefficient. In the 2016 IP, the runoff coefficients for the MS4 TMDL segments ranged from 0.43 to 0.86.

The runoff coefficients are sensitive to changes in impervious landcover. Between 2008 and 2019, the overall impervious landcover in the MS4 increased by approximately 4.3 percent (Figure 4-2) (OCTO 2008 and 2019). These data layers were developed by the District Office of the Chief Technology Officer (OCTO) in 2008 and 2019, respectively. The total impervious areas from these two layers were clipped by the MS4 area and summed using ArcGIS software. A portion of the observed 4.3% increase in impervious area is likely due to more accurate data in those impervious layers in 2019 vs. 2008. For example, some features (i.e. wastewater holding ponds at Blue Plains Wastewater Treatment Plant) were included as impervious areas in 2019, but they weren't in 2008.

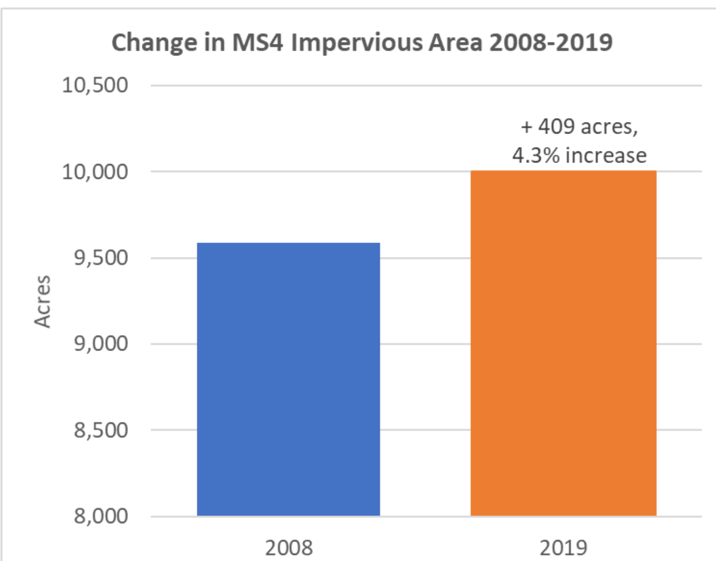

Figure 4-2: Change in Impervious Landcover Area in the MS4, 2008-2019

While there is an overall maximum increase of 4.3% in impervious landcover across the entire MS4 area (due to consistent development and redevelopment around the city), there is variability between MS4 TMDL segments, with some MS4 segments increasing in impervious landcover and some decreasing. The composite runoff coefficients for the MS4 TMDL segments on average increased one percent (1.0%) and vary from 0.42 to 0.83.

Note that while the overall impervious landcover area in the MS4 increased during the period from 2008 to 2019, the overall impervious landcover area treated by BMPs also increased, but at a much higher rate. The MS4 impervious landcover area increased by 4.3% during the period between 2008 and 2019, while the MS4 impervious landcover area that is controlled by BMPs increased by 201% between 2008 and 2019. This is shown in Figure 4-3 below.

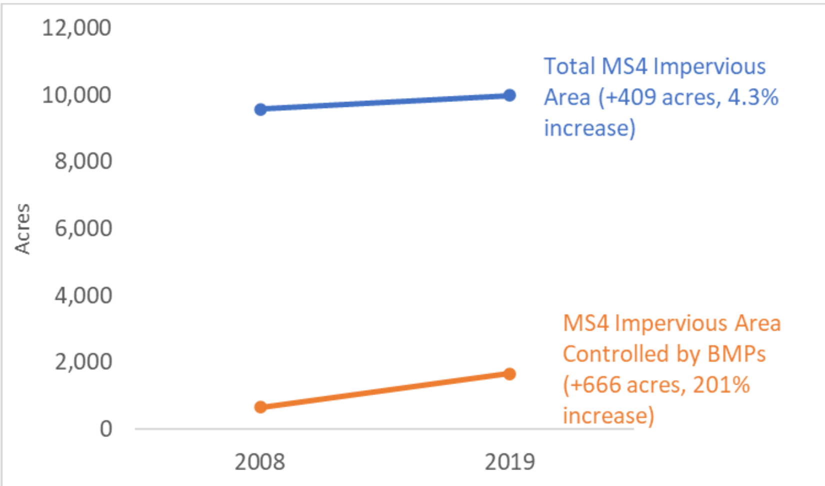

Figure 4-3: Change in Total vs. Controlled Impervious Area in the MS4, 2008-2019

4.2.3 Application of Sediment Delivery Ratios for In-Stream Erosion and Sediment and Nutrient Transport

The IPMT uses sediment delivery ratios (SDR) to calculate how much of the sediment generated by local streams through bed and bank erosion is deposited locally in a stream compared to what is transported to a downstream location of interest. This SDR factor is also applied to the raw estimated stream restoration load reduction to calculate the net load reduction from stream restoration.

For the 2016 IP, sediment delivery ratios ("SDR") provided by the Chesapeake Bay Program were used. For Washington DC, these values included a SDR of 0.181 for sediment delivery from non-coastal plain streams to the Chesapeake Bay, and a SDR of 0.061 for coastal plain streams to the Chesapeake Bay (CWP/CSN, 2014). An SDR of 0.23 for sediment delivery from the Anacostia River tributaries to the Anacostia River mainstem and a SDR of 0.77 for sediment delivery within Watts Branch were also used, based on information obtained from the 2007 Anacostia River TMDL.

In 2020, the Chesapeake Bay Program updated the sediment delivery ratio. For Washington DC, there are now unique stream-to-river and river-to-bay SDRs for 12 different areas in the District (also called "land river segments," see Figure 4-4), and there are now also delivery ratios for total nitrogen ("TN") and total phosphorus ("TP") that did not exist previously.

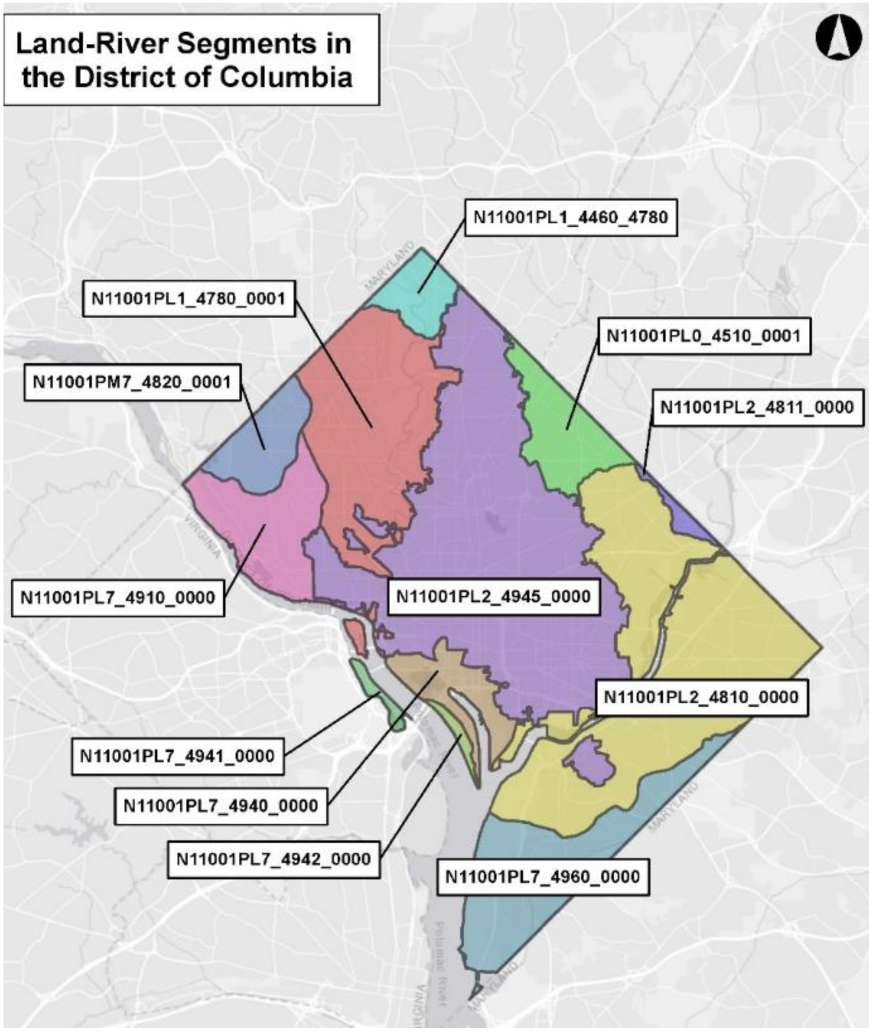

Figure 4-4: Land River Segments in Washington DC

These newer delivery ratios replace the older delivery ratios used in the 2016 IPMT. Table 4-2 below shows the 2016 values and the updated 2020 values, and the local streams to which they are applied. On average, the 2020 SDR values have gone up relative to the 2016 SDR values, meaning that more sediment is delivered from streams to the Bay. This is consistent with the current version of the Chesapeake Bay Model. Overall, the delivery ratios have limited impact on the modeling results or on meeting WLAs in the IPMT, because the IPMT imposes a "cap" for the calculated load reductions from stream restoration (i.e., load can't reduce by more than the stream generates), and these caps come into effect regardless of the SDRs that are used.

Table 4-2: Delivery Ratios Used in the IPMT for Tributaries with TMDL MS4 WLAs

Land River Segment	Associated Tributaries with TMDLs	Sediment Delivery Ratio		Total Nitrogen Delivery Ratio		Total Phosphorus Delivery Ratio	
		2016 Stream to Bay	2020 Stream to Bay	2016 Stream to Bay	2020 Stream to Bay	2016 Stream to Bay	2020 Stream to Bay
N11001PL0_4510_0001	Northwest Branch Tributaries	0.061	1.379	n/a[4]	0.755	n/a	1.274
N11001PL1_4460_4780	Fenwick Branch, Portal Branch	0.181	0.586	n/a	0.707	n/a	0.611
N11001PL1_4780_0001	Bingham Run, Broad Branch, Dumbarton Oaks, Klingle Valley Run, Luzon Branch, Melvin Hazen Valley Branch, Milkhouse Run, Normanstone Creek, Pinehurst Branch, Piney Branch, Soapstone Creek	0.181	0.413	n/a	0.813	n/a	0.682
N11001PL2_4810_0000	Fort Chaplin Tributary, Fort Davis Tributary, Fort Dupont Tributary, Fort Stanton Tributary, Hickey Run, Lower Beaverdam Creek, Nash Run, Pope Branch, Stickfoot Branch, Texas Avenue Tributary, Watts Branch	0.061	0.555	n/a	0.939	n/a	0.878
N11001PL7_4910_0000	Battery Kemble Creek, Foundry Branch	0.181	1.000	n/a	1.000	n/a	1.000
N11001PL7_4960_0000	Oxon Run	0.181	0.600	n/a	0.920	n/a	0.913
N11001PM7_4820_0001	Dalecarlia Tributary	0.181	1.044	n/a	0.950	n/a	0.813

[4] There were no nutrient delivery ratios in 2016, so these are marked as n/a.

4.3 BMPs Assessed and Updated

The 2016 IP included modeling capabilities for 13 structural BMPs including green roofs, rainwater harvesting, impervious surface disconnections, permeable pavement, bioretentions, filtering systems, infiltration, open channel systems, ponds, wetlands, storage practices, proprietary practices and tree planting and preservation. The 2016 IP also included modeling for several non-structural BMPs, including phosphorus fertilizer ban regulations, stream restoration, street sweeping, impervious surface removal, coal tar sealant removal, and trash reduction BMPs.

This section describes the changes or updates to the BMP inventory and how BMPs are represented and incorporated into the IPMT.

4.3.1 Review of Historic BMPs

For the 2016 IP, a BMP inventory was developed and then reviewed. During the review process, some of the historical BMPs (i.e.: BMPs installed before 2013) were removed from the inventory because they did not have sufficient characterizing information to be modeled by the IPMT (for example, they had missing coordinates or missing drainage areas), or they had potentially inaccurate data (for example, drainage areas larger than 10,000 square feet). After submission of the 2016 IP, DOEE began an effort to review and verify all BMPs that were removed from the inventory. Incomplete or incorrect BMP records were updated using available plans. A robust and targeted BMP inspection program was also developed to further inspect the historical BMPs and ensure that they were still functioning as intended. BMPs that passed the review, verification, and inspection process were then incorporated into DOEE's Surface and Groundwater System ("SGS") database.

4.3.2 BMP Retirement

In the 2016 IP, all BMPs installed between 2000 and 2013 (the evaluation period) were included in the IPMT as long as those BMPs included the required attribute data (such as BMP type, drainage area, coordinates, etc.).

For this 2022 IP, BMPs that have not had an inspection within the last 10 years are removed from analysis by the IPMT. This criterion is consistent with the criterion used by the Chesapeake Bay Program and is intended to remove BMPs that are not maintained and are therefore likely not performing to standards or failing.

4.3.3 Bayscaping BMPs

In 2018, "bayscaping" was approved by the Chesapeake Bay Program as a BMP credit option for meeting Chesapeake Bay TMDL load reduction requirements. Bayscaping is a conservation landscaping practice in which areas of turf or impervious surfaces are removed and replaced with perennial meadows using species that are native to the Chesapeake Bay region. The landscaping areas are slightly depressed so they can hold rainfall and, in some cases, treat runoff from adjacent impervious surfaces.

For this 2022 IP Report, bayscaping BMPs were included as an accepted BMP in the IPMT.

4.3.4 Street Sweeping

In September of 2015, the Chesapeake Bay Program released an expert panel report entitled "Recommendations of the Expert Panel to Define Removal Rates for Street and Storm Drain Cleaning Practices". This expert panel report provides a new methodology for calculating the pollutant load reductions provided by street sweeping. The updated methodology provides total suspended solids ("TSS"), total nitrogen ("TN"), and total phosphorus ("TP") pollutant load reductions for different types of street cleaning practices. The load reductions are dependent on the street sweeping technology employed (advanced or mechanical) and on the number of street sweeping passes per year on any given street. The updated 2015 street sweeping crediting methodology could not be implemented in the 2016 IP because the data to support the calculations (i.e., information on routes, the frequency of street sweeping, and the technology employed) were not available at that time.

In 2019, DOEE started receiving annual street sweeping data that provides the information needed to calculate the load reductions using the methodology from the 2015 expert panel report. The 2015 Chesapeake Bay Program crediting approach is therefore now applied in the IPMT. For purposes of this 2022 IP, the average of the 2019 and 2020 areas of streets swept were used to calculate the average annual load reductions associated with street sweeping. This load reduction crediting is applied in the IPMT beginning in calendar year 2018. Prior to calendar year 2018, the older crediting approach was applied consistent with the data available for the years prior to 2018.

4.3.5 Tree Inventory

The 2016 IP primarily relied on the SGS database to provide the tree planting inventory in the MS4. At that time, the tree inventory in the SGS database was limited to tree plantings that were associated with stormwater permit requirements. In 2016, the tree inventory was expanded to include the following tree planting efforts:

- Trees that are planted through DOEE's RiverSmart program (now included in the SGS).
- Trees that are planted through the Casey Trees organization (tracked and provided to DOEE by Casey Trees). These data are now imported into the IPMT.
- Street trees that are planted by the DC Department of Transportation's Urban Forestry Division (UFD). This tree database is now imported into the IPMT.

5. ASSESSMENT OF CURRENT CONDITIONS

5.1 Introduction

The IP develops a strategy and a schedule to attain applicable WLAs for each established or approved TMDL. The District's MS4 permit requires modeling to demonstrate how each applicable WLA will be attained. Subtracting the load reductions achieved from BMP implementation from the baseline loads allows a snapshot of progress at any given time, and this progress can be compared to the WLA to determine if the WLA has been achieved or if more needs to be done (Figure 5-1).

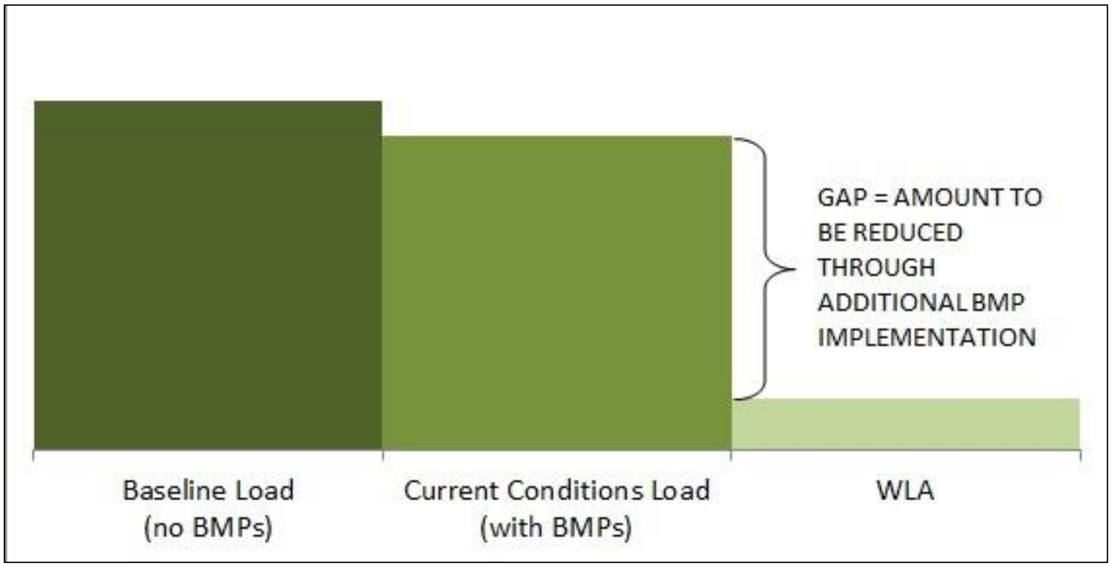

Figure 5-1: Load and Gap Analysis

To make this comparison, particularly at a point in time when some progress has already been made, three data points are needed. These are:

- The baseline load, which represents the stormwater loads that occur prior to the addition or implementation of any BMPs intended to achieve the TMDL WLAs. For the purposes of the IP, the baseline loads are fixed values that represent the loads for each MS4 WLA at the beginning of year 2000. The year 2000 is the representative year when the majority of the District's MS4 TMDLs came into effect;
- The current condition load, which reflects the stormwater load after implementation of BMPs, beginning in the year 2000. The current condition load is less than the baseline load due to the impact of BMPs in reducing loads; and
- The WLA, which is the fixed target. Once the current condition load equals the WLA, the WLA has been achieved. When all WLAs are met for all the sources listed in a TMDL, water quality standards are presumed to be achieved.

The baseline loads were determined and presented in Section 5 of the 2016 IP (DOEE, 2016a). There are no changes to the baseline loads in the 2022 IP. Some of the WLAs have changed since 2016 due to updates or changes to individual TMDL studies, as summarized in Chapter 3.

This chapter describes the current state of BMP implementation, the current condition loads and gap analysis, and the progress made towards the milestones and benchmarks.

5.2 BMP Implementation (2000-2020)

An inventory of BMPs was compiled from DOEE's SGS, the Urban Forestry Administration ("UFA") Street Trees database, Casey Trees large parcel tree planting, and from other information received by DOEE (e.g., street sweeping records) for the time period from 2000 through the end of 2020. The year 2000 represents the TMDL baseline year and the year 2020 represents the most recent full year for which complete BMP information was available at the time of the IP Report development. BMPs were removed from the inventory if they were installed more than 10 years ago and have not been inspected in the last 10 years. This is consistent with the criterion used by the Chesapeake Bay Program to remove BMPs that are not maintained from the inventory. The IPMT also excludes BMPs that do not meet a minimum quality control requirements (for example, missing coordinates or drainage area). Overall, approximately 1,658 BMPs in the MS4 were removed from the inventory based on the quality assurance quality control ("QAQC") criteria.

The BMPs are divided into two categories: structural and non-structural BMPs. For this report, structural BMPs include the 13 groups of BMPs that can be used to meet the stormwater retention volume and/or peak flow criteria and are included in the DOEE's 2020 Stormwater Management Guidebook (DOEE, 2020). Non-structural BMPs consist of programmatic, operational, and restoration practices that help prevent or minimize pollutant loading or runoff generation, including stream restoration, street sweeping, trash removal, a ban on use of phosphorus fertilizer, and coal tar pavement removal.

5.2.1 Summary of Structural BMPs

Table 5- 1 summarizes the number of BMPs accounted for in the IPMT by watershed for the time period from 2000 through 2020[5]. BMP maps are published each year in the MS4 Annual Report Storymap, available at https://doee.dc.gov/publication/ms4-discharge-monitoring-and-annual-reports. The number of BMPs currently modeled in the 2022 IP is four times the number in the 2016 IP. This large increase is due to a variety of factors including: BMP implementation that has occurred since the last IP through regulated and voluntary efforts; historic BMPs that were excluded from the 2016 IP but were included in this 2022 IP after being reviewed, verified, and inspected; inclusion of additional BMP types; and inclusion of additional BMP data sources. The changes and additions to the BMP inventory are explained in further detail in Chapter 4.

[5] This table excludes 1,658 BMPs in the MS4 that did not meet the QAQC criteria as explained in Section 5.2.

Table 5-1: Current Conditions: Number and Distribution of MS4 Area BMPs by Watershed (2000-2020)

BMP Type	Total Number in MS4	Number in Anacostia Watershed	Number in Potomac Watershed	Number in Rock Creek Watershed
Bioretention	1,996	1,222	416	358
Filtering Systems	169	91	58	20
Green Roof	427	198	145	84
Impervious Surface Disconnect	97	39	20	38
	514	168	250	96
Open Channel Systems	66	29	26	11
Permeable Pavement Systems	657	360	142	155
Ponds	8	4	4	0
Proprietary Practices	448	194	190	64
Rainwater Harvesting	3,255	1,886	479	890
Storage Practices	45	29	9	7
Tree Planting and Preservation	60,268	30,931	16963	12,374
Wetland	3	1	2	0
Bayscaping	1,222	753	224	245
TOTAL (without trees)	8,907	4,974	1,965	1,968
TOTAL (with trees)	69,175	35,905	18,928	14,342

Figure 5-2 below shows the number of BMPs installed beginning in 2000 through 2020. A few observations can be made from this figure, including:

- The number of BMPs installed over time has grown steadily in the past two decades, in large part due to changes in stormwater program funding and regulations.
- The creation of the RiverSmart program and the increase in the stormwater fee in 2008-2009 has resulted in a large increase in BMPs, particularly from rain barrels.
- The adoption of the 2013 stormwater regulations also resulted in an increase in BMPs, particularly retention-based BMPs such as bioretention, green roof, and permeable pavement practices.
- Removing BMPs from the inventory if they were installed more than 10 years ago and have had no inspection in the last 10 years has a significant impact on the total number of BMPs that are credited for pollutant load reduction, as shown in the contrast in the number of BMPs pre- and post-2010.
- The types of BMPs installed in the District are currently trending more towards retention-based BMPs, which are the types of BMPs promoted by the 2013 stormwater regulation.

