Total Maximum Daily Loads for Organics and Metals in the Anacostia River Watershed

Prepared by
District of Columbia Department of Energy and Environment
1200 First Street, Northeast
Washington, D.C. 20002
and
Maryland
Department of the Environment
1800 Washington Boulevard, Suite 540
Baltimore, MD 21230-1718

Submitted **[DATE]**

To

Water Division
U.S. Environmental Protection Agency Region III
1650 Arch Street
Philadelphia, PA 19103-2029

DEPARTMENT OF ENERGY & ENVIRONMENT

MARYLAND

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This document is an interjurisdictional TMDL submitted by the District of Columbia, Washington DC and the State of Maryland. It addresses organochlorine pesticides (i.e., chlordane, dichlorodiphenyltrichloroethane (DDT), dieldrin, heptachlor epoxide), polycyclic aromatic hydrocarbons (PAHs), and metals (arsenic, copper, zinc) impairments in the Anacostia River, its tributaries, and Kingman Lake.

The document was prepared by District Department of Energy and Environment (DOEE) and Maryland Department of the Environment (MDE) with technical support from Tetra Tech and the U.S. Environmental Protection Agency (EPA).

DOEE and MDE would like to acknowledge Tetra Tech's technical support, which included collecting additional water sampling for toxic pollutants, collating and using available data, developing the Anacostia Toxics Model, and calculating TMDLs for toxic pollutants. This effort is discussed further in the 'Draft Anacostia River Toxic Constituents TMDL Modeling Report' (Tetra Tech 2021).

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EXECUTIVE SUMMARY

This document, upon approval by the U.S. Environmental Protection Agency (EPA), establishes total maximum daily loads (TMDLs) for three metals- arsenic, copper, zinc; four pesticides- chlordane, dieldrin, heptachlor epoxide and dichlorodiphenyltrichloroethane (DDT) and metabolites; and three polycyclic aromatic hydrocarbon (PAH) groups- PAH 1, PAH 2, and PAH 3 (hereafter, referred to as ten toxic pollutants) for 14 listed impaired water body segments in the Anacostia River watershed in the District of Columbia and Maryland. This results in a total of 63 waterbody pollutant combinations for which TMDLs are established. Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations direct each state to identify and list waters, known as water quality limited segments (WQLS), in which current required controls of a specified substance are inadequate to achieve water quality standards (WQS). For each WQLS, each jurisdiction is required to either establish a TMDL for the specified substance that the waterbody can receive without violating WQS, or demonstrate that WQS are being met (40 C.F.R. § 130.7).

The District of Columbia (District) has listed, in two defined segments, all of the tidal Anacostia River within District borders as impaired for the ten toxic pollutants. In addition, the District has listed nine tributaries to the Anacostia River and Kingman Lake for some of these toxic pollutants as well. These WQLSs are designated for the Class C (protection and propagation or fish, shellfish, and wildlife) and Class D (protection of human health related to consumption of fish and shellfish) beneficial uses, which are not supported due to elevated levels of toxic pollutants in fish tissue, and were initially listed on the District's 303(d) list in 1998. Toxic pollutant TMDLs were established for the Anacostia River by the District of Columbia in 2003 (DOH 2003). The TMDLs developed in this report will, when approved, replace the 2003 Anacostia TMDL.

The State of Maryland has listed the Anacostia River Tidal Fresh Chesapeake Bay Tidal Segment (Assessment Unit ID: MD-ANATF) on the State's Integrated Report (IR) as impaired for heptachlor epoxide in fish tissue in 2014 (MDE 2018). Maryland also identified the Northwest Branch of the Non-tidal Anacostia River Watershed (Assessment Unit ID: MD-02140205-Northwest_Branch) in the State's IR as impaired for heptachlor epoxide in water column in 2002 (MDE 2018). These waters are designated Use II: Support of estuarine and marine aquatic life and shellfish harvesting (COMAR 2020b).

In 2006, Friends of the Earth successfully challenged other District TMDLs because they did not include a daily load expression (*Friends of the Earth vs. the Environmental Protection Agency,* 446 F.3d 140, 144 (D.C. Cir. 2006)). The court ruled in favor of the Plaintiffs, stating that 'daily means daily.' Following that litigation, Anacostia Riverkeepers, Friends of the Earth, and Potomac Riverkeepers filed a complaint (Case No.: 1:09-cv-00098-JDB) on January 15, 2009 because numerous other District TMDLs did not have daily load expressions. EPA conceded that the TMDLs lacked daily loads and the court ordered that the TMDLs must be vacated, but allowed time for the District of Columbia Department of Energy and Environment (DOEE) to develop daily loads. As DOEE began development of the replacement Anacostia River toxic pollutants TMDLs with support from EPA, DOEE agreed to collaborate with Maryland Department of the Environment (MDE) upon MDE's request on an interjurisdictional effort to jointly present heptachlor epoxide TMDLs to address listings in both the Maryland and District portions of the Anacostia River.

The objective of the toxic pollutant TMDLs established in this document is to ensure that the "fish consumption", "shellfish harvesting", and "propagation of aquatic life" uses are protected in each of the impaired waterbodies. This was accomplished by identifying maximum allowable toxic pollutant loads that would meet the applicable water quality criteria (WQC). This objective was accomplished through:

- The identification of toxic pollutant sources and loads using existing data and literature, which were used to estimate baseline conditions;
- The configuration and calibration of a linked watershed/receiving water model;
- The selection of a representative TMDL endpoint for each of the ten toxic pollutants from both jurisdictions' applicable WQC;
- The execution of the linked watershed/receiving water model to assess the impact of flow/rainfall conditions and the major source categories on toxic pollutant loads, running the model with an iterative series of adjustments to input loads until a set of loads (the TMDL scenario) that met the TMDL endpoint in all model segments was achieved, and completing an analysis to determine the impact of natural attenuation on toxic pollutant loads;
- The application of conservative assumptions to the TMDL scenario methods for each source category to provide an implicit margin of safety (MOS).

EPA's regulations require TMDLs to account for seasonality and critical conditions related to stream flow, loading, and water quality parameters (40 C.F.R. § 130.7(c)(1)). Seasonality and critical conditions are captured in this TMDL document through the use of a dynamic model and analysis of all flow conditions (i.e., under both low flow and high flow scenarios) in the watershed over a 4-year simulation period. The linkage of the tidal Anacostia River to a dynamic watershed loading model ensures that nonpoint and stormwater point source loads from the watershed delivered at times other than the critical period were also considered in the analysis. Critical conditions for toxic parameter loads were incorporated by determining wasteload allocations (WLAs) based on maximum flows from dischargers set by design flows specified in National Pollutant Discharge Elimination System (NPDES) permits for each facility. Model simulation of multiple complete years accounted for seasonal variations. Continuous simulation (modeling over a period of several years that captured precipitation extremes) inherently considers seasonal hydrologic and source loading variability.

The CWA and EPA regulations require reasonable assurance that TMDL load allocations (LAs) will be implemented. Progress toward achieving the Anacostia River toxic pollutant TMDLs described in this report will require substantial reductions from point and nonpoint sources of toxic pollutants to the watershed. The jurisdictions expect to proceed with an adaptive implementation approach concurrently with activities (e.g., on-going monitoring, best management practices (BMPs)) to reduce toxic pollutant loadings. Toxic pollutant regulatory activities will include the incorporation of WLAs in NPDES permits after the TMDL has been approved. In both jurisdictions, several monitoring, restoration, and regulatory programs are already in place that will reduce toxic pollutant loads from both point and nonpoint sources. These programs involve storm water runoff controls, erosion control measures to reduce sediments and nutrients, identification of additional toxic pollutant sources and contaminated sites, and remediation of contaminated sites. While not part of TMDL development, instream remediation efforts, such as dredging and capping river bottom sediment in certain toxic hotspots, may be undertaken in connection with the Anacostia River Sediment Project (ARSP) to address PCB contamination. Nothing in these TMDLs is inconsistent with these remediation efforts, and in fact, it is reasonable to anticipate that instream remediation efforts will aid implementation of these TMDLs and decrease the amount of time it takes for water quality to approach the TMDL endpoints. Follow-up monitoring of water, sediment, and fish tissue is an important feature of each jurisdiction's implementation strategy.

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ABBREVIATIONS

Adj-tBAFs	Adjusted total bioaccumulation factors
Adj-sediBAFs	Adjusted sediment bioaccumulation factors
ANATF	Anacostia River Tidal Fresh Chesapeake Bay Segment
ARSP	Anacostia River Sediment Project
As	Arsenic
ATSDR	Agency for Toxics Substances and Disease Registry
AWRP	Anacostia Watershed Restoration Partnership
BARC	Beltsville Agricultural Research Center
BAF	Bioaccumulation factor
BMP	Best management practice
CBP	Chesapeake Bay Program
CBT	Chesapeake Bay Trust
CCC	Criteria continuous concentration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIP	Consolidated implementation plan
CMC	Criteria maximum concentration
COMAR	Code of Maryland Regulations
CSO	Combined sewer overflow
CSS	Combined sewer system
Cu	Copper
CWA	Clean Water Act
DC	District of Columbia
DCMR	District of Columbia Municipal Regulations
DDD	4,4'-dichlorodiphenyldichloroethane
DDE	4,4'-dichlorodiphenyldichloroethylene
DDT	4,4'-dichlorodiphenyltrichloroethane
DMR	Discharge monitoring report
DOEE	District of Columbia Department of Energy and Environment
EFDC	Environmental Fluid Dynamics Code

EPA	U.S. Environmental Protection Agency
FS	Feasibility study
g/year	Gram per year
H.E.	Heptachlor epoxide
HH	Human health
IR	Integrated report
JBAB	Joint Base Anacostia-Bolling
kg/g	Kilogram per gram
LA	Load allocation
L/kg	Liter per kilogram
LRP-MAP	Land Restoration Program Geospatial Database
LSPC	Loading Simulation Program in C++
LTCP	Long term control plan
MD	Maryland
MD-ANATF	Maryland Anacostia Tidal Fresh Chesapeake Bay tidal segment
MDE	Maryland Department of the Environment
MOS	Margin of safety
MS4	Municipal separate storm sewer system
MSGP	Multi-Sector General Permit
MWCOG	Metropolitan Washington Council of Governments
NASA	National Aeronautics and Space Administration
ng/L	Nanogram per liter
ng/g	Nanogram per gram
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint source
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PEPCO	Potomac Electric Power Company
PS	Point source
ROD	Record of decision
RI	Remedial investigation

sediBAFs	Sediment bioaccumulation factors
SHA	State Highway Administration
tBAF	Total bioaccumulation factors
tPCB	Total polychlorinated biphenyl
TMDL	Total maximum daily loads
TSS	Total suspended solids
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WLA	Wasteload allocation
WNY	Washington Navy Yard
WPD	Watershed Protection Division (DOEE)
WQC	Water quality criteria
WQLS	Water quality limited segments
WQS	Water quality standards
WWTP	Wastewater treatment plant
Zn	Zinc
μg/L	Microgram per liter

1 INTRODUCTION

Section 303(d) of the federal Clean Water Act (CWA) and the U.S. Environmental Protection Agency's (EPA) implementing regulations direct states and the District of Columbia to identify and list waterbodies, or Water Quality Limited Segments (WQLS), in which required technology-based controls of a specified substance are inadequate to achieve water quality standards (WQS). For each WQLS, the state or jurisdiction is required to either establish a total maximum daily load (TMDL) of the specified substance that the waterbody can receive without violating WQS or demonstrate that WQS are being met (40 C.F.R. § 130.7). The TMDL needs to account for seasonal variations, critical conditions, and a protective margin of safety (MOS) to account for uncertainty.

A TMDL reflects the loading of an impairing substance that a waterbody can receive and still meet WQS. WQS are the combination of a designated use for a particular body of water, the water quality criteria (WQC) designed to protect that use, and antidegradation requirements. Designated uses include activities such as swimming, drinking water supply, as well as fish and shellfish propagation and harvest. WQC consist of narrative statements and numeric values designed to protect the designated uses. The WQC may differ in waters with different designated uses.

1.1 History of Impairment

1.1.1 District of Columbia

In 1998, the District of Columbia characterized the Anacostia River and its tributaries as impaired for metals and organic pollutants on its 303(d) list of WQLS. To address these impairments, TMDLs were developed for arsenic, copper, lead, mercury, chlordane, 4,4'-dichlorodiphenyldichloroethane (DDD), 4,4'-dichlorodiphenyldichloroethylene (DDE), 4,4'-dichlorodiphenyltrichloroethane (DDT), dieldrin, heptachlor epoxide, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs). The TMDLs in the report, "District of Columbia Final 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," were approved by EPA on August 29, 2003 with amended approval on October 16, 2003.

In 2006, Friends of the Earth successfully challenged other District of Columbia (District) TMDLs because they did not include a daily load expression (*Friends of the Earth vs. the Environmental Protection Agency,* 446 F.3d 140, 144 (D.C. Cir. 2006)). The court ruled in favor of the Plaintiffs, stating that 'daily means daily.' Following that litigation, Anacostia Riverkeepers, Friends of the Earth, and Potomac Riverkeepers filed a complaint (Case No.: 1:09-cv-00098-JDB) on January 15, 2009 because numerous other District TMDLs did not have daily load expressions. EPA conceded that the TMDLs lacked daily loads and the court ordered that the TMDLs must be vacated, but stayed vacatur until January 1, 2017 to allow EPA and Department of Energy and Environment (DOEE) time to develop daily loads. These Anacostia River toxic pollutants TMDLs represent the last of the TMDLs that were the subject of the 2009 lawsuit that still require revision. Due to additional data needs, the court granted a first request to extend the stay of vacatur of the Anacostia River toxic pollutants TMDLs until January 31, 2020. Following continued delays to the project as a result of several complicating factors, the court granted a second request to extend the stay of vacatur until September 30, 2021. The TMDLs developed in this report will, when approved, replace the 2003 Anacostia River toxic pollutants TMDL.

Most of the original toxic impairments from the 1996 and 1998 303(d) lists were based on very limited data, including fish tissue data collected from the mainstem Potomac and Anacostia Rivers and not specific tributaries. Consequently, DOEE reviewed available monitoring data for the existing impairments and collected additional data to clarify and identify the current impairment status for each of the tributaries. Under contract with EPA, Tetra Tech collected samples in the listed waterbodies on October 29, 2013, November 27, 2013, and January 12, 2014 as part of a larger effort to confirm or refute the identified impairments for toxic pollutants across the District. The samples were analyzed for metals, pesticides, and PAHs. The remaining impairment listings for toxics in the Anacostia tributaries in the District are based on water column exceedances of the applicable criteria. Table 1-1 shows the remaining toxic pollutant impairments that will be addressed through this TMDL. Furthermore, additional monitoring was completed in 2018 and 2019 by Tetra Tech under a contract with DOEE. These monitoring data were used for comparison purposes across 2013-2014 and 2018-2019 conditions.

For each tributary where a pollutant exceeded a numeric water quality criterion, a revised TMDL has been developed herein, including a daily load expression. These pollutant/waterbody combinations remained in Category 4a (waterbody is impaired and a TMDL has been developed) in the District's 2020 Integrated Report (IR) (DOEE 2020). Rather than simply revising the existing TMDLs to establish a daily load for the toxics that were detected, DOEE decided to develop new TMDLs for these pollutants due to the following:

- Since the original TMDLs had been established in 2003, the WQS changed for these toxic pollutants. These changes are described in more detail in Section 1.3.1.
- Additional monitoring data had been collected under DC's municipal separate storm sewer system (MS4) permit in the Anacostia River watershed and could be used for modeling purposes.
- DOEE has undertaken considerable effort to develop a model for the Anacostia River as part of the Anacostia River Sediment Remedial Investigation (RI) and Feasibility Study (FS), Anacostia River Sediment Project (ARSP). EPA and DOEE wanted to benefit from the availability of a more up-to-date modeling framework.

In 2007, EPA approved the "Total Maximum Daily Loads of Polychlorinated Biphenyls (PCBs) for Tidal Portions of the Potomac and Anacostia Rivers in the District of Columbia, Maryland, and Virginia" which adequately addressed PCB impairments in direct tributaries to the Potomac and Anacostia Rivers. These TMDLs included daily load expressions, therefore no additional PCB TMDLs are required for the Anacostia River watershed.

TMDLs are not presented for pollutant(s)/waterbody combinations that did not exceed any numeric WQC. For tributaries hydrologically connected to the Anacostia River, where there was no data other than fish tissue data from the mainstem Anacostia, the toxic pollutant(s)/waterbody combinations were placed in Category 3 (insufficient data). For waters that are not hydrologically connected to the Anacostia River and have no evidence of toxic pollutant presence, those waters are no longer considered impaired for the specific parameter.

1.1.2 Maryland

The Maryland Department of the Environment (MDE) identified the Anacostia River Tidal Fresh Chesapeake Bay Tidal Segment (Assessment Unit ID: MD-ANATF) on the State's Integrated Report (IR) as impaired for heptachlor epoxide in fish tissue in 2014 (MDE 2018). MDE also identified the Northwest Branch of the Non-tidal Anacostia River Watershed (Assessment Unit ID: MD-02140205-Northwest_Branch) in the State's IR as impaired for heptachlor epoxide in water column in 2002 (MDE 2018). Maryland's heptachlor epoxide listings are displayed in Table 1-1. From this point on in the document the "Anacostia River Tidal Fresh Chesapeake Bay Tidal Segment" and "Northwest Branch of the Non-tidal Anacostia River" will be referred to as the "MD-ANATF tidal segment" and "Northwest Branch", respectively. As DOEE began development of the replacement Anacostia River toxic pollutants TMDLs with support from EPA, DOEE agreed to collaborate with MDE upon their request on an interjurisdictional effort to jointly present heptachlor epoxide TMDLs to address listings in both the MD and DC portions of the Anacostia River.

Table 1-1 Toxics[a] Impairments Being Addressed by TMDLs

Segment	Jurisdiction[b,c]	Uses supporting	Uses not supporting	Arsenic	Copper	Zinc	4,4 DDD	4,4 DDE	4,4 DDT	Chlordane	Dieldrin	Heptachlor epoxide	PAHs
Anacostia #1	DC	E	A, B, C, D	D	D	D	D	D	D	D	D	D	D
Anacostia #2	DC	E	A, B, C, D	D	D	D	D	D	D	D	D	D	D
Kingman Lake	DC	E	A, B, C, D	D					D	D			D
Nash Run	DC		A, B, C, D	D						D	D	D	D
Popes Branch	DC		A, B, C, D					D		D		D	D
Watts Branch	DC		A, B, C, D							D	D		
Hickey Run	DC		A, B, C, D					D		D			D
Fort Dupont Creek	DC		A, B, C, D	D									
Fort Chaplin Run	DC		A, B, C, D	D									
Fort Davis Tributary	DC		A, B, C, D	D									
Fort Stanton Tributary	DC		A, B, C, D	D									D
Texas Avenue Tributary	DC		A, B, C, D	D			D	D	D	D	D	D	D
MD-ANATF	MD		II									II	
Northwest Branch	MD		I									I	

Notes:

DDD = dichlorodiphenyldichloroethane; DDE = dichlorodiphenyldichloroethylene; DDT = dichlorodiphenyltrichloroethane

[a] Header shading color indicates type of toxin: Medium blue = metals, Yellow = organochlorine pesticides, Green = 1-6 ring PAHs.