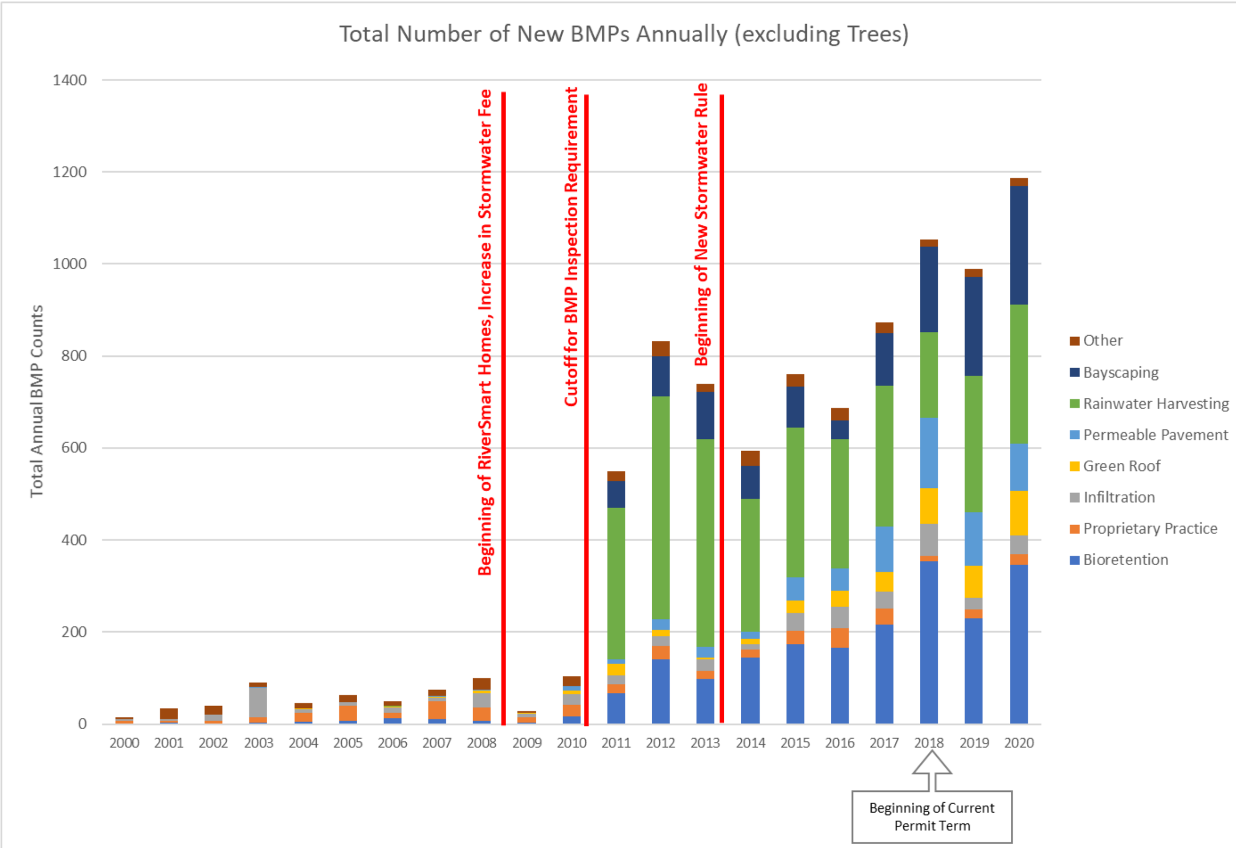

Figure 5-2: Changes in Number and Types of BMPs Implemented over Time[6]

The change in BMP types from the pre-2013 stormwater regulations era to the post-2013 stormwater regulations is also shown in Figure 5-3 below. This figure shows the composition of types of BMPs that were used before and after adoption of the 2013 stormwater regulations. For example, before 2013, 13 percent (13%) of all BMPs were bioretention BMPs whereas after 2013 27 percent (27%) of all BMPs are bioretention BMPs. Figure 5-3, similar to in Figure 5-2, shows that the types of BMPs installed in the District are currently trending more towards retention-based BMPs, which are the types of BMPs promoted by the 2013 stormwater regulation.

[6] Note that trees are not included in this figure because trees vastly outnumber any type of BMP and would therefore skew the results. For information on the trees, please refer to Table 5-1 above.

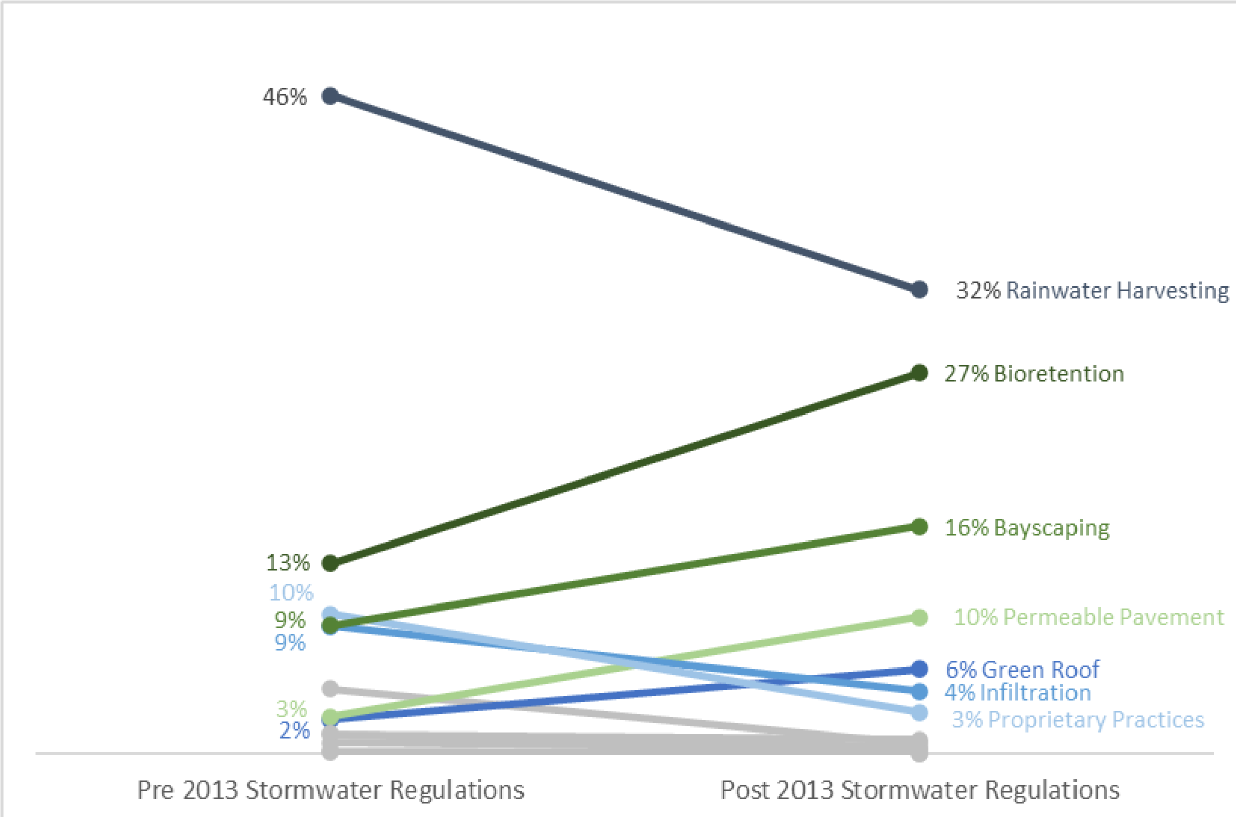

Figure 5-3: Changes in types of BMPs implemented before and after the 2013 stormwater regulations

Table 5- 2 shows each BMP type and the contributing drainage area ("CDA") controlled by BMPs in each MS4 watershed – expressed both in actual area and also as a percent of the total MS4 watershed area. The CDA of BMPs in this 2022 IP is approximately six times larger than what was included in the 2016 IP. The amount of total MS4 area controlled by BMPs is now approximately 9%, compared to the 1.4% shown in the 2016 IP. The increase in CDA relative over the CDA in the 2016 IP is due to additional BMP implementation that has occurred since the 2016 IP, and inclusion of historic BMPs, new BMP types, or additional BMP sources that were not included in the 2016 IP.

Table 5-2: Area Controlled by BMPs in Each MS4 Watershed

BMP	BMP Contributing Drainage Area (sq. ft.)	Percent of Watershed Controlled (%)	BMP Contributing Drainage Area (sq. ft.)	Percent of Watershed Controlled (%)	BMP Contributing Drainage Area (sq. ft.)	Percent of Watershed Controlled (%)
	Anacostia Watershed		Potomac Watershed		Rock Creek Watershed	
Bioretention	9,049,640	1.81	4,369,841	1.12	2,129,199	0.75
Filtering Systems	2,492,188	0.50	2,117,942	0.54	587,562	0.21
Green Roof	1,258,083	0.25	750,734	0.19	296,380	0.11
Impervious Surface Disconnect	22,014	0.00	96,680	0.02	20,461	0.01
Infiltration	1,961,004	0.39	1,971,193	0.50	995,629	0.35
Open Channel Systems	410,302	0.08	584,815	0.15	237,353	0.08
Permeable Pavement Systems	2,217,973	0.44	978,951	0.25	1,238,348	0.44
Ponds	9,543,172	1.90	1,424,989	0.36	0	-
Proprietary Practices	39,568,490	7.89	7,495,821	1.91	2,703,791	0.96
Rainwater Harvesting	1,083,850	0.22	508,336	0.13	238,708	0.08
Storage Practices	2,718,196	0.54	490,758	0.13	144,695	0.05
Tree Planting and Preservation	4,454,064	0.89	2,442,672	0.62	1,781,856	0.63
Wetland	126,759	0.03	12,955	0.00	0	-
Bayscaping	97,602	0.02	28,656	0.01	31,915	0.01
TOTAL (without trees)	**70,549,273**	**14.07**	**20,831,671**	**5.32**	**8,624,041**	**3.06**
TOTAL (with trees)	**75,003,337**	**14.96**	**23,274,343**	**5.94**	**10,405,897**	**3.69**

Figure 5-4 below shows the annual contributing drainage area of new BMPs installed from 2000 to 2020. A few observations can be made from this figure, including:

- The total CDA of BMPs installed varies annually but has grown steadily in the past two decades, in large part due to increases in stormwater program funding and changes to regulations.
- Large scale BMPs such as ponds add considerable variability in CDA from year to year.
- Smaller scale retention-based BMPs such as bioretention continue to increase the CDA steadily over time.
- The impact of the 2013 stormwater rule, which promotes retention-based BMPs, is noticeable after 2014. The range of annual CDA post-stormwater rule is roughly between 82 and 201 acres, whereas in earlier years it was around 15 to 162 acres.

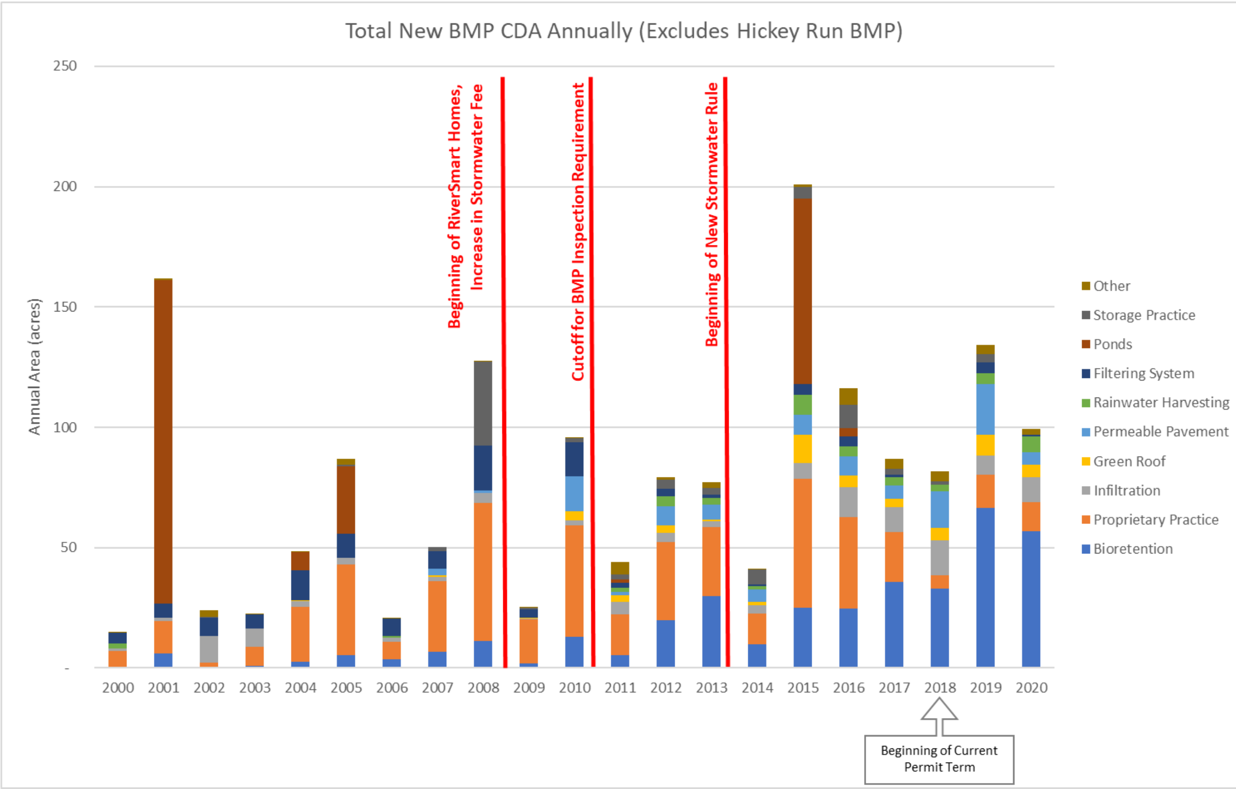

Figure 5-4: Changes in BMP Contributing Drainage Area over time[7]

5.2.2 Summary of Non-Structural BMPs

In addition to the structural BMPs summarized in the previous subsection, the following non-structural BMPs are included in this 2022 IP. These BMPs are effective at reducing pollutant loads to help meet the MS4 WLAs.

Stream Restoration

Table 5-3 below shows the stream restoration projects implemented in the District since the early 2000's. Five new stream restoration projects were completed since the publication of the 2016 IP. Table 5.3 shows which Chesapeake Bay Program restoration protocols were applied for each project. Information on the restoration protocols is available at https://chesapeakestormwater.net/bmp-resources/urban-stream-restoration/.

[7] This figure excludes the CDA from the Hickey Run BMP, which is a regional-level BMP with a CDA of over 650 acres. This BMP was installed in 2013.

Table 5-3: Stream Restoration Projects

Project Name	Applicable Local TMDL/Tributary	Completion Year	Restored Length (ft.)	CBP Stream Restoration Protocols Applied[8]
Watts Branch - Upper	Watts Branch - Upper	2011	17,952	Interim Rate
Bingham Run	Rock Creek Upper	2012	1,700	Interim Rate
Milkhouse Run	Rock Creek Upper	2012	2,150	Interim Rate
Pope Branch RSCs	Pope Branch	2012	650	Interim Rate
Broad Branch	Broad Branch	2014	3,800	Interim Rate
Broad Branch RSCs	Broad Branch	2014	1,550	Interim Rate
Linnean Gully (Soapstone)	Soapstone Creek	2014	400	Interim Rate
Linnean Park	Broad Branch	2014	2,000	Interim Rate
Park Drive	Texas Avenue Tributary	2014	650	Interim Rate
Nash Run	Nash Run	2016	2,800	Interim Rate
Pope Branch	Pope Branch	2016	8,400	Interim Rate
Springhouse Run	Hickey Run	2017	3,800	Interim Rate
Texas Ave/Alger Park	Texas Avenue Tributary	2017	3,000	1,2,3,4
Spring Valley	Dalecarlia Tributary	2019	2,143	1
Branch Avenue	Oxon Run	2021	884	1,2,5

Street Sweeping

Table 5-4 shows the area (in acres) of streets in the MS4 that were swept using advanced (regenerative air) sweepers grouped by the number of passes per year. This type of tracking aligns with the Chesapeake Bay Program expert panel report entitled "Recommendations of the Expert Panel to Define Removal Rates for Street and Storm Drain Cleaning Practices" (CSN, 2015). This advanced technology allows the District to get credit for street sweeping beyond its baseline street sweeping practices. See also Chapter 4 for more information on the street sweeping load reduction methodology.

[8] Interim Rate = Prevented Sediment Credit using the planning rates
Protocol 1 = Prevented Sediment Credit using site-specific rates
Protocol 2 = Hyporheic Exchange Credit
Protocol 3 = Floodplain Reconnection Credit
Protocol 4 = Dry Channel Regenerative Stormwater Conveyance
Protocol 5 = Alternative Prevented Sediment for Outfalls

Table 5-4: Average Annual Area of Streets Swept in the MS4 (acres)

TMDL Segment Name	SCP-1 100x Passes	SCP-2 50-99x Passes	SCP-3 25-49x Passes	SCP-4 10-24x Passes	SCP-5 6-9x Passes	SCP-6 4-5x Passes	Total Area
Anacostia	2.34	7.08	13.55	52.66	62.74	51.65	190.02
Anacostia Lower	0.23	2.27	2.77	8.49	10.37	6.01	30.14
Anacostia Upper	2.11	4.81	10.78	44.17	52.37	45.63	159.88
ANATF_DC	1.26	6.02	13.23	49.12	54.20	40.01	163.84
ANATF_MD	1.23	1.21	3.26	8.94	12.55	15.01	42.21
Battery Kemble Creek	0.00	0.00	0.00	0.03	0.00	0.14	0.17
Broad Branch	0.00	0.00	0.03	2.42	3.17	3.66	9.28
C&O Canal	0.00	0.00	0.00	0.14	0.10	1.26	1.50
Dalecarlia Tributary	0.00	0.00	0.00	0.76	1.71	3.81	6.28
Dumbarton Oaks	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fenwick Branch	0.00	0.00	0.00	0.00	0.20	0.47	0.66
Fort Chaplin Tributary	0.00	0.06	0.10	1.29	1.31	1.14	3.89
Fort Davis Tributary	0.00	0.00	0.00	0.71	0.74	0.60	2.05
Fort Dupont Tributary	0.00	0.15	0.42	0.70	0.38	0.30	1.94
Fort Stanton Tributary	0.04	0.05	0.00	0.33	0.27	0.08	0.76
Foundry Branch	0.00	0.00	0.00	0.05	0.16	0.57	0.79
Hickey Run	0.11	0.64	0.75	3.77	4.60	2.02	11.88
Kingman Lake	0.41	0.36	0.59	2.43	2.29	1.33	7.41
Klingle Valley Run	0.00	0.00	0.00	0.00	0.00	0.39	0.40
Lower Beaverdam Creek	0.00	0.00	0.00	0.23	0.01	0.03	0.27
Luzon Branch	0.00	0.03	1.08	3.35	3.61	4.01	12.08
Melvin Hazen Valley Branch	0.00	0.00	0.00	0.00	0.15	0.08	0.23
Nash Run	0.00	0.00	0.08	1.90	4.32	2.86	9.17
Normanstone Creek	0.00	0.00	0.00	0.00	0.16	1.20	1.36
Northwest Branch	1.23	1.21	3.26	7.78	9.07	11.80	34.35
Oxon Run	1.40	2.69	4.98	10.71	11.47	10.70	41.95
Pinehurst Branch	0.00	0.00	0.00	0.12	0.70	1.49	2.31
Piney Branch	0.00	0.00	0.00	0.00	0.02	0.13	0.15
Pope Branch	0.00	0.07	0.26	0.74	1.08	1.46	3.61
Portal Branch	0.00	0.00	0.00	0.05	0.37	0.28	0.70
Potomac Lower	1.53	3.18	5.65	12.49	16.92	13.61	53.37
Potomac Middle	0.15	0.16	3.14	5.66	4.36	3.75	17.22
Potomac Upper	0.00	0.00	0.00	1.21	2.91	9.34	13.45
POTTF_DC	1.53	3.21	7.56	20.66	30.24	37.28	100.48
POTTF_MD	0.00	0.00	0.00	0.90	1.99	4.35	7.24
Rock Creek Lower	0.00	0.00	0.06	0.33	1.14	4.26	5.78
Rock Creek Upper	0.00	0.03	1.66	7.26	10.92	14.05	33.92
Soapstone Creek	0.00	0.00	0.04	0.41	1.46	1.80	3.71
Texas Avenue Tributary	0.00	0.00	0.00	0.49	0.49	0.13	1.11
Tidal Basin	0.00	0.00	0.72	1.14	0.88	1.33	4.07
Washington Ship Channel	0.15	0.16	1.35	3.83	2.55	1.76	9.79
Watts Branch	0.00	0.08	0.52	10.75	13.01	9.23	33.60
Watts Branch - Lower	0.00	0.02	0.19	2.40	3.43	2.25	8.29
Watts Branch - Upper	0.00	0.06	0.33	8.35	9.58	6.98	25.30

Trash Removal

Trash removal activities have not changed since the 2016 IP, but the amount of trash removed has increased. In the 2016 IP, the average amount of trash removed annually was 91,471 pounds, while for this 2022 IP, the average amount of trash removed annually is 137,014 pounds. This meets DOEE's NPDES permit requirement that 108,347 pounds of trash shall be captured, removed, or prevented from entering the Anacostia River within the MS4 Permit Area each year (permit §§1.5.3.2 and 3.7.1.1). Table 5-5 below shows the trash (in pounds) removed for the years 2017 through 2021. Note: the numbers below do not include any smalll trash clean-ups that may occur on an informal basis.

Table 5-5: Trash Removal Activities

Trash Removal Activity	Annual Pounds of Trash Reduced (from MS4 Annual Reports)			
	2017	**2019***	**2020**	**2021**
Trash Traps	8,430	6,940	7,129	5,493
Environmental Hotspots	4,524	4,524	2,444	2,444
Clean-up Events	3,951	4,429	1,789	36,595
Skimmer Boats	8,821	8,919	8,656	8,459
Clean Team Program	100,314	106,015	106,506	110,584
Bag Law	272	272	272	272
TOTAL	**126,312**	**131,099**	**126,796**	**163,847**
Average Annual	**137,014**			

* DOEE did not compile a 2018 MS4 report, so trash reduction data is not available for that year.

Maps of the trash removal activities are published each year in the MS4 Annual Report Storymap, available at https://doee.dc.gov/publication/ms4-discharge-monitoring-and-annual-reports.

Phosphorus Fertilizer Ban

Management of fertilizers in the District was implemented through the Anacostia River Clean Up and Protection Fertilizer Act of 2012. This Act restricts the application of fertilizers, implements a public education program, imposes specific labeling requirements on manufacturers, and establishes a fine structure for violations. There have been no changes to the phosphorus fertilizer ban since the 2016 IP. More information on the phosphorus fertilizer ban can be found in Appendix F of the 2015 Comprehensive Baseline Analysis Report (DOEE, 2015a).

Coal Tar Pavement Removal

Under the Comprehensive Stormwater Management Enhancement Amendment Act of 2008, it is illegal to sell, use, or permit the use of coal tar pavement products in the District. As of March 29, 2019, the Limitations on Products Containing Polycyclic Aromatic Hydrocarbons Amendment Act of 2018 expanded the law to include sealants containing steam cracked asphalt, also known as ethylene cracker residue, and any other products with polycyclic aromatic hydrocarbon (PAH) concentrations greater than 0.1% (1000 ppm) by weight on the list of banned sealant products (D.C. Official Code 8-153.01). Violators of this ban are subject to a daily fine of up to $2,500. DDOE maintains a tip line for residents to report suspected use of coal tar, and DDOE follows up with inspections of suspected coal tar applications. No additional coal tar or PAH containing products have been identified or removed in the MS4 since the expanded amendment in 2019. More information on the coal tar pavement removal program can be found in Appendix F of the 2015 Comprehensive Baseline Analysis Report (DOEE, 2015a).

5.3 Gap Analysis

The gap analysis evaluates the difference between the current condition load and the individual TMDL WLAs, where:

$$\text{Gap} = \text{Current Condition Load} - \text{TMDL WLA}$$

As explained in Chapter 3, there are currently 439 individual MS4 WLAs (273 annual; 150 daily; 15 seasonal; 1 monthly). Assessments of progress towards achieving the MS4 WLAs is primarily evaluated using the annual WLAs because it is assumed that the daily, seasonal, and/or monthly expressions will be met when the annual WLAs are also met. Gaps were calculated for 162 out of the 273 WLAs. Gaps were not calculated for the other 111 WLAs for these reasons:

- 79 MS4 annual WLAs were not included in the modeling because the impairments underlying these WLAs were removed or moved to Category 3 in the 2014 Integrated Report ("IR"). These MS4 WLAs are for organics and metals for the Anacostia River and its tributaries as well as for the Tidal Basin and Washington Ship Channel. The TMDL for organics and metals for the Anacostia River and its tributaries is currently being revised and updated and is expected to be finalized in 2022. This TMDL is expected to exclude WLAs for the pollutants removed or moved to Category 3 in the 2014 IR. It is expected that future updates to the organics and metals TMDLs for the Tidal Basin and Washington Ship Channel will similarly exclude WLAs for the pollutants removed or moved to Category 3 in the 2014 IR.
- 28 PCB MS4 annual WLAs were not included in the modeling because these WLAs are to be managed through management plans and source control activities.
- Two *E.coli* MS4 annual WLAs were not included in the modeling because they included allocations from Maryland.
- Two copper MS4 annual WLAs from the Upper and Lower Anacostia River were not included in the modeling because the WLAs are known to be incorrect.

Of the 162 annual WLAs remaining, 112 WLAs are unchanged and 50 WLAs differ from the values published in the 2016 IP. The WLAs that have changed are due to recent changes or updates to individual TMDL studies, as summarized in Chapter 3. Of the 50 WLAs that were changed, 28 have lower WLA values, meaning that they require more load reduction than previously estimated, and 22 have higher WLAs, meaning they require less load reduction than previously estimated.

The baseline loads, current condition loads, WLAs, and gaps for each of these pollutant/impaired waters segment combinations are shown in Appendix A. The subsection below provides a higher-level summary of the current gap analysis.

5.3.1 Gap as a Percent Load Reduction

Expressing the gap as a percent load reduction provides a simple way to convey the relative amount of additional load reduction needed to meet WLAs. Figure 5-5 below shows the percent reductions needed to meet the annual WLAs and ranks them in ascending order. The blue bars represent the percent reduction needed for the 162 annual WLAs that were evaluated with the IP Modeling Tool.

The distribution of WLA gaps have changed since the 2016 IP. This is because:

- Some WLA values have increased, making the WLA easier to meet and decreasing the load reduction needed (resulting in smaller percent gaps)
- Some WLA values have decreased, making the WLA harder to meet and increasing the load reduction needed (resulting in larger percent gaps)
- Updating the imperviousness and related runoff coefficient has increased the amount of pollutant load generated by the MS4, and therefore increased the load reduction needed (resulting in larger percent gaps)
- Adding more BMPs has improved the load reduction achieved, therefore decreasing the load reduction needed (resulting in smaller percent gaps)

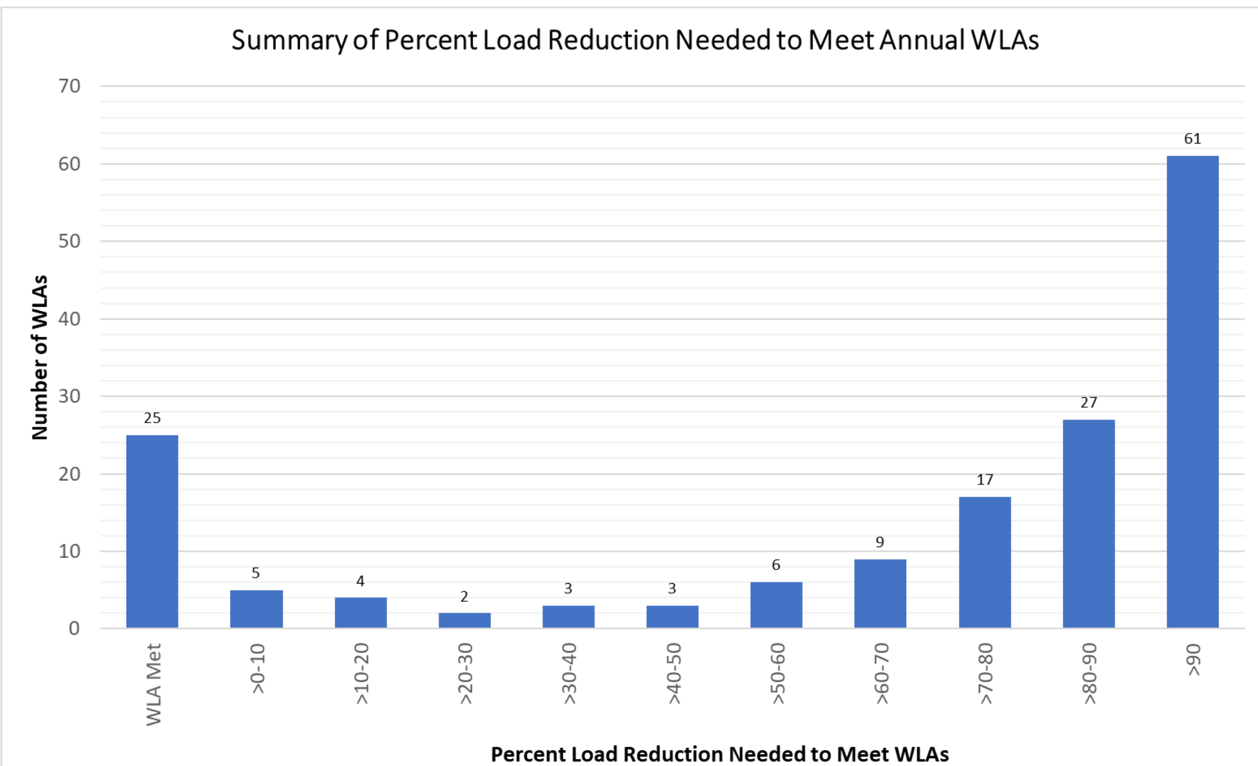

Figure 5-5: Gap Expressed as Percent Reduction Needed to Meet WLA

The large progress made in BMP accounting and implementation since 2016 means that many WLA gaps have decreased over time. However, the benefits of a 4-fold increase in the number of BMPs accounted for in the 2022 IP versus the 2016 IP is sometimes outweighed by the change in WLA or imperviousness (primarily the change in WLA). As a result, not all WLA gaps have decreased since 2016, as shown in

Figure 5-6 below. Each dot in the figure represents a WLA. The line connecting dots shows whether the gap for that particular WLA has increased or decreased over time. Overall:

- 42 WLAs have gaps that increased from 2016 to 2020
- 101 WLA have gaps that decreased from 2016 to 2020
- 19 WLAs have gaps that are the same from 2016 to 2020 (these are all for WLA that are "met" in both 2016 and 2020)

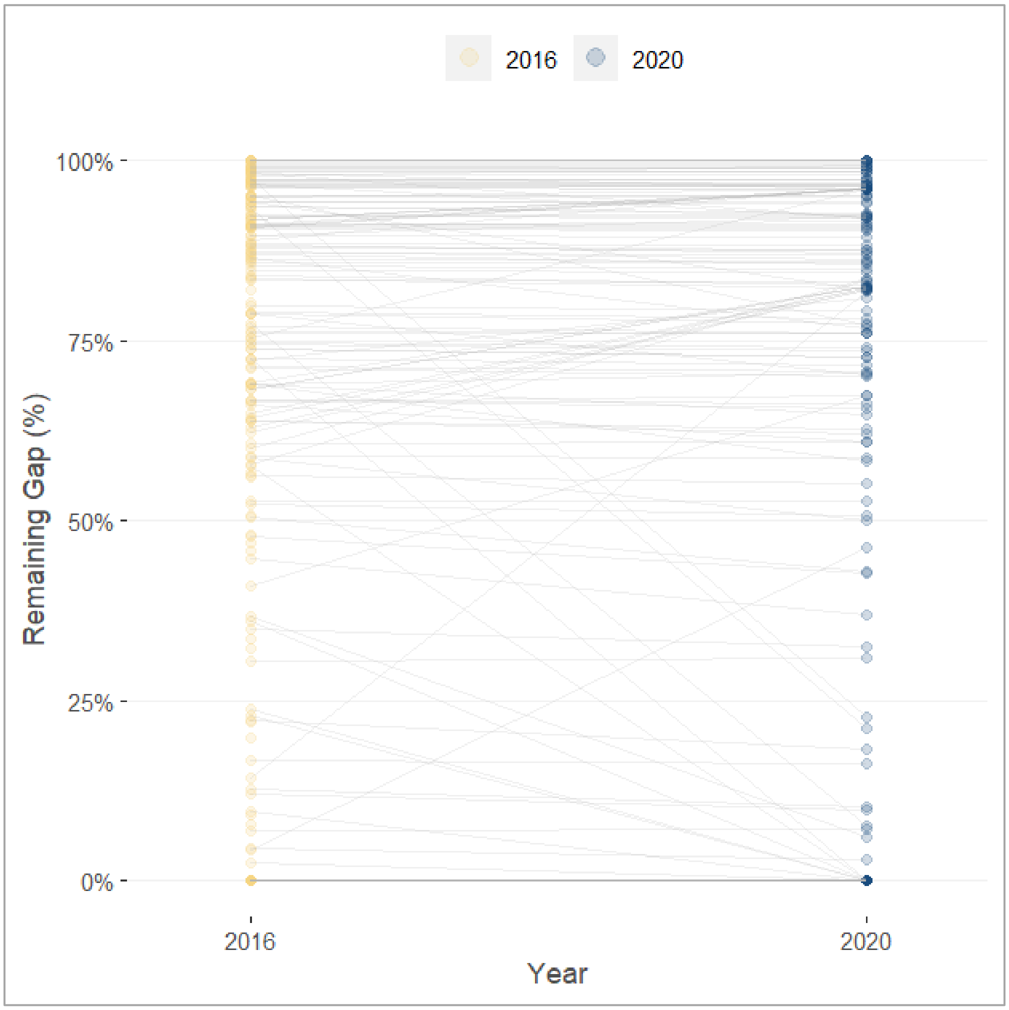

Figure 5-6: Changes in WLA Gaps Between 2016 and 2020.

The current percent load reductions needed to meet the annual WLAs is summarized qualitatively by segment and pollutant in Figure 5-7. The larger the bubble and as the color progresses from green to red, the larger the percent reduction required to meet the WLA. Empty squares indicate that the WLA has been achieved. If there is no square, then there is no annual WLA for that pollutant/waterbody combination.

Figure 5-7 below shows that, in addition to being abundant, the WLAs for bacteria and organic pollutants still require the greatest load reductions. The figure also shows that the Anacostia River watershed still has the greatest number of WLAs of all watersheds, and that all tributaries, regardless of their location in the MS4, have a multitude of WLAs.

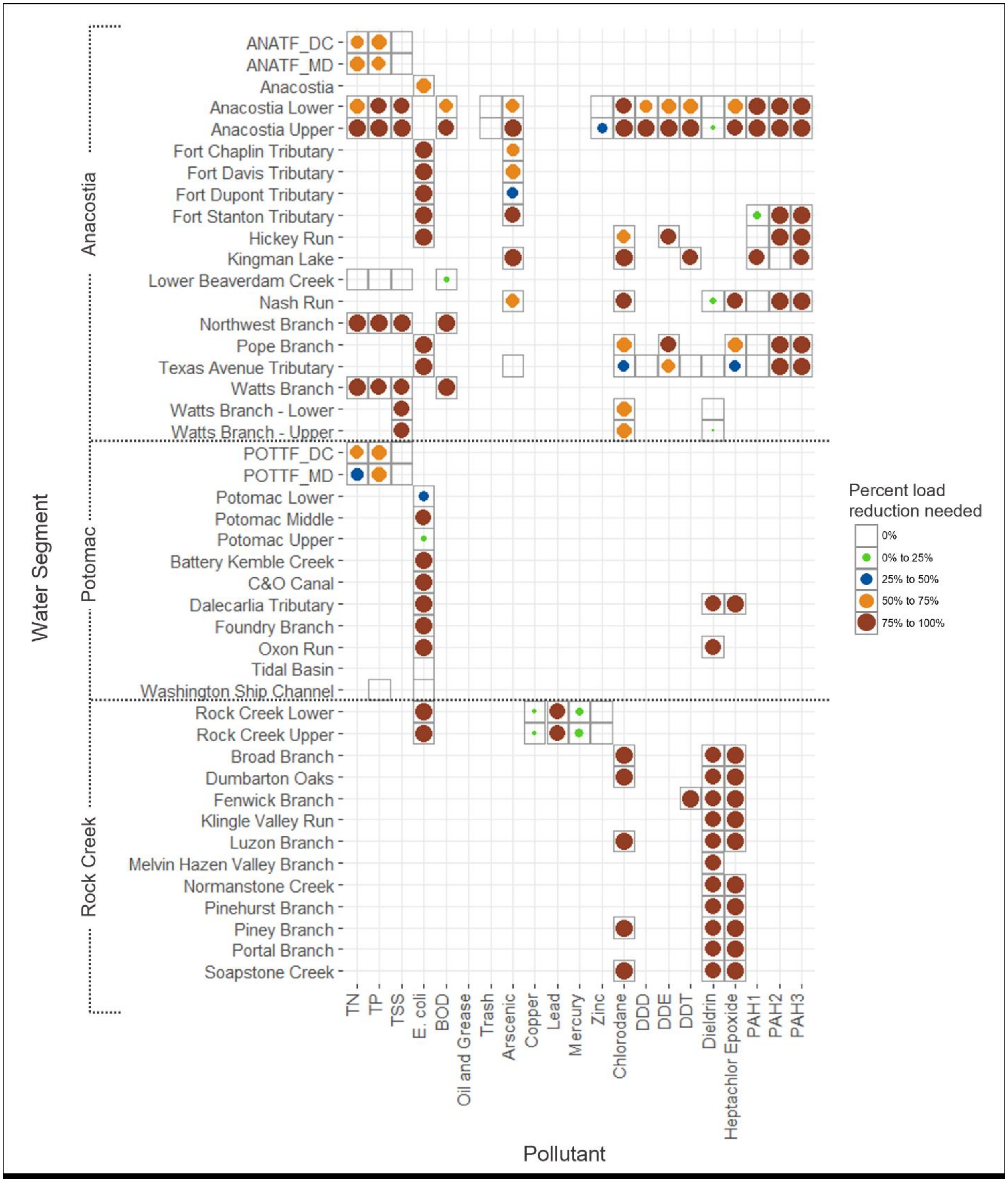

Figure 5-7: Percent Load Reduction Needed to Meet Annual WLAs

5.3.2 Examples of Individual WLA Gap Analysis

The baseline loads, current condition loads, WLAs, and gaps for each of these pollutant/impaired waters segment combinations are shown in Appendix A. The figures below are representative graphical illustrations of the current condition gap analysis for a few representative pollutant-segment combinations.

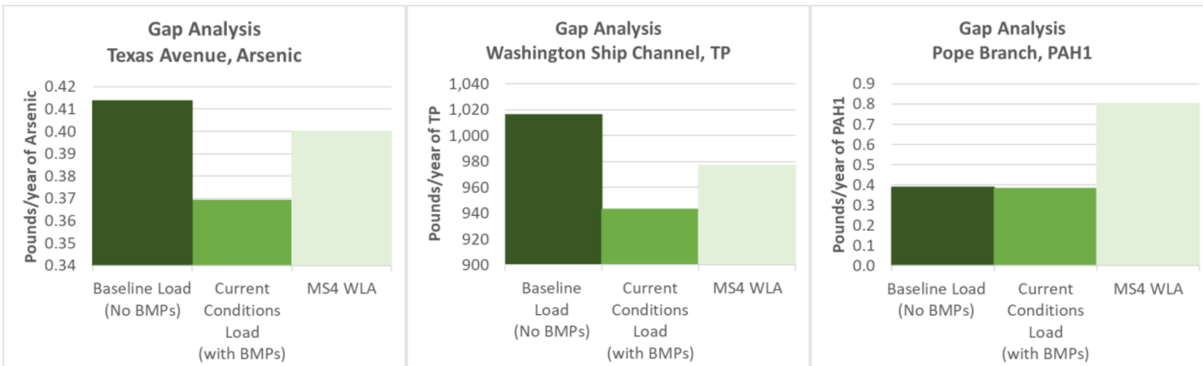

Figure 5-8: Examples of MS4 WLAs That are Currently Being Met

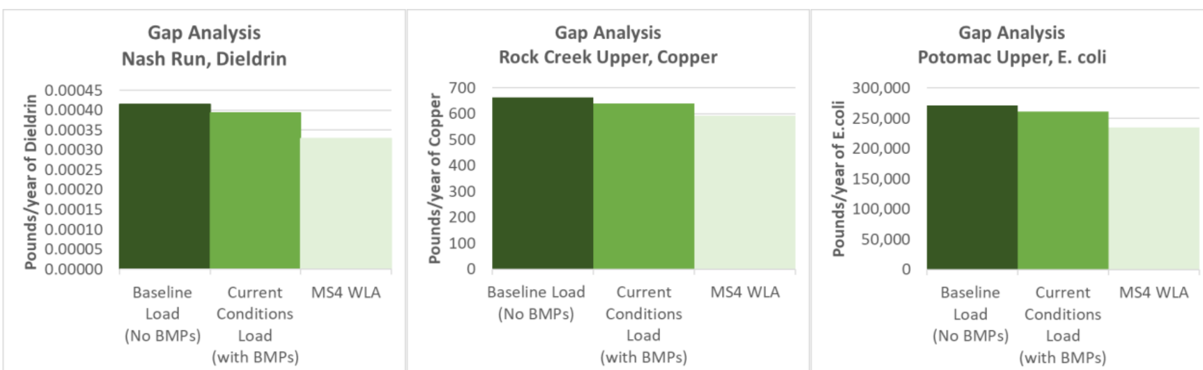

Figure 5-9: Examples of MS4 WLAs That are Close to Being Met

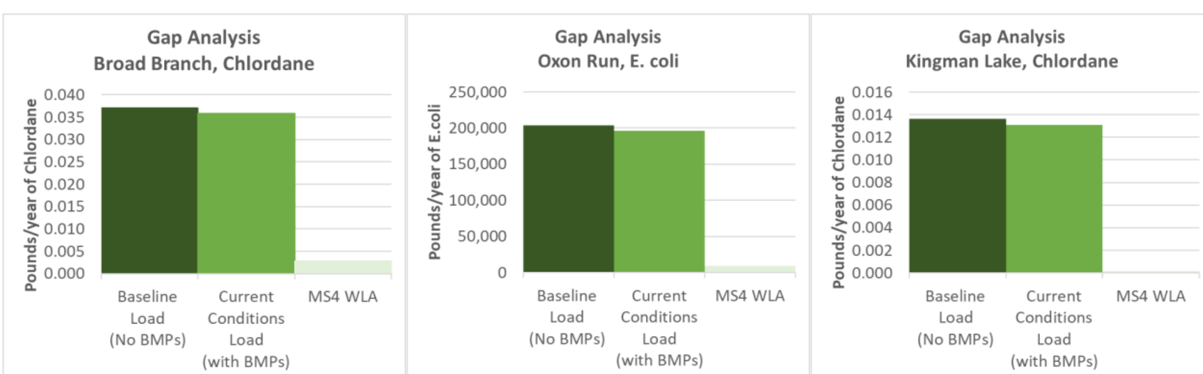

Figure 5-10: Examples of MS4 WLAs That are Far from Being Met

5.4 Progress Against Numeric Milestones

DOEE's NPDES permit includes 5-year numeric milestones, which are based on "acres managed" by BMPs. The permit defines an "acre managed" as one acre of land treated by stormwater control measures to the applicable standard established in the Permittee's stormwater regulations or consistent with the relevant voluntary program. The current permit provides specific numeric milestone targets for each major basin with the MS4 area (Table 1, permit §1.5.3), as shown below in Table 5-6.

Table 5-6: Numeric Milestone Targets

Major Basin	5-Year Target (Acres Managed)
Anacostia River	307
Potomac River	116
Rock Creek	96
Anywhere in the MS4 Permit Area	519
Total	**1,038**

In addition to the numeric milestones, the permit states that at least 62 of the total 1,038 Acres Managed must be located in Public Rights-of Way (PROWs) in the MS4 Permit Area (regardless of major basin).

The numeric milestones apply to the permit term limit (June, 2018 – June, 2023). However, for purposes of this 2022 IP, the numeric milestones were evaluated for the five year period from 01/2016 – 12/2020. This five-year period represents the most complete five-year period available at the time of the development of this 2022 IP. The milestones are also tracked for the permit term in DOEE's MS4 Annual Reports.

The BMPs that are counted towards achievement of the numeric milestones include all the BMPs from the SGS database, including all the structural BMPs discussed in Section 5.5.1, and the stream restoration projects discussed in Section 5.5.2. Non-structural BMPs such as trash removal, pesticide ban, coal tar removal, and street sweeping are not included in the "acres managed" calculations since these measures are not typically used to meet the applicable standard in DOEE's stormwater regulations.

Figures 5-11 and 5-12 below show the results by watershed and by PROW, respectively. The specific permit numeric milestones are met for each watershed, for the PROW, and for the MS4 as a whole. The blue bars show the amount achieved while the grey bars show the amount required by the permit.