[b] DC uses: A = Primary contact recreation; B = secondary contact recreation and aesthetic enjoyment; C = protection and propagation of fish, shellfish, and wildlife; D = protection of human health related to consumption of fish and shellfish; E = navigation.
[c] MD uses: I = Water contact recreation and protection of nontidal warmwater aquatic life; II = support of estuarine and marine aquatic life and shellfish harvesting.

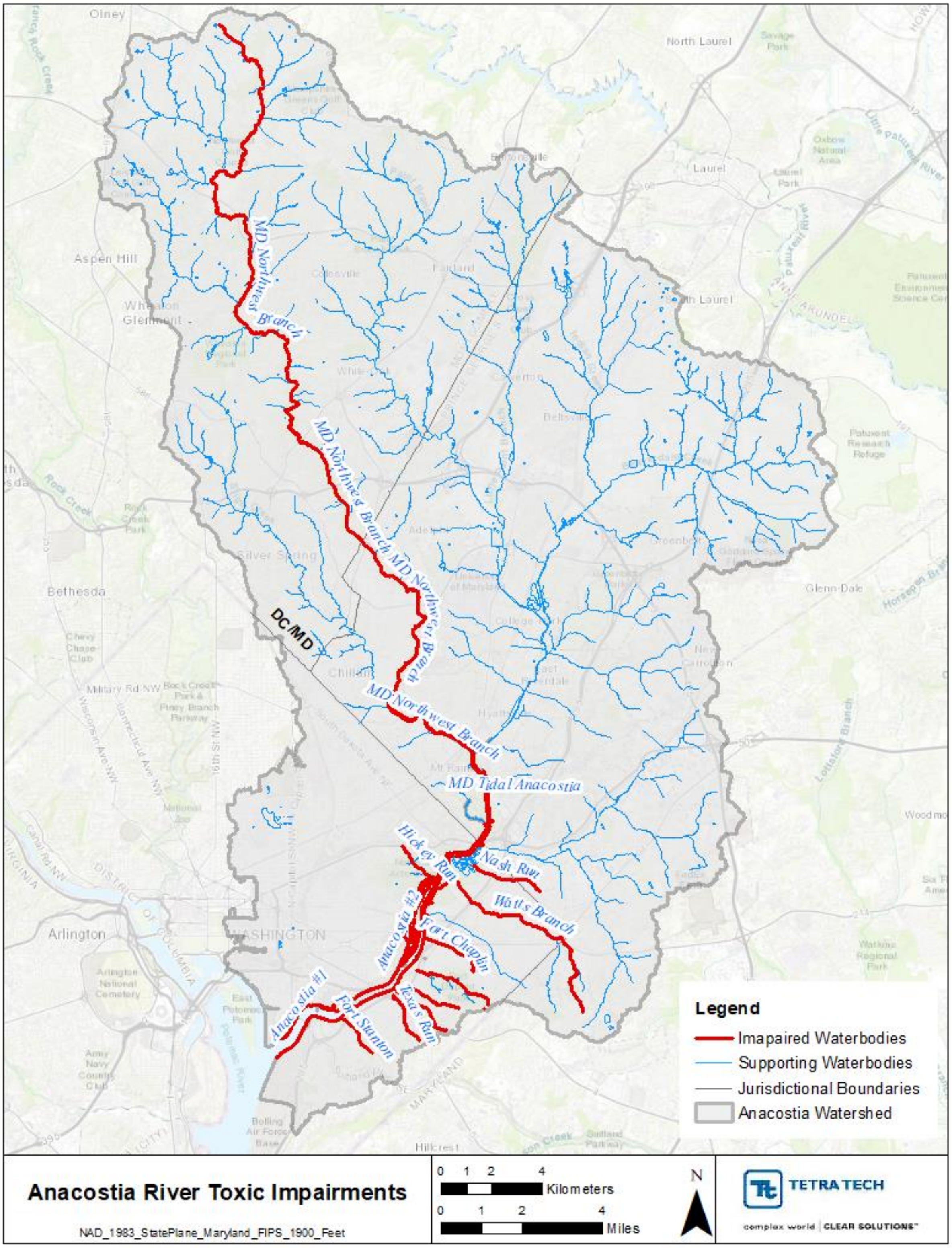

Figure 1-1 Waterbodies Impaired for Toxic Pollutants in the Anacostia River Watershed

1.2 Water Quality Model Background

The Anacostia River is a complex tidally influenced waterbody with a drainage area that transitions from the suburban mixed land use headwaters in Maryland to the highly urbanized DC metropolitan area along its mainstem. The wide range of land cover and management conditions throughout the watershed, including legacy soil and sediment contamination, requires a robust modeling framework to properly simulate the hydrology, hydrodynamics, sediment and toxics fate and transport of the system. A linked watershed/receiving water model is best suited to capture the critical system components of the Anacostia River. Such an integrated modeling system, after calibration, appropriately represents the linkage between the sources in the watershed and legacy sources in the riverbed, as well as the impact of possible sources from the Potomac River, hence supporting the development of a comprehensive TMDL scenario.

The modeling approach consists of a linked watershed/receiving water modeling system that can describe and simulate hydrology, hydrodynamics, and pollutant loading in the Anacostia River watershed. The Loading Simulation Program in C++ (LSPC) model version 5.0 (U.S. EPA 2009) was selected for watershed simulation and Environmental Fluid Dynamics Code (EFDC) was selected as the receiving water model for this project (Tetra Tech 2021). This linked watershed/receiving water modeling system was used extensively in the Anacostia River as part of the Anacostia River Sediment RI/FS, for the ARSP.

1.3 Toxic Pollutants

1.3.1 Metals

Metals (e.g., copper and zinc) and metalloids (e.g., arsenic) are elements that have a relatively high density compared to water. The density or heaviness of a metal is often correlated with toxicity, meaning that some metals can result in toxicity at a low level of exposure (ATSDR 2004, 2007a). Although metals occur naturally in the environment, contamination of the environment results from metals that enter the environment through anthropogenic activities at levels that pose a risk to human health. Major sources include mining and smelting, industrial production and use, and domestic and agricultural use and other minor sources include corrosion, leaching, atmospheric deposition, and natural phenomena such as volcanic eruptions and weathering (ATSDR 2004, 2007a).

Many metals are essential for good human health but exposure to higher doses can be harmful. Drinking water with higher than normal levels of these metals may cause nausea, vomiting, and stomach aches (ATSDR 2004, 2005, 2007a). Intentionally high consumption can result in significant organ damage and death. In addition, arsenic poisoning can also lead to other serious health issues including fatigue, abnormal heart rhythm, impaired nerve function, and cancer (ATSDR 2007a).

Metals or metallic compounds can enter aquatic systems through a variety of mechanisms but the most common include stormwater runoff and industrial or domestic waste discharge. Metals can be found at elevated concentrations in the environment due to natural background conditions or contamination at hazardous waste sites. Most of the metals that reach aquatic environments will collect in the sediment of lakes, rivers, and estuaries, though a percentage can be suspended in water and can be transported through the system or into groundwater. Metals can accumulate in aquatic plants and animals, particularly fish and filter feeders (e.g., freshwater mussels). These metals can be acutely toxic at a range of concentrations.

1.3.2 Organochlorine Pesticides

Chlordane, DDT, dieldrin, and heptachlor epoxide are all organochlorine pesticides or pesticide degradation products. Chlordane was marketed as a mixture of compounds, including heptachlor. Technical chlordane (CAS no. 12789-03-6) can contain over 120 different compounds. In this report chlordane refers to CAS no. 57-74-9, which is a mixture containing approximately 95% cis- and trans-chlordane isomers. These isomers are also known as α- and γ-chlordane, respectively (U.S. EPA 1997). DDT is an insecticide that degrades in the environment via microorganism action into DDD and DDE. DDD also had a limited use as a pesticide itself. Dieldrin, while an insecticide in its own right, is also a degradation product of aldrin; heptachlor epoxide is the degradation product of the pesticide heptachlor.

Organochlorine pesticides can have a wide variety of harmful acute and chronic effects on aquatic organisms, including neurological damage and endocrine disorders, and humans, including illness and cancer (Nowell et al. 1999, ATSDR 2002, 2007b, 2018, 2019). As a result, aside from a handful of specialized uses, all uses of chlordane, DDT, dieldrin, and heptachlor epoxide are banned by EPA or voluntarily withdrawn by their manufacturers in the U.S. Therefore, these pesticides are no longer actively used in Maryland and the District. Some of these pesticides still enter the environment during manufacturing and application in other parts of the world and may enter the U.S. via atmospheric transport. These pollutants are on the CWA's Priority Pollutant List and EPA recommends the adoption of WQC for these chemicals to protect aquatic life and human health.

Smith et al. (1998) note that organochlorine pesticides share a range of physical and chemical properties including:

- Slow degradation rates in soils and sediments;
- Very limited solubility in water;
- Strong adherence to soils or sediments;
- Dissolve readily in non-polar organic solvents and fats;
- Limited volatility (except for DDT); and
- Strong tendency to bioaccumulate in fish, plants, and animals.

These properties explain the persistence of organochlorine pesticides in the environment, even though their use in the U.S. has been banned for decades. Their limited solubility in water prevents them from being rapidly flushed from a watershed and their resistance to physical or biological degradation prevents them from diminishing quickly *in situ*. For example, chlordane can persist in soils for longer than 20 years after it is applied (ATSDR 2018). Nevertheless, concentrations of organochloride pesticides are decreasing in sediments and in fish tissue over time due to natural attenuation (Gilliom et al. 2006, Van Metre et al. 1997, Van Metre and Mahler 2005).

1.3.3 PAHs

Polycyclic aromatic hydrocarbons (PAHs) are a group of chemicals that are formed during the incomplete combustion of gas, oil, coal, wood, trash, or other organic substances. There are over 100 documented PAHs and these often exist in the environment in complex mixtures. Important sources of

PAHs in surface waters include atmospheric deposition, municipal wastewater discharge, urban stormwater runoff, and runoff and effluent from other industries and oil spills (ATSDR 1995). In addition to occurring naturally, more simple PAHs can be manufactured as individual compounds. ATSDR (1995) grouped 17 PAHs based on amount of available information, incidence in the environment and supposed level of harmfulness. These 17 PAHs are:

- acenaphthene
- acenaphthylene
- anthracene
- benz[a]anthracene
- benzo[a]pyrene
- benzo[e]pyrene
- benzo[b]fluoranthene
- benzo[g,h,i]perylene
- benzo[j]fluoranthene
- benzo[k]fluoranthene
- chrysene
- dibenz[a,h]anthracene
- fluoranthene
- fluorene
- indeno[1,2,3-c,d]pyrene
- phenanthrene
- pyrene

PAHs can have a wide variety of negative effects on aquatic life and human health. PAHs can have systemic, immunological, neurological, developmental, reproductive, and carcinogenic effects on human health. For these reasons, EPA has set regulations to protect people from contact with or inhalation and ingestion of PAHs. These pollutants are on the CWA's Priority Pollutant List and EPA recommends the adoption of WQC for these chemicals to protect aquatic life and human health.

Smith et al. 1988 describes that PAHs share many physical and chemical characteristics, including:

- Slow biodegradation rates once sorbed to sediment;
- Relatively low solubility and vapor pressure;
- Strong tendency to partition from water into biota and particulate and dissolved organic matter;
- Strong adherence to soils and sediments; and
- Accumulation in lipid stores of aquatic organisms.

In aquatic systems, PAHs generally do not dissolve in water but rather sorb to sediment particles, settling to the river or stream bottom. Often, the PAH content of aquatic plants and animals is higher than that of the surrounding water. PAHs in the water or sediment can be broken down into more stable products by the actions of microorganisms. Additionally, studies in animals have found that PAHs that enter the body are often excreted shortly after inhalation, ingestion, or dermal exposure (ATSDR 1995). PAHs can be persistent in soils and sediment particles found in surface waters and are ubiquitous in the environment as a result of continuous releases from combustion and contaminated soils.

1.4 Designated Uses and Applicable Water Quality Standards

TMDLs are established to determine the allowable pollutant loadings required to achieve and maintain WQS. WQS are comprised of a designated use for a particular body of water, the WQC designed to protect that use, and antidegradation requirements. Designated uses include activities such as swimming, drinking water supply, protection of aquatic life, and fish and shellfish propagation and harvest. WQC consist of narrative statements and numeric values designed to protect the designated uses. Criteria may differ between waters with different designated uses. Below is jurisdiction specific WQS information for DC and MD.

1.4.1 District of Columbia

Categories of District surface water designated uses are contained in the District of Columbia Water Quality Standards, Title 21 of District of Columbia Municipal Regulations, Chapter 11 (DCMR, Effective May 22, 2020). Use classes in Section 1101 are:

Class A – primary contact recreation;
Class B – secondary contact recreation and aesthetic enjoyment;
Class C – protection and propagation of fish, shellfish, and wildlife;
Class D – protection of human health related to consumption of fish and shellfish; and
Class E – navigation.

The categories of use classes for the Anacostia River and its tributaries are listed in Table 1-2 (Section 1101.2).

Table 1-2 Classification of the District's Waters

	Use Classes	
Surface Waters of the District	**Current Use**	**Designated Use**
Anacostia River	B, C, D, E	A, B, C, D, E
Anacostia River tributaries (except as listed below)	B, C, D	A, B, C, D
Hickey Run	B, C, D	A, B, C, D
Watts Branch	B, C, D	A, B, C, D

The District of Columbia's WQS include both narrative and numeric criteria that protect its surface waters. Section 1104.1 states the following narrative criteria:

The surface waters of the District shall be free from substances attributable to point or nonpoint sources discharged in amounts that do any one of the following:

(a) Settle to form objectionable deposits;
(b) Float as debris, scum, oil, or other matter to create a nuisance;
(c) Produce objectionable odor, color, taste, or turbidity;

(d) Cause injury to, are toxic to, or produce adverse physiological or behavioral changes in humans, plants, or animals;
(e) Produce undesirable or nuisance aquatic life or result in the dominance of nuisance species; or
(f) Impair the biological community that naturally occurs in the waters or depends upon the waters for its survival and propagation.

The District's numeric WQC include a criteria maximum concentration (CMC) and the criteria continuous concentration (CCC) to protect acute and chronic exposure of aquatic life (Class C waters), respectively. The CMC is the highest concentration of a pollutant to which aquatic life can be exposed for a short period (one-hour average) without deleterious effects at a frequency that does not exceed more than once every three years. The CCC is the highest concentration of a pollutant to which aquatic life can be exposed for an extended period (four-day average) without deleterious effects at a frequency that does not exceed more than once every three years.

Another numeric criterion is the 30-day average concentration that is applied for the protection of human health related to the consumption of fish and shellfish (Class D waters). For the organochlorine pesticides and some PAHs, it represents the maximum 30-day average water column concentration of a pollutant that would result in a fish tissue pollutant concentration that would not raise an individual's lifetime risk of contracting cancer from the consumption of fish by more than one in one million (Table 1-3, footnote b). For the metals and remaining PAHs, the 30-day average concentration is not associated with carcinogenicity, but rather is based on reference doses. The 30-day average is based on average body weight, fish consumption rates, and bioaccumulation rates of the pollutant in the food chain (U.S. EPA 2014).

Since the original TMDLs were developed, numeric WQC for toxic pollutants (e.g., DDT and PAHs) were updated in the District's WQS based on EPA's nationally recommended Human Health Ambient Water Quality Criteria (WQC) (U.S. EPA 2015). The updated WQC include the latest scientific information and EPA policies that include updated exposure factors (body weight, drinking water consumption, and fish consumption rate), bioaccumulation factors, health toxicity values, and relative source contributions. For example, EPA updated the fish consumption rate to 22 grams per day (U.S. EPA 2015). These human health ambient WQC updates in the District's WQS were approved by EPA on August 5, 2020. The TMDL herein uses the updated criteria as noted in Table 1-3 (DCMR 2020). Further, the most stringent metal and toxic pollutant numeric WQC across both aquatic life and human health designated uses are used as TMDL endpoints. As required by CWA §303(d)(1)(c) and EPA's regulations at 40 CFR §130.7(c)(1) the TMDLs attain and maintain the applicable numeric water criteria. Numeric criteria are particularly important where the toxicity cause is known or to protect human health or where pollutants have the potential to bioaccumulate (U.S. EPA 2014).

In addition to the numeric criteria, TMDLs must attain and maintain the applicable narrative criteria. Narrative criteria, which supplement numeric criteria, are statements that describe the desired water quality goal (U.S. EPA 2014). The applicable narrative criteria in DC's WQSs include section 1104.1(d), noted above, which prohibits substances attributable to discharges in amounts that "[c]ause injury to, are toxic to, or produce adverse physiological or behavioral changes in humans, plants, or animals. EPA's Human Health Ambient WQC, which have been adopted into the District's WQS, represent the latest scientific information and policies that consider the amounts at which pollutants "are toxic to" humans using updated exposure inputs, bioaccumulation factors, and updated toxicity values. As these Human Health Ambient WQC are the most stringent criteria in the District's WQS regulations, attainment of these criteria will prevent injury to, toxicity to, and adverse physiological or behavioral changes in humans, plants, and animals. As a result, the TMDLs developed and described in this document attain and maintain the narrative criteria.

Table 1-3 Numeric Water Quality Criteria for District Waters

Pollutant Group (where applicable)	Pollutant	Criteria for Classes (µg/L)		
		C		D
		CCC 4-Day Average	CMC 1-Hour Average	30-Day Average
--	Arsenic	150	340	0.14
--	Copper	8.96[a]	13.44[a]	--
--	Zinc	118.14[a]	117.18[a]	26000
--	Chlordane	0.0043	2.4	0.00032,[b]
--	Dieldrin	0.056	0.24	0.0000012,[b]
DDT	4,4'-DDD	0.001	1.1	0.00012,[b]
DDT	4,4'-DDE	0.001	1.1	0.000018,[b]
DDT	4,4'-DDT	0.001	1.1	0.000030,[b]
--	Heptachlor Epoxide	0.0038	0.52	0.000032,[b]
PAH 1 (2+3 ring)	Acenaphthene	50	--	90
PAH 1 (2+3 ring)	Anthracene	--	--	400
PAH 1 (2+3 ring)	Naphthalene	600	--	--
PAH 1 (2+3 ring)	Fluorene	--	--	70
PAH 2 (4 ring)	Benzo[a]anthracene	--	--	0.0013,[b]
PAH 2 (4 ring)	Chrysene	--	--	0.13,[b]
PAH 2 (4 ring)	Fluoranthene	400	--	20
PAH 2 (4 ring)	Pyrene	--	--	30
PAH 3 (5 + 6 ring)	Benzo[a]pyrene	--	--	0.00013,[b]
PAH 3 (5 + 6 ring)	Benzo[b]fluoranthene	--	--	0.0013,[b]
PAH 3 (5 + 6 ring)	Benzo[k]fluoranthene	--	--	0.013,[b]
PAH 3 (5 + 6 ring)	Dibenzo[a,h]anthracene	--	--	0.00013,[b]

	Indeno[1,2,3-c,d]pyrene	--	--	0.0013,[b]

[a] Criterion is equation based, as described in the District's WQS. All values are based on a hardness value of 100 mg/L $CaCO_3$.