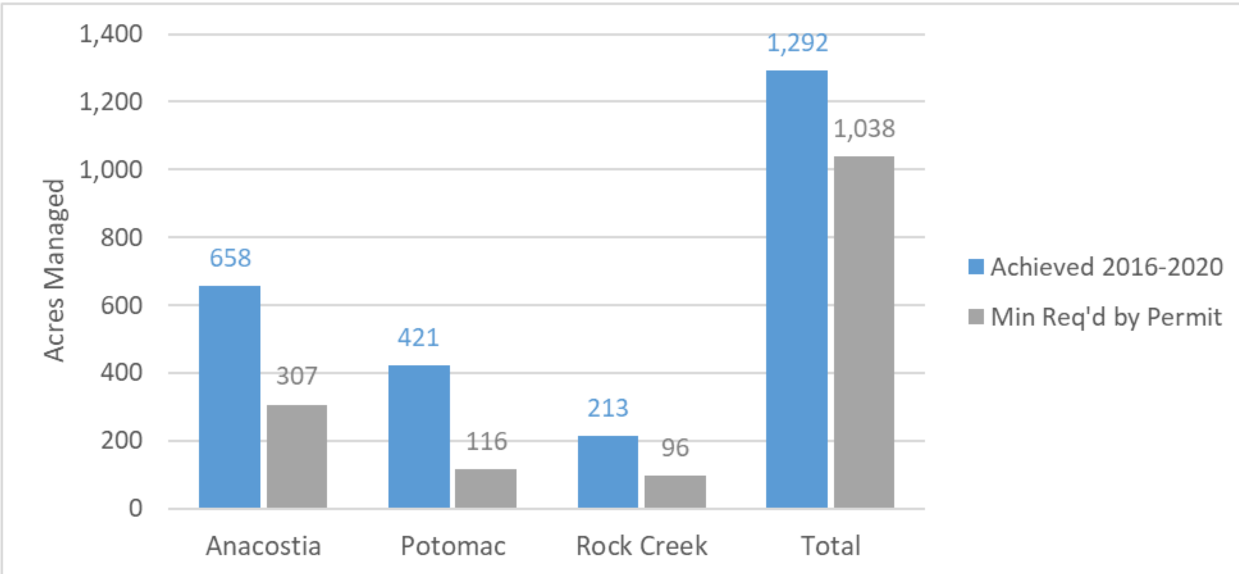

Figure 5-11: MS4 BMP "Acres Managed" by Watershed (2016 - 2020)

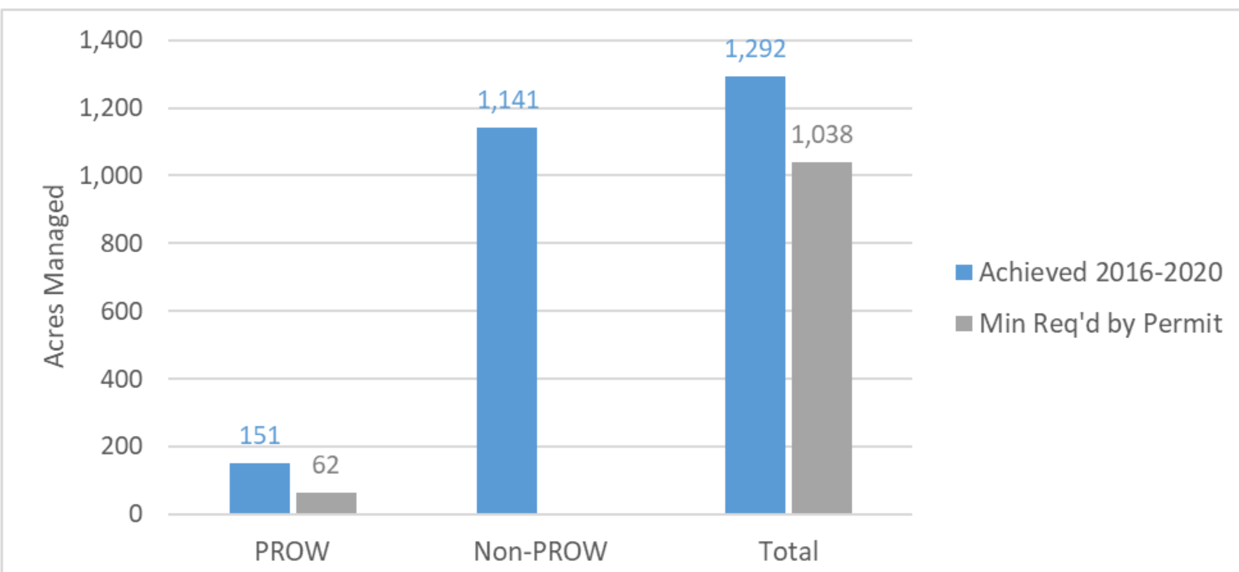

Figure 5-12: MS4 BMP "Acres Managed" in the PROW (2016 - 2020)

5.5 Progress Toward Programmatic Milestones

5.5.1 SRC Program

As part of its evaluation of District Stormwater Management Regulations, DOEE made several changes to its Stormwater Retention Credit ("SRC") program. One was to update the SRC generating eligibility cutoff date. Now, only projects installed after July 1, 2013, are eligible and must submit their first SRC certification application within 3 years of the project completion. This means that a GI project that was installed more than 3 years ago and has never applied for SRCs will lose its SRC program eligibility, thereby reducing the supply of SRCs potentially available and improving the financial incentives for installation of new GI retrofits in the MS4 area. Regulatory amendments that DOEE proposed in September 2020 would further prioritize SRCs that are associated with new, voluntary GI retrofit projects in the MS4 area, which DOEE refers to as High-Impact SRCs. New regulated projects anywhere within the District that seek to meet off-site retention requirements through purchase of SRCs are required to purchase these High-Impact SRCs before any others. The proposed amendments also include removing the 2-year peak discharge requirements for projects in the CSS area that will drain to combined sewer overflow (CSO) storage tunnels if the project developers commit to complying with the stormwater standards off-site and using at least 50% High-Impact SRCs to do so. These proposed amendments are expected to incentivize GI installation in the MS4 area.

In addition, in January 2020, DOEE launched an optional subsidy for High-Impact SRC sales by SRC Price Lock Program participants. An important objective of the program was to make High-Impact SRCs more competitive with SRCs generated from exceeding the regulatory standards or from GI built prior to 2013. The SRC Price Lock subsidy provides High-Impact SRC sellers in the SRC Price Lock Program with a small payment from DOEE for each High-Impact SRC sale, which enables these SRC sellers to set a more competitive SRC market price and increases their chances of selling their SRCs on the market. DOEE reported in the 2020 MS4 Annual Report that, in the first year of the program, this subsidy has increased High-Impact SRC sales to developers from 27% to 74% and freed up $193,280 of DOEE funds to be reinvested in the SRC Price Lock Program.

5.5.2 Targeted Watersheds

Section 2.2.2.3 of the District's MS4 permit requires DOEE to develop a list of targeted watersheds and targeted implementation approaches. The District has used multiple strategies to identify watersheds for targeted implementation. As one example, as part of its Phase III WIP for the Chesapeake Bay, the District has identified subwatersheds for which additional nitrogen and phosphorus controls will support local priorities. The District considered the following factors when identifying targeted subwatersheds:

- Local water quality: Identified subwatersheds with TMDLs for pollutants that would also be reduced by nitrogen and phosphorus controls, including BOD, nitrogen, phosphorus, sediment, and polyaromatic hydrocarbons (PAHs). PAHs are addressed in the TMDLs for organics.
- Habitat and stream health: Identified subwatersheds with completed or planned stream restoration projects. Practices upland of these restoration sites will reduce stormwater runoff and pollutants from upland areas as well as erosion of sediments from the streams themselves, protecting the District's investment in habitat and stream health. District also considered areas that drain to tributaries of the Anacostia or Potomac Rivers so they would protect local streams in addition to these mainstem rivers.

- Climate resilience: Areas identified by the District's Climate Ready DC adaption plan as having residences and community assets vulnerable to flooding and extreme heat events associated with climate change.

Another example is the implementation of the District's Project Priority Rating System (PPRS), which describes the process through which DOEE chooses projects for inclusion in applications for the Clean Water Construction grants funded by EPA. A key component of the scoring criteria for Stormwater Green Infrastructure projects is that the project benefits the same priority watersheds identified in the WIP. DOEE provides a link to its priority watersheds at https://dcgis.maps.arcgis.com/apps/webappviewer/index.html?id=d872faed1f8642d190c45befed97c760.

5.5.3 Stormwater Fee Increases

Section 2.2.3 of the District's MS4 permit requires DOEE to evaluate its Stormwater Fee to determine its adequacy for achieving the water quality goals of the permit. A discussion of DOEE's evaluation of its Stormwater Fee is provided in Chapter 10.

5.5.4 TMDL Revisions

As described in Chapter 3, DOEE has updated several TMDLs since the 2016 IP. These TMDL revisions focused on metals, organics, and PCBs, and were done in response to court orders requiring all TMDLs to be expressed as daily loads. In revising the TMDLs, DOEE conducted additional sampling to "confirm" whether individual pollutants were causing impairments. The revised TMDLs remove WLAs for pollutants that were not "confirmed" as causing impairment. This addresses the concern that the original toxics TMDLs (e.g., toxics TMDLs for Rock Creek and Potomac tributaries) were not based on sufficient evidence that specific toxics were causing impairments. Thus, the current TMDL/MS4 WLA inventory that includes these revised TMDLs better reflects the causes of impairments.

5.5.5 Evaluate Changes to District Stormwater Management Regulations

As reported in Attachments to the District's MS4 2020 Annual Report, the District evaluated several options to improve stormwater management in the District through regulatory changes. As required by the District's MS4 permit Section 2.2.4, the District considered the following options:

1. Increasing the on-site stormwater retention standard to 2 inches;
2. Applying a different retention standard to priority watersheds;
3. Lowering the threshold for regulated projects or eliminating exemptions for unregulated projects; and
4. Revising standards in stormwater management, taking into account factors such as sea level rise, extreme weather, and changing precipitation patterns.

After the initial evaluation, DOEE determined that there are two options that represent cost-effective opportunities for enhancing stormwater management. These are:

<u>Lowering the threshold for application of the full stormwater regulations to projects by adopting small area regulations</u> – Lowering the threshold for what constitutes a regulated project appears to be both feasible and warranted, and DOEE has started researching and developing new regulations.

Revising the peak discharge requirements to better prepare for the increased frequency of relatively large storms due to climate change - DOEE is currently exploring changes to the peak discharge requirement for the 15-year storm in its stormwater management regulations based on the projected increase in the size of the 15-year storm.

In addition to researching and developing new regulations to lower the threshold for regulated projects, the District amended its stormwater regulations on January 31, 2020, and proposed additional regulatory updates on September 18, 2020. The January amendments include three key changes that should increase the installation of new, voluntary GI retrofit projects in the MS4. First, for projects in the CSS that drain to storage tunnels designed to prevent CSOs, DOEE will waive the 50% minimum on-site retention requirement if the project commits to using SRCs generated from GI in the MS4 to achieve their off-site retention. Second, projects in the MS4 are now required to purchase SRCs from the MS4 to meet off-site retention requirements. Last, DOEE made changes to the SRC program, which are discussed in subsection 5.5.1 above.

5.5.6 Update Programmatic Milestones

DOEE set programmatic milestones, including numeric milestones for acres managed and numeric benchmarks for load reduction, as part of the 2016 IP. Section 2.2.2 of the District's MS4 permit also includes programmatic milestones, including conducting various studies (e.g., bacteria source tracking and toxics studies); evaluating possible changes to the stormwater fee and the stormwater regulations; and developing prioritized watersheds and implementation. DOEE has reported on these milestones in multiple documents, including the MS4 Annual Report, various individual study reports, and other documents.

As reported in section 5.4 above, DOEE is on track to meet the programmatic milestones related to implementing the IP. Achieving these milestones has been an important element in meeting the goals of the IP and continuing to reduce loads, make progress towards meeting MS4 WLAs, and improve water quality in the District.

Through the process of adaptive management, DOEE has evaluated its existing programmatic milestones as part of updating the IP. This evaluation focused on whether the existing programmatic milestones are adequate to keep the IP on track to meet its goals into the future. Discussions with EPA Region 3 have been a critical component of this evaluation. DOEE has concluded that the types of programmatic milestones included in the IP are sufficient to ensure continued progress in achieving the goals of the IP. In conjunction with EPA, DOEE will continue to re-evaluate the actual numeric targets and specific technical requirements included in these milestones to ensure that they are adequate to ensure progress and will update the milestones as necessary. The use of the adaptive management process to develop future programmatic milestones is discussed in Chapter 6 of this document.

5.6 Results and Implications for the TMDL Implementation Plan

The major findings of the evaluation of the current conditions are:

- The inventory of existing BMPs has increased by a factor of four and the BMP contributing drainage area has increased by a factor of 6 since the 2016 IP. The majority of these BMPs are recorded in DOEE's SGS database, except for some trees that are recorded in the UFA database.

The large increase in BMPs since 2016 is due to more BMPs being implemented and a review of historical BMPs that identified more BMPs that could be recorded in the SGS database.

- The number and contributing drainage area of BMPs installed over time has grown steadily over the past two decades, in large part due to changes in stormwater program funding and stormwater regulations.
- The creation of the RiverSmart program and the increase in the stormwater fee that occurred in 2008-2009 resulted in a large increase in the number of BMPs, particularly rain barrels.
- The 2013 stormwater rule, which promotes retention-based BMPs, resulted in an increase in BMPs, particularly retention-based BMPs, such as bioretention, green roof, and permeable pavement practices. The range of annual contributing drainage area after promulgation of this stormwater rule is roughly between 82 and 201 acres, whereas it was around 15 to 162 acres before promulgation of the rule.
- The types of BMPs installed in the District are currently trending towards retention-based BMPs, which are the types of BMPs promoted by the 2013 stormwater rule.
- Removing BMPs from the inventory if they were installed more than 10 years ago and have had no inspection in the last 10 years has had a significant impact on the total number of BMPs that are credited for pollutant load reduction.
- Several TMDLs were updated since the 2016 IP was published -- the overall WLA inventory decreased from 485 to 439 numeric MS4 WLAs between 2016 and 2022. With respect to annual WLAs, the count decreased from 206 to 162 MS4 Annual WLAs over that same period.
- The gap analysis showed that:
  - 25 of the 162 annual MS4 WLAs have been attained.
  - 42 WLAs have gaps that increased between 2016 and 2020, primarily because of changes to the WLA value or due to the changing conditions in the city (higher imperviousness, BMP retirements, etc.).
  - 101 WLA have gaps that decreased from 2016 to 2020, primarily due to more BMPs going being installed and reducing the pollutant loads.
  - 19 WLAs have gaps that are the same from 2016 to 2020. These are all for WLA that are “met” in both 2016 and 2020).
- Bacteria and organic substances are still the pollutants that require the greatest percent of load reduction to meet WLAs. These pollutants make up the majority of MS4 TMDL WLAs.
- The numeric milestones in the permit (“acres managed”) were attained for the period between 2016 and 2020, and the District is on track to meet the acres managed milestone for the current 2018-2023 permit term.
- The current permit’s programmatic milestones have been completed.

6. IMPLEMENTATION PLAN: WLA ATTAINMENT

6.1 Introduction

In order to develop and implement a plan to achieve MS4 WLAs as required by its MS4 permit, the District intends to enforce and amend as necessary the existing stormwater management regulations, maintain the programs and practices currently in place, and implement new programs as necessary. This section presents the specific plan for achieving WLAs and the timeframes over which MS4 WLAs will be achieved. The plan is based on continued implementation of District programmatic and source control efforts, BMP implementation from development and redevelopment activities to meet the District's 2013 Stormwater Management Rule, and BMP implementation from other programs described in Chapters 5 and 6 of the 2016 IP. As previously stated, this 2022 IP is updated to reflect implementation that has occurred since completion of the 2016 IP. Because of the dispersed nature of ongoing programmatic stormwater management activities implemented throughout the MS4 area, load reduction will take place in all watersheds throughout the MS4 area.

6.2 Implementation Plan Strategies

6.2.1 Implementation Plan for all Pollutants Except Trash and PCBs

The 2016 IP identified the following implementation strategies for reducing MS4 pollutant loads:

- BMP implementation from development and redevelopment activities and the application of the District's 2013 Stormwater Management Rule.
- BMP implementation from voluntary programs, such as DOEE's RiverSmart programs, stream restoration program, and the SRC program.
- Implementation and enforcement of existing programmatic and source control efforts such as street sweeping, public education, and single use product bans.
- Implementation of other potential source reduction programs such as bacterial source tracking ("BST") and pollutant minimization planning (including pollution prevent projects and activities).

These strategies will continue to be used into the future. For more detailed information on the strategies, please refer to Chapter 5.3 of the 2016 IP.

In addition, DOEE is in the process of identifying suitable locations for potential future stormwater retrofit projects in the District that can be implemented over the next several years to help meet MS4 WLA targets. These partially vetted sites will be publicly accessible and may be selected for full design and construction by staff, vendors, sister agencies, grantees, and/or Stormwater Retention Credit (SRC) aggregators to help meet the District's MS4, TMDL, and Chesapeake Bay requirements with the goal of improving water quality in the Anacostia and Potomac Rivers for the benefit of District residents, visitors, wildlife and the environment. An initial list of 82 projects were identified in the Potomac River Watershed, which represents about one third of the expected full list of retrofit projects. It is expected that this initial set of projects could achieve as much as 5.7 million gallons of runoff reduction, over 2,500 pounds of sediment reduction, and over 40 acres of MS4 area managed to the 1.2 inch retention standard. The full list of projects is expected to be finalized in the late summer of 2022 and will include projects in the Rock Creek and Anacostia River Watersheds. Implementation of projects will depend on available funding and feasibility of the projects. For more information on these projects, please see: https://storymaps.arcgis.com/stories/c2e9bd50e03c4e089f35073e0113edf7.

6.2.2 Implementation Plan for Trash

DOEE has achieved the trash WLAs through their current trash removal practices, so DOEE will continue with current practices for meeting the Anacostia River Watershed Trash TMDL, described above in Section 5.5.2. The average annual pounds of trash currently removed is 137,014 pounds, which exceeds the TMDL WLA of 108,347 pounds. The District will continue to track and report existing trash removal activities and the implementation of any new practices along with their load reduction calculation methods.

6.2.3 Implementation Plan for PCBs

As explained in Chapter 6.4 of the 2016 IP, the expectations for MS4 load reductions for the PCB TMDL are different than for other pollutants because the implementation approach focuses on BMP implementation rather than achieving specific numeric WLAs. The use of non-numeric water quality-based effluent limitations (WQBELs) and BMPs rather than numeric limits is based on an explicit recognition of the challenges of achieving meaningful numeric goals for PCBs. One of these challenges is that, even if numeric MS4 WLAs are achieved, water quality standards may not be met in the receiving waters because of other ongoing sources of contamination to the water bodies such as PCBs in river sediment and atmospheric deposition.

Therefore, the load reduction plan for PCBs continues to focus on leveraging the BMP planning and implementation developed to address other pollutants to simultaneously address PCBs. Because the focus for the PCB TMDLs is on BMP implementation instead of numeric WLAs, this plan maximizes the effectiveness and efficiency of BMP implementation in the District. Structural and non-structural controls and BMPs that remove Total Suspended Solids ("TSS"), such as most structural BMPs, street sweeping, erosion and sediment control, and other practices, will be effective in reducing PCB loads as well.

DOEE is already implementing actions to address sources of PCBs in the sediment in the Anacostia River. As part of the Anacostia River Sediment Project (https://restoretheanacostiariver.com/arsp-home), DOEE developed the Proposed Plan: Early Action Areas in Main Stem, Kingman Lake, and Washington Channel document (DOEE, 2019) to guide sediment cleanup in the Anacostia River. PCBs are one of the specific pollutants identified for remediation as part of this project.

DOEE will also continue to track stormwater PCB concentrations through MS4 outfall monitoring. PCB concentrations and loads should continue to decrease as additional BMPs are implemented and atmospheric contributions continue to decline. However, should monitoring show that PCB loads are still an issue, adaptive management principles can be used to change course and develop different tactics to address PCBs.

6.3 Updated Projected WLA Attainment Date

6.3.1 Overview of modeling approach

The future load reductions that will be achieved from the IP strategies were determined using the IPMT. It was also used to project end dates for achieving each MS4 WLA (except for PCBs – see discussion above), as required by the District's MS4 NPDES permit. Loads are reduced more over time as more

BMPs are implemented. Progress towards achieving WLAs occurs as the amount of load reduction closes the gap for individual MS4 WLAs. When the gap is zero, the WLA is achieved.

Estimated load reductions are based on future projections of BMP implementation to comply with the stormwater regulations, ongoing BMP implementation not associated with the stormwater regulations, and source and programmatic controls. The methodology for estimating these projections remains the same as what was used in the 2016 IP and is explained in detail in the 2015 Final Scenario Analysis Report (DOEE, 2015b). There are two main types of projections used to estimate future load reduction:

- **Load reductions from 2020 through 2040 are based primarily on estimates of areas that will be developed or redeveloped during this time period and will therefore require compliance with the stormwater regulations**. The projections of areas that must comply with the stormwater regulations were developed using information provided by the DC Office of Planning, as well as data on past BMP implementation. The DC Office of Planning offers spatially discrete projections, and thus forecasted load reductions are specific to each TMDL segment. The WLA achievement for this timeframe can be projected with a relatively good confidence.
- **Load reductions beyond 2040 are based on spatially redistributed extrapolations of the total projected BMP implementation rates through 2040**. Projections for this timeframe assume that the entire MS4 area will gradually be retrofitted with BMPs at the same rate as calculated for the period of 2020 through 2040. The 2020-2040 projections, however, are based on spatially discrete forecasts, and long-term development would be biased towards existing development patterns. Therefore, the total 2020-2040 rate was distributed uniformly across all TMDL segments according to the composition of small residential parcels, large residential and commercial parcels, and public right-of-way. These parcel types were chosen because each has a distinct regulatory threshold, and the 2020-2040 forecasts suggest differential rates of development. Under this assumption, the last TMDL segment in the MS4 area will become entirely retrofitted with BMPs by 2134. It was assumed in making this projection that the retrofitted areas will manage 1.2 inches of runoff. However, even after all areas are retrofitted to meet this standard, additional control will still be necessary to meet the most stringent WLAs because even the most advanced BMPs are not efficient enough to meet the load reduction required to meet some TMDL WLAs. In other words, the BMP pollutant reduction efficiency (e.g.: 83.5% reduction efficiency for enhanced bioretention with underdrain) is less than the percent pollutant reduction required to meet some TMDL WLAs (e.g.: 98.64% reduction required to meet the Chlordane WLA in Kingman Lake). It is assumed that technological and other strategic advancements will arise to allow for continued load reduction at the same rate, and thus load reductions are projected beyond the date on which the MS4 is projected to be completely retrofitted. This in turn will allow achievement of all remaining WLAs by 2189. Because this implementation rate is based on further extrapolation of existing trends and assumptions regarding future BMPs and efficiencies, these projections are made with a low level of confidence.

6.3.2 Updates to the modeling approach

The 2022 IP instituted three main changes to the modeling approach or inputs for estimating future WLA attainment dates relative to the 2016 IP. These are explained below.

Update to the Representative, System-Wide BMP Efficiency

BMP efficiencies are used in the IPMT to estimate how much stormwater volume and pollutant load is reduced by any given BMP and is typically expressed as a percentage. The BMP efficiency is typically calculated using the following equation:

$$BMP\ Efficiency = \frac{Pollutant\ Load\ Entering\ the\ BMP - BMP\ Load\ Exiting\ the\ BMP}{Pollutant\ Load\ Entering\ the\ BMP}$$

A BMP with a high efficiency reduces more pollutant load in stormwater than a BMP with a low efficiency.

The IPMT estimates the BMP efficiency for any given BMP based on its design characteristics and its design runoff retention depth. This methodology is described in Appendix A, Technical Memorandum: Model Selection and Justification to the Final Comprehensive Baseline Analysis Report document (DDOE, 2015). The individual BMP-specific efficiencies are used to then calculate the volume and load reductions from BMPs that are currently installed and operational.

To estimate future volume and load reductions from BMPs that are not yet constructed, an average future BMP efficiency must be assumed because it is not known what type of BMP [e.g., bioretention, permeable pavement, infiltration trench, or other] might be constructed in the future. In the 2016 IP, this average future BMP efficiency assumed was 83.5 percent (83.5%), which is the efficiency of an enhanced bioretention with underdrain practice runoff retention designed to the 1.2-inch design standard. This efficiency was chosen because it is slightly less than the median efficiency of all the retention-based BMPs included in the DOEE Stormwater Management Guidebook (Table 6-1) and therefore represented the best estimate of average future efficiency of runoff retention BMPs. However, runoff retention BMPs only started being promoted and encouraged with the advent of DOEE's 2013 stormwater regulations, so very little historical data existed at the time of the 2016 IP to estimate the representative average BMP efficiency of a typical runoff retention BMP or validate the assumption of 83.5%.

Table 6-1: Efficiencies of Retention Based BMPs Using a 1.2 Inch Design Standard

BMP Type	Efficiency
Enhanced Permeable Pavement without Underdrain	92%
Infiltration Trench	92%
Enhanced Bioretention Without Underdrain	90%
Enhanced Permeable Pavement with Underdrain	87%
Enhanced Bioretention With Underdrain	83.5%
Standard Bioretention	60%
Green Roof	53%
Standard Permeable Pavement	0%

Since 2016, the District's MS4 area has seen much implementation of both retention-based and non-retention based BMPs, and DOEE has tracked these BMPs and their characteristics through the SGS database. This information was reviewed to better estimate the representative, system-wide BMP efficiency. For this 2022 IP, the average efficiency of a representative BMP was reassessed based on the BMP data that DOEE has collected. For runoff-retention BMPs, this includes the BMP type and design retention depth. Using these two pieces of information, the BMP efficiency can be calculated using the runoff reduction efficiency equations that were developed for the 2016 IP and as documented in Table 13 of Appendix F of the 2015 Comprehensive Baseline Analysis Report (DOEE, 2015a). For non-runoff based BMPs, the percent efficiencies are based on published literature values for various BMP types and is documented in Table 9 of Appendix F of the 2015 Comprehensive Baseline Analysis Report (DOEE, 2015a). Modeled BMP efficiencies for all retention-based and non-retention based BMPs are compared in Figure 6-1.

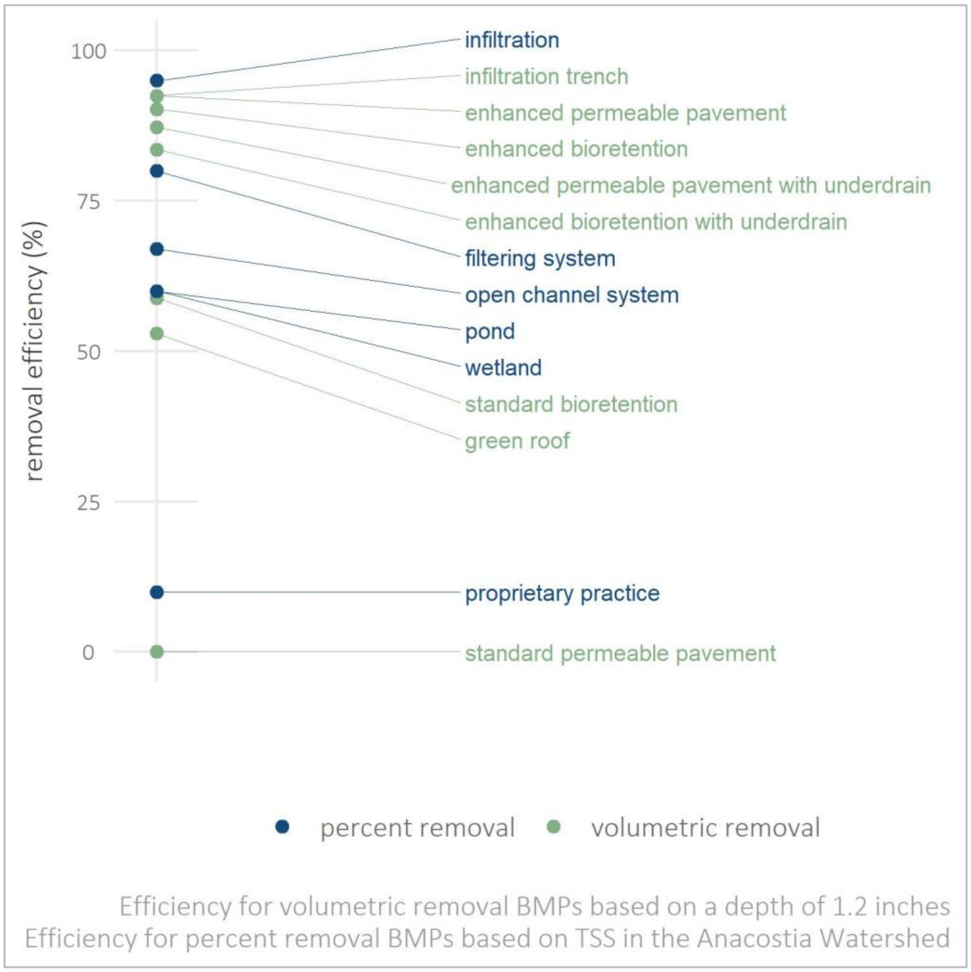

Figure 6-1: Modeled BMP Efficiencies for all Retention-based and Non-retention Based BMPs

To understand the impact of recent BMP selections and installations across the MS4, the average annual efficiency was calculated for BMPs installed since the 2013 stormwater regulations went into effect 2013, using the sum of all modeled loads going into all BMPs and the sum of all modeled loads coming out of all BMPs for a given year. Figure 6-2 below shows the results of this analysis.

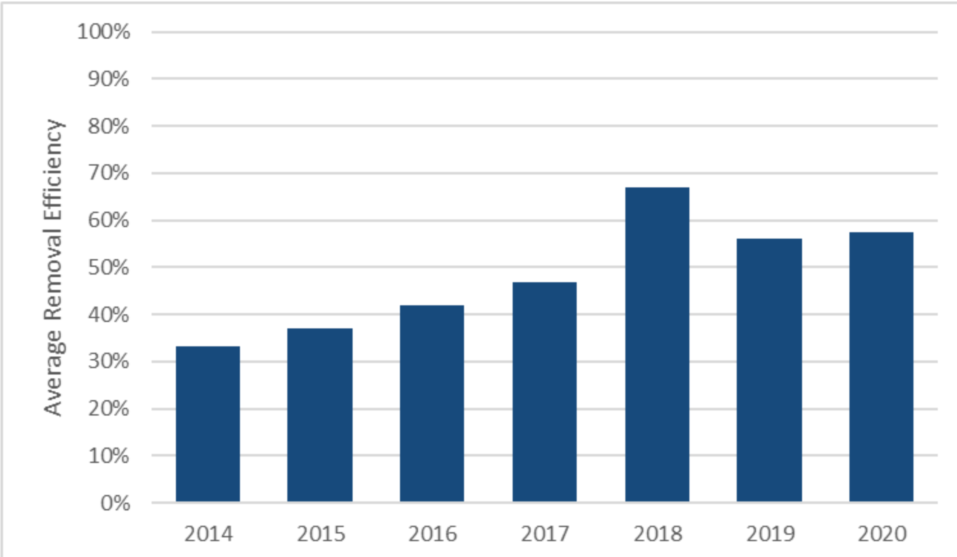

Figure 6-2: Calculated Annual Average BMP Efficiency

The annual average efficiency shows a steady increase over the first few years of the 2013 stormwater regulations. It took time for developers to adapt to new design standards and strategies after these regulations were promulgated. To account for this, BMP data from the years 2017-2020 were used to estimate the average efficiency of BMPs under the 2013 regulations. The load-weighted average efficiency from 2017 through 2020 was 57%. This efficiency replaces the 83.5% efficiency estimate that was used in the 2016 IP forecasts. The use of a lower load removal efficiency in the modeling/projections means that it likely will take longer to meet all WLAs because less stormwater and pollutant loads will be reduced than assumed under the 2016 IP, and thus it will require more BMP implementation to meet all WLAs.

Additional analysis of BMP efficiencies revealed that, on average, the efficiency of unregulated BMPs (i.e., voluntary BMPS not subject to regulatory requirements that have more flexibility in setting runoff retention requirements) are lower than the efficiency of regulated BMPs (i.e., those BMPs implemented to meet strict runoff retention requirements established in regulations), as shown in Figure 6-3 below. This observation presents an opportunity for DOEE to review its unregulated BMP design protocols to try to increase the overall average efficiency. This opportunity is discussed in more detail in Section 6.4.

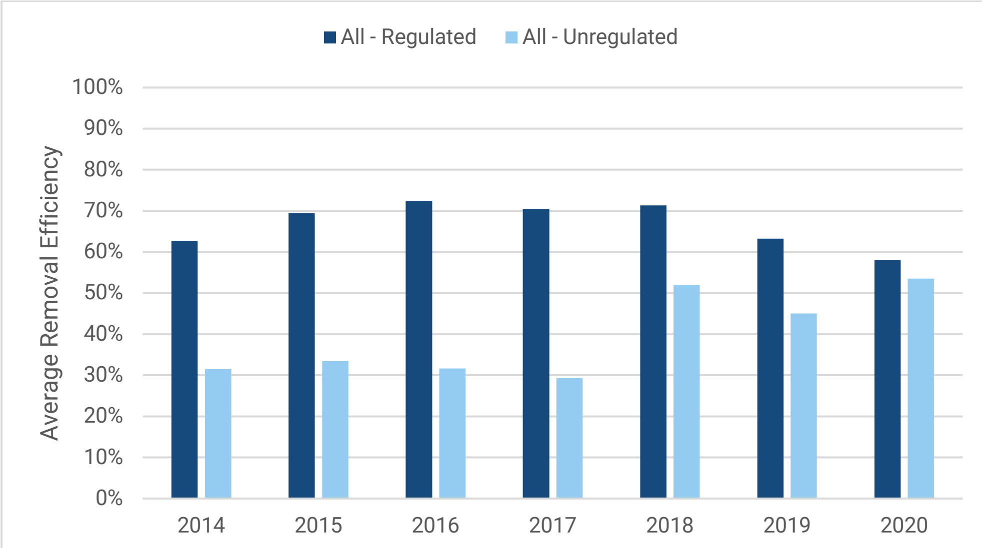

Figure 6-3: Differences in Calculated Annual Average BMP Efficiency for Regulated and Unregulated BMPs

Update to the forecast methodology after 2040

In the 2016 IP, BMP implementation after 2040 was assumed to continue based on 2016-2040 rates of forecasted implementation on parcels zoned as public right-of-way, R1-R4 (small residential parcels), and non R1-R4 (large residential and commercial parcels). BMP implementation was assumed to continue to occur on each of these parcel types until they were 100% retrofitted. The year in which this was forecasted to occur was different for each parcel type. For the 2016 IP, it was assumed that if a parcel type achieved 100% BMP coverage, then no further load reductions would occur on that parcel type until all other parcel types also achieved 100% BMP coverage. This meant that a TMDL segment's forecasted rate of BMP implementation would become lower, proportional to its parcel type composition, as certain parcel types achieved 100% retrofit.

After reviewing the modeling assumptions as part of the adaptive management process, it became clear that this was an overly conservative assumption. For example, properties are sometimes redeveloped more frequently than once every several decades. When redevelopment occurs, newer and more efficient BMP technologies are expected to be implemented. Similarly, BMP lifespans typically range from 5 to 15 years, after which they will need to be replaced. This means that newer and more efficient BMP technology could be implemented on a more frequent basis than what had been originally assumed for modeling purposes. For these reasons, the forecast methodology was updated to assume that, once a parcel type is completely retrofitted, the load reductions will continue at the same rate due to some combination of new technologies, improved BMP efficiencies, and BMP treatment trains until all WLAs across each TMDL segment are met. This specific change in the forecast methodology accelerates the timeline for meeting WLAs.

Update to the overall impervious landcover in the MS4

As mentioned in Section 4.2.2, the overall impervious landcover in the MS4 increased approximately 4.3 percent between 2008 and 2019. This translates into higher runoff coefficients for some of the TMDL segments relative to the runoff coefficients that were used in the 2016 IP. More impervious landcover means that it will take longer to meet all WLAs because more stormwater and pollutant loads are generated in the MS4 that will require more BMP implementation.

Update to the WLA values

As mentioned in Chapter 3 and Section 5.3, some MS4 WLAs were updated due to changes or updates to existing TMDLs. In particular, 50 WLA values are different relative to the values initially published in the 2016 IP. Of those, 28 have lower WLA values, meaning that they require more load reduction than previously estimated. The remaining 22 have higher WLAs, meaning they require less load reduction than previously estimated. These changes are incorporated into the WLA attainment projections. For WLAs that require more load reduction than previously estimated, those WLAs will take longer to achieve because more BMP implementation will be required. Conversely, for WLAs that require less load reduction than previously estimated, those WLAs will be achieved faster because less BMP implementation will be required to meet those WLAs.

Sensitivity Analysis

As the sections above indicate, the modeling assumptions and inputs become more uncertain as the timeline stretches out further into the future. It is difficult to predict the level and spatial distribution of development or redevelopment activities that will trigger BMP implementation, or the long-range BMP efficiencies, precipitation patterns, or changes in impervious landcover in the MS4. Changes to the modeling assumptions can shift the projected attainment of WLAs to shorten or lengthen the timeline. For informational purposes, the 2022 IP includes a sensitivity analysis of the modeling assumptions and inputs, and their impacts on the WLA attainment timeline.

6.3.3 Updated WLA attainment timeline

A summary of the timeline in which WLAs are expected to be achieved is provided in Figure 6-4. Twenty-six (26) WLAs are currently attained under the current conditions at the time of the 2022 IP, and additional BMP implementation over time will result in additional WLA attainment. All 162 WLAs are projected to be attained by 2189 using the assumptions and modeling updates described in section 6.3.2.

The projected timeline can be broken down into three timeframes, characterized by differing modeling assumptions:

- The first twenty years of load reduction projections (2020-2040) are based on recent BMP implementation and discrete development forecasts produced by DC Office of Planning. Therefore, there is a good degree of confidence in the load reductions projected for this period. **By 2040, a total of 30 WLAs are projected to be attained.**
- Load reductions projected for the years 2041-2130 reflect BMP implementation through the year that the entire MS4 is projected to be retrofitted. All projected load reductions from this period are extrapolations of the 2020-2040 projections, however, there is less confidence in the projections for this timeline. Confidence in the projections decreases over time because the rates of implementation are based on current trends and BMP efficiencies are based on current technologies and regulatory standards. **By 2130, the year in which the entire MS4 is expected to be retrofitted, a total of 69 WLAs are projected to be attained.**

- Load reductions projected for the years 2130-2189 reflect continued redevelopment and stormwater management in the MS4 until all WLAs have been attained. There is a low degree of confidence in the load reductions over this timeline because it is assumed that new BMP technologies, regulatory standards, and other management strategies are implemented in a way that continues to the previous rates of load reduction. **By 2189, all 162 WLAs are projected to be attained.**

The dates of attainment for each WLA are shown in Appendix B.

Figure 6-4 shows the dates of attainment by pollutant. Each dot represents a different WLA and the colors reflect the different pollutant categories (e.g.: grey are toxics, green are metals, etc.). This figure shows that pollutants such as toxics and bacteria, which typically require the most load reduction to meet WLAs (often higher than a 90 percent load reduction), will take the longest to achieve. DOEE is currently conducting additional monitoring and assessments to determine the best path forward to meeting these WLAs.

DOEE is currently finalizing a review of toxic impairments. The review consists of analysis of historic and recent water column data for toxic organic and metals pollutants to determine if water quality data support previous assumptions of impairment by specific toxic pollutants. Preliminary results indicate that many presumed toxic impairments are not supported by water quality data. Once these results are finalized, DOEE will evaluate removal of any specific existing pollutant causes of impairment documented from the Integrated Report ("IR") that are not supported by water quality data. Subsequently, DOEE will review existing TMDLs to determine if they should be revised to remove pollutants and MS4 WLAs that are no longer listed as causing impairments in the IR.

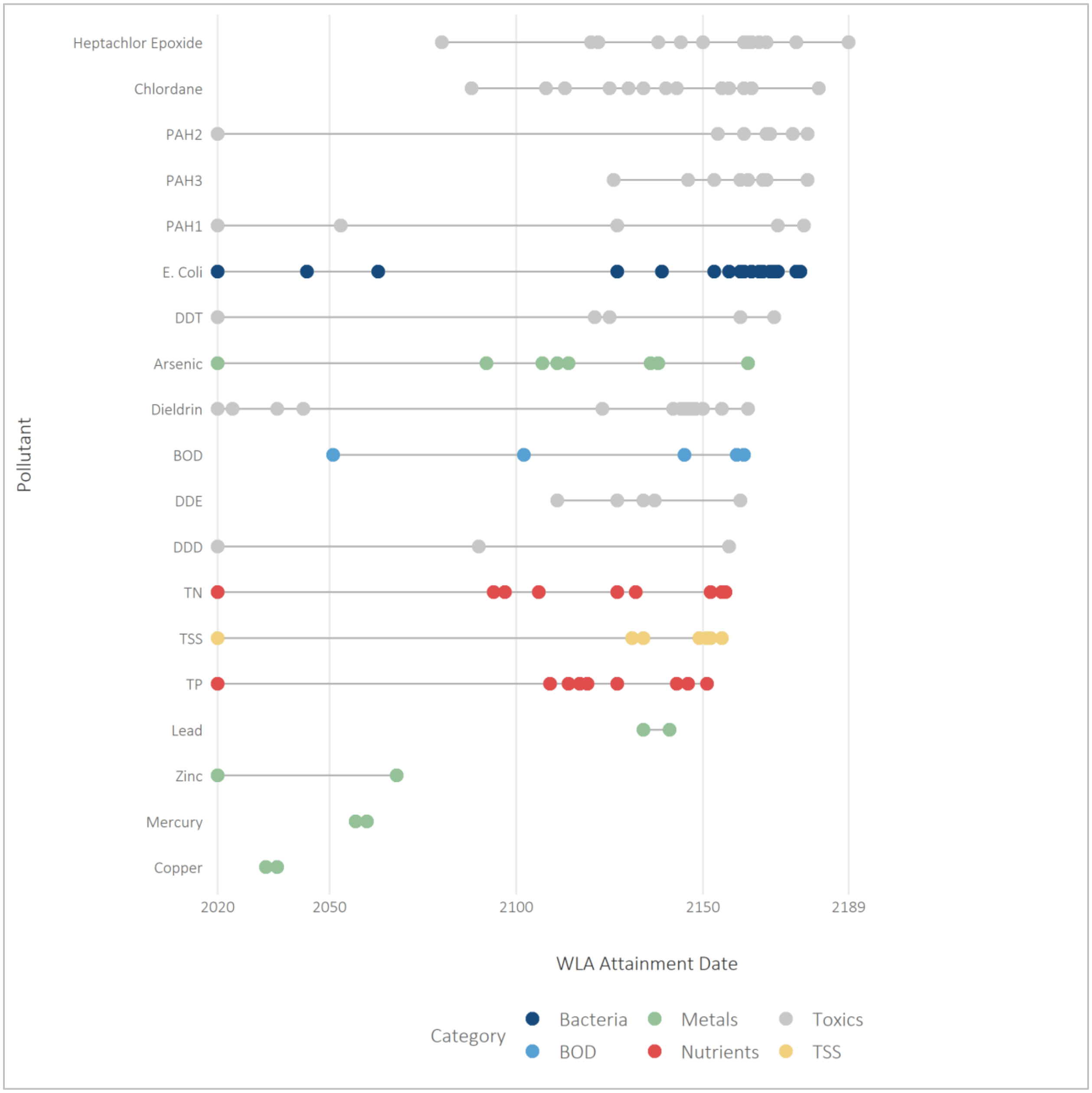

Figure 6-4: Projected WLA by Pollutant Category

Figure 6-5 below shows that the predicted WLA attainment in the 2022 IP is approximately 34 years longer than the WLA attainment date in the 2016 IP (2189 vs 2155). The figure also shows that there are fewer WLAs in the 2022 IP compared to the 2016 IP (as explained in the previous section and in Chapter 3 and 5.3). This change in attainment date is due to several factors described in section 6.3.2, including:

- Using updated WLA values that are different than the values previously used in the 2016 IP (or were removed).
- Using a lower representative BMP efficiency (57% instead of 83.5%).

- Using more recent data showing that there is more impervious landcover in the MS4, which generates more stormwater volume and pollutant loads.
- Using an updated forecast methodology to predict developments after 2040.

As noted previously, however, changes to the modeling assumptions can have a dramatic shift in the projected attainment timeline. A less conservative approach could be taken that assumes more efficient BMPs will be implemented in the future, or at a faster rate of implementation, or more aggressive source control and programmatic efforts will take effect. Conversely, a more conservative approach could be taken that assumes less efficient BMPs, more rainfall due to climate change, or a slower rate of BMP implementation. Further, the WLA timeline may change depending on actual progress achieved over time.

It is difficult to predict the aggregate effect of these assumptions on the actual load reductions that will be achieved in the future, but a sensitivity analysis on the modeling assumptions and inputs allows visualization of the potential range of dates for attainment of WLAs. The projected attainment timeline could be shortened to 2130 with less conservative but still realistic modeling assumptions, while more conservative modeling assumptions would extend the timeline to 2233. However, the assumptions that have been made are based on our current understanding of the MS4 and BMP implementation and performance, and based on these assumptions, it is calculated that the final WLA attainment date will be 2189.

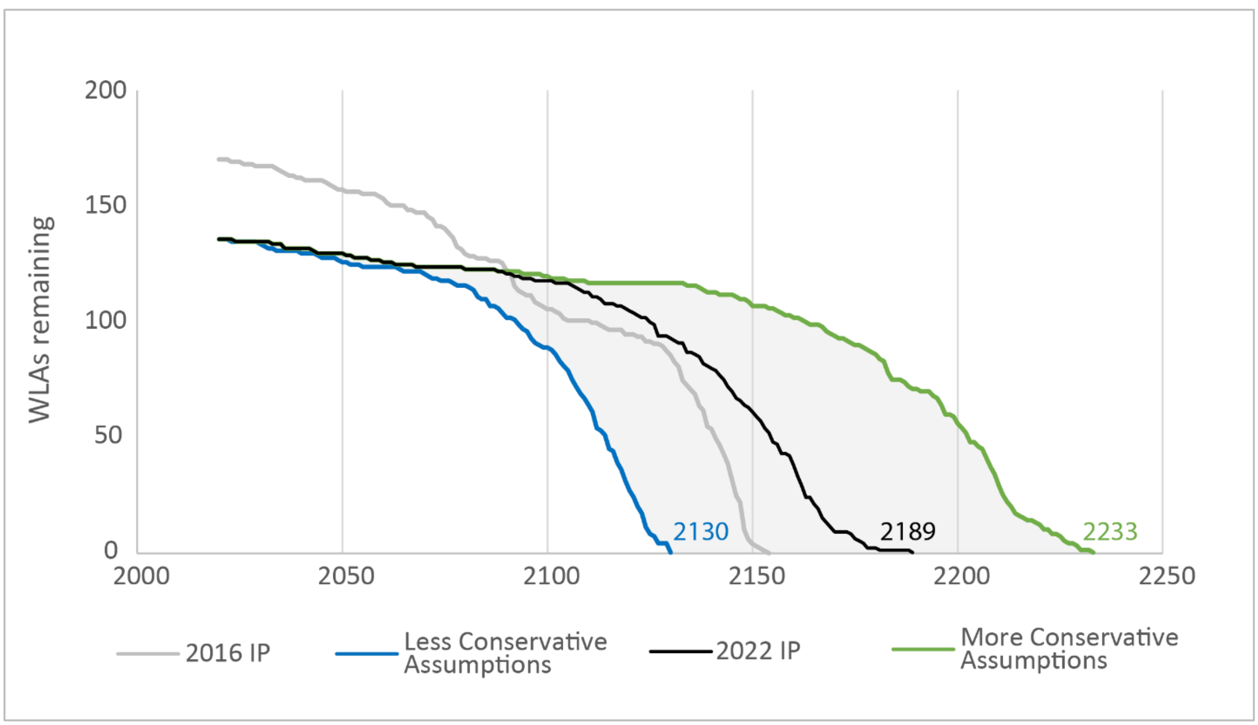

Figure 6-5: Projected WLA Attainment Timeline

6.4 Programmatic Initiatives to Accelerate the Attainment of WLAs

As required by the 2018 MS4 permit, DOEE completed a number of programmatic initiatives to evaluate the current status of BMP implementation and WLA attainment and to determine whether new or updated strategies for reducing loads are practical and/or warranted. Among these programmatic initiatives were various studies of specific pollutants and sources, evaluations of regulatory and funding programs, and development of targeted implementation strategies. Many of these initiatives were discussed in Section 5.5 of this document.