[b] Denotes a Class D Human Health Criteria numeric value that is based on carcinogenicity of 10^{-6} risk level.

1.4.2 Maryland

Maryland WQS specify that all surface waters of the State shall be protected for Use Class I - *water contact recreation, fishing, and protection of aquatic life and wildlife* (COMAR 2020a) (Table 1-4). The designated use class of the MD-ANATF tidal segment is Class II – *Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting* (COMAR 2020b). The designated use class for the Northwest Branch is Class IV – *non-tidal recreational trout waters.* Class II, III, and IV designations also include all applicable uses identified for Use Class I – *water contact recreation, fishing, and protection of aquatic life and wildlife* (COMAR 2020b).

Table 1-4 Classification of Maryland's Waters

Description	Use[b]
Water contact recreation and protection of non-tidal warmwater aquatic life	I
Support of estuarine and marine aquatic life and shellfish harvesting	II
Non-tidal cold water[c]	III
Non-tidal recreational trout waters	IV

[b] Each Maryland Use can also have a "-P" suffix indicating use as a public water supply. No waterbodies in the Anacostia River watershed fall under this designation, however.
[c]The Anacostia River does not have any Use Class III streams.

MDE evaluates whether a waterbody meets heptachlor epoxide water quality standards based on six criteria: 1) the IR fish tissue consumption heptachlor epoxide listing threshold (9.3 ng/g), 2) the human health water column heptachlor epoxide criterion (0.39 ng/L), 3) the freshwater acute heptachlor epoxide criterion for protection of aquatic life (520 ng/L), 4) the freshwater chronic heptachlor epoxide criterion for protection of aquatic life (3.8 ng/L), 5) the saltwater acute heptachlor epoxide criterion for protection of aquatic life (53 ng/L), and 6) the saltwater chronic heptachlor epoxide criterion for protection of aquatic life (3.6 ng/L) (COMAR 2020d).

Table 1-5 Numeric Water Quality Criteria for Maryland Waters

	Aquatic Life (µg/L)				Human Health for Consumption of Organism Only (µg/L)	IR Fish Tissue Consumption Listing Threshold (µg/kg)
	Freshwater		Salt Water			
Pollutant	Acute	Chronic	Acute	Chronic		
Heptachlor Epoxide	0.52	0.0038	0.053	0.0036	0.00039	9.3

The State of Maryland defines the waters of the “Washington Metropolitan Area” (MD 6-Digit Basin: 021402) which includes the MD-ANATF tidal segment and the Northwest Branch as fresh water (COMAR 2020e). Thus, the freshwater aquatic life criteria will be applicable to these segments.

The Northwest Branch was listed as impaired for heptachlor epoxide due to water column concentration exceedances of the human health criterion for consumption of organism only (0.00039 µg/L). Since the human health criterion is more stringent than the freshwater aquatic life criteria, if the human health criterion is met, all applicable WQC would be satisfied.

The MD-ANATF tidal segment was listed as impaired for heptachlor epoxide due to fish tissue concentration exceedances of MD’s IR fish tissue consumption listing threshold (9.3 µg/kg).

1.5 TMDL Endpoints

TMDL development generally uses applicable WQC as TMDL endpoints for impaired waterbodies. The WQC are available for all current impairment listings in the Anacostia River watershed, thus the applicable WQC will be applied as TMDL endpoints as they were for the original Anacostia River TMDLs developed by DC in 2003.

Because the District’s human health WQC are ten times more stringent than Maryland’s human health WQC and TMDLs must protect downstream water quality, load allocations are prescribed at the MD state boundary to meet the District’s downstream WQC. Appendix A lists MDE’s and DOEE’s WQC for all ten toxic pollutants for comparison purposes. The final TMDLs are protective of all applicable WQC.

Certain pollutants were grouped within the model to align with the modeling platform, minimize unnecessary modeling complexity, and maintain consistency with the original TMDLs. These groupings are included in Table 1-3. DDD, DDE, and DDT were grouped together, and the most stringent criterion of the three was used as the TMDL endpoint. Additionally, PAHs were divided into three different groups based on benzene ring structure and the most stringent criterion in each group was used as the TMDL endpoint. The PAH 1 group represents PAHs with two and three rings, the PAH 2 group represents PAHs with four rings, and the PAH 3 group represents PAHs with five and six rings.

The TMDL endpoints are presented in Tables 1.6-1.8. The most stringent applicable criteria are **bold** and highlighted yellow and represent criteria that were used as TMDL endpoints and to develop TMDL allocations. All applicable criteria were evaluated to ensure they were met under the TMDL modeling scenario.

Table 1-6 TMDL Endpoints for Metals

Metal	CMC (1-hour average) (µg/L)	CCC (4-day average) (µg/L)	Human Health (30-day average) (µg/L)
Arsenic (dissolved)	340	150	**0.14**
Copper (dissolved)	13.44[1]	**8.96[1]**	
Zinc (dissolved)	**117.18[1]**	118.14[1]	26000

[1] Criterion is equation based, as described in DC’s WQS. All values are based on a hardness value of 100 mg/L $CaCO_3$.

Table 1-7 TMDL Endpoints for Organochlorine Pesticides

Organochlorine Pesticide	Groupings	CMC (1-hour average) (µg/L)	CCC (4-day average) (µg/L)	EPA's Human Health (30-day average, risk level of 10-6) (µg/L)
4,4, DDD	DDT	1.1	0.001	0.00012
4,4, DDE		1.1	0.001	**0.000018**
4,4, DDT		1.1	0.001	0.000030
Chlordane		2.4	0.0043	**0.00032**
Dieldrin		0.24	0.056	**0.0000012**
Heptachlor Epoxide		0.52	0.0038	**0.000032**[1]

[1] MD applies a human health criterion (organism only) of 0.00039 µg/L as the TMDL endpoint for heptachlor epoxide impairment listings in MD. However, additional load reductions will be required to meet downstream water quality in DC due the WQC being more stringent.

Table 1-8 TMDL Endpoints for PAHs

PAHs	PAH Groupings	CCC (4-day average) (µg/L)	EPA's Human Health (30-day average, risk level of 10-6) (µg/L)
Acenaphthene	PAH 1 (2 + 3 ring)	**50**	90
Acenapthylene			
Anthracene			400
Fluorene			70
Naphthalene		600	
Benzo[a]anthracene	PAH 2 (4 ring)		**0.0013**
Chrysene			0.13
Fluoranthene		400	20
Pyrene			30
Benzo[a]pyrene	PAH 3 (5 + 6 ring)		**0.00013**
Benzo[b]fluoranthene			0.0013
Benzo[k]fluoranthene			0.013
Dibenzo[a,h]anthracene			0.00013
Indeno[1,2,3-c,d]pyrene			0.0013

1.5.1 Fish Tissue Based Endpoints in MD

As described in Section 1.3.2, MDE evaluates whether a waterbody meets heptachlor epoxide WQS based on six criteria. Notably, Maryland defines the waters of the "Washington Metropolitan Area" (MD 6-Digit Code: 021402) as freshwater which contains the MD-ANATF tidal segment and Northwest Branch (COMAR 2020e). Thus, the freshwater aquatic life criteria will be applicable to these segments when assessing water quality.

Since the MD-ANATF tidal segment was identified as impaired for heptachlor epoxide in fish tissue and the Northwest Branch was identified as impaired for heptachlor epoxide in water based on the human health criterion (organism consumption only), the overall objective of the heptachlor epoxide TMDLs for these segments is to ensure that the "fishing" designated use is supported. However, this TMDL will also ensure the protection of all other applicable designated uses.

The heptachlor epoxide TMDL endpoint for the Northwest Branch will be defined as the human health criterion for heptachlor epoxide as the impairment is based on water column and not fish tissue. However, for the MD-ANATF tidal segment, in order to derive a fish tissue based heptachlor epoxide TMDL endpoint the fish tissue consumption heptachlor epoxide listing threshold concentration must be translated into an associated water column heptachlor epoxide threshold concentration, as the water quality model only simulates water column and sediment heptachlor epoxide concentrations and does not incorporate a food web model to predict fish tissue heptachlor epoxide concentrations (see Equation 1-1).

Translating the heptachlor epoxide fish tissue concentration into water column and sediment concentrations was accomplished using Adjusted Total Bioaccumulation Factors (Adj-tBAFs), the derivation of which follows the method applied within the Potomac River tPCB TMDLs (Haywood and Buchanan, 2007). First, a total Bioaccumulation Factor (tBAF) is calculated per fish species, and subsequently the tBAFs are normalized by the species median lipid content and median dissolved water column tPCB concentration in their home range to produce the Adj-tBAF per species [see Section 2.4.1 of the Draft Anacostia River Toxic Constituents TMDL Modeling Report (hereafter, the "Draft TMDL Modeling Report") for further details regarding the calculation of the Adj-tBAF (Tetra Tech 2021)]. Then, the most environmentally conservative of the Adj-tBAFs is selected to calculate the water column heptachlor epoxide threshold concentration. The Adj-tBAF for carp was selected for TMDL endpoint development. Finally, the water column heptachlor epoxide threshold concentration is compared to the heptachlor epoxide human health criterion, the most conservative of MD's water column criteria, to identify the most stringent concentration which is selected as the TMDL endpoint. The water column heptachlor epoxide threshold concentrations for the MD-ANATF tidal segment are presented in Table 1-9. The table includes the tidal segment, Adj-tBAF, fish tissue heptachlor epoxide listing threshold concentration, water column heptachlor epoxide threshold concentrations, and human health criterion.

$$C_{WCLT} = \frac{C_{FTLT}}{\text{Adj-tBAF} * \text{Unit Conversion}} \qquad \textbf{(Equation 1-1)}$$

C_{WCLT} = Water Column heptachlor epoxide Threshold Concentration (ng/L)
C_{FTLT} = Fish Tissue heptachlor epoxide Listing Threshold Concentration (ng/g)
Adj-tBAF = Adjusted Total Bioaccumulation Factor (L/kg)
Unit Conversion = 0.001 (kg/g)

Table 1-9 Water Column Heptachlor Epoxide Threshold Concentrations for the MD-ANATF Tidal Segment

Segment	Adj-tBAF (L/kg)*	Fish Tissue H.E. Listing Threshold Concentration (ng/g)	Water Column H.E. Threshold Concentration (ng/L)**	MD Human Health Criterion (ng/L)
MD-ANATF	48,072	9.3	0.194	0.39

* Adj-tBAF calculations presented in Section 2.4.1 of the Draft TMDL Modeling Report.
**Water column heptachlor epoxide threshold concentration is applied as the TMDL endpoint for the water column in the MD-ANATF Tidal Segment.

The water column heptachlor epoxide threshold concentration for the MD-ANATF tidal segment (0.194 ng/L) is more stringent than the human health criterion (0.39 ng/L), the most conservative of MD's heptachlor epoxide water column criteria. However, because the TMDLs need to be protective of downstream waters, and particularly, the District's most stringent water column criterion of 0.032 ng/L, this criterion was ultimately chosen as the TMDL endpoint.

A similar method was used to relate fish tissue heptachlor epoxide concentrations to a heptachlor epoxide TMDL endpoint for the sediment in the river (see Equation 1-2). This was accomplished using the Adjusted Sediment Bioaccumulation Factors (Adj-SediBAFs), the derivation of which follows the method applied within the Potomac River tPCB TMDLs (Haywood and Buchanan 2007). Similar to the calculation of the water column Adj-tBAF, a sediment Bioaccumulation Factor (SediBAF) is calculated per fish species, and subsequently the SediBAFs are normalized by the median species lipid content and median organic carbon heptachlor epoxide sediment concentration in their home range to produce the Adj-SediBAF per species (see Section 2.4.1 of the Draft TMDL Modeling Report for further details regarding the calculation of the Adj-SediBAF) (Tetra Tech 2021). The most environmentally conservative of the Adj-SediBAFs is then selected to calculate the sediment heptachlor epoxide threshold concentration which is applied as the TMDL endpoint for sediment. The Adj-SediBAF for carp was the most conservative, which is expanded upon in the Draft TMDL Modeling Report (Tetra Tech 2021). The sediment heptachlor epoxide threshold concentrations for the MD-ANATF tidal segment are presented in Table 1-10. The table includes the tidal segment, Adj-SediBAF, fish tissue heptachlor epoxide listing threshold concentration, and sediment heptachlor epoxide threshold concentrations.

$$C_{SLT} = \frac{C_{FTLT}}{\text{Adj-SediBAF}} \qquad \textbf{(Equation 1-2)}$$

C_{SLT} = Sediment heptachlor epoxide Threshold Concentration (ng/g)
C_{FTLT} = Fish Tissue heptachlor epoxide Listing Threshold Concentration (ng/g)
Adj-SediBAF = Adjusted Total Bioaccumulation Factor (unitless)

Table 1-10 Sediment Heptachlor Epoxide Threshold Concentrations for MD-ANATF Tidal Segment

Segment	Adj-SediBAF*	Fish Tissue H.E. Listing Threshold Concentration (ng/g)	Sediment H.E. Threshold Concentration** (ng/g)
MD-ANATF	60.35	9.3	0.15

*Adj-SediBAF calculations presented in Section 2.4.1 of the Draft TMDL Modeling Report
**Sediment heptachlor epoxide threshold concentration is applied as the TMDL endpoint for sediment in the MD-ANATF tidal segment

The sediment heptachlor epoxide threshold concentrations for the MD-ANATF tidal segment (0.15 ng/g) was selected as the TMDL endpoint.

The CWA requires TMDLs to be protective of all the designated uses applicable to a particular waterbody. In addition to the "fishing" designated use, the TMDL presented herein is also supportive of the other applicable designated uses within the impaired waters of the MD-ANATF tidal segment and Northwest Branch, as described in Section 1.3.2. These include "marine and estuarine aquatic life", "shellfish harvesting", "water contact recreation", for the MD-ANATF tidal segment and "non-tidal recreational trout waters" and "water contact recreation" for the Northwest Branch. The water column heptachlor epoxide TMDL endpoint concentration was applied in this TMDL analysis for the MD-ANATF tidal segment and is more stringent than Maryland's freshwater aquatic life heptachlor epoxide criterion. This indicates that the TMDL will be protective of the "aquatic life" designated use, specifically the protection of "marine and estuarine aquatic life and shellfish harvesting". The heptachlor epoxide human health criteria will be applied in this TMDL analysis for the Northwest Branch and is more stringent than Maryland's freshwater heptachlor epoxide aquatic life criteria. This indicates that the TMDL will be protective of the "aquatic life" designated use, specifically the protection of "non-tidal recreational trout waters". These two criteria for heptachlor epoxide were only applied to meet water quality in Maryland and not downstream water quality in DC. More information on the use of the District's WQC to meet downstream water quality is described in Section 1.5.

Lastly, the designated use for "water contact recreation" is not associated with any potential human health risks due to heptachlor epoxide from direct exposure. Dermal contact and accidental consumption of water from activities associated with "water contact recreation" is not a significant pathway for the uptake of heptachlor epoxide. The EPA human health criterion was developed solely based on aquatic organism (e.g., fish or shellfish) consumption, as drinking water consumption does not pose any risk for cancer development at environmentally relevant levels.

2 WATERSHED CHARACTERIZATION

The Anacostia River, with its headwaters in Montgomery and Prince George's Counties, Maryland, drains more than 170 square miles. The watershed terminates at the confluence with the Potomac River in the District of Columbia. Approximately 80 percent of the watershed is in Maryland and 20 percent is in the District. The main subwatersheds include the Northwest Branch, Paint Branch, Little Paint Branch, Indian Creek, Upper and Lower Beaverdam Creeks, the Northeast Branch, Still Creek, Brier Ditch, Fort Dupont, Pope Branch, Watts Branch, Hickey Run and Sligo Creek. The upper tributaries are non-tidal freshwater, while the mainstem of the Anacostia River is tidally influenced. Figure 2-1 depicts the subwatersheds of the Anacostia River watershed.

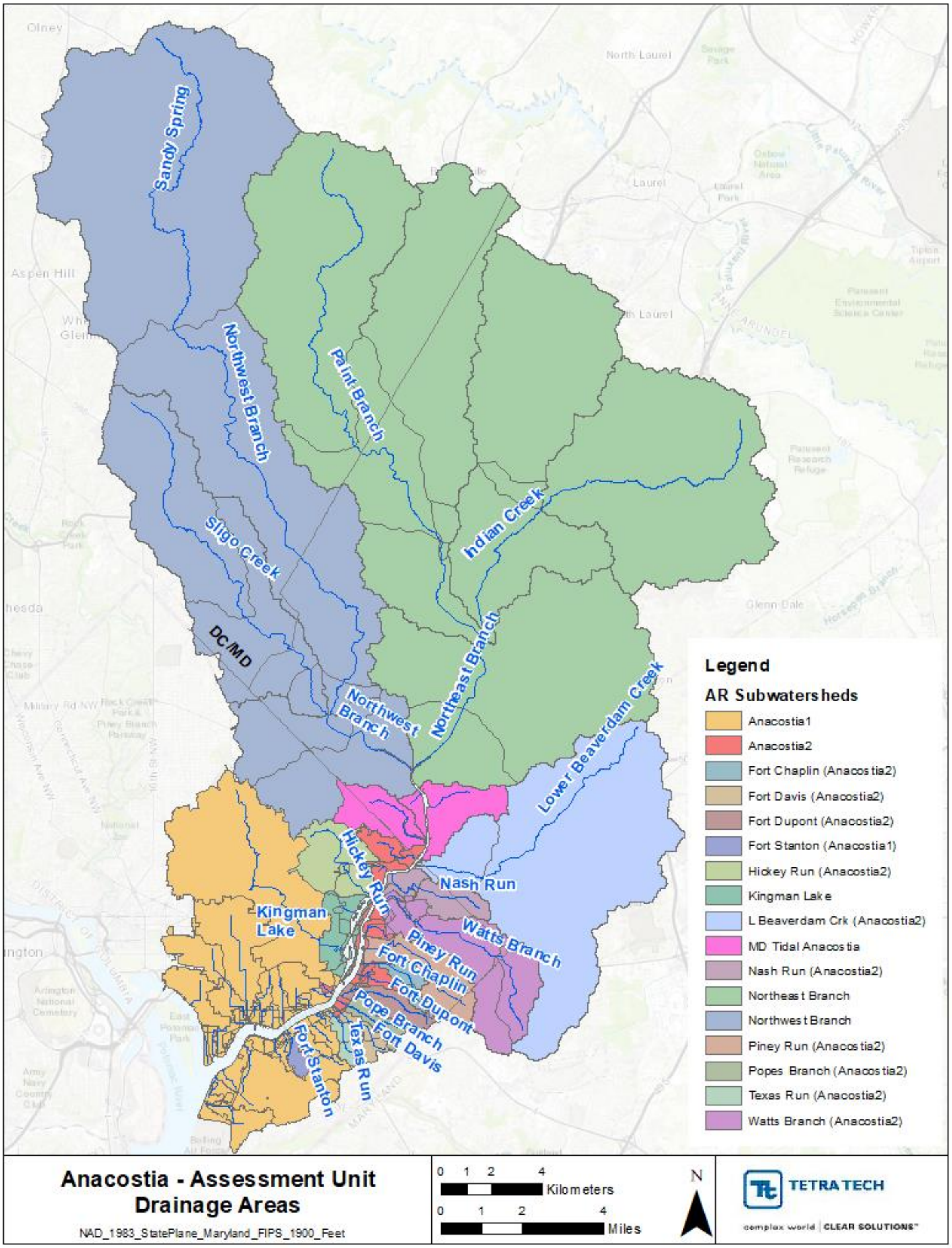

Figure 2-1 Anacostia River Watershed Assessment Unit Drainage Areas

The watershed's population exceeds 850,000 people in the District of Columbia and Maryland. The upper portions of the watershed are in the Piedmont Plateau, which is characterized by gently rolling hills. The remainder of the watershed is in the Coastal Plain, which is somewhat flatter, but can also contain gently rolling hills. Elevations in the watershed range from sea level to about 400 feet above sea level.