DOEE intends to continue these initiatives and use the results of these initiatives to help steer implementation into the future.

6.4.1 Required Pollutant Studies

<u>Bacteria/Microbial Source Tracking Study</u>

Section 2.2.2.1 of the 2018 MS4 permit requires DOEE to complete a bacteria source tracking study. DOEE is undertaking three separate sampling studies to do microbial source tracking (MST) of bacteria sources in its watersheds. Sampling and analysis is underway for two of the studies (one in Rock Creek with two (2) mainstem and one (1) tributary sampling sites; and one in the Anacostia River watershed). A third study that will focus on identifying human markers of bacteria is planned for 2022 in the Anacostia River watershed.

DOEE intends to use the results of the studies to conduct targeted bacteria source reduction actions, such as eliminating potential sewer cross connections and developing and implementing programs focused on pet waste. These targeted actions should help DOEE continue to make progress in meeting bacteria WLAs.

<u>Toxics Study</u>

Section 2.2.2.2 of the 2018 MS4 permit requires DOEE to investigate specific toxic pollutants “to identify current sources, including a determination of whether or not these toxic contaminants are largely in situ in the sediments of receiving streams rather than in ongoing MS4 discharges.” To address this requirement, DOEE developed the draft *Investigations of Ongoing MS4 Toxic Contaminants to the Anacostia River* report in October 2020. Under this study, DOEE’s contractor compiled and evaluated data from previously conducted studies that could be used to better understand the presence of toxic contaminants in Anacostia River surface water. However, the study concluded that data from recent wet weather surface water studies does not contain many additional detected toxic contaminant concentrations.

DOEE will continue to use the results of its toxics studies to inform possible future activities targeted at reducing toxic load reductions (including source reduction, such as sediment remediation) successfully.

In addition, as discussed in Section 6.3, DOEE is finalizing a separate analysis of toxic pollutants that may result in the removal on specific pollutant causes of impairment, and subsequent revision of TMDLs to remove these pollutant WLAs. This process should help DOEE to focus its efforts on those toxic WLAs that can be confirmed in its watersheds.

6.4.2 Required Programmatic Evaluations

DOEE completed multiple programmatic evaluations, including review of its stormwater regulations, review of its stormwater fee, and development of a process for prioritizing watersheds for implementation, as part of 2018 MS4 permit requirements. These evaluations were discussed in detail in Section 5 of this document.

DOEE intends to use the results of these evaluations to shape implementation in the future. For example, DOEE continues to use its “Priority Watershed” list and process to drive implementation in priority watersheds. Similarly, DOEE is using its analysis of the stormwater regulations to evaluate the potential to update its regulations to lower the threshold for regulating projects. Another option is to revise the peak discharge requirements to better prepare for the increased frequency of relatively large storms due to climate change.

6.4.3 Additional Programmatic Evaluations

Section 6.2.2. describes the pollutant removal efficiencies of various types of BMPs used to meet WLA load reduction requirements. Investigation of BMP efficiencies revealed that, on average, the efficiency of unregulated BMPs is lower than the efficiency of regulated BMPs, as shown in Figure 6-3. As a result of this observation, DOEE intends to provide internal “best practices” guidance related to unregulated BMP selection and design to promote the implementation of BMPs that have higher average pollutant removal efficiencies.

6.5 Adaptive Management

DOEE continues to use adaptive management in implementing the IP. Since the 2016 IP, DOEE has conducted numerous evaluations of its data, processes, and programs to ensure that the IP is based on the best possible data. Examples of successful uses of adaptive management are the updates to the IPMT and the load modeling methodology and to the assumptions on which the modeling is based to ensure that the model utilizes the best possible and most updated data and information; and changes to the SRC program to increase financial incentives for installation of new GI retrofits in the MS4.

The adaptive management process will continue to be used as this IP is implemented. DOEE will continue to gather better data on pollutant impairments to its watersheds, about BMP and program effectiveness in reducing loads, and about other aspects of implementation. Some of these data-gathering exercises may be driven by current and future permit requirements, while others will be developed to address specific needs or data gaps. DOEE will then use these data to ensure that program effectiveness is maximized and that WLA attainment is achieved as effectively, economically, and expeditiously as possible.

7. TRACKING PROGRESS

The success of the IP depends on the implementation of many individual pollution control activities that are spread out over a long timeline. Tracking progress in a consistent manner over time is critical to this effort. Tracking progress enables program managers and others to assess the pace of implementation and achievement of the planned pollution load reduction goals that are set out in the IP. Long-term commitments are broken down into smaller, more manageable pieces, such as benchmarks and other programmatic measures that are assessed on an annual basis, and milestones that are assessed every five (5) years. Evaluating progress based on these shorter segments provides DOEE with the necessary evidence to determine whether TMDL Implementation is on track to meet projected timeframes for achieving WLAs and allows any necessary shifts in course through adaptive management to ensure that milestones are met and the goals of the IP are achieved in a timely manner.

A robust system of modeling, monitoring, and other programmatic tracking was developed as part of the 2016 IP. This system has been used to evaluate progress towards milestones, benchmarks, and other programmatic targets during the implementation of the IP over the last five-plus years, and it remains in place as part of this 2022 IP. The actual progress in implementing the IP and the success of this tracking system was discussed previously in Chapter 5, “Implementation Plan Assessment.” The current chapter describes the methodology and plan for continuing to track progress under this 2022 IP.

Progress towards meeting the 2022 IP and achieving WLAs will be tracked using three different methods, including:

- **Modeling:** The IPMT will be used to demonstrate attainment of individual MS4 WLAs. The IPMT was used to evaluate progress made since 2016 (See Chapter 5), and it will continue to be used to track BMP implementation, calculate load reductions over time, and evaluate progress made towards achieving benchmarks and milestones.
- **Monitoring**: DOEE collects datasets on multiple aspects of District waters and on discharges into those waters, including data on the loads from the MS4 system, on ambient conditions, and on the health of receiving waterbodies. Monitoring data is useful to confirm improvements in water quality, and, ultimately, achievement of WLAs projected by modeling. Monitoring data can also be helpful in other ways, such as wet weather discharge monitoring data (i.e., MS4 outfall monitoring data) to help update the EMCs used in the IPMT or the use of data from future BMP effectiveness studies to ensure that the IPMT is accurately reflecting pollutant removal by BMPs.
- **Other Programmatic Tracking**: DOEE implements a wide variety of measures that contribute to achievement of the planned pollution load reduction goals. This includes tracking BMP-specific information like the number of BMPs implemented, the number of BMPs inspected, etc. It also includes tracking of iterative actions that result in pollutant load reduction, but which may not be quantifiable in terms of actual loads reduced - activities such as site inspections, public education, and hazardous waste collection. The 2018 MS4 permit includes requirements to implement and report on achievement of specific targets for acres managed, green roof implementation, tree planting, and trash removal. While progress on these targets is reported in

the District's MS4 Annual Reports, this programmatic tracking is incorporated into the 2022 IP to help ensure adequate evaluation of progress towards the IP's goals.

The following subsections describe these three types of progress tracking in more detail. For more information on the initial development of these types of progress tracking see Chapter 7, *Tracking Progress in Meeting MS4 WLAs*, in the 2016 IP.

7.1 Modeling and Use of the IPMT

The IPMT will continue to be the primary method used to track progress toward milestones, benchmarks, and attainment of individual WLAs. As part of this 2022 IP and as described in Chapter 6 of this document, the IPMT has been used to evaluate progress to date. This "progress to date" becomes the "Current Condition" for this 2022 IP from which to measure progress towards meeting the individual WLAs and closing the load reduction gap in future years. Modeling provides a consistent and straightforward way to track results over time as this gap is closed.

The IPMT uses specific information on BMPs to calculate load reduction. This includes:

- Type of BMP;
- Location of BMP;
- Implementation date;
- Area controlled by the BMP; and
- Design stormwater volume retained by the BMP.

The District's SGS is the primary database for recordation of stormwater management plans, soil erosion and sediment control plans, green area ratio plans, and other detailed information on green infrastructure and BMPs associated with regulated and non-regulated activities. BMP information is updated and tabulated in this database as the facilities are planned, inspected, and become operable. In addition to the SGS, there are several other sources of BMPs that are used in the IPMT, including:

- The District Department of Transportation's UFD database of street trees.
- DOEE's inventory of trash reduction BMPs and coal tar removal projects.
- DC Department of Public Works records on street sweeping activities.

DOEE is continuously working on expanding, improving, and updating the SGS database and its recording capabilities to ultimately include all District BMPs into a single consolidated database.

Data on BMPs and other programmatic information is input into the IPMT to model progress in meeting MS4 WLAs and achieving the goals of the IP. The IPMT is applied annually across the entire MS4 area to quantify the load reduction achieved with the new BMPs that have been put in place and become operational each year. For tracking purposes, this annual quantification of load reduction is compared directly against the benchmarks established for each of the MS4 WLAs. As described in Section 6.6 of the 2016 IP (DOEE, 2016a), benchmarks have been set as the average annual amount of pollutant reduction that must be achieved to meet the WLA by the date projected by the modeling. Thus, comparing the load reduced each year against the annual benchmark helps determine if sufficient progress is being made over time. Data on BMPs is also used to quantify the acres managed milestone for the MS4. The acres managed milestone is the primary metric by which progress on the IP, and compliance with the permit, is evaluated.

7.2 Monitoring

The primary monitoring data used to track the achievement of WLAs is the monitoring and tracking of BMP implementation data as described above in Section 7.1, Modeling. Monitoring and tracking BMP implementation provides the IPMT with the input data required to evaluate achievement of WLAs. Other monitoring data will be used to supplement BMP monitoring information and provide additional information on achieving the goals of the IP. This includes wet weather discharge monitoring (i.e., MS4 outfall monitoring data) and other types of data. MS4 outfall monitoring data provides direct evidence of pollutant loads from individual MS4 outfalls However, since not every pollutant for which there is a WLA is monitored at every MS4 outfall, outfall monitoring data cannot be used to evaluate the achievement of WLAs directly. Instead, it can be used as an indicator – for example, to determine if loads of specific pollutants are decreasing over time, as would be expected with the implementation of additional BMPs and as is necessary to achieve WLAs. Other monitoring data, such as receiving water quality monitoring, aquatic life use support assessment, fish tissue analysis, geomorphological assessment, physical habitat assessment, and trash monitoring, can also be used as indicators to evaluate improvements in water quality and habitat conditions that would be expected if progress is being made in achieving WLAs.

For additional information on how specific types of monitoring data are used in tracking progress on the IP, please see Section 7.3 of the 2016 IP.

7.3 Other Programmatic Tracking

In addition to acres managed, other programmatic data for which reporting is required by the 2018 MS4 permit includes green roof implementation, tree planting, and trash removal.

The 2016 IP also identified multiple other programmatic elements that are useful in assessing progress, including BMP inspections, illicit discharge, detection, and elimination (“IDDE”) inspections, miles of streets swept, number of catch basins inspected and cleaned, and Stormwater Pollution Prevention Plans implemented. All of these programmatic elements contribute to better stormwater management, which ultimately leads to reductions in pollutant loading and progress towards achieving individual WLAs. Thus, even though they cannot be used directly to evaluate progress in meeting WLAs, they are an important to the overall goals of the IP, and DOEE will continue to report on them to provide additional context for progress in achieving the District’s TMDL and IP-related requirements.

8. PUBLIC OUTREACH PLAN

A public outreach plan that engaged key stakeholders and the general public was developed and implemented during the development of the 2016 IP. This plan focused on informing stakeholders and the public regarding the available data, the tools, and the methods for developing and implementing the IP. Soliciting and addressing stakeholder feedback and informing the public regarding TMDL planning was critical in building support for implementation efforts. The plan included hosting public meetings and participating in “roadshows” with environmental organizations and regional partners like the DC Environmental Network (“DCEN”) and Metropolitan Washington Council of Governments (“MWCOG”) to present a summary of the IP. DOEE also developed an IP website at https://dcstormwaterplan.org/ to provide information on the TMDL planning and implementation process.

Since 2016, DOEE’s primary outreach efforts have been through website updates and the MS4 Annual Report StoryMaps. Section 5.3 of the 2018 MS4 permit, Reporting to the Public, requires the website to be maintained as a repository of the most recent or updated version of all documents, reports, and assessments, including the IP Report (§ 5.3.2 Website Information Repository). Section 5.3 also requires DOEE to develop and maintain a web-based graphical interface to support the MS4 Annual Report (§ 5.3.1 Stormwater Program Dynamic Web-based Graphical Interface). This graphical user interface is specifically designed to provide data and information to District residents and other stakeholders in a useful and accessible format. The graphical user interface is required to provide the following types of information:

- A GIS-referenced set of maps that include the locations of all stormwater control measures in the MS4 Permit Area, sortable by type/function, drainage area, storage volume and installation date;
- Data on stormwater retention credits certified in the MS4 Permit Area;
- Statistics on implementation of specific types of management practices, such as green roofs and trees;
- TMDL WLAs by stream segment and by pollutant; and
- Monitoring locations linked to monitoring data.

DOEE has implemented an ArcGIS StoryMap format to meet this requirement and posts MS4 Annual Report StoryMaps on its website[9]. For example, the 2021 Annual Report StoryMap[10] provides information on the MS4 program, stormwater pollution and control, stormwater pollution prevention, stormwater pollution modeling, public education and outreach, TMDL planning and implementation, monitoring, and a new “project highlight” each year.

The StoryMaps are published each year in January and subsequently advertised through DOEE’s social media outlets. Since 2021, DOEE is also tracking the number of views to the StoryMaps.

The District also continues to develop and implement outreach programs as required by the 2018 MS4 permit. Section 3.10 of the 2018 MS4 permit requires the District to conduct targeted public education to “measure the understanding and adoption of selected targeted behaviors among the targeted

[9] https://doee.dc.gov/publication/ms4-discharge-monitoring-and-annual-reports

[10] https://storymaps.arcgis.com/collections/792b0984eab54a998838569915e1d619?item=1

audiences." The purpose of these outreach and education efforts is to engage and educate the general public regarding stormwater and pollution issues and to influence public behavior to reduce stormwater impacts and minimize pollution. Specific components of the outreach and education include information on:

- General sources of stormwater pollution and impacts of stormwater flows into surface waters.
- Source control practices and environmental stewardship actions in landscaping and rainwater re-use.
- A household hazardous waste education and outreach program to control illicit discharges to the MS4.
- Vehicle maintenance stormwater control measures, including car washing practices.
- Stormwater control measures for removing ice from sidewalks and roads.
- Meaningful watershed educational experiences and other education for District youth and teachers.
- The District's Litter Prevention Campaign.

DOEE also hosts a Watershed Stewards Academy, which is an 8-week hands-on certification course offered twice a year to District residents seeking to address local pollution problems in their local watersheds. Watershed Stewards serve as human resources and community leaders in the effort to clean up local waterways, coordinate efforts to infiltrate stormwater, and reduce pollution sources within sub-watersheds. Among the topics included in the Academy's courses are stormwater management, pollution reduction strategies, rainscaping techniques, and stream restoration.

DOEE includes summaries of its public outreach efforts as part of a written MS4 Annual Report that supplements the StoryMap. This written report is also available on DOEE's website https://doee.dc.gov/publication/ms4-discharge-monitoring-and-annual-reports and is in the format of a form that DOEE updates and posts annually. The form includes a summary of targeted public education in the reporting year. For example, in 2021, DOEE reported on:

- Number of views of the District stormwater website;
- Number of retweets of District tweets on stormwater topics;
- For pet waste, number of bag dispensers/ disposal containers available;
- Number of pet waste signs installed;
- Number of RiverSmart audits completed;
- Number of RiverSmart Practices installed;
- Stormwater Retention Credits generated by the RiverSmart Program;
- Number of District youth receiving environmental training;
- Number of District teachers receiving environmental training; and
- Number of participants in environmental boat tours.

The report also includes short written summaries of what has been achieved in the environmental education training program and the District's Litter Prevention Campaign for the plan year.

DOEE also continues to maintain the IP website at https://dcstormwaterplan.org/. This website includes previous reports, documents, and meeting records that were published during the 2016 TMDL IP planning and implementation process. This website will also be updated with the 2022 IP Report.

9. INTEGRATION WITH OTHER WATERSHED PLANNING EFFORTS

The IP functions as the District's watershed implementation plan to meet the requirements of the Clean Water Act Section 319 Nonpoint Source (NPS) Management Program. As such, this Plan supersedes the Oxon Run WIP (2010), the Rock Creek WIP (2010), and the Anacostia River WIP (2011). It identifies waterbody impairments, technically appropriate implementation projects, and timelines that guide DOEE in its work. It also includes a process for prioritizing subwatersheds for NPS implementation in the District.

The IP addresses EPA's nine essential elements for watershed planning. These elements, commonly called the "a through i criteria" are important for the creation of thorough, robust, and meaningful watershed plans and incorporation of these elements into the plan is of particular importance in receiving funding for implementation. EPA has clearly stated that, to ensure that Section 319-funded projects make progress towards restoring waters impaired by nonpoint source pollution, watershed-based plans that are developed or implemented with Section 319 funds to address 303(d)-listed waters must include at least the nine elements. While this IP is focused on MS4 point sources, EPA recommends including these nine elements in all watershed plans because they provide a quantitative framework for the planning process that leads to water quality improvements and restoration to attain water quality standards.

The planning elements are:

a. An identification of the causes and sources that will need to be controlled to achieve the load reductions estimated in the plan and to achieve any other watershed goals identified in the plan, as discussed in element (b) immediately below.
b. An estimate of the load reductions expected for the management measures described under element (c) below, recognizing the natural variability and the difficulty in precisely predicting the performance of management measures over time.
c. A description of the management measures that will need to be implemented to achieve the load reductions estimated under element (b) above, as well as to achieve other watershed goals identified in the plan, and an identification of the critical areas in which those measures will be needed to implement this plan.
d. An estimate of the amount of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon, to implement this plan.
e. An information/education component used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the recommended management measures.
f. A schedule for implementing the management measures identified in this plan that is reasonably expeditious.
g. A description of interim programmed restoration for determining whether management measures or other control actions are being implemented.
h. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether the plan needs to be revised.

i. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under element (h) immediately above.

Much of the information on causes and sources of impairment for the pollutants covered in this IP (element a) comes from the original listings documented in the Integrated Reports as well as the TMDL studies. The expected load reductions (element b), management measures (element c), schedule milestones (elements f and g), and load reduction criteria (element h) are covered in detail in this IP. This IP also includes discussions of financing (element d), education and public participation (element e), and monitoring (element i). These elements and the IP sections in which they are addressed are shown in Table 9-1 below.

Table 9-1: Cross Reference of 2016 IP with EPA's Nine Essential Elements for Watershed Planning

Requirement	Met?	Page/Section Reference* and Comments
A. Identification of Causes & Sources of Impairment (overall)	**Yes**	
a. Sources of impairment are identified and described.	Yes	Pg. 18-23 and Appendices A and G of 2016 IP
b. Specific sources of impairment are geographically identified (i.e., mapped)	Yes	Appendix C of the 2016 IP
c. Data sources are accurate and verifiable, assumptions can be reasonably justified		Pg. 44 of the 2016 IP
B. Expected Load Reductions (overall)	**Yes**	
a. Load reductions achieve environmental goal (e.g., TMDL allocation)	Yes	Appendix D of the 2016 IP
b. Desired load reductions are quantified for each source of impairment identified in Element A	Yes	Appendix D of the 2016 IP
c. Expected load reductions are estimated for each management measure identified in Element C and overall watershed.	Yes	Pg. 45-54 of the 2016 IP. Also see Final Scenario Analysis document available at https://dcstormwaterplan.org/documents-and-deliverables/ for further detail on projected load reductions resulting from management measures
d. Data sources and/or modeling process are accurate and verifiable, assumptions can be reasonably justified	Yes	Pg. 44-54 of the 2016 IP
C. Proposed Management Measures (overall)	**Yes**	
a. Specific management measures are identified and rationalized	Yes	Pg. 65 - 73 of 2016 IP
b. Proposed management measures are strategic and feasible for the watershed	Yes	Pg. 65 - 73 of 2016 IP
c. Critical/Priority implementation areas have been identified	Yes	Pg. 100 of 2016 IP

Table 9-1: Cross Reference of 2016 IP with EPA's Nine Essential Elements for Watershed Planning		
Requirement	**Met?**	**Page/Section Reference* and Comments**
d. The extent of expected implementation is quantified (e.g., x miles of streambank fenced, etc.)	Yes	Pg. 71 - 73 of 2016 IP
D. Technical and Financial Assistance Needs (overall)	**Yes**	
a. Cost estimates reflect all planning and implementation costs	Yes	Pg. 127-135 of 2016 IP
b. Cost estimates are provided for each management measure	Yes	Pg. 127-135 of 2016 IP
c. All potential Federal, State, Local, and Private funding sources are identified	Yes	Pg. 128-132 of 2016 IP
d. Funding is strategically allocated - activities are funded with appropriate sources (e.g., NRCS funds for BMP cost share)	Yes	Pg. 127-132 of 2016 IP
E. Information, Education, and Public Participation Component (overall)	**Yes**	
a. A stakeholder outreach strategy has been developed and documented.	Yes	Pg. 117-118 of 2016 IP
b. All relevant stakeholders are identified and procedures for involving them are defined.	Yes	Pg. 117-118 of 2016 IP
c. Educational/Outreach materials and dissemination methods are identified.	Yes	Pg. 117-118 of 2016 IP
F/G. Schedule and Milestones (overall)	**Yes**	
a. Implementation schedule includes specific dates and expected accomplishments	Yes	Pg. 76-77, 84-88, 95-100 and Appendix D of 2016 IP
b. Implementation schedule follows a logical sequence	Yes	Pg. 75-100 of 2016 IP
c. Implementation schedule covers a reasonable time frame	Yes	Pg. 75-100 and Appendix D of 2016 IP
d. Measurable milestones with expected completion dates are identified to evaluate progress	Yes	Pg. 76-77, 84-88, 95-100 and Appendix D of 2016 IP
e. A phased approach with interim milestones is used to ensure continuous implementation	Yes	Pg. 75-100 and Appendix D of 2016 IP
H. Load Reduction Evaluation Criteria (overall)	**Yes**	
a. Proposed criteria effectively measure progress toward load reduction goal	Yes	Pg. 45-54 and 109-116 of 2016 IP. Also see Comprehensive Baseline Analysis and Final Scenario Analysis documents available at https://dcstormwaterplan.org/documents-

Table 9-1: Cross Reference of 2016 IP with EPA's Nine Essential Elements for Watershed Planning		
Requirement	**Met?**	**Page/Section Reference* and Comments**
		and-deliverables/ for further detail on approach to crediting specific BMPs
b. Criteria include both: quantitative measures of implementation progress and pollution reduction; and qualitative measures of overall program success (including public involvement and buy-in)	Yes	Pg. 109-116 of 2016 IP
c. Interim WQ indicator milestones are clearly identified; The indicator parameters can be different from the WQ standard violation	Yes	Pg. 84-88 and Appendix F of 2016 IP
d. An Adaptive Management approach is in place, with threshold criteria identified to trigger modifications	Yes	Pg. 104 of 2016 IP
I. Monitoring Component (overall)	**Yes**	
a. Monitoring plan includes an appropriate number of monitoring stations	Yes	Pg. 111-115 of the 2016 IP and Pg. 19-43 of Revised Monitoring Program. Revised Monitoring Program document available at https://dcstormwaterplan.org/documents-and-deliverables/
b. Monitoring plan has an adequate sampling frequency	Yes	Pg. 111-115 of the 2016 IP and Pg. 19-43 of Revised Monitoring Program. Revised Monitoring Program document available at https://dcstormwaterplan.org/documents-and-deliverables/
c. Monitoring plan will effectively measure evaluation criteria identified in Element 8	Yes	Pg. 109-116 of the 2016 IP
*References are to sections of the 2016 IP because the 2022 IP focuses on updates to the program/plan that was developed and implemented through the 2016 IP. Thus the 2022 IP does not follow the same structure and crosswalk with EPA planning elements.		