The Anacostia River watershed is highly urbanized. According to the Anacostia Watershed Restoration Partnership (AWRP), established by the Metropolitan Washington Council of Governments (MWCOG), about 45 percent of the watershed is residential, the dominant land use in the watershed. Undeveloped land covers just under 30 percent of the watershed. That undeveloped land is primarily comprised of forests and parks. Commercial and institutional land uses comprise more than 15 percent of the watershed. Agriculture land use makes up 4.5 percent of the watershed. Industrial land use makes up less than 4 percent of the watershed. Water and wetlands cover an additional 1 percent (ARWP 2010).

According to the ARWP, the overall imperviousness of the watershed is 22.5 percent, although that is variable among subwatersheds. The Upper Beaverdam Creek subwatershed has the lowest level of imperviousness at 6 percent, largely because of the presence of the U.S. Department of Agriculture, Beltsville Agricultural Research Center (BARC), which occupies most of the subwatershed (AWRP 2010). The highest levels of imperviousness are in the Hickey Run (41 percent) and the Northeast Branch (37 percent) subwatersheds (AWRP 2010). Land use in Hickey Run is 30 percent industrial and 29 percent residential, while land use in the Northeast Branch is 51 percent residential and 10 percent commercial (AWRP 2010). Some areas of the tidal mainstem of the Anacostia in the District, such as the northwest bank, have significantly higher levels of imperviousness (48 percent) (District Department of the Environment 2012).

3 SOURCE ASSESSMENT

3.1 Nonpoint Sources

Nonpoint sources of toxic pollutants specific to each jurisdiction are outlined in Sections 3.1.1 and 3.1.2 below. There are some additional nonpoint sources of toxic pollutants, such as resuspension of bed sediments and atmospheric deposition, that are common to both the District and Maryland because they impact the entire watershed, and therefore, are discussed immediately below.

Resuspension and Diffusion from Bottom Sediments

The transport of toxic pollutants from bottom sediments to the water column through resuspension and diffusion can be a major source of toxic pollutants in the Anacostia River, particularly in the tidal segments; however, under the framework of this TMDL, it is not considered a nonpoint source. The water quality model developed for this TMDL simulates conditions within the water column and sediment as a single system, therefore exchanges between the sediment and water column are considered an internal load. Furthermore, because elevated toxins in fish tissue are a function of both water column and bottom sediment concentrations, modeling both media as part of one internal system is appropriate.

Many of these toxic pollutants, particularly the persistent organic pollutants, preferentially sorb to the organic carbon fraction of suspended sediment in the water column and settle on the floor accumulating in the bottom sediments of the river. In this way, bottom sediments can function as a pollutant sink as pollutants within the water column sorb to sediments and settle on the floor. Over time, this accumulation of pollutants within the bottom sediment can also subsequently become a source of contaminants to the water column via the disturbance and resuspension of sediments. Additionally, dissolved pollutant concentrations in sediment pore water can also diffuse into the water column depending on the concentration gradient between the overlying water and the underlying bottom sediments. Please see Sections 5.4 and 7.6 for more information on how toxic concentrations in the bottom sediment were considered in this TMDL.

Atmospheric Deposition

Atmospheric deposition may be a source of heavy metals and persistent organic pollutants to the Anacostia River watershed; although other sources, such as groundwater and interflow pollutant loading and stormwater/surface runoff pollutant loading, are considered to be greater sources of toxic pollutants to the system. Additionally, atmospheric deposition is expected to decrease over time since the production and use of many of the toxic pollutants in these TMDLs were previously banned. To account for this source, atmospheric deposition was included as a pollutant loading pathway to surface and groundwater simulated in the watershed model. The watershed model included two atmospheric loading rates to account for both dry and wet deposition. Data used to inform these loading rates came from the ATSDR toxicological profiles for each pollutant. In some cases, loading rates for certain pollutants were negligible and were not included as a source (e.g., PAHs in dry deposition due to their hydrophobic nature). Atmospheric deposition was not assigned a baseline load and TMDL allocation because the loads associated with this source were incorporated as part of the loads from the watershed to surface waters and groundwater.

3.1.1 District of Columbia

Within the District, the two nonpoint sources of toxic pollutants to the river are from the contaminated sites and the upstream loads from Maryland.

DC Contaminated Sites

Nonpoint sources contributing toxic pollutant loads to the Anacostia River include losses from historically contaminated sites and current industrial operation areas, which are not regulated by National Pollutant Discharge Elimination System (NPDES) permits.

A list of contaminated sites and industrial operation areas, and their brief history can be found in Table 3-1 and the location of each site can be found in Figure 3-1. In general, representative loads for these sources were developed from monitoring data in the literature and the simulated rainfall-runoff and pollutant loading relationships for the watershed land areas.

Table 3-1 List of Historic Contaminated Sites along the Anacostia River

Site	Description
Firth Sterling Steel	The Firth Sterling Steel Co., built in 1906 and 1907, made steel casings for artillery shells. The casting plant closed in the 1920s. Joint Base Anacostia–Bolling currently occupies the site.
Former Hess Petroleum Terminal	This site is located in southeast Washington, DC, just south of Nationals Park and north of the Anacostia River. Hess operated a bulk petroleum storage facility from 1968 until approximately 1983, and from 1984 to 1985.
Former Steuart Petroleum	Located on M Street SE along the western bank of the Anacostia River, this site was a bulk fuel storage and distribution facility by Steuart Petroleum company from 1948 to 1996.
Fort McNair	Fort McNair is a United States Army post located on the tip of Buzzard Point, at the confluence of the Potomac River and the Anacostia River. Originally named Washington Arsenal, the fort has been an army post for more than 200 years.
JBAB	Joint Base Anacostia-Bolling (JBAB) is a 905-acre military installation, located in southeast DC, situated between the Potomac and Anacostia rivers. JBAB was established in 2010 as a result of the 2005 Base Realignment and Closure process and is comprised of the former Naval Support Facility Anacostia, the former BAFB, and the Bellevue Housing Area.
Kenilworth Park Landfill	The Kenilworth Park Landfill Site is located within Anacostia Park, a unit of National Capital Parks – East, on the eastern bank of the Anacostia River. From 1942 until 1970, as permitted by the Federal Government (War Department), the District used the site for municipal solid waste disposal. Municipal waste incineration, incinerator ash disposal, and landfilling of municipal solid waste occurred at the site. By the 1970s, the entire landfill had ceased operations, was covered with soil, revegetated, and reclaimed for recreational purposes.
Poplar Point	The Poplar Point site is located in Anacostia Park in southeast Washington, DC, approximately one mile upstream from the confluence of the Anacostia and Potomac rivers. The Poplar Point area has undergone a variety of land use changes including nursery and greenhouse operations and naval operations. The site is home to Headquarters for National Capital Parks-East, U.S. Park Police Anacostia Operations Facility, and U.S. Park Police Aviation Unit facilities, and includes various storage buildings, wetlands, and managed meadows.

Southeast Federal Center	The Southeast Federal Center (SEFC) is a site in the southeast quadrant of the District along the Anacostia River. The site had previously been used for shipbuilding (1800s) and was later heavily industrialized by ordinance manufacturing through WWII.
Washington Gas	Washington Gas – East Station Site is located in southeast Washington, DC along the western bank of the Anacostia River, south of "M" Street and east of 11th Street. The site includes areas impacted by the residuals of gas manufacturing from a former manufactured gas plant that once operated on an adjacent parcel of property to the north.
CSX	CSX Benning Yard located at 225 33rd Street, SE, Washington, DC is an active railroad switching yard. Historically, a portion of Benning Yard was used to store and dispense diesel fuel to locomotives. In 2004, a new office building and parking facility were constructed in the area where fueling operations had previously been conducted.

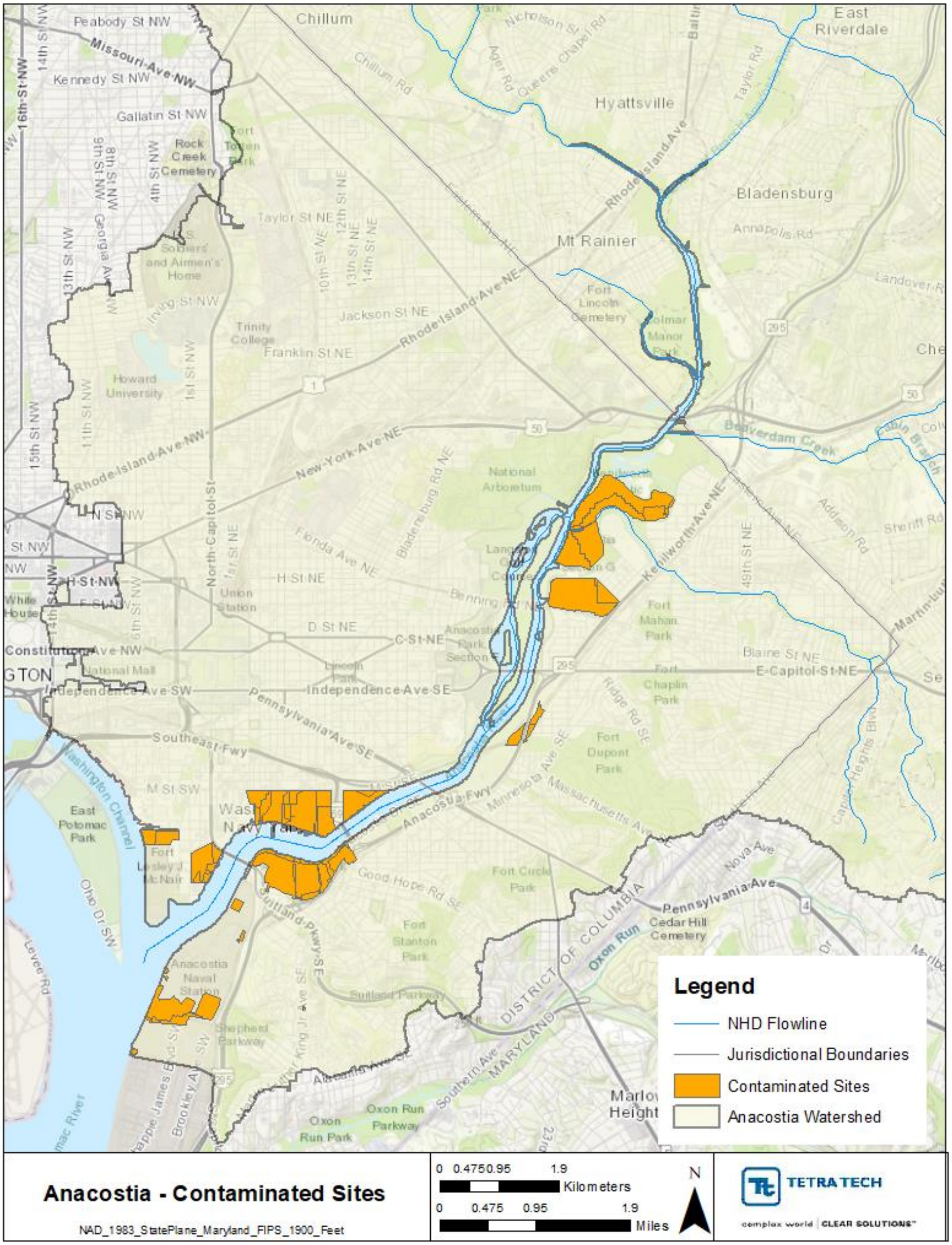

Figure 3-1 Location of Contaminated Sites in the Anacostia River Watershed

Maryland Upstream Loads

The Maryland portion of the Anacostia River watershed comprising the Northeast Branch, Northwest Branch and MD-ANATF direct drainage, drains to the MD portion of the Tidal Anacostia River (MD-ANATF tidal segment) which flows into the DC portion of the Tidal Anacostia River (Anacostia #2 tidal segment) (See Figure 2-2). In addition, an upstream portion of the Northwest Branch and MD-ANATF direct drainage within DC drain to the Maryland portion of these watersheds and the Maryland portions of the Lower Beaverdam Creek, Watts Branch, and Nash Run drain into the DC portion of these watersheds which flows directly into the DC portion of the Tidal Anacostia River (Anacostia #2 tidal segment) (See Figure 2-1).

The TMDL report presents this upstream loading from Maryland for all DC pollutants for which MD does not have impairment listings, which includes arsenic (As), copper (Cu), zinc (Zn), DDT, dieldrin, chlordane and PAHs. Upstream loads from the DC portion of the Northwest Branch and MD-ANATF direct drainage are also included. The Maryland upstream watersheds within Nash Run, Watts Branch, and Lower Beaverdam Creek are also not listed as impaired for heptachlor epoxide and will thus only be assigned a single nonpoint source baseline load.

These upstream loads are presented as a single value, representing the total load from the upstream watershed; however, it could include both point and nonpoint sources. For the purposes of this analysis, the load is treated as a single nonpoint source load (See Section 3.3.5 of the Draft TMDL Modeling Report for more information) (Tetra Tech 2021). The Maryland upstream loads that are considered nonpoint sources to the DC portion of the watershed are presented in Table 3-2.

Table 3-2 Summary of Maryland Upstream Baseline Loads

Pollutant	MD Upstream Load* (g/year)
As	183,909
Cu	1,462,014
Zn	2,262,913
DDT	104
Chlordane	1,364
Dieldrin	251
Heptachlor Epoxide**	231
PAH 1	17,167
PAH 2	40,381
PAH 3	33,313

*Upstream loads from the MD portion of the Anacostia watershed comprising the Northeast Branch, Northwest Branch, MD-ANATF direct drainage, Lower Beaverdam Creek, Watts Branch, and Nash Run watersheds. Loads from the DC portion of the Northwest Branch and MD-ANATF direct drainage are also included.

**Includes upstream loads from the MD-ANATF watershed which have also been assigned baseline loads and allocations for individual nonpoint and point sources in this TMDL to address Maryland listings for heptachlor epoxide.

3.1.2 Maryland

As described in Section 3.1.1, the Maryland portion of the Anacostia River watershed comprising the Northeast Branch, Northwest Branch, and MD-ANATF direct drainage, Nash Run, Watts Branch, and Lower Beaverdam Creek watersheds will be assigned an upstream nonpoint source baseline load for all those pollutants that are listed as impairments in DC, but not in MD. These pollutants include As, Cu, Zn, DDT, dieldrin, chlordane, and PAHs. In addition, the Maryland portion of the Nash Run, Watts Branch and Lower Beaverdam Creek watersheds are also not listed as impaired for heptachlor epoxide and will thus only be assigned an upstream nonpoint source baseline load.

For heptachlor epoxide, since MD waters are listed as impaired for this pollutant, nonpoint sources within the Northwest Branch and MD-ANATF watersheds include only runoff from non-regulated watershed areas, corresponding to the non-urbanized areas (i.e., primarily forest) of the watershed.

No contaminated sites with heptachlor epoxide contamination were identified in the Northwest Branch or MD-ANATF watersheds based on information gathered from MDE's Land Restoration Program Geospatial Database (LRP-MAP) (MDE 2021). A detailed explanation of baseline nonpoint source load calculations for non-regulated watershed runoff is presented in the following section.

Non-regulated Watershed Runoff

A calibrated watershed model using the LSPC framework was used to characterize total watershed loadings from the Northwest Branch and MD-ANATF watersheds (see Section 4 of the Draft TMDL Modeling Report) (Tetra Tech 2021). The non-regulated watershed runoff heptachlor baseline loads were estimated by multiplying the percentage of non-urban land use within the Northwest Branch and MD-ANATF watersheds and the corresponding total watershed heptachlor epoxide baseline loads. Non-urban land use percentage is calculated based on the Chesapeake Conservancy's high resolution 2013/2014 land-cover data product for the Phase 6 Bay Watershed Model (See Section 3.3.5 of the Draft TMDL Modeling Report for more information) (Tetra Tech 2021). The non-regulated watershed runoff heptachlor epoxide baseline loads from the Northwest Branch and MD-ANATF watersheds are presented in Table 3-3. The table includes the watershed, non-urban land use percentage, and non-regulated watershed runoff heptachlor epoxide baseline loads.

Table 3-3 Non-regulated Watershed Runoff Heptachlor Epoxide Baseline Loads in the Northwest Branch and MD-ANATF Watersheds

Watershed	Total Watershed Heptachlor Epoxide Load (g/year)	Non-Urban Land Use (%)	Non-Regulated Watershed Runoff Heptachlor Epoxide Load (g/year)
Northwest Branch	73.0808	0.10%	0.0755
MD-ANATF	178.2584	0.89%	1.5866

3.2 Point Sources

3.2.1 District of Columbia

For this TMDL, point sources include individually permitted facilities, stormwater discharge (i.e., MS4 and entities covered under the Multi-Sector General Permit (MSGP)) and discharges from the combined sewer system (CSS).

The individually permitted facilities used were the Washington Navy Yard, PEPCO Environment Management Services, Super Concrete Corporation, and District of Columbia Water and Sewer Authority (DC Water). A map of the permitted facilities is included in Figure 3-3 and associated facility information and EPA NPDES Permit number can be found in Table 3-4.

For existing conditions, discharge monitoring reports for each facility were used to characterize flow and toxic pollutant concentrations. Typically, discharge monitoring report (DMR) data included flow, but not toxic pollutant concentrations. There was, however, some metal (copper and zinc) concentration data available for PEPCO. For facilities that did not have data enumerating toxic pollutant concentrations, the WQC for toxic pollutants (e.g., DDT, chlordane, dieldrin) in the District's WQS were used.

The Naval District Washington, also known as the Washington Navy Yard (WNY), occupies about 80 acres on the banks of the Lower Anacostia River and borders the eastern boundary of the Southeast Federal Center. It served as a major shipbuilding facility and gun factory during 19th century. In 1961, gun production ceased and the facility was converted to administrative and supply use. For this TMDL, WNY was considered a contaminated site. To calculate toxic pollutant loads, WNY was delineated as a subbasin and is simulated based on associated runoff and toxic pollutant loading characteristics.

PEPCO at the Benning Service Station is authorized to discharge to the Anacostia River. To calculate toxic pollutant loads, discharge monitoring data for flow and metals were used. Since there was no DMR data for toxic pollutant concentrations, the WQC concentrations for toxic pollutants (e.g., DDT, chlordane, dieldrin) in the District's WQS were used.

Both PEPCO and WNY were included in the model as dual sources. This means that toxic pollutant loads associated with the individual NPDES permits and their status as contaminated sites were used in calculating TMDL allocations. See Section 5.6 for more detail.