10. FUNDING THE IMPLEMENTATION PLAN

The methods for funding the IP were included in the 2016 IP and remain fundamentally the same for the 2022 IP. Implementation occurs both through BMPs directly funded by the District Government as well as through BMPs funded by private entities to comply with the District's Stormwater Regulations or other requirements.

The following subsections summarize the available public funding sources, non-public funding from compliance with the Stormwater Regulations, the current funding available for direct BMP implementation, the overall IP funding plan, and evaluation of additional funding for the IP through analysis of the current Stormwater Fee.

10.1 Public Funding Sources

The currently allocated public resources that fund the IP include:

- The Enterprise Fund (funds generated from the stormwater fee)
- The Anacostia River Clean Up and Protection Fund (funds generated from the "Bag Law")
- EPA Clean Water Act Grants (Clean Water State Revolving Fund and Section 319 grants)
- EPA Chesapeake Bay Program Funds (Chesapeake Bay Implementation and Regulatory and Accountability Program grants)

The following subsections provide short summaries of the public funding and other investments that will drive implementation and load reduction. For full discussions of these funding sources and funding programs, see the 2016 IP Section 10.

10.1.1 Enterprise Fund

The Enterprise Fund and the District's stormwater fee were established in 2000, and the stormwater fee was subsequently updated to be based on that amount of impervious surface in 2009. The Enterprise Fund receives revenue from the District's stormwater fee. The revenue from this fee addresses the costs of implementing the EPA permits issued to the District for the MS4, including costs to manage and treat pollutants in stormwater runoff.

The stormwater fee generates approximately $13 million in revenue per year. DOEE uses most of this revenue to address MS4 programmatic requirements (e.g., the MS4 permit's monitoring requirements; staff time for inspection and enforcement, IDDE; and permit reporting and administration). Revenue from the stormwater fee supports over 60 full-time equivalent staff within DOEE, whose work addresses permit requirements such as inspection and enforcement efforts, stream and stormwater outfall monitoring, programs to incentivize green infrastructure, and permit reporting and administration. Fee revenue also provides for contractual support to address permit requirements for planning, monitoring, and analysis. Sizeable portions are also distributed directly to other District agencies such as DDOT, DPW, and DGS to fund stormwater grey and green infrastructure projects and other source control activities under interagency Memorandums of Understanding ("MOUs"). The amount that is available for direct investment in BMPs and other pollution controls is approximately $3.65 million per year.

10.1.2 The Anacostia River Clean Up and Protection Fund

This fund was established by the Anacostia River Clean Up and Protection Act (DC 2009) and is frequently referred to as the "Bag Law." The Bag Law generates approximately $2.0 million in revenue per year. This revenue is used to fund a variety of activities including installing and maintaining trash retention projects, stream restoration projects, and watershed educational programs. The amount that is available for direct investment in new practices to keep trash and other pollutants out of District waterways is approximately $1.0 million per year.

10.1.3 Clean Water State Revolving Fund

The Clean Water State Revolving Fund ("CWSRF") is a Congressionally authorized loan program administered by EPA that provides low interest loans to municipalities, water agencies, and other entities to help communities achieve the goals of the Clean Water Act. The District receives approximately $6 million in CWSRF funds each year, with approximately $3.1 million typically dedicated for green infrastructure projects. The remaining funds are utilized by DC Water for grey infrastructure improvements. In the case of the District, the CWSRF funds are treated as a grant, not a loan, and repayment is not required, although there are matching fund requirements for the grant. DOEE receives approximately $7M annually in CWSRF funds, of which $3-5M are spent on stormwater capital projects (both green and grey infrastructure) to reduce pollutant loads to waterways.

The Bipartisan Infrastructure Law (BIL) will be providing significant additional funding to the CWSRF over the next five years to advance green and gray infrastructure in the District; more than $50 million of federal funds will require over $10 million of local match. As with the traditional CWSRF program, projects will be selected for funding from the Project Priority Lists each year.

10.1.4 Section 319 Grants

EPA awards Section 319 grants to states under the Clean Water Act for the implementation of nonpoint source management programs. The District receives approximately $1.0 million in Section 319 grant funds each year. Approximately one-half of this funding, or $600,000 per year, is available for direct investment in watershed and water quality-oriented projects.

Section 319 funds are restricted for use for nonpoint source control – not MS4 stormwater management. Consequently, much of this funding is directed toward stream and outfall restoration projects. However, while stream restoration may not directly reduce pollutant loads from the MS4 system, it has the benefit of improving stream health, which is one of the ultimate goals of meeting MS4 WLAs. DOEE is also taking credit for "acres managed" for stream restoration projects, which helps in achieving one of the IP milestone metrics.

10.1.5 Chesapeake Bay Implementation Grants

The Chesapeake Bay Implementation Grants ("CBIGs") are authorized under the Chesapeake Bay Agreement and administered by the EPA Chesapeake Bay Program. This federal funding source is given to the District to implement pollution management and control programs that address nutrients (nitrogen and phosphorus) and sediment, the major pollutants affecting the water quality of the Chesapeake Bay.

The District receives approximately $1.2 million in CBIG funds granted to DOEE each year. Nearly half of this amount is directed toward supporting the RiverSmart Communities Program. This program provides financial and technical assistance to District non-profit organizations and houses of worship interested in installing green infrastructure on their properties.

10.1.6 Chesapeake Bay Regulatory and Accountability Program Grants

The Chesapeake Bay Regulatory and Accountability Program ("CBRAP") provides grants to support regulatory and accountability programs aimed at improving water quality in the Chesapeake Bay. CBRAP funds are authorized by Congress and administered by EPA. The funds are used for a variety of purposes to include development and implementation of:

- Regulatory monitoring, tracking, reporting and verification activities.
- Trading and offset programs.
- Technical and compliance assistance and guidance for Watershed Implementation Programs.

The District receives approximately $700,000 in CBRAP funds each year. While this funding is used to support implementation, none of the funding is available for direct investment in BMPs and other pollution control measures.

10.1.7 Other Competitive Grants

DOEE evaluates opportunities to apply for competitive grant funds from Federal agencies and non-governmental organizations on an ongoing basis. However, these funds are not considered a core part of DOEE's funding plan for TMDL implementation or stormwater management, as neither their availability nor DOEE's ability to successfully compete for them is guaranteed.

10.1.8 Tree Fund

Through an MOU, DDOT will transfer $650,000 to DOEE to plant up to 3,500 trees in FY22. This MOU represents a commitment by both agencies to continue tree planting on private properties and public spaces throughout the District. The new Request for Applications for Tree Canopy Restoration Grant, the primary vehicle to distribute these funds, was published on August 28, 2020, and the two-year grant was awarded to the District on November 9, 2020.

Through a grant with Casey Trees, trees are planted through the RiverSmart Homes Program, the Tree Rebate Program, and by direct installation on other private and public lands (e.g., multifamily residential properties, cemeteries, university campuses, National Park Service lands, DC Parks and Recreation facilities, DC Public Schools school yards, and other District lands).

10.1.9 Other District Programs

Although not tracked directly, the District does utilize other sources of funds to invest in BMPs and pollution control including green infrastructure. District General Funds are used for capital projects and improvements by a number of District agencies, including DDOT road reconstruction projects, public facilities construction by DGS, and DC Housing Authority projects. All public projects must comply with the District's stormwater management regulations and projections.

10.2 Direct Implementation Through Private Development

10.2.1 Development / Redevelopment to Comply with Stormwater Management

The District achieves a major part of its load reductions through regulations requiring stormwater control and BMP implementation when lands are developed or re-developed. These regulations, as codified in the is 2013 Stormwater Management Rule, affect public as well as privately–owned land, and includes portions of the PROW. The cost of implementing these BMPs will be absorbed by those doing the development and redevelopment. Approximately 80 percent of the projected total stormwater volume reduction achieved towards the IP's required progress is achieved through BMPs funded to comply with these regulations.

10.2.2 Other Funding Mechanisms

The Stormwater Retention Credit (SRC) Trading Program helps to leverage private investment GI practices that restore the District's streams and rivers. Properties in the District can generate SRCs by voluntarily installing GI or by removing impervious surfaces. The owner of a regulated site may achieve a portion of the stormwater retention volume off-site by purchasing SRCs from another site, generating SRCs elsewhere at another site they own, or paying an In-Lieu Fee (ILF) to the District Government. This provides flexibility to developers and incentivizes voluntary GI projects in the District. When a developer in the CSS purchases SRCs generated in the MS4, this essentially shifts funding to build and maintain GI from the CSS to the MS4. DOEE continues to prioritize investing in GI in the MS4 due to the fact that the CSS area will ultimately be addressed by infrastructure and treatment associated with the DC Clean Rivers Program.

DOEE has made a significant investment to accelerate GI retrofits in the MS4 by establishing the Stormwater Retention Credit (SRC) Price Lock Program. Green infrastructure totaling 22.5 acres has been installed through this program, with another 1.2 acres in currently in the design, permitting, and/or construction phase.

To participate in the SRC Price Lock Program, SRC generators must build new, voluntary GI in the MS4. Participants have the option to sell their SRCs to DOEE at fixed prices for the first 12 years of SRC certification. This program offers certainty about the revenue from selling SRCs. All SRCs purchased through this program are retired and removed from the market, meaning they cannot be resold. DOEE has made $11.5 million available solely for SRC purchases.

10.3 Summary of Current Funding

The District currently pays for its investment in stormwater management and pollution control under the MS4 program with funds from seven separate sources. In addition, there are several other District programs that provide and invest funds in stormwater management and pollution control activities for which the specific amount of funding is not easily tracked. The seven current sources of funding are summarized in Table 10-1. As shown, almost $11 million is available annually for direct investment in BMPs and other pollution control measures. This investment in BMPs is for stormwater management retrofits that are not otherwise required by the District's stormwater management regulations.

Table 10-1: Current Sources and Levels of MS4 Funding For Direct Investments in BMPs and Other Pollution Control Measures

Funding Source	Funding ($) Available for Direct Investment in Pollution Controls
Enterprise Fund	3,650,000
Anacostia River Clean Up and Protection fund	1,000,000
Clean Water State Revolving Fund	3,100,000
Section 319 Grants	600,000
Chesapeake Bay Implementation Grants	1,200,000
Chesapeake Bay Regulatory and Accountability Program Grants	700,000
DDOT Tree Fund	650,000
Total:	**$10,900,000**

In addition to these funds, the investment in BMPs by projects subject to the District's 2013 Stormwater Management Rule (including public projects) is projected to be many times greater than the investments summarized in Table 10-1.

10.4 Overall Plan for Achieving and Funding Implementation

Achieving the pollutant load reductions and MS4 WLAs within this IP requires BMP implementation on a vast scale. Public funding and public land for BMP implementation can only meet a small portion of what is needed to achieve WLAs. Therefore, the District relies on the 2013 Stormwater Management Rule, which requires BMP implementation greater than what can be achieved through public funding and on public land. Approximately 80 percent of the projected total stormwater volume reduction achieved towards the IP's required progress is through application of the District's Stormwater Regulation's requirements for construction and operation of BMPs to development and redevelopment in the MS4 area. The remaining approximate 20 percent of the projected total stormwater volume reduction towards the IP's required progress is financed by a variety of funding sources as described above. The annual level of funding, approximately $9 million per year, is expected to remain constant over time or to grow at a slow rate due to inflation. Use of these funds will be for stormwater retrofits through:

- RiverSmart Programs;
- DOEE-funded Stream Restoration;
- DOEE-funded Green Infrastructure Projects; and
- DDOT BMP Projects.

In addition, DOEE continues to invest in and execute existing programmatic activities and stormwater infrastructure that contributes to load reductions including:

- Catch basin cleaning;
- Street sweeping;
- Ongoing source control efforts;
- Illicit Discharge Detection and Elimination (IDDE);
- Coal tar ban;

- Household hazardous waste collection;
- Fertilizer control;
- Leaf collection;
- Education and outreach on stormwater issues;
- Installation, operation and maintenance of District-owned BMPs;
- Single use product ban (Plastic straws, stirrers, and Styrofoam);
- Stormwater pollution prevention program; and
- Trash reduction activities (clean-up events, Clean Team program, and others).

10.5 Re-evaluation of the District's Stormwater Fee

Section 2.2.3 of the 2018 MS4 permit requires the District to complete an evaluation of the adequacy of the District's Stormwater Fee for achieving the water quality goals of the permit. This evaluation must also include an assessment of how the Stormwater Fee works in tandem with other financing options. The District completed this analysis and reported on findings as part of the 2020 MS4 Annual Report.

As summarized in the 2020 MS4 Annual report, the Stormwater Fee currently generates approximately $13.5 million each year in revenue. The fee is charged based on a property's amount of impervious surfaces and appears on a property's DC Water bill. DC Water processes the bills and collects the fee on behalf of DOEE. The current monthly rate is $2.67 per Equivalent Residential Unit ("ERU") 1 ERU = 1,000 square feet) of impervious surface. Commercial properties are billed based on individual assessments of impervious surface while residential properties are billed according to a tiered structure.

The amount of revenue generated by the Stormwater Fee has remained flat since 2010. The monthly charge per ERU has also not changed since 2010 when the tiered structure for residential billing was introduced.

As part of the 2016 IP, the pollutant load reductions and water quality improvements that would be realized by the District's current level of funding, investment, and implementation of GI were evaluated, and this analysis was used to forecast a schedule for achieving TMDL WLAs. Based on the evaluation, the current level of funding provided by the Stormwater Fee was determined to be adequate to achieve the permit's water quality goals. In addition, as part of the evaluation of the Stormwater Fee conducted to fulfill permit Section 2.2.3, DOEE concluded that increasing the Stormwater Fee was infeasible at the current time.

The fee evaluation was conducted throughout 2020 while the financial impact of the COVID-19 pandemic was still unclear but was anticipated to be substantial. However, DOEE will continue to evaluate the adequacy of the fee and the feasibility of fee increases on an ongoing basis.

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APPENDIX A: RESULTS OF GAP ANALYSIS

TMDL Segment	Parameter Name	Units	TMDL Allocation	Baseline Loads	Current Load	Current Gap	Percent Reduction Needed to Meet Allocation
Anacostia	**E. coli**	Billion MPN/year	2.30E+05	9.48E+05	8.72E+05	6.42E+05	73.6
Anacostia Lower	**Arsenic**	lbs/year	3.41E+00	1.02E+01	9.14E+00	5.73E+00	62.7
Anacostia Lower	**BOD**	lbs/year	9.84E+04	2.38E+05	2.20E+05	1.22E+05	55.3
Anacostia Lower	**Chlordane**	lbs/year	7.80E-03	6.51E-02	6.00E-02	5.22E-02	87.0
Anacostia Lower	**DDD**	lbs/year	8.70E-03	1.99E-02	1.77E-02	8.97E-03	50.8
Anacostia Lower	**DDE**	lbs/year	2.11E-02	8.81E-02	7.77E-02	5.66E-02	72.8
Anacostia Lower	**DDT**	lbs/year	5.70E-02	2.27E-01	2.00E-01	1.43E-01	71.6
Anacostia Lower	**Dieldrin**	lbs/year	3.50E-03	1.92E-03	1.80E-03	0.00E+00	0.0
Anacostia Lower	**Heptachlor Epoxide**	lbs/year	2.00E-03	6.34E-03	5.92E-03	3.92E-03	66.2
Anacostia Lower	**PAH1**	lbs/year	1.06E-01	4.36E+00	4.07E+00	3.97E+00	97.4
Anacostia Lower	**PAH2**	lbs/year	6.41E-01	2.75E+01	2.51E+01	2.45E+01	97.5
Anacostia Lower	**PAH3**	lbs/year	4.09E-01	1.78E+01	1.55E+01	1.51E+01	97.4
Anacostia Lower	**Total Nitrogen**	lbs/year	5.17E+03	2.20E+04	1.99E+04	1.48E+04	74.1
Anacostia Lower	**Total Phosphorus**	lbs/year	5.09E+02	2.52E+03	2.14E+03	1.63E+03	76.2
Anacostia Lower	**Trash**	lbs/year	2.45E+04	2.40E+04	0.00E+00	0.00E+00	0.0
Anacostia Lower	**TSS**	lbs/year	9.28E+04	4.86E+05	4.23E+05	3.30E+05	78.0
Anacostia Lower	**Zinc**	lbs/year	1.34E+03	8.01E+02	7.08E+02	0.00E+00	0.0
Anacostia Upper	**Arsenic**	lbs/year	1.44E+00	4.84E+01	4.54E+01	4.40E+01	96.8
Anacostia Upper	**BOD**	lbs/year	1.82E+05	1.13E+06	1.09E+06	9.05E+05	83.3
Anacostia Upper	**Chlordane**	lbs/year	1.41E-02	3.09E-01	2.96E-01	2.82E-01	95.2
Anacostia Upper	**DDD**	lbs/year	5.20E-03	9.44E-02	8.80E-02	8.28E-02	94.1
Anacostia Upper	**DDE**	lbs/year	1.27E-02	4.18E-01	3.88E-01	3.75E-01	96.7
Anacostia Upper	**DDT**	lbs/year	3.40E-02	1.08E+00	9.99E-01	9.65E-01	96.6
Anacostia Upper	**Dieldrin**	lbs/year	8.20E-03	9.12E-03	8.84E-03	6.39E-04	7.2
Anacostia Upper	**Heptachlor Epoxide**	lbs/year	4.10E-03	3.01E-02	2.92E-02	2.51E-02	85.9
Anacostia Upper	**PAH1**	lbs/year	1.93E-01	2.07E+01	2.01E+01	1.99E+01	99.0
Anacostia Upper	**PAH2**	lbs/year	1.14E+00	1.31E+02	1.24E+02	1.23E+02	99.1
Anacostia Upper	**PAH3**	lbs/year	7.30E-01	8.44E+01	7.75E+01	7.67E+01	99.1
Anacostia Upper	**Total Nitrogen**	lbs/year	1.05E+04	1.04E+05	9.89E+04	8.84E+04	89.4
Anacostia Upper	**Total Phosphorus**	lbs/year	9.66E+02	1.20E+04	1.06E+04	9.64E+03	90.9
Anacostia Upper	**Trash**	lbs/year	8.39E+04	9.92E+04	0.00E+00	0.00E+00	0.0
Anacostia Upper	**TSS**	lbs/year	1.69E+05	2.31E+06	2.11E+06	1.94E+06	92.0
Anacostia Upper	**Zinc**	lbs/year	2.39E+03	3.80E+03	3.53E+03	1.14E+03	32.4
ANATF_DC	**Total Nitrogen**	lbs/year	4.95E+04	1.04E+05	9.94E+04	4.99E+04	50.2
ANATF_DC	**Total Phosphorus**	lbs/year	3.48E+03	1.19E+04	1.07E+04	7.18E+03	67.3

TMDL Segment	Parameter Name	Units	TMDL Allocation	Baseline Loads	Current Load	Current Gap	Percent Reduction Needed to Meet Allocation
ANATF_DC	**TSS**	lbs/year	3.89E+06	2.32E+06	2.12E+06	0.00E+00	0.0
ANATF_MD	**Total Nitrogen**	lbs/year	1.01E+04	3.51E+04	3.43E+04	2.41E+04	70.5
ANATF_MD	**Total Phosphorus**	lbs/year	1.45E+03	4.02E+03	3.72E+03	2.27E+03	61.0
ANATF_MD	**TSS**	lbs/year	2.61E+06	7.75E+05	7.48E+05	0.00E+00	0.0
Battery Kemble Creek	**E. coli**	Billion MPN/year	7.04E+01	8.20E+03	7.97E+03	7.90E+03	99.1
Broad Branch	**Chlordane**	lbs/year	2.79E-03	3.71E-02	3.59E-02	3.31E-02	92.2
Broad Branch	**Dieldrin**	lbs/year	1.86E-04	1.09E-03	1.06E-03	8.74E-04	82.5
Broad Branch	**Heptachlor Epoxide**	lbs/year	1.34E-04	3.61E-03	3.50E-03	3.36E-03	96.2
C&O Canal	**E. coli**	Billion MPN/year	9.59E+01	4.48E+04	4.20E+04	4.19E+04	99.8
Dalecarlia Tributary	**Dieldrin**	lbs/year	2.00E-04	1.15E-03	1.13E-03	9.25E-04	82.2
Dalecarlia Tributary	**E. coli**	Billion MPN/year	4.01E+02	9.89E+04	9.57E+04	9.53E+04	99.6
Dalecarlia Tributary	**Heptachlor Epoxide**	lbs/year	1.44E-04	3.80E-03	3.71E-03	3.57E-03	96.1
Dumbarton Oaks	**Chlordane**	lbs/year	5.34E-05	6.35E-04	6.32E-04	5.79E-04	91.6
Dumbarton Oaks	**Dieldrin**	lbs/year	3.56E-06	1.87E-05	1.86E-05	1.51E-05	80.9
Dumbarton Oaks	**Heptachlor Epoxide**	lbs/year	2.57E-06	6.18E-05	6.15E-05	5.90E-05	95.8
Fenwick Branch	**DDT**	lbs/year	1.28E-04	2.12E-02	2.06E-02	2.05E-02	99.4
Fenwick Branch	**Dieldrin**	lbs/year	3.15E-05	1.79E-04	1.75E-04	1.44E-04	82.0
Fenwick Branch	**Heptachlor Epoxide**	lbs/year	2.27E-05	5.92E-04	5.78E-04	5.55E-04	96.1
Fort Chaplin Tributary	**Arsenic**	lbs/year	3.80E-01	8.30E-01	8.05E-01	4.25E-01	52.8
Fort Chaplin Tributary	**E. coli**	Billion MPN/year	1.32E-03	1.34E+04	1.29E+04	1.29E+04	100.0
Fort Davis Tributary	**Arsenic**	lbs/year	1.00E-01	3.78E-01	3.67E-01	2.67E-01	72.8
Fort Davis Tributary	**E. coli**	Billion MPN/year	8.17E-04	6.11E+03	5.93E+03	5.93E+03	100.0
Fort Dupont Tributary	**Arsenic**	lbs/year	1.70E-01	3.25E-01	2.97E-01	1.27E-01	42.8
Fort Dupont Tributary	**E. coli**	Billion MPN/year	2.34E-03	5.26E+03	4.77E+03	4.77E+03	100.0
Fort Stanton Tributary	**Arsenic**	lbs/year	5.00E-02	2.35E-01	2.22E-01	1.72E-01	77.5
Fort Stanton Tributary	**E. coli**	Billion MPN/year	1.08E-03	3.80E+03	3.58E+03	3.58E+03	100.0
Fort Stanton Tributary	**PAH1**	lbs/year	7.80E-02	1.01E-01	9.53E-02	1.73E-02	18.2
Fort Stanton Tributary	**PAH2**	lbs/year	9.00E-03	6.36E-01	6.00E-01	5.91E-01	98.5
Fort Stanton Tributary	**PAH3**	lbs/year	6.00E-03	4.10E-01	3.85E-01	3.79E-01	98.4

TMDL Segment	Parameter Name	Units	TMDL Allocation	Baseline Loads	Current Load	Current Gap	Percent Reduction Needed to Meet Allocation
Foundry Branch	**E. coli**	Billion MPN/year	6.85E+01	1.13E+04	1.10E+04	1.09E+04	99.4
Hickey Run	**Chlordane**	lbs/year	1.42E-02	3.96E-02	3.75E-02	2.33E-02	62.2
Hickey Run	**DDE**	lbs/year	6.90E-03	5.36E-02	4.78E-02	4.09E-02	85.6
Hickey Run	**E. coli**	Billion MPN/year	6.31E-03	1.00E+05	8.96E+04	8.96E+04	100.0
Hickey Run	**PAH1**	lbs/year	3.88E+00	2.66E+00	2.56E+00	0.00E+00	0.0
Hickey Run	**PAH2**	lbs/year	4.70E-01	1.68E+01	1.56E+01	1.51E+01	97.0
Hickey Run	**PAH3**	lbs/year	3.00E-01	1.08E+01	9.46E+00	9.16E+00	96.8
Kingman Lake	**Arsenic**	lbs/year	3.97E-02	2.14E+00	2.04E+00	2.00E+00	98.1
Kingman Lake	**Chlordane**	lbs/year	1.78E-04	1.37E-02	1.31E-02	1.29E-02	98.6
Kingman Lake	**DDT**	lbs/year	7.77E-03	4.75E-02	4.51E-02	3.73E-02	82.8
Kingman Lake	**PAH1**	lbs/year	1.20E-01	9.15E-01	8.81E-01	7.61E-01	86.4
Kingman Lake	**PAH2**	lbs/year	7.08E+00	5.78E+00	5.53E+00	0.00E+00	0.0
Kingman Lake	**PAH3**	lbs/year	4.50E-01	3.73E+00	3.52E+00	3.07E+00	87.2
Klingle Valley Run	**Dieldrin**	lbs/year	2.64E-05	1.54E-04	1.46E-04	1.20E-04	82.0
Klingle Valley Run	**Heptachlor Epoxide**	lbs/year	1.90E-05	5.09E-04	4.83E-04	4.64E-04	96.1
Lower Beaverdam Creek	**BOD**	lbs/year	4.03E+02	4.50E+02	4.49E+02	4.57E+01	10.2
Lower Beaverdam Creek	**Total Nitrogen**	lbs/year	4.50E+01	4.15E+01	4.14E+01	0.00E+00	0.0
Lower Beaverdam Creek	**Total Phosphorus**	lbs/year	6.00E+00	4.76E+00	4.67E+00	0.00E+00	0.0
Lower Beaverdam Creek	**TSS**	lbs/year	1.20E+03	9.18E+02	9.07E+02	0.00E+00	0.0
Luzon Branch	**Chlordane**	lbs/year	2.13E-03	2.73E-02	2.67E-02	2.46E-02	92.0
Luzon Branch	**Dieldrin**	lbs/year	1.42E-04	8.07E-04	7.89E-04	6.47E-04	82.0
Luzon Branch	**Heptachlor Epoxide**	lbs/year	1.03E-04	2.66E-03	2.60E-03	2.50E-03	96.0
Melvin Hazen Valley Branch	**Dieldrin**	lbs/year	2.19E-05	1.37E-04	1.33E-04	1.11E-04	83.5
Nash Run	**Arsenic**	lbs/year	8.60E-01	2.20E+00	2.08E+00	1.22E+00	58.7
Nash Run	**Chlordane**	lbs/year	3.20E-03	1.41E-02	1.33E-02	1.01E-02	76.0
Nash Run	**Dieldrin**	lbs/year	3.29E-04	4.15E-04	3.93E-04	6.43E-05	16.4
Nash Run	**Heptachlor Epoxide**	lbs/year	3.10E-04	1.37E-03	1.30E-03	9.88E-04	76.1
Nash Run	**PAH1**	lbs/year	1.59E+00	9.43E-01	8.93E-01	0.00E+00	0.0
Nash Run	**PAH2**	lbs/year	1.92E-01	5.95E+00	5.63E+00	5.44E+00	96.6
Nash Run	**PAH3**	lbs/year	1.23E-01	3.84E+00	3.62E+00	3.50E+00	96.6
Normanstone Creek	**Dieldrin**	lbs/year	3.49E-05	2.17E-04	2.12E-04	1.77E-04	83.6
Normanstone Creek	**Heptachlor Epoxide**	lbs/year	2.52E-05	7.16E-04	7.00E-04	6.75E-04	96.4
Northwest Branch	**BOD**	lbs/year	1.44E+04	2.95E+05	2.84E+05	2.70E+05	94.9

TMDL Segment	Parameter Name	Units	TMDL Allocation	Baseline Loads	Current Load	Current Gap	Percent Reduction Needed to Meet Allocation
Northwest Branch	**Total Nitrogen**	lbs/year	1.96E+03	2.72E+04	2.61E+04	2.42E+04	92.5
Northwest Branch	**Total Phosphorus**	lbs/year	1.62E+02	3.12E+03	2.84E+03	2.67E+03	94.3
Northwest Branch	**TSS**	lbs/year	5.24E+04	6.02E+05	5.69E+05	5.17E+05	90.8
Oxon Run	**Dieldrin**	lbs/year	4.02E-04	2.37E-03	2.31E-03	1.91E-03	82.6
Oxon Run	**E. coli**	Billion MPN/year	9.52E+03	2.03E+05	1.96E+05	1.86E+05	95.1
Pinehurst Branch	**Dieldrin**	lbs/year	4.75E-05	2.74E-04	2.69E-04	2.21E-04	82.3
Pinehurst Branch	**Heptachlor Epoxide**	lbs/year	3.43E-05	9.03E-04	8.88E-04	8.53E-04	96.1
Piney Branch	**Chlordane**	lbs/year	1.28E-04	1.70E-03	1.62E-03	1.49E-03	92.1
Piney Branch	**Dieldrin**	lbs/year	8.51E-06	5.00E-05	4.80E-05	3.95E-05	82.3
Piney Branch	**Heptachlor Epoxide**	lbs/year	6.15E-06	1.65E-04	1.58E-04	1.52E-04	96.1
Pope Branch	**Chlordane**	lbs/year	1.70E-03	5.77E-03	5.69E-03	3.99E-03	70.1
Pope Branch	**DDE**	lbs/year	1.60E-03	7.81E-03	7.66E-03	6.06E-03	79.1
Pope Branch	**E. coli**	Billion MPN/year	1.67E-03	1.46E+04	1.43E+04	1.43E+04	100.0
Pope Branch	**Heptachlor Epoxide**	lbs/year	1.90E-04	5.62E-04	5.54E-04	3.64E-04	65.7
Pope Branch	**PAH1**	lbs/year	8.04E-01	3.87E-01	3.81E-01	0.00E+00	0.0
Pope Branch	**PAH2**	lbs/year	9.30E-02	2.44E+00	2.40E+00	2.31E+00	96.1
Pope Branch	**PAH3**	lbs/year	5.90E-02	1.58E+00	1.54E+00	1.48E+00	96.2
Portal Branch	**Dieldrin**	lbs/year	1.19E-05	6.75E-05	6.63E-05	5.44E-05	82.1
Portal Branch	**Heptachlor Epoxide**	lbs/year	8.60E-06	2.23E-04	2.19E-04	2.10E-04	96.1
Potomac Lower	**E. coli**	Billion MPN/year	2.65E+05	3.98E+05	3.83E+05	1.18E+05	30.9
Potomac Middle	**E. coli**	Billion MPN/year	1.24E+04	1.04E+05	1.00E+05	8.80E+04	87.7
Potomac Upper	**E. coli**	Billion MPN/year	2.35E+05	2.71E+05	2.61E+05	2.57E+04	9.9
POTTF_DC	**Total Nitrogen**	lbs/year	5.31E+04	1.31E+05	1.27E+05	7.44E+04	58.4
POTTF_DC	**Total Phosphorus**	lbs/year	4.13E+03	1.50E+04	1.39E+04	9.75E+03	70.2
POTTF_DC	**TSS**	lbs/year	7.64E+06	2.20E+06	1.93E+06	0.00E+00	0.0
POTTF_MD	**Total Nitrogen**	lbs/year	8.32E+03	1.58E+04	1.55E+04	7.19E+03	46.4
POTTF_MD	**Total Phosphorus**	lbs/year	5.96E+02	1.82E+03	1.69E+03	1.10E+03	64.8
POTTF_MD	**TSS**	lbs/year	1.53E+06	2.30E+05	1.95E+05	0.00E+00	0.0
Rock Creek Lower	**Copper**	lbs/year	2.09E+02	2.31E+02	2.22E+02	1.32E+01	5.9
Rock Creek Lower	**E. coli**	Billion MPN/year	1.01E+04	1.09E+05	1.04E+05	9.41E+04	90.3
Rock Creek Lower	**Lead**	lbs/year	1.55E+01	6.98E+01	6.65E+01	5.11E+01	76.8
Rock Creek Lower	**Mercury**	lbs/year	6.30E-01	8.32E-01	7.99E-01	1.69E-01	21.1

TMDL Segment	Parameter Name	Units	TMDL Allocation	Baseline Loads	Current Load	Current Gap	Percent Reduction Needed to Meet Allocation
Rock Creek Lower	**Zinc**	lbs/year	6.04E+02	4.45E+02	4.26E+02	0.00E+00	0.0
Rock Creek Upper	**Copper**	lbs/year	5.93E+02	6.63E+02	6.41E+02	4.80E+01	7.5
Rock Creek Upper	**E. coli**	Billion MPN/year	2.87E+04	3.12E+05	3.01E+05	2.73E+05	90.5
Rock Creek Upper	**Lead**	lbs/year	4.39E+01	2.00E+02	1.93E+02	1.49E+02	77.2
Rock Creek Upper	**Mercury**	lbs/year	1.78E+00	2.38E+00	2.30E+00	5.24E-01	22.8
Rock Creek Upper	**Zinc**	lbs/year	1.72E+03	1.28E+03	1.23E+03	0.00E+00	0.0
Soapstone Creek	**Chlordane**	lbs/year	1.45E-03	1.93E-02	1.88E-02	1.73E-02	92.3
Soapstone Creek	**Dieldrin**	lbs/year	9.67E-05	5.70E-04	5.55E-04	4.59E-04	82.6
Soapstone Creek	**Heptachlor Epoxide**	lbs/year	6.98E-05	1.88E-03	1.83E-03	1.76E-03	96.2
Texas Avenue Tributary	**Arsenic**	lbs/year	4.00E-01	4.00E-01	3.56E-01	0.00E+00	0.0
Texas Avenue Tributary	**Chlordane**	lbs/year	1.30E-03	2.55E-03	2.27E-03	9.74E-04	42.8
Texas Avenue Tributary	**DDD**	lbs/year	6.99E-03	7.79E-04	6.93E-04	0.00E+00	0.0
Texas Avenue Tributary	**DDE**	lbs/year	1.20E-03	3.46E-03	3.07E-03	1.87E-03	60.9
Texas Avenue Tributary	**DDT**	lbs/year	4.01E-02	8.89E-03	7.89E-03	0.00E+00	0.0
Texas Avenue Tributary	**Dieldrin**	lbs/year	1.74E-04	7.53E-05	6.72E-05	0.00E+00	0.0
Texas Avenue Tributary	**E. coli**	Billion MPN/year	1.36E-03	6.47E+03	5.75E+03	5.75E+03	100.0
Texas Avenue Tributary	**Heptachlor Epoxide**	lbs/year	1.40E-04	2.49E-04	2.22E-04	8.16E-05	36.8
Texas Avenue Tributary	**PAH1**	lbs/year	6.13E-01	1.71E-01	1.52E-01	0.00E+00	0.0
Texas Avenue Tributary	**PAH2**	lbs/year	7.10E-02	1.08E+00	9.62E-01	8.91E-01	92.6
Texas Avenue Tributary	**PAH3**	lbs/year	4.50E-02	6.97E-01	6.19E-01	5.74E-01	92.7
Tidal Basin	**E. coli**	Billion MPN/year	5.53E+04	2.58E+04	2.54E+04	0.00E+00	0.0
Washington Ship Channel	**E. coli**	Billion MPN/year	1.83E+05	6.66E+04	6.33E+04	0.00E+00	0.0
Washington Ship Channel	**Total Phosphorus**	lbs/year	9.77E+02	1.02E+03	9.43E+02	0.00E+00	0.0
Watts Branch	**BOD**	lbs/year	1.43E+04	1.68E+05	1.61E+05	1.47E+05	91.1
Watts Branch	**Total Nitrogen**	lbs/year	1.73E+03	1.55E+04	1.48E+04	1.31E+04	88.3
Watts Branch	**Total Phosphorus**	lbs/year	2.48E+02	1.78E+03	1.60E+03	1.36E+03	84.5
Watts Branch	**TSS**	lbs/year	4.84E+04	3.43E+05	3.21E+05	2.73E+05	84.9
Watts Branch - Lower	**Chlordane**	lbs/year	3.70E-03	1.19E-02	1.14E-02	7.68E-03	67.5
Watts Branch - Lower	**Dieldrin**	lbs/year	3.68E-04	3.52E-04	3.40E-04	0.00E+00	0.0

TMDL Segment	Parameter Name	Units	TMDL Allocation	Baseline Loads	Current Load	Current Gap	Percent Reduction Needed to Meet Allocation
Watts Branch - Lower	**TSS**	lbs/year	1.12E+04	8.90E+04	8.05E+04	6.93E+04	86.1
Watts Branch - Upper	**Chlordane**	lbs/year	9.60E-03	3.40E-02	3.29E-02	2.33E-02	70.8
Watts Branch - Upper	**Dieldrin**	lbs/year	9.45E-04	1.00E-03	9.74E-04	2.86E-05	2.9
Watts Branch - Upper	**TSS**	lbs/year	2.96E+04	2.54E+05	2.41E+05	2.11E+05	87.7

APPENDIX B: FORECASTED ATTAINMENT FOR ALL WLAS

TMDL Segment	Major Watershed	Pollutant	Forecasted Attainment Date
Texas Avenue Tributary	Anacostia	Arsenic	2020
Texas Avenue Tributary	Anacostia	DDD	2020
Texas Avenue Tributary	Anacostia	DDT	2020
Anacostia Lower	Anacostia	Dieldrin	2020
Texas Avenue Tributary	Anacostia	Dieldrin	2020
Watts Branch - Lower	Anacostia	Dieldrin	2020
Tidal Basin	Potomac	E. coli	2020
Washington Ship Channel	Potomac	E. coli	2020
Hickey Run	Anacostia	PAH1	2020
Nash Run	Anacostia	PAH1	2020
Pope Branch	Anacostia	PAH1	2020
Texas Avenue Tributary	Anacostia	PAH1	2020
Kingman Lake	Anacostia	PAH2	2020
Lower Beaverdam Creek	Anacostia	TN	2020
Lower Beaverdam Creek	Anacostia	TP	2020
Washington Ship Channel	Potomac	TP	2020
ANATF_DC	Anacostia	TSS	2020
ANATF_MD	Anacostia	TSS	2020
Lower Beaverdam Creek	Anacostia	TSS	2020
POTTF_DC	Potomac	TSS	2020
POTTF_MD	Potomac	TSS	2020
Anacostia Lower	Anacostia	Zinc	2020
Rock Creek Lower	Rock Creek	Zinc	2020
Rock Creek Upper	Rock Creek	Zinc	2020
Watts Branch - Upper	Anacostia	Dieldrin	2024
Rock Creek Lower	Rock Creek	Copper	2033
Rock Creek Upper	Rock Creek	Copper	2036
Anacostia Upper	Anacostia	Dieldrin	2036
Nash Run	Anacostia	Dieldrin	2043
Potomac Upper	Potomac	E. coli	2044
Lower Beaverdam Creek	Anacostia	BOD	2051
Fort Stanton Tributary	Anacostia	PAH1	2053
Rock Creek Lower	Rock Creek	Mercury	2057
Rock Creek Upper	Rock Creek	Mercury	2060
Potomac Lower	Potomac	E. coli	2063
Anacostia Upper	Anacostia	Zinc	2068
Texas Avenue Tributary	Anacostia	Heptachlor Epoxide	2080
Texas Avenue Tributary	Anacostia	Chlordane	2088
Anacostia Lower	Anacostia	DDD	2090

TMDL Segment	Major Watershed	Pollutant	Forecasted Attainment Date
Fort Dupont Tributary	Anacostia	Arsenic	2092
ANATF_DC	Anacostia	TN	2094
POTTF_MD	Potomac	TN	2097
Anacostia Lower	Anacostia	BOD	2102
POTTF_DC	Potomac	TN	2106
Fort Chaplin Tributary	Anacostia	Arsenic	2107
Hickey Run	Anacostia	Chlordane	2108
ANATF_MD	Anacostia	TP	2109
Anacostia Lower	Anacostia	Arsenic	2111
Texas Avenue Tributary	Anacostia	DDE	2111
Watts Branch - Lower	Anacostia	Chlordane	2113
Nash Run	Anacostia	Arsenic	2114
ANATF_DC	Anacostia	TP	2114
POTTF_MD	Potomac	TP	2117
POTTF_DC	Potomac	TP	2119
Pope Branch	Anacostia	Heptachlor Epoxide	2120
Kingman Lake	Anacostia	DDT	2121
Anacostia Lower	Anacostia	Heptachlor Epoxide	2122
Dumbarton Oaks	Rock Creek	Dieldrin	2123
Pope Branch	Anacostia	Chlordane	2125
Anacostia Lower	Anacostia	DDT	2125
Kingman Lake	Anacostia	PAH3	2126
Anacostia Lower	Anacostia	DDE	2127
Anacostia	Anacostia	E. coli	2127
Kingman Lake	Anacostia	PAH1	2127
ANATF_MD	Anacostia	TN	2127
Anacostia Lower	Anacostia	TP	2127
Watts Branch - Upper	Anacostia	Chlordane	2130
Watts Branch - Lower	Anacostia	TSS	2131
Anacostia Lower	Anacostia	TN	2132
Dumbarton Oaks	Rock Creek	Chlordane	2134
Hickey Run	Anacostia	DDE	2134
Rock Creek Lower	Rock Creek	Lead	2134
Anacostia Lower	Anacostia	TSS	2134
Fort Davis Tributary	Anacostia	Arsenic	2136
Pope Branch	Anacostia	DDE	2137
Fort Stanton Tributary	Anacostia	Arsenic	2138
Kingman Lake	Anacostia	Arsenic	2138
Dumbarton Oaks	Rock Creek	Heptachlor Epoxide	2138
Potomac Middle	Potomac	E. coli	2139

TMDL Segment	Major Watershed	Pollutant	Forecasted Attainment Date
Kingman Lake	Anacostia	Chlordane	2140
Rock Creek Upper	Rock Creek	Lead	2141
Klingle Valley Run	Rock Creek	Dieldrin	2142
Piney Branch	Rock Creek	Dieldrin	2142
Nash Run	Anacostia	Chlordane	2143
Watts Branch	Anacostia	TP	2143
Dalecarlia Tributary	Potomac	Dieldrin	2144
Soapstone Creek	Rock Creek	Dieldrin	2144
Nash Run	Anacostia	Heptachlor Epoxide	2144
Anacostia Upper	Anacostia	BOD	2145
Fenwick Branch	Rock Creek	Dieldrin	2145
Portal Branch	Rock Creek	Dieldrin	2146
Hickey Run	Anacostia	PAH3	2146
Anacostia Upper	Anacostia	TP	2146
Melvin Hazen Valley Branch	Rock Creek	Dieldrin	2147
Broad Branch	Rock Creek	Dieldrin	2148
Pinehurst Branch	Rock Creek	Dieldrin	2148
Watts Branch	Anacostia	TSS	2149
Oxon Run	Potomac	Dieldrin	2150
Anacostia Upper	Anacostia	Heptachlor Epoxide	2150
Northwest Branch	Anacostia	TP	2151
Northwest Branch	Anacostia	TSS	2151
Anacostia Upper	Anacostia	TN	2152
Anacostia Upper	Anacostia	TSS	2152
Hickey Run	Anacostia	E. coli	2153
Rock Creek Lower	Rock Creek	E. coli	2153
Texas Avenue Tributary	Anacostia	PAH3	2153
Hickey Run	Anacostia	PAH2	2154
Texas Avenue Tributary	Anacostia	PAH2	2154
Piney Branch	Rock Creek	Chlordane	2155
Normanstone Creek	Rock Creek	Dieldrin	2155
Northwest Branch	Anacostia	TN	2155
Watts Branch - Upper	Anacostia	TSS	2155
Watts Branch	Anacostia	TN	2156
Anacostia Lower	Anacostia	Chlordane	2157
Soapstone Creek	Rock Creek	Chlordane	2157
Anacostia Upper	Anacostia	DDD	2157
C&O Canal	Potomac	E. coli	2157
Northwest Branch	Anacostia	BOD	2159
Anacostia Upper	Anacostia	DDE	2160

TMDL Segment	Major Watershed	Pollutant	Forecasted Attainment Date
Anacostia Upper	Anacostia	DDT	2160
Foundry Branch	Potomac	E. coli	2160
Pope Branch	Anacostia	PAH3	2160
Watts Branch	Anacostia	BOD	2161
Broad Branch	Rock Creek	Chlordane	2161
Rock Creek Upper	Rock Creek	E. coli	2161
Klingle Valley Run	Rock Creek	Heptachlor Epoxide	2161
Pope Branch	Anacostia	PAH2	2161
Anacostia Upper	Anacostia	Arsenic	2162
Luzon Branch	Rock Creek	Dieldrin	2162
Piney Branch	Rock Creek	Heptachlor Epoxide	2162
Anacostia Upper	Anacostia	PAH3	2162
Anacostia Upper	Anacostia	Chlordane	2163
Battery Kemble Creek	Potomac	E. coli	2163
Texas Avenue Tributary	Anacostia	E. coli	2163
Dalecarlia Tributary	Potomac	Heptachlor Epoxide	2163
Soapstone Creek	Rock Creek	Heptachlor Epoxide	2163
Pope Branch	Anacostia	E. coli	2165
Fenwick Branch	Rock Creek	Heptachlor Epoxide	2165
Portal Branch	Rock Creek	Heptachlor Epoxide	2165
Dalecarlia Tributary	Potomac	E. coli	2166
Anacostia Lower	Anacostia	PAH3	2166
Broad Branch	Rock Creek	Heptachlor Epoxide	2167
Pinehurst Branch	Rock Creek	Heptachlor Epoxide	2167
Anacostia Upper	Anacostia	PAH2	2167
Fort Stanton Tributary	Anacostia	PAH3	2167
Oxon Run	Potomac	E. coli	2168
Fort Stanton Tributary	Anacostia	PAH2	2168
Fenwick Branch	Rock Creek	DDT	2169
Fort Dupont Tributary	Anacostia	E. coli	2169
Fort Stanton Tributary	Anacostia	E. coli	2170
Anacostia Upper	Anacostia	PAH1	2170
Anacostia Lower	Anacostia	PAH2	2174
Fort Davis Tributary	Anacostia	E. coli	2175
Normanstone Creek	Rock Creek	Heptachlor Epoxide	2175
Fort Chaplin Tributary	Anacostia	E. coli	2176
Anacostia Lower	Anacostia	PAH1	2177
Nash Run	Anacostia	PAH2	2178
Nash Run	Anacostia	PAH3	2178
Luzon Branch	Rock Creek	Chlordane	2181

TMDL Segment	Major Watershed	Pollutant	Forecasted Attainment Date
Luzon Branch	Rock Creek	Heptachlor Epoxide	2189