Super Concrete is authorized to discharge to a tributary that contributes water to the Northwest Branch of the Anacostia River. The permit authorizes discharges from outfall 004 and that outfall is used in this TMDL. Since there was no DMR data for toxic pollutant concentrations, the WQC concentrations for toxic pollutants (e.g., DDT, chlordane, dieldrin) in the District's WQS were used.

DC Water's Blue Plains Advanced Wastewater Treatment Plant (WWTP) covers 150 acres and has a design capacity of 384 MGD. For this TMDL, outfall 019, which used to discharge to the Anacostia River was used. The TMDL model simulation period was from 2014 through 2017; therefore, it does not account for the on-the-ground changes due to the operation of the Anacostia tunnel system since March 2018.

For stormwater discharges, the toxic pollutant loads were determined for both the District's MS4 and the permitted sites that receive coverage from the MSGPs for Industrial Activities. The MS4 is located along the outer edges of the city and surrounds the CSS that serves the inner portions of the city (Figure

3-2). Watershed simulations for the contributing areas were used to estimate toxics pollutant loads from the MS4. The contributing toxic pollutant loading of sites under the MSGP were estimated using a GIS overlay of site boundaries, land cover data, and unit area runoff data.

Toxic pollutant loads were also estimated for the CSS using the watershed model. A map of areas covered by the CSS can be found in Figure 3-2. Overflow relationships were developed to determine combined sewer overflow (CSO) during substantial rainfall events. Toxic constituent concentrations were then assigned to overflows based on simulated in-stream concentrations.

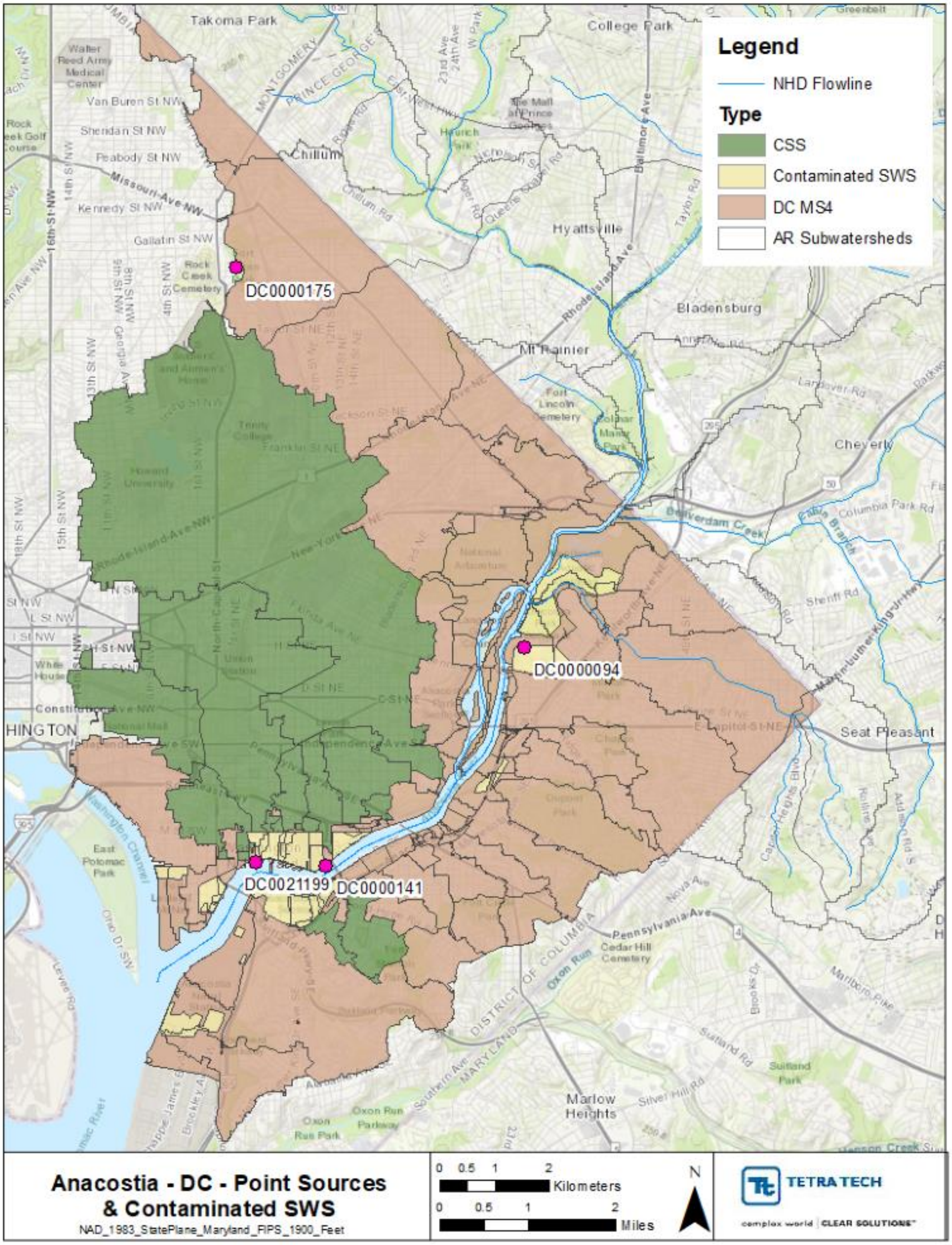

Figure 3-2 Locations of MS4, CSS and Contaminated Site Subwatersheds in the District

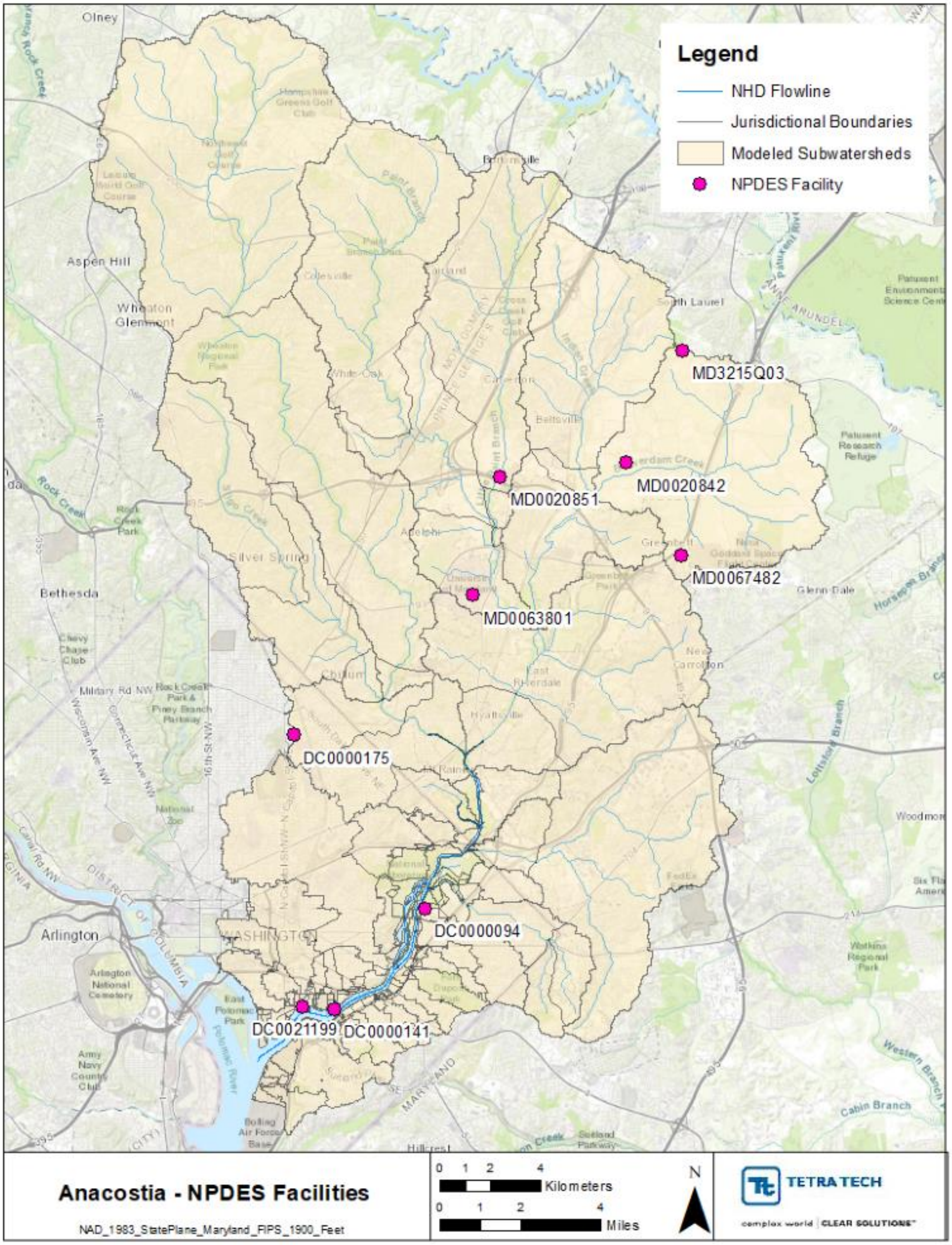

Figure 3-3 Facilities with individual NPDES permits

Table 3-4 Individual NPDES permits represented in the Anacostia Toxic Pollutants Model

NPDES Permit No.	Facility Name	Type	Outfall Number	Latitude	Longitude
DC0000094	PEPCO Environment Management Services	Industrial	013, 101	38.9000	-76.9583
DC0000141[1]	Washington Navy Yard	Industrial	001,005, 006, 007, 008, 009, 013, 014, CSO-14F, CSO-15G, CSO-15H, MS4-01E	38.87194	-76.991389
DC0000175	Super Concrete Corporation	Industrial	004	38.9486	-77.0058
DC0021199	D.C. Water (Blue Plains WWTP)	Publicly Owned Treatment Works	019	38.8725	-77.0025
MD0063801	University of Maryland, College Park	Industrial	001, 002, 003, 004, 005, 007, 010, 012, 014, 016, 017, 018, 019	38.9892	-76.9461
MD0020842	USDA East Side WWTP	Municipal	002	39.0247	-76.8861
MD0020851	USDA West Side WWTP	Municipal	002	39.0215	-76.9322
MD0067482	NASA Goddard Flight Center	Industrial	001, 002, 003, 004	38.998888	-76.866000
MD3215Q03[2]	FDA – Center for Veterinary Medicine	Industrial	001	39.056007	-76.865892

Notes: WWTP = wastewater treatment plant; USDA = U.S. Department of Agriculture; NASA = National Aeronautics and Space Administration; FDA = Food and Drug Administration

[1]Included in the allocation tables as a WLA for the Washington Navy Yard; representative latitude/longitude is for outfall 001.

[2]Estimated latitude/longitude is from GIS.

3.2.2 Maryland

For heptachlor epoxide, since these MD waters are listed as impaired for this pollutant, point sources in the Northwest Branch and MD-ANATF watersheds include NPDES-regulated municipal WWTPs and stormwater discharges regulated under Phase I and Phase II of the NPDES stormwater program. Three NPDES-regulated Industrial Process Water Facilities were identified in the Northwest Branch and MD-ANATF watersheds, however they do not discharge heptachlor epoxide and will not be assigned baseline loads or allocations in the TMDL. A detailed explanation of point source heptachlor epoxide baseline loads for 1) Municipal WWTPs and 2) NPDES regulated stormwater is presented in the following sections.

Municipal WWTPs

There are two municipal WWTPs, USDA East Side (MD0020842) and USDA West Side (MD0020851), located within the MD-ANATF watershed that have permit monitoring requirements for heptachlor epoxide (See Figure 3-3 in previous section). The heptachlor epoxide baseline loads from these WWTPs are calculated using discharge flow and heptachlor epoxide effluent concentration data reported in the facilities' DMRs (See Section 3.3.5 of the Draft TMDL Modeling Report for more information) (Tetra Tech 2021). All heptachlor epoxide concentrations were reported as non-detects in the DMRs for both facilities. For modeling purposes, loadings were calculated using the heptachlor epoxide human health criterion as the discharge concentration as a conservative assumption. While these loadings are included in the model, they are considered insignificant and will not be assigned baseline loads or allocations. These facilities discharge to the Northeast Branch, which is not listed as impaired for heptachlor epoxide and in-stream heptachlor epoxide concentrations below both facilities' outfalls are meeting Maryland's WQC. No appreciable environmental benefit would be gained from assigning allocations as the facilities do not impact water quality.

NPDES Regulated Stormwater

MDE applies EPA's requirement that "stormwater discharges that are regulated under Phase I or Phase II of the NPDES stormwater program are point sources that must be included in the Wasteload Allocation (WLA) portion of a TMDL" (U.S. EPA 2002). Phase I and II permits can include the following types of discharges:

1. Municipal Separate Storm Sewer Systems (MS4s) – these can be owned by local jurisdictions, municipalities, and state and federal entities (e.g., departments of transportation, hospitals, military bases);
2. Industrial facilities permitted for stormwater discharges; and
3. Small and large construction sites.

A list of NPDES regulated stormwater permits within the Northwest Branch and MD-ANATF watersheds that could potentially convey heptachlor epoxide loads to these segments is presented in Appendix B.

The Northwest Branch and MD-ANATF watersheds are located within the following counties regulated under Phase I of the NPDES stormwater program: Montgomery and Prince George's County, Maryland. The NPDES stormwater permits within the watershed include: (i) the area covered under Phase I jurisdictional MS4 permit for these counties, (ii) the State Highway Administration's Phase I MS4 permit, (iii) Phase II MS4 permits for municipalities, (iv) Phase II MS4 permits for State and Federal Agencies, (v) industrial facilities permitted for stormwater discharges, and (vi) MDE's general permit for construction sites (see Appendix B for a list of all NPDES regulated stormwater permits). The loads for all NPDES stormwater permittees are presented as an aggregate under the Phase I MS4 counties within the Northwest Branch and MD-ANATF watersheds.

The NPDES regulated stormwater heptachlor epoxide baseline loads were estimated by multiplying the percentage of regulated urban land use area within the regulated county portions of the Northwest Branch and MD-ANATF watersheds by the corresponding county portions of the total watershed heptachlor epoxide baseline loads. Urban land use percentage is calculated based on the Chesapeake Conservancy's high resolution 2013/2014 land-cover data product for the Phase 6 Bay Watershed Model (See Section 3.3.5 of the Draft TMDL Modeling Report for more information) (Tetra Tech 2021). The MD-ANATF watershed comprises regulated county portions within the Northwest Branch, the Northeast Branch, and the MD-ANATF tidal segment direct drainage. The NPDES regulated stormwater heptachlor epoxide baseline loads from the Northwest Branch, Northeast Branch, and MD-ANATF direct drainage are presented in Table 3-5. The table includes the watershed, county, urban land use percentage, and NPDES regulated stormwater heptachlor epoxide baseline loads.

Table 3-5 Aggregate Regulated Stormwater Heptachlor Epoxide Baseline Loads in the Northwest Branch, Northeast Branch, and MD-ANATF Direct Drainage

Watershed	County	Total Watershed Heptachlor Epoxide Load (g/year)	County Portion of Watershed Heptachlor Epoxide Load (g/year)	Regulated Urban Land Use (%)	NPDES Regulated Stormwater Heptachlor Epoxide Load (g/year)
Northwest Branch	Prince George's	73.0808	18.8556	99.97%	18.8502
	Montgomery		54.2252	99.87%	54.1551
Northeast Branch	Prince George's	100.9543	72.7846	98.28%	71.5301
	Montgomery		28.1697	99.14%	27.928
MD-ANATF Direct Drainage	Prince George's	4.2233	4.2233	99.65%	4.2084

3.3 District of Columbia Source Assessment Summary

From this source assessment, all identified nonpoint and point sources of metals (arsenic, copper, zinc), organochlorine pesticides (chlordane, DDT and its degradants, dieldrin, heptachlor epoxide), and PAHs in the DC portion of the Anacostia River, its tributaries, and Kingman Lake have been characterized.

The source assessment for the District of Columbia captures point and nonpoint sources within the District's boundaries but also incorporates the upstream loads from Maryland. As the Anacostia River is an interjurisdictional water, it is important to capture the loads from each jurisdiction. For each pollutant in DC, the upstream Maryland segments (Northeast Branch, Northwest Branch, MD-ANATF) and the tributaries to the Anacostia River that originate in Maryland (Nash Run, Watts Branch, and Lower Beaverdam Creek) are included as upstream loads to DC. This is the case for all pollutants aside from heptachlor epoxide since the Northwest Branch and MD-ANATF are listed as impaired in Maryland and therefore are provided specific TMDLs and allocations applicable to individual MD sources.

The only nonpoint source of toxic pollutants in DC is stormwater runoff from historically contaminated sites (Table 3-1). These contaminated sites are assigned baseline loads and load allocations.

Stormwater runoff is a major source of toxic pollutants to the Anacostia River watershed. The majority of stormwater runoff in DC is captured by the DC MS4 or the CSS. The DC MS4 and CSS are the sources within DC that contribute the highest loads of toxic pollutants to the river system. Other sources that capture and convey stormwater include other point sources that are regulated under NPDES (e.g., sites that have coverage under the MSGP and individual permitted facilities). These permitted facilities include both stormwater and process water discharges to the Anacostia River and are listed in Table 3-4. Facilities with individual NPDES permits that are not expected to discharge significant quantities of these pollutants are provided a baseline load and allocation, but no percent reduction. This applies to both the DC Water Blue Plains WWTP and Super Concrete Corporation. They were included in the model to accurately represent all potential sources of toxic pollutants in the Anacostia River watershed in DC. A summary of the baseline loads for the impaired DC segments can be found in the annual allocation tables, starting in Tables 5-15 through 5-23 in Section 5.6.3.

3.4 Maryland Source Assessment Summary

From this source assessment, all identified point and nonpoint sources of heptachlor epoxide in the Northwest Branch and MD-ANATF segments have been characterized. The only nonpoint source of heptachlor epoxide for these segments is non-regulated watershed runoff.

The Maryland portion of the Anacostia River watershed will be assigned an upstream nonpoint source load for all DC pollutants being addressed by this TMDL for which MD does not have impairment listings. Upstream baseline loads were presented previously in Table 3-2.

No contaminated sites with heptachlor epoxide contamination were identified in the Northwest Branch or MD-ANATF watersheds.

Point sources of heptachlor epoxide include municipal WWTPs and NPDES regulated stormwater. Two municipal WWTPs were identified, however, their loadings were considered insignificant, having no impact on water quality, and thus, not assigned baseline loads or allocations. Three NPDES-regulated Industrial Process Water Facilities were identified in the Northwest Branch and MD-ANATF watersheds, however, they do not discharge heptachlor epoxide and will not be assigned baseline loads.

A summary of the heptachlor epoxide baseline loads for the Northwest Branch and MD-ANATF segments is presented in Table 3-6.

Table 3-6 Summary of Heptachlor Epoxide Baseline Loads in the Northwest Branch and MD-ANATF Segments

Segment	Source	Baseline Load (g/year)	Baseline Load (%)
Northwest Branch	MD Non-regulated Watershed Runoff[1]	0.08	0.09
	DC Upstream Load[2]	7.63	9.46
	Nonpoint Sources/LAs	**7.71**	**9.55**
	MD NPDES Regulated Stormwater[1,5]		
	Montgomery County	54.16	67.10
	Prince George's County	18.85	23.35
	Point Sources/WLAs	**73.01**	**90.45**
	Total Northwest Branch Anacostia	**80.71**	**100.0**
MD-ANATF	MD Non-regulated Watershed Runoff[3]	1.59	0.85
	DC Upstream Load[4]	8.55	4.58
	Nonpoint Sources/LAs	**10.14**	**5.43**
	MD NPDES Regulated Stormwater[3,5]		
	MD-ANATF Direct Drainage		
	Prince George's County	4.21	2.25
	Northeast Branch Anacostia River		
	Montgomery County	27.93	14.95
	Prince George's County	71.53	38.29
	Northwest Branch Anacostia River		
	Montgomery County	54.16	28.99
	Prince George's County	18.85	10.09

	Point Sources/WLAs	**176.67**	**94.57**
	Total MD-ANATF	**186.81**	**100.00**

[1]Loads from the MD portion of the Northwest Branch watershed.
[2]Upstream loads from the DC portion of the Northwest Branch watershed.
[3]Loads from the MD portion of the MD-ANATF watershed comprising the Northeast Branch, Northwest Branch, and MD-ANATF direct drainage. Does not include loads from the MD portion of the Lower Beaverdam Creek, Watts Branch, and Nash Run which drain directly to DC waters. These loads are included in the upstream load to DC impaired segments.
[4]Upstream loads from the DC portion of the Northwest Branch and MD-ANATF direct drainage.
[5]NPDES regulated stormwater baseline loads and WLAs are an aggregate of loadings from areas covered under the following permits: (i) Phase I jurisdictional MS4 permits, (ii) the State Highway Administration's Phase I MS4 permit, (iii) Phase II MS4 permits for municipalities, (iv) Phase II MS4 permits for State and Federal Agencies, (v) industrial facilities permitted for stormwater discharges, and (vi) MDE's general permit for construction sites.

Note: Columns may not precisely add to totals due to rounding.

4 MODELING APPROACH

A linked watershed/receiving water model is best suited to capture the critical system components of the Anacostia River. An integrated modeling system, after calibration, appropriately represents the linkage between the sources in the watershed and legacy sources in the riverbed, as well as the impact of possible sources from the Potomac River, hence supporting the development of a comprehensive TMDL scenario. This system can describe and simulate hydrology, hydrodynamics, and pollutant loading in the Anacostia River watershed.

A watershed model is a series of algorithms applied to watershed characteristics and meteorological data to simulate land-based processes over a selected period, including rainfall-runoff, interflow, groundwater flow, flow routing, water temperature, and pollutant loadings. Watershed models often use build-up and wash-off representations of pollutants on land surfaces and can accommodate other processes including pollutant-soil/sediment association, subsurface pollutant transport, and atmospheric deposition of pollutants.

Receiving water models are composed of a series of algorithms to simulate water circulation, water temperature, suspended sediment transport, fate and transport of contaminants, and kinetics and transport of conventional water quality constituents of the waterbody. External forces are applied including meteorological data, flow and pollutant loadings from point and nonpoint sources, and other boundary conditions. The models are used to represent physical, chemical, and biological aspects of a lake, river, or estuary. These models vary from simple 1-dimensional box models to complex 3-dimensional models capable of simulating water movement, salinity, temperature, sediment transport, pollutant transport, and bio-chemical interactions occurring in the water column.

Watershed models can provide flow and pollutant loading (boundary conditions) to a receiving water model and can also simulate water quality processes within streams and lakes with relatively simple algorithms. Receiving water models can simulate detailed processes in rivers, lakes, and estuaries. More specifics on the model domains and their configuration used in these TMDLs are discussed below.

This section and Sections 5.2-5.4 describe only a few key aspects of the linked watershed/receiving water model for the Anacostia River watershed. These pertinent sections are included to aid in the understanding of how the TMDL allocations were developed. A complete description of the modeling framework, its configuration, and calibration are included in the separate Draft TMDL modeling report (Tetra Tech 2021).

4.1 Loading Simulation Program in C++ (LSPC) Configuration

The Loading Simulation Program in C++ (LSPC) model version 5.0 (U.S. EPA 2009) is the platform selected for watershed simulation and toxic pollutants TMDL development for the Anacostia River, its tributaries, and Kingman Lake because it meets the above criteria. A calibrated watershed model was used to characterize loadings from the Anacostia River watershed beginning at the headwaters in Maryland, ensuring that all major watershed sources and pathways are represented, including catchments adjacent to the tidal reaches of the Anacostia River. The watershed model estimated the relative pollutant contributions from multiple sources and connected these contributions to the spatial distribution of contamination over time. For TMDL development, the applied model possessed the following capabilities, making it a scientifically sound representation of the watershed loading and transport system and an advantageous management tool:

- Simulated hydrologic variations due to time variable weather patterns and the related transient saturation or unsaturated condition of the land surface/subsurface.
- Simulated time variable chemical loadings from various sources in the watershed, including the sediment associated pollutants (metals, organochlorine pesticides, and PAHs) that are the target of TMDL development.
- Simulated interactions within a stream channel.
- Provided model results with a broad range of spatial and temporal scales.
- Evaluated source loading abatement scenarios for water quality control/management design.

4.2 Environmental Fluid Dynamics Code (EFDC) Configuration

A receiving water model was used given the complex flow dynamics in the tidal Anacostia River, coupled with the variable hydrologic inputs from the surrounding watershed. Environmental Fluid Dynamics Code (EFDC) was selected as the receiving water model for this project (Tetra Tech 2021). Previous receiving water studies completed in the Anacostia River provide a strong basis for using an EFDC framework for the tidal Anacostia River (Tetra Tech, 2019a). The EFDC model has been applied worldwide for both hydrodynamic and water quality applications and can be easily linked to the LSPC watershed model, which was used to represent watershed source loadings.

EFDC is a general-purpose modeling package for simulating one- or multi-dimensional flow, transport, and bio-geochemical processes in surface water systems including rivers, lakes, estuaries, reservoirs, wetlands, and coastal regions. The EFDC model (Hamrick 1992) was originally developed at the Virginia Institute of Marine Science for estuarine and coastal applications and is considered public domain software. This model is EPA-supported and is used extensively to support receiving water modeling studies and TMDLs throughout the world.

Modeling the Anacostia River to develop these TMDLs requires evaluating source-response linkages and estimating existing loadings. As part of the linked modeling system, the EFDC model provides a dynamic representation of hydrodynamic conditions, conventional water quality conditions, sediment transport, and toxic pollutant concentrations in the tidal Anacostia River. Flows, suspended sediment, and pollutant loads from the catchments adjacent to the tidal Anacostia River are described using the LSPC model.

In tidal systems such as the tidal Anacostia River, the transport of particulate and dissolved materials is a process governed by the interaction between freshwater inflows, ocean tidal oscillations, and windshear over the water surface. During periods of high tributary inflows, estuary processes are mostly driven by advective transport and have a higher flushing capacity. During periods of low tributary inflows, conversely, the estuary processes are more influenced by dispersive transport largely driven by tidal dynamics.

5 TOTAL MAXIMUM DAILY LOADS AND ALLOCATIONS

5.1 Overview

The purpose of a TMDL is to allocate allowable loads among different pollutant sources to achieve WQS (U.S. EPA 1991). This TMDL considers all significant sources contributing metals, organochlorine pesticides, and PAHs to the impaired streams. The sources can be separated into point and nonpoint sources.

The TMDL was calculated using the following equation:

$$TMDL = WLA + LA + MOS$$

Where, WLA = sum of the wasteload (regulated or point source) allocations

LA = sum of load (nonpoint source) allocations; and

MOS = margin of safety

This report addresses 14 WQLS and up to ten impairing toxic pollutants (Table 1-1). This translates to a total of 63 TMDLs for the various WQLS/pollutant combinations in the Anacostia River, its tributaries, and Kingman Lake. The LAs and WLAs are provided in Section 5.6 for each of these impairments. Although a TMDL allocation is provided for each impairment, it is important to recognize the inter-connectedness of the impaired waterbodies. Many tributaries to the Anacostia River begin in MD (e.g., Lower Beaverdam Creek, Watts Branch, Nash Run), cross jurisdictional lines into DC, and meet the Anacostia River mainstem at their confluences within DC. Additionally, upstream segments of the mainstem Anacostia River (i.e., Northeast and Northwest Branches, MD-ANATF) flow directly into the downstream segments (i.e., Anacostia #2 and #1). These tidal waters move toxics pollutant loads between the WQLS, and, particularly for heptachlor epoxide, the TMDL allocation for one impairment in MD has an impact on the TMDL allocation for the neighboring impairment in DC. Therefore, it can be valuable to view the TMDLs for the Anacostia River as a package of allocations.

5.2 Baseline Scenario

The existing conditions of pollutant concentrations were determined from available monitoring data. Sources of pollutants that were considered included urban, agricultural, and other runoff, atmospheric deposition, point source discharges, spills and/or leaks (i.e., contaminated sites and industrial operation areas contributing contaminant loads), legacy contaminants in bed sediments of the Anacostia River, and groundwater contributions to both the Anacostia River and its tributaries. Sources of existing data considered can be grouped into three general categories: toxic pollutant monitoring data (e.g., agency monitoring, NPDES DMRs, the ARSP), general watershed characteristic data (e.g., land use, meteorological, USGS gages), and other data from a large body of literature (e.g., pollutant toxicological profiles). The relevant existing data were used as inputs to the linked watershed (LSPC) and receiving water models (EFDC). Specifics on the data sources used can be found in the Draft TMDL Modeling Report (Tetra Tech 2021). Additional details on source considerations and baseline load calculations can be found in Section 3 of this TMDL report.

The linked models were simulated over a four-year period from 2014-2017 to capture a representative period of existing conditions in the Anacostia River system. Initially, baseline conditions were simulated for each identified source for each of the ten pollutants in every subwatershed. A calibration process was completed using the large dataset compiled on existing data and simulated data. Daily, monthly, seasonal, and total modeled flow volumes were compared to observed data, and error statistics were calculated. Model results were also visually compared to observed data using time series plots, and additional graphical and tabular monthly comparisons were performed. Once it was determined that the model simulation was appropriately capturing existing conditions when compared to observed data, the calibration was deemed acceptable and the process of developing a TMDL scenario was begun. When considering the acceptability of the calibration, focus was placed on the accurate representation of the trends, relationships, and magnitudes and thus, the underlying physics and kinetics. A more in-depth description of model calibration can be found in Sections 5 and 6 of the Draft TMDL Modeling Report (Tetra Tech 2021).

5.3 TMDL Scenario

The development of a TMDL scenario is the process of reducing pollutant loads to achieve the applicable TMDL endpoints, which in most cases are the WQC for the specific pollutant. The TMDL scenario was developed through an iterative process of first implementing watershed reductions until the endpoints were met in the tributaries and then evaluating whether those reductions were sufficient to meet the endpoints in the tidal segments of the Anacostia River. Initial reductions were applied throughout the watershed in LSPC as follows:

1. Individual point source discharges were, in most cases, set to criteria concentrations (see Section 3.2.1 for more information on point sources).
2. Watershed loading was reduced using a top-down approach where the farthest upstream subwatersheds were targeted first. Once instream water quality targets were met in those watersheds, the subwatersheds directly downstream were then reduced until targets were met in all subwatersheds.
3. Instream water quality concentrations were compared against the endpoints at the model reach pour point.
4. Watershed loadings were reduced on a land use basis. In each subbasin, all urban land uses were assigned equal percent load reductions up to a threshold of 99.9% reduction. If this was not sufficient to meet the endpoint, then all agricultural land uses in the subbasin were reduced equally until the water quality target was met.
5. After the above subbasin watershed reductions were implemented in the model, if there were still areas not meeting the endpoints, then bed sediment toxic pollutant concentrations were

reduced universally for the tidal mainstem to estimate the post-TMDL bed sediment toxic pollutant concentrations.

Evaluation of the results of the initial watershed reductions in EFDC showed water quality meeting the endpoints in the tidal segments of the Anacostia for two of the ten toxic pollutants: zinc and PAH 1. All other toxic pollutants exceeded the TMDL endpoints in most of the tidal segments of the river.

Further analysis of flow and rainfall conditions associated with model results showed that simulated water column concentrations in the tidal segments were exceeding the endpoints during both wet and dry conditions. Further, these analyses demonstrated that upstream watershed loads were driving non-compliance during wet, high flow periods, whereas pollutant fluxes from the bed sediments to the water column and decreased flushing were driving non-compliance during dry, low flow conditions. Therefore, it was determined that additional reductions would be required to meet the TMDL endpoints. A methodology was developed and implemented to achieve additional watershed reductions aimed at ensuring the endpoints in the tidal segments were met during wet, high flow periods and simulated reductions to bed sediment in the tidal segments were geared at ensuring the endpoints were achieved during dry, low flow periods. This methodology for additional watershed reductions in LSPC was implemented as follows:

1. Load reductions from individually NPDES-permitted process water facilities were kept at the same level as previously determined in the initial round of reductions (i.e., no further reductions to these sources).
2. The same land uses, which had loads reduced during round one, were then targeted for additional load reductions. Additional reductions were applied based on available capacity remaining after the first round of reductions. For example, if the load reduction to a land use was 85% in the first round and an additional 50% load reduction was required on the remaining load to meet the WQC in the tidal portion of the Anacostia during wet periods, then the new reduction applied was 92.5% (0.85 + (1-0.85) * 0.50 = 0.925).
3. First, the urban land use load reductions were maximized by applying the additional reductions equally to all the urban land uses targeted in the first round.
4. If maximizing urban land use load reductions was not sufficient, agricultural land uses targeted for reduction in the first round were further reduced. Dieldrin, PAH 2, and PAH 3 required further agricultural land use reductions. Dieldrin also required targeting agricultural areas that were not targeted in the previous round.
5. The reduced LSPC loads were evaluated in the EFDC model to ensure endpoint attainment during wet conditions.

Once the watershed reductions were sufficient to achieve the TMDL endpoints in the tidal segments during all periods of high flow, a complementary exercise was completed to identify bed sediment concentrations which would result in achievement of the TMDL endpoints in tidal segments during dry, low flow conditions. Bed sediments contain elevated concentrations of all toxicants addressed in this TMDL, and they act as a source to the overlying water column during dry periods. To address this, estimated load reductions to bed sediment concentrations of pollutants that do not meet the TMDL targets with watershed reductions alone were calculated.

Once the watershed and estimated bed sediment load reductions were sufficient to achieve the TMDL endpoints throughout the entire system, a final analysis was completed to estimate the time needed for the prescribed watershed load reductions (and other instream processes) to result in future bed sediment conditions that achieve the TMDL endpoints via natural attenuation. See Section 5.4 for additional information on natural attenuation estimates.

To confirm that the TMDL scenario would result in attaining the TMDL endpoints, the models were run with the TMDL scenario as the starting condition and the model outputs were checked at 15 locations throughout the watershed, comprising the pour point of each subwatershed in the non-tidal areas and representative cell clusters in the tidal areas. These 15 areas are referred to as verification units. Figure 5.1 illustrates the location of each verification unit throughout the watershed. The results of the verification analysis indicated that the TMDL endpoint for each of the toxic pollutants was achieved at each of the 15 verification units in the TMDL scenario. The Draft TMDL Modeling Report (Tetra Tech 2021) provides figures which illustrate the results graphically.

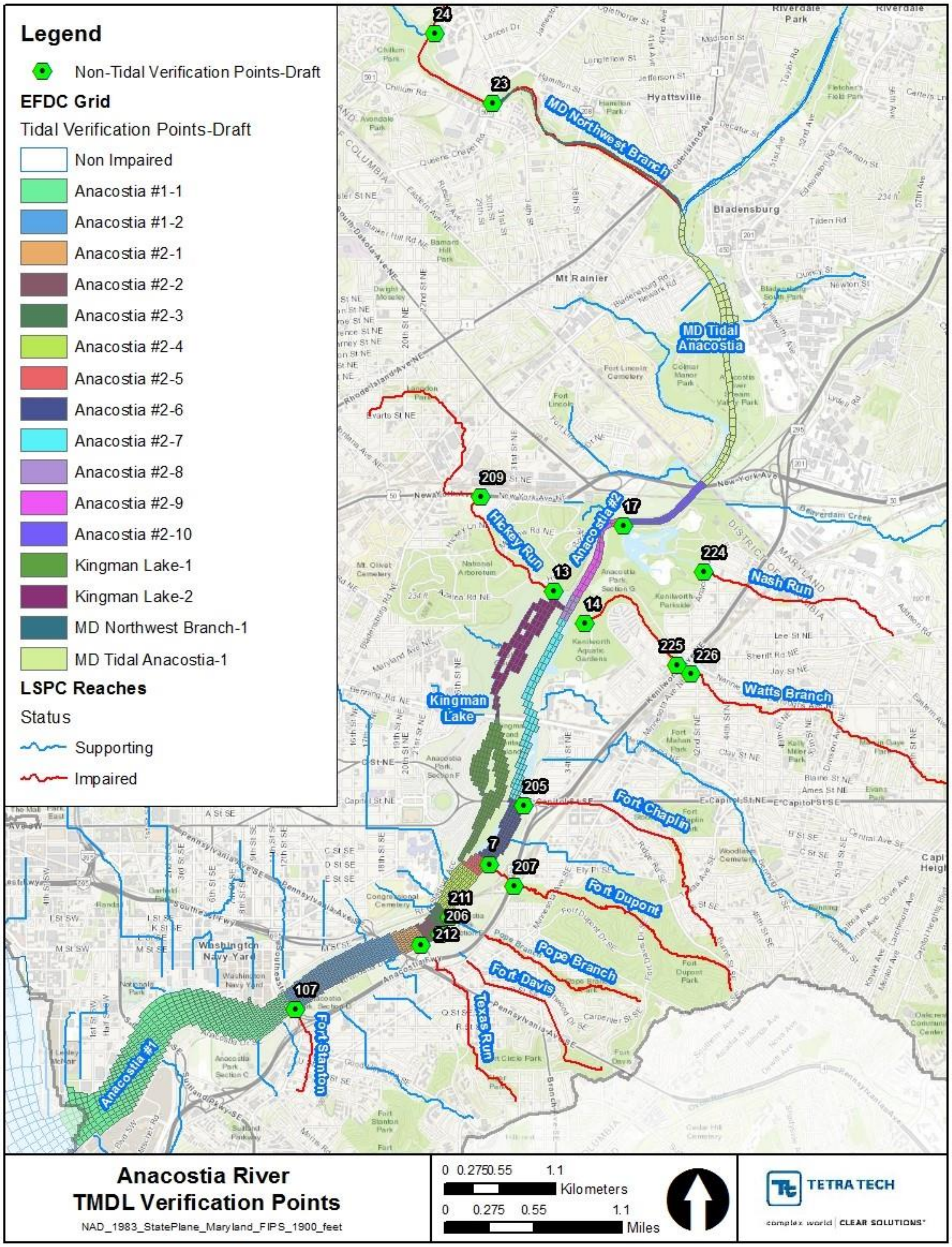

Figure 5-1 Anacostia River TMDL Verification Units

5.4 Natural Attenuation Estimates

As introduced above, natural attenuation was incorporated in the TMDL scenario as a TMDL assumption. As load reductions to nonpoint and point sources in the watershed are implemented, the net decrease in toxic pollutants in runoff and other discharges to the Anacostia River will result in the decrease of toxic pollutant concentrations in the water column, allowing the process of natural attenuation to occur. Due to the effects of contaminant flux from bed sediments to the overlying water column in the TMDL scenario, there is an expectation that over time, clean sediments from the watershed following source reduction will eliminate the contaminant flux and, therefore, allow for the attainment of TMDL endpoints in the water column. A methodology was developed to use changes in bed sediment concentrations during the 4-year model simulation period to extrapolate and predict bed sediment concentrations over time and identify the length of time that it will take, after the load reductions are implemented, for natural attenuation to result in the attainment of the TMDL endpoints. The estimated timelines for natural attenuation to result in attainment of the TMDL endpoints after the TMDL scenario is implemented are provided in Table 5.1. The estimated timeline for natural attenuation varies based on location in the watershed and pollutant, but generally, the analysis suggests that natural attenuation occurs quickest in the MD Tidal Anacostia segment and slowest in the lower segment of Kingman Lake. Some factors that explain this variation include existing bed sediment concentrations (i.e., levels of contamination) and other physical factors that impact flushing (e.g., river morphology, discharge, water velocity). This analysis demonstrated that the load reductions expressed in the TMDL will ultimately result in reduction of contaminant flux from the bottom sediment. As discussed further in Section 7 below, nothing in these TMDLs is inconsistent with sediment remediation efforts in connection with the ARSP. In fact, it is reasonable to anticipate that instream remediation efforts will aid implementation of these TMDLs and decrease the amount of time it takes for water quality to approach the TMDL endpoints.

Table 5-1 Attenuation Timeline Estimates for Each Pollutant and Tidal Verification Unit

	Attenuation years									
Verification unit	**Heptachlor epoxide**	**Chlordane**	**Dieldrin**	**DDT**	**Arsenic**	**Copper**	**Zinc**	**PAH 1**	**PAH 2**	**PAH 3**
MD Northwest Branch-1	3	6	6	12	13	9	N/A	N/A	10	10
MD Tidal Anacostia-1	4	7	6	6	7	7	N/A	N/A	7	7
Anacostia #2-1	42	62	59	67	66	50	N/A	N/A	68	69
Anacostia #2-2	21	25	45	40	53	48	N/A	N/A	46	44
Anacostia #2-3	15	21	20	25	31	23	N/A	N/A	32	32
Anacostia #2-4	15	28	41	37	34	32	N/A	N/A	34	32
Anacostia #2-5	13	25	29	25	27	22	N/A	N/A	31	30
Anacostia #2-6	17	22	20	29	34	21	N/A	N/A	26	27
Anacostia #2-7	6	15	12	17	16	15	N/A	N/A	17	17
Anacostia #2-8	5	9	10	8	9	8	N/A	N/A	9	9
Anacostia #2-9	7	13	9	14	12	0	N/A	N/A	14	15
Anacostia #2-10	4	10	11	17	12	7	N/A	N/A	12	12

Kingman Lake-1	111	117	151	175	206	184	N/A	N/A	199	210
Kingman Lake-2	7	17	19	17	25	25	N/A	N/A	23	24

5.5 Daily Load Methodology

In November 2006, EPA released the memorandum *Establishing TMDL Daily Loads in Light of the Decision by the U.S. Court of Appeals for the D.C. Circuit in Friends of the Earth, Inc. v. EPA et. al., No. 05-5015 (April 25, 2006) and Implications for NPDES permits*, which recommends that all TMDLs and associated LAs and WLAs include a daily time increment in conjunction with other appropriate temporal expressions that might be necessary to implement the relevant WQS. In compliance with that recommendation, this report presents daily load expressions (i.e., TMDLs) in addition to annual load allocations for the Anacostia River, its tributaries, and Kingman Lake.

Daily loads were developed in a manner consistent with Section 303(d) of the CWA, EPA's implementing regulations at 40 C.F.R. § 130.7, and the 2006 Daily Loads Memorandum (U.S. EPA 2006). Daily loads were calculated using the LSPC model's reach output, which contains a time series for each of the watersheds that are feeding into the impaired segments. Specifically, daily flow and concentration (for each of the ten toxics pollutants) time series data from the most downstream pour point of the impaired segments were extracted. The loading of the toxicant from the reach is subject to various transformation processes after it reaches the water from the watershed. Please see the Draft TMDL Modeling Report (Tetra Tech 2021) for more information. The daily output time series for each of the impaired segments was used to calculate the maximum of the daily loads. Ratios of the WLA and LA loadings from the annual average loadings calculated for each impaired segment were used to identify the total maximum daily load at the WLA and LA levels. The WLA and LA are aggregated for each segment (i.e., individual sources are not assigned daily loads).

5.6 TMDL Allocations

The TMDLs for the Anacostia River, its tributaries, and Kingman Lake cover 14 WQLS and up to ten impairing toxic pollutants. This translates to a total of 63 TMDLs for the various WQLS/pollutant combinations. Table 5-2 summarizes the baseline load (g/year) and load reduction (%) for the ten toxic pollutants by jurisdiction.

Table 5-2 Summary of Baseline Loads and Associated Reductions

Jurisdiction	Pollutant	Baseline load (g/year)	Load Reduction (%)	Cumulative[1] Annual Load Allocation (g/year)
DC	Arsenic	230,080	96.63	7758.93
	Copper	1,77,265	5.48	1659002.13
	Zinc	2,847,024	1.65	2800152.88
	Chlordane	1,597	98.28	27.51
	DDT	135	98.89	1.50
	Dieldrin	313	100	0.01
DC and MD	Heptachlor epoxide	285	97.5	7.12

DC	PAH1	20,696	0	137176.63
	PAH2	49,746	99.98	8.11
	PAH3	41	100	0.85

[1]Cumulative annual load allocations from the downstream most segment of the Anacostia River (Anacostia #1).

TMDL load allocations are expressed in three ways for each toxic pollutant. The tables that follow in Sections 5.6.3, 5.6.4, and Appendix C include the same information, structure, and organization for each of the toxic pollutants. Heptachlor epoxide is the only pollutant assigned TMDLs in Maryland, therefore there are two sets of tables for heptachlor epoxide, one each for the District and Maryland. In Section 5.6.3, Tables 5-3 through 5-13 show total maximum daily load allocations. In Section 5.6.4, Tables 5-14 through 5-24 show annual load allocations for each impaired segment/pollutant combination. Finally, Appendix C includes a set of tables that provide additional detail on the unimpaired segments. The jurisdictions reserve the right to revise these allocations among different sources provided the revisions are consistent with achieving WQS of the Anacostia River.

5.6.1 Wasteload Allocation

The wasteload allocation (WLA) portion of the TMDL in DC includes permitted point sources. This includes the CSS, MS4, the MSGP for stormwater, and four individual NPDES permitted facilities: Blue Plains WWTP (DC0021199), Super Concrete (DC0000175), the Washington Navy Yard (WNY) (DC0000141), and PEPCO (DC0000094). Aside from having individual NPDES permits, WNY and PEPCO are also considered contaminated sites with completed or ongoing clean-up investigations for legacy contamination.

In Maryland, for heptachlor epoxide, the WLA is represented as an aggregate of the loads attributed to all NPDES regulated stormwater point sources (i.e., Phase I jurisdictional MS4 permits, State Highway Administration's Phase I MS4 permit, Phase II MS4 permits for municipalities, Phase II MS4 permits for State and Federal Agencies, industrial facilities permitted for stormwater discharges, and MDE's general permit for construction sites). In some circumstances, the available data and information may be insufficient to assign each source an individual WLA. Consequently, it is appropriate to express allocations from NPDES-regulated discharges as a single categorical aggregate WLA. See Memorandum from Robert H. Wayland and James A. Hanlon to EPA Water Division Directors, Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on those WLAs (2002). Such aggregate WLAs constitute "available WLA[s] for the discharge[s] prepared by the State and approved by EPA" for purposes of 40 C.F.R. § 122.44(d)(1)(vii)(B)." All other NPDES regulated point sources (i.e., municipal WWTPs, industrial process water) identified in the MD portion of the Anacostia River watershed were determined to be insignificant and are not assigned allocations in this TMDL.

5.6.2 Load Allocation

The load allocation (LA) portion of the TMDL is representative of nonpoint sources of contaminants. In DC the LA includes a group of known contaminated sites: CSX, Firth Sterling Steel, Former Hess Petroleum Terminal, Former Steuart Petroleum, Fort McNair, Joint Base Anacostia-Bolling (JBAB), JBAB AOC 1, JBAB Site 2, JBAB Site 3, Kenilworth Park Landfill North, Kenilworth Park Landfill South, Poplar Point, Southeast Federal Center and Washington Gas. Within DC, an LA is also included for the upstream loads originating in Maryland. Non-regulated stormwater runoff is not included as a nonpoint source in DC as all other watershed runoff is incorporated into the stormwater loads associated with the MS4 or CSS permits.

In Maryland for heptachlor epoxide, the LA is represented as Non-regulated Watershed Runoff. This LA captures non-regulated stormwater runoff from non-urban land uses. For the other nine pollutants, the only allocation attributed to Maryland is an upstream LA, which may contain point and nonpoint sources, because Maryland has not identified its waters as impaired for these TMDL pollutants (aside from heptachlor epoxide). Instead, the overall loading from MD and the prescribed reduction needed from MD to achieve downstream water quality in DC will be presented as a single loading condition for each pollutant. This single upstream loading condition represents a boundary condition at the state boundary under which the TMDL will only be met once these conditions are achieved.

5.6.3 Total Maximum Daily Load Tables

Table 5-3 Total Maximum Daily Loads for Heptachlor Epoxide in Maryland

Segment	LA (g/day)	WLA (g/day)	Heptachlor Epoxide TMDL (g/day)
Northwest Branch	0.0006	0.2351	0.2357
MD-ANATF[1]	0.0001	0.0164	0.0164

[1]Daily loads presented for MD-ANATF loads include upstream loads from the Northeast Branch, Northwest Branch, and direct drainage.
Note: The MOS is implicit.

Table 5-4 Total Maximum Daily Loads for Heptachlor Epoxide in the District

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	Heptachlor Epoxide TMDL (g/day)
Nash Run	DCTNA01R_00	0.0003	0.0053	0.0055
Popes Branch[1]	DCTPB01R_00	0	0.0022	0.0022
Texas Avenue Tributary[1]	DCTTX27R_00	0	0.0021	0.0021
Anacostia #2[2]	DCANA00E_02	0.002	0.122	0.1239
Anacostia #1[3]	DCANA00E_01	0.003	0.057	0.0595

[1]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.
[2]Daily loads presented for Anacostia #2 include upstream loads from MD-ANATF, tributaries, and direct drainage.
[3]Daily loads presented for Anacostia #1 include upstream loads from Anacostia #2, tributaries, and direct drainage.
Note: The MOS is implicit.

Table 5-5 Total Maximum Daily Loads for Arsenic in the District

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	Arsenic TMDL (g/day)
Nash Run	DCTNA01R_00	0.24	10.59	10.82
Kingman Lake[1]	DCAKL00L_00	0	14.16	14.16
Fort Chaplin Run[1]	DCTFC01R_00	0	6.17	6.17
Fort Dupont Creek	DCTDU01R_00	0.18	12.19	12.37
Fort Davis Tributary[1]	DCTFD01R_00	0	4.90	4.90
Texas Avenue Tributary[1]	DCTTX27R_00	0	5.17	5.17
Anacostia #2[2]	DCANA00E_02	4.94	318.33	323.27
Fort Stanton Tributary[1]	DCTFS01R_00	0	3.39	3.39
Anacostia #1[3]	DCANA00E_01	2.07	145.73	147.80

[1]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[2]Daily loads presented for Anacostia #2 include upstream loads from MD-ANATF, tributaries, and direct drainage.

[3]Daily loads presented for Anacostia #1 include upstream loads from Anacostia #2, tributaries, and direct drainage.

Note: The MOS is implicit.

Table 5-6 Total Maximum Daily Loads for Chlordane in the District

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	Chlordane TMDL (g/day)
Nash Run	DCTNA01R_00	0.001	0.030	0.031
Hickey Run[1]	DCTHR01R_00	0	0.047	0.047
Watts Branch[2]	DCTWB00R_01, DCTWB00R_02	0.001	0.097	0.098
Kingman Lake[1]	DCAKL00L_00	0	0.023	0.023
Popes Branch[1]	DCTPB01R_00	0	0.010	0.010
Texas Avenue Tributary[1]	DCTTX27R_00	0	0.010	0.010
Anacostia #2[3]	DCANA00E_02	0.011	0.654	0.665
Anacostia #1[4]	DCANA00E_01	0.012	0.255	0.267

[1]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[2]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

[3]Daily loads presented for Anacostia #2 include upstream loads from MD-ANATF, tributaries, and direct drainage.

[4]Daily loads presented for Anacostia #1 include upstream loads from Anacostia #2, tributaries, and direct drainage.

Note: The MOS is implicit.

Table 5-7 Total Maximum Daily Loads for Copper in the District

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	Copper TMDL (g/day)
Anacostia #2[1]	DCANA00E_02	1025.27	75924.10	76949.37
Anacostia #1[2]	DCANA00E_01	704.93	38724.89	39429.82

[1]Daily loads presented for Anacostia #2 include upstream loads from MD-ANATF, tributaries, and direct drainage.

[2]Daily loads presented for Anacostia #1 include upstream loads from Anacostia #2, tributaries, and direct drainage.

Note: The MOS is implicit.

Table 5-8 Total Maximum Daily Loads for DDT and its Degradants in the District

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	DDT TMDL (g/day)
Hickey Run[1]	DCTHR01R_00	0	0.0035	0.0035
Kingman Lake[1]	DCAKL00L_00	0	0.0020	0.0020
Popes Branch[1]	DCTPB01R_00	0	0.0008	0.0008
Texas Avenue Tributary[1]	DCTTX27R_00	0	0.0007	0.0007
Anacostia #2[2]	DCANA00E_02	0.0031	0.0495	0.0526
Anacostia #1[3]	DCANA00E_01	0.0087	0.0251	0.0338

[1]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[2]Daily loads presented for Anacostia #2 include upstream loads from MD-ANATF, tributaries, and direct drainage.

[3]Daily loads presented for Anacostia #1 include upstream loads from Anacostia #2, tributaries, and direct drainage.

Note: The MOS is implicit.

Table 5-9 Total Maximum Daily Loads for Dieldrin in the District

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	Dieldrin TMDL (g/day)
Nash Run	DCTNA01R_00	0	0	0
Watts Branch[1]	DCTWB00R_01, DCTWB00R_02	0	0.0001	0.0001
Texas Avenue Tributary[2]	DCTTX27R_00	0	0	0
Anacostia #2[3]	DCANA00E_02	0	0.0002	0.0002
Anacostia #1[4]	DCANA00E_01	0	0.0001	0.0001

[1]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

[2]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[3]Daily loads presented for Anacostia #2 include upstream loads from MD-ANATF, tributaries, and direct drainage.

[4]Daily loads presented for Anacostia #1 include upstream loads from Anacostia #2, tributaries, and direct drainage.

Note: The MOS is implicit.

Table 5-10 Total Maximum Daily Loads for the PAH 1 Group in the District

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	PAH 1 TMDL (g/day)
Nash Run	DCTNA01R_00	6.17	27.25	33.42
Hickey Run[1]	DCTHR01R_00	0	40.87	40.87
Kingman Lake[1]	DCAKL00L_00	0	18.31	18.31
Popes Branch[1]	DCTPB01R_00	0	9.21	9.21
Texas Avenue Tributary[1]	DCTTX27R_00	0	8.30	8.30
Anacostia #2[2]	DCANA00E_02	19.16	588.67	607.83
Fort Stanton Tributary[1]	DCTFS01R_00	0	5.63	5.63
Anacostia #1[3]	DCANA00E_01	21.36	3972.79	3994.15

[1]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.
[2]Daily loads presented for Anacostia #2 include upstream loads from MD-ANATF, tributaries, and direct drainage.
[3]Daily loads presented for Anacostia #1 include upstream loads from Anacostia #2, tributaries, and direct drainage.

Note: The MOS is implicit.

Table 5-11 Total Maximum Daily Loads for the PAH 2 Group in the District

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	PAH 2 TMDL (g/day)
Nash Run	DCTNA01R_00	0	0	0
Hickey Run[1]	DCTHR01R_00	0	0	0
Kingman Lake[1]	DCAKL00L_00	0	0	0
Popes Branch[1]	DCTPB01R_00	0	0	0
Texas Avenue Tributary[1]	DCTTX27R_00	0	0	0
Anacostia #2[2]	DCANA00E_02	0.003	0.100	0.103
Fort Stanton Tributary[1]	DCTFS01R_00	0	0	0
Anacostia #1[3]	DCANA00E_01	0	0.109	0.109

[1]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[2]Daily loads presented for Anacostia #2 include upstream loads from MD-ANATF, tributaries, and direct drainage.

[3]Daily loads presented for Anacostia #1 include upstream loads from Anacostia #2, tributaries, and direct drainage.

Note: The MOS is implicit.

Table 5-12 Total Maximum Daily Loads for the PAH 3 Group in the District

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	PAH 3 TMDL (g/day)
Nash Run	DCTNA01R_00	0	0	0
Hickey Run[1]	DCTHR01R_00	0	0	0
Kingman Lake[1]	DCAKL00L_00	0	0	0
Popes Branch[1]	DCTPB01R_00	0	0	0
Texas Avenue Tributary[1]	DCTTX27R_00	0	0	0
Anacostia #2[2]	DCANA00E_02	0.0002	0.0101	0.0103
Fort Stanton Tributary[1]	DCTFS01R_00	0	0	0
Anacostia #1[3]	DCANA00E_01	0	0.0109	0.0109

[1]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[2]Daily loads presented for Anacostia #2 include upstream loads from MD-ANATF, tributaries, and direct drainage.

[3]Daily loads presented for Anacostia #1 include upstream loads from Anacostia #2, tributaries, and direct drainage.

Note: The MOS is implicit.

Table 5-13 Total Maximum Daily Loads for Zinc in the District

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	Zinc TMDL (g/day)
Anacostia #2[1]	DCANA00E_02	1545.47	83408.47	84953.93
Anacostia #1[2]	DCANA00E_01	2473.19	42505.27	44978.46

[1]Daily loads presented for Anacostia #2 include upstream loads from MD-ANATF, tributaries, and direct drainage.

[2]Daily loads presented for Anacostia #1 include upstream loads from Anacostia #2, tributaries, and direct drainage.

Note: The MOS is implicit.

5.6.4 Annual Load Tables

Table 5-14 Annual Allocations for Heptachlor Epoxide in Maryland

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Northwest Branch	MD Non-regulated Watershed Runoff[1]	0.0755	0.09	0.0021	97.22
	Nonpoint Sources/Las	**0.0755**	**0.09**	**0.0021**	**97.22**
	MD NPDES Regulated Stormwater[1,2]				
	Montgomery County	54.1551	67.10	0.5289	99.02
	Prince George's County	18.8502	23.35	0.1813	99.04

Northwest Branch	DC Upstream Load[3]				
	DC Individual NPDES Dischargers	0.0194	0.02	0.0194	0
	DC MS4	7.5856	9.40	0.0531	99.30
	DC MSGP	0.0266	0.03	0.0001	99.62
	Point Sources/WLAs	**80.6369**	**99.91**	**0.7828**	**99.03**
	Total Northwest Branch Anacostia	**80.7124**	**100**	**0.7849**	**99.03**
MD-ANATF	MD Non-regulated Watershed Runoff[4]	1.5866	0.85	0.0281	98.23
	Nonpoint Sources/LAs	**1.5866**	**0.85**	**0.0281**	**98.23**
	MD NPDES Regulated Stormwater[2,4]				
	MD-ANATF Direct Drainage				
	Prince George's County	4.2084	2.25	0.0523	98.76
	Northeast Branch Anacostia River				
	Montgomery County	27.9280	14.95	0.2497	99.11
	Prince George's County	71.5301	38.29	1.0529	98.53
	Northwest Branch Anacostia River				
	Montgomery County	54.1551	28.99	0.5289	99.02
	Prince George's County	18.8502	10.09	0.1813	99.04
	DC Upstream Load[5]				
	DC Individual NPDES Dischargers	0.0194	0.01	0.0194	0
	DC MS4	8.5048	4.55	0.0609	99.28
	DC MSGP	0.0266	0.01	0.0001	99.62
	Point Sources/WLAs	**185.2226**	**99.15**	**2.1455**	**98.84**
	Total MD-ANATF	**186.8092**	**100**	**2.1736**	**98.84**

[1]Loads from the MD portion of the Northwest Branch Anacostia River watershed.
[2]NPDES regulated stormwater baseline loads and WLAs are an aggregate of loadings from areas covered under the following permits: (i) Phase I jurisdictional MS4 permits, (ii) the State Highway Administration's Phase I MS4 permit, (iii) Phase II MS4 permits for municipalities, (iv) Phase II MS4 permits for State and Federal Agencies, (v) industrial facilities permitted for stormwater discharges, and (vi) MDE's general permit for construction sites.
[3]Loads from the DC portion of the Northwest Branch Anacostia River watershed.
[4]Loads from the MD portion of the MD-ANATF watershed comprising the Northeast Branch, Northwest Branch, and MD-ANATF direct drainage. Does not include loads from the MD portion of the Lower Beaverdam Creek, Watts Branch, and Nash Run which drain directly to DC waters. These loads are included in the upstream load to DC impaired segments.
[5]Loads from the DC portion of the MD-ANATF watershed comprising the Northwest Branch and MD-ANATF direct drainage.

Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

Table 5-15 Annual Allocations for Heptachlor Epoxide in the District

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Nash Run	MD Upstream Load[1]	0.7099	18.26	0.0069	99.03
	DC Contaminated Sites	1.7446	44.88	0.0010	99.94
	Nonpoint Sources/LAs	**2.4545**	**63.15**	**0.0079**	**99.68**
	DC MS4	1.4324	36.85	0.0130	99.09
	Point Sources/WLAs	**1.4324**	**36.85**	**0.0130**	**99.09**
	Total Nash Run	**3.8869**	**100**	**0.0209**	**99.46**
Popes Branch[2]	DC MS4	0.7833	100	0.0066	99.16
	Point Sources/WLAs	**0.7833**	**100**	**0.0066**	**99.16**
	Total Popes Branch	**0.7833**	**100**	**0.0066**	**99.16**
Texas Avenue Tributary[2]	DC MS4	0.7833	100	0.0066	99.16
	Point Sources/WLAs	**0.7833**	**100**	**0.0066**	**99.16**
	Total Texas Avenue Tributary	**0.7833**	**100**	**0.0066**	**99.16**
Anacostia #2[3]	Upstream Loads				
	Cumulative Load from MD-ANATF[4]	186.8092	75.10	2.1736	98.84
	Cumulative Load from Tributaries	1.5733	0.63	0.0132	99.16
	Load from Kingman Lake	52.4165	21.07	4.6551	91.12
	Cumulative Upstream Load	**240.7990**	**96.80**	**6.8419**	**97.16**
	Anacostia #2 Direct Drainage				
	DC Contaminated Sites	0.991	0.40	0.0006	99.94
	Nonpoint Sources/LAs	**0.9910**	**0.40**	**0.0006**	**99.94**
	Anacostia #2 Direct Drainage				
	DC MS4	5.5304	2.22	0.0481	99.13
	DC MSGP	0.0181	0.01	0.0002	98.90
	PEPCO (DC0000094)[5]	1.4183	0.57	0.0041	99.71
	Point Sources/WLAs	**6.9668**	**2.80**	**0.0524**	**99.25**
	Total Anacostia #2	**248.7568**	**100**	**6.8949**	**97.23**
Anacostia #1[6]	Upstream Loads				
	Cumulative Load from Anacostia #2	248.7568	87.25	6.8949	97.23
	Cumulative Load from Tributaries	1.0621	0.37	0.0097	99.09
	Cumulative Upstream Load	**249.8189**	**87.63**	**6.9046**	**97.24**
	Anacostia #1 Direct Drainage				
	DC Contaminated Sites	15.6629	5.49	0.0102	99.93
	Nonpoint Sources/LAs	**15.6629**	**5.49**	**0.0102**	**99.93**
	Anacostia #1 Direct Drainage				
	DC CSS	5.7618	2.02	0.0469	99.19
	DC MS4	9.9230	3.48	0.0934	99.06
	DC MSGP	0.3409	0.12	0.0026	99.24

Anacostia #1[6]	Blue Plains WWTP (DC0021199)	0.0547	0.02	0.0547	0
	Washington Navy Yard (DC0000141)[5]	3.5339	1.24	0.0045	99.87
	Point Sources/WLAs	**19.6143**	**6.88**	**0.2021**	**98.97**
	Total Anacostia #1	**285.0961**	**100**	**7.1169**	**97.50**

[1]Upstream land based loads from the MD portion of the Nash Run watershed.

[2]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[3]Loads presented for the Anacostia #2 segment are cumulative. The loads for Anacostia #2 include loads from MD Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF), Kingman Lake, tributaries to Anacostia #2, and direct drainage.

[4]Upstream loads from the MD portion of the Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF) watershed comprising the Northeast Branch, Northwest Branch, and MD-ANATF direct drainage, as well as upstream loads from the MD portion of the Lower Beaverdam Creek, Watts Branch, and Nash Run which drain directly to DC waters.

[5]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.

[6]Loads presented for the Anacostia #1 segment are cumulative. The loads for Anacostia #1 include cumulative loads from Anacostia #2, tributaries to Anacostia #1, and direct drainage.

Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

Table 5-16 Annual Allocations for Arsenic in the District

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Nash Run	MD Upstream Load[1]	542.44	19.07	12.44	97.71
	DC Contaminated Sites	1171.48	41.18	0.79	99.93
	Nonpoint Sources/LAs	**1713.92**	**60.26**	**13.23**	**99.23**
	DC MS4	1130.53	39.74	22.92	97.97
	Point Sources/WLAs	**1130.53**	**39.74**	**22.92**	**97.97**
	Total Nash Run	**2844.45**	**100**	**36.15**	**98.73**
Kingman Lake[2]	DC MS4	1292.84	100	33.40	97.42
	Point Sources/WLAs	**1292.84**	**100**	**33.40**	**97.42**
	Total Kingman Lake	**1292.84**	**100**	**33.40**	**97.42**
Fort Chaplin Run[2]	DC MS4	699.53	100	18.04	97.42
	Point Sources/WLAs	**699.53**	**100**	**18.04**	**97.42**
	Total Fort Chaplin Run	**699.53**	**100**	**18.04**	**97.42**
Fort Dupont Creek	DC Contaminated Sites	186.31	19.14	0.32	99.83
	Nonpoint Sources/LAs	**186.31**	**19.14**	**0.32**	**99.83**
	DC MS4	787.14	80.86	21.73	97.24
	Point Sources/WLAs	**787.14**	**80.86**	**21.73**	**97.24**
	Total Fort Dupont Creek	**973.45**	**100**	**22.05**	**97.74**
Fort Davis Tributary[2]	DC MS4	530.38	100	15.87	97.01
	Point Sources/WLAs	**530.38**	**100**	**15.87**	**97.01**
	Total Fort Davis Tributary	**530.38**	**100**	**15.87**	**97.01**

Texas Avenue Tributary[2]	DC MS4	579.50	100	14.85	97.44
	Point Sources/WLAs	**579.50**	**100**	**14.85**	**97.44**
	Total Texas Avenue Tributary	**579.50**	**100**	**14.85**	**97.44**
Anacostia #2[3]	Upstream Loads				
	Cumulative Load from MD-ANATF[4]	150468.97	76.06	5920.27	96.07
	Cumulative Load from Tributaries	39739.48	20.09	1131.92	97.15
	Load from Kingman Lake	1292.84	0.65	33.40	97.42
	Cumulative Upstream Load	**191501.29**	**96.80**	**7085.59**	**96.30**
	Anacostia #2 Direct Drainage				
	DC Contaminated Sites	674.08	0.34	0.41	99.94
	Nonpoint Sources/LAs	**674.08**	**0.34**	**0.41**	**99.94**
Anacostia #2[3]	Anacostia #2 Direct Drainage				
	DC MS4	4343.06	2.20	102.65	97.64
	DC MSGP	13.21	0.01	0.30	97.71
	PEPCO (DC0000094)[5]	1307.34	0.66	5.62	99.57
	Point Sources/WLAs	**5663.61**	**2.86**	**108.57**	**98.08**
	Total Anacostia #2	**197838.98**	**100**	**7194.57**	**96.36**
Fort Stanton Tributary[2]	DC MS4	833.28	100	19.86	97.62
	Point Sources/WLAs	**833.28**	**100**	**19.86**	**97.62**
	Total Fort Stanton Tributary	**833.28**	**100**	**19.86**	**97.62**
Anacostia #1[6]	Upstream Loads				
	Cumulative Load from Anacostia #2	197838.98	85.99	7194.57	96.36
	Cumulative Load from Tributaries	833.28	0.36	19.86	97.62
	Cumulative Upstream Load	**198672.26**	**86.35**	**7214.43**	**96.37**
	Anacostia #1 Direct Drainage				
	DC Contaminated Sites	10837.56	4.71	7.89	99.93
	Nonpoint Sources/LAs	**10837.56**	**4.71**	**7.89**	**99.93**
	Anacostia #1 Direct Drainage				
	DC CSS	4335.35	1.88	94.63	97.82
	DC MS4	13177.13	5.73	194.53	98.52
	DC MSGP	228.44	0.10	4.98	97.82
	Blue Plains WWTP (DC0021199)	239.16	0.10	239.16	0
	Washington Navy Yard (DC0000141)[5]	2590.60	1.13	3.30	99.87
	Point Sources/WLAs	**20570.69**	**8.94**	**536.61**	**97.39**
	Total Anacostia #1	**230080.51**	**100**	**7758.93**	**96.63**

[1]Upstream land based loads from the MD portion of the Nash Run watershed.

[2]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[3]Loads presented for the Anacostia #2 segment are cumulative. The loads for Anacostia #2 include loads from MD Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF), Kingman Lake, tributaries to Anacostia #2, and direct drainage.

[4]Upstream loads from the MD portion of the Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF) watershed comprising the Northeast Branch, Northwest Branch, and MD-ANATF direct drainage, as well as upstream loads from the MD portion of the Lower Beaverdam Creek, Watts Branch, and Nash Run which drain directly to DC waters.

[5]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.
[6]Loads presented for the Anacostia #1 segment are cumulative. The loads for Anacostia #1 include cumulative loads from Anacostia #2, tributaries to Anacostia #1, and direct drainage.
Note 1: The MOS is implicit.
Note 2: Columns may not precisely add to totals due to rounding.

Table 5-17 Annual Allocations for Chlordane in the District

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Nash Run	MD Upstream Load[1]	4.278	29.69	0.049	98.86
	DC Contaminated Sites	1.864	12.94	0.007	99.62
	Nonpoint Sources/LAs	**6.142**	**42.63**	**0.056**	**99.09**
	DC MS4	8.267	57.37	0.119	98.56
	Point Sources/WLAs	**8.267**	**57.37**	**0.119**	**98.56**
	Total Nash Run	**14.409**	**100**	**0.175**	**98.79**
Hickey Run[2]	DC MS4	21.502	90.41	0.276	98.71
	DC MSGP	2.281	9.59	0.026	98.86
	Point Sources/WLAs	**23.783**	**100**	**0.302**	**98.73**
	Total Hickey Run	**23.783**	**100**	**0.302**	**98.73**
Watts Branch[3]	MD Upstream Load[4]	20.164	42.85	0.329	98.37
	DC Contaminated Sites	2.179	4.63	0.008	99.62
	Nonpoint Sources/LAs	**22.343**	**47.48**	**0.337**	**98.49**
	DC MS4	23.442	49.82	0.339	98.55
	PEPCO (DC0000094)[5]	1.273	2.70	0.005	99.62
	Point Sources/WLAs	**24.715**	**52.52**	**0.344**	**98.61**
	Total Watts Branch	**47.058**	**100**	**0.681**	**98.55**
Kingman Lake[2]	DC MS4	8.640	100	0.108	98.75
	Point Sources/WLAs	**8.640**	**100**	**0.108**	**98.75**
	Total Kingman Lake	**8.640**	**100**	**0.108**	**98.75**
Popes Branch[2]	DC MS4	4.553	100	0.052	98.86
	Point Sources/WLAs	**4.553**	**100**	**0.052**	**98.86**
	Total Popes Branch	**4.553**	**100**	**0.052**	**98.86**
Texas Avenue Tributary[2]	DC MS4	4.470	100	0.058	98.71
	Point Sources/WLAs	**4.470**	**100**	**0.058**	**98.71**
	Total Texas Avenue Tributary	**4.470**	**100**	**0.058**	**98.71**
Anacostia #2[6]	Upstream Loads				
	Cumulative Load from MD-ANATF[7]	1114.183	76.18	21.146	98.10
	Cumulative Load from Tributaries	297.608	20.35	3.963	98.67
	Load from Kingman Lake	8.640	0.59	0.108	98.75
	Cumulative Upstream Load	**1420.430**	**97.12**	**25.217**	**98.22**

Anacostia #2[6]	Anacostia #2 Direct Drainage				
	DC Contaminated Sites	1.230	0.08	0.005	99.63
	Nonpoint Sources/LAs	**1.230**	**0.08**	**0.005**	**99.63**
	Anacostia #2 Direct Drainage				
	DC MS4	32.785	2.24	0.392	98.80
	DC MSGP	0.116	0.01	0.001	98.88
	PEPCO (DC0000094)[5]	8.028	0.55	0.036	99.56
	Point Sources/WLAs	**40.928**	**2.80**	**0.429**	**98.95**
	Total Anacostia #2	**1462.588**	**100**	**25.650**	**98.25**
Anacostia #1[8]	Upstream Loads				
	Cumulative Load from Anacostia #2	1462.588	91.55	25.650	98.25
	Cumulative Load from Tributaries	6.138	0.38	0.081	98.67
	Cumulative Upstream Load	**1468.726**	**91.94**	**25.732**	**98.25**
	Anacostia #1 Direct Drainage				
	DC Contaminated Sites	23.1768	1.45	0.0834	99.64
	Nonpoint Sources/LAs	**23.1768**	**1.45**	**0.0834**	**99.64**
	Anacostia #1 Direct Drainage				
	DC CSS	35.0448	2.19	0.3983	98.86
	DC MS4	59.7903	3.74	0.6888	98.85
	DC MSGP	2.3743	0.15	0.027	98.86
	Blue Plains WWTP (DC0021199)	0.5467	0.03	0.5467	0
	Washington Navy Yard (DC0000141)[5]	7.9088	0.50	0.0299	99.62
	Point Sources/WLAs	**105.6649**	**6.61**	**1.6907**	**98.40**
	Total Anacostia #1	**1597.5674**	**100**	**27.5057**	**98.28**

[1]Upstream land based loads from the MD portion of the Nash Run watershed.

[2]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[3]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

[4]Upstream land based loads from the MD portion of the Watts Branch watershed.

[5]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.

[6]Loads presented for the Anacostia #2 segment are cumulative. The loads for Anacostia #2 include loads from MD Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF), Kingman Lake, tributaries to Anacostia #2, and direct drainage.

[7]Upstream loads from the MD portion of the Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF) watershed comprising the Northeast Branch, Northwest Branch, and MD-ANATF direct drainage, as well as upstream loads from the MD portion of the Lower Beaverdam Creek, Watts Branch, and Nash Run which drain directly to DC waters.

[8]Loads presented for the Anacostia #1 segment are cumulative. The loads for Anacostia #1 include cumulative loads from Anacostia #2, tributaries to Anacostia #1, and direct drainage.

Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

Table 5-18 Annual Allocations for Copper in the District

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Anacostia #2[1]	Upstream Loads				
	Cumulative Load from MD-ANATF[2]	1196772.01	76.26	1196772.01	0
	Cumulative Load from Tributaries	313745.53	19.99	298677.56	4.80
	Load from Kingman Lake	9083.76	0.58	8745.12	3.73
	Cumulative Upstream Load	**1519601.30**	**96.83**	**1504194.69**	**1.01**
	Anacostia #2 Direct Drainage				
	DC Contaminated Sites	3363.69	0.21	100.91	97.00
	Nonpoint Sources/LAs	**3363.69**	**0.21**	**100.91**	**97.00**
	Anacostia #2 Direct Drainage				
	DC MS4	32930.72	2.10	32437.95	1.50
	DC MSGP	103.34	0.01	103.34	0
	PEPCO (DC0000094)[3]	13418.82	0.86	532.43	96.03
	Point Sources/WLAs	**46452.88**	**2.96**	**33073.72**	**28.80**
	Total Anacostia #2	**1569417.87**	**100**	**1537369.32**	**2.04**
Anacostia #1[4]	Upstream Loads				
	Cumulative Load from Anacostia #2	1569417.87	89.41	1537369.32	2.04
	Cumulative Load from Tributaries	6302.04	0.36	6302.04	0
	Cumulative Upstream Load	**1575719.91**	**89.77**	**1543671.36**	**2.03**
	Anacostia #1 Direct Drainage				
	DC Contaminated Sites	53838.23	3.07	2174.56	95.96
	Nonpoint Sources/LAs	**53838.23**	**3.07**	**2174.56**	**95.96**
	Anacostia #1 Direct Drainage				
	DC CSS	35424.57	2.02	35424.57	0
	DC MS4	59356.69	3.38	59232.80	0.21
	DC MSGP	2293.44	0.13	2293.38	0
	Blue Plains WWTP (DC0021199)	15306.35	0.87	15306.35	0
	Washington Navy Yard (DC0000141)[3]	13326.39	0.76	899.10	93.25
	Point Sources/WLAs	**125707.45**	**7.16**	**113156.21**	**9.98**
	Total Anacostia #1	**1755265.58**	**100**	**1659002.13**	**5.48**

[1]Loads presented for the Anacostia #2 segment are cumulative. The loads for Anacostia #2 include loads from MD Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF), Kingman Lake, tributaries to Anacostia #2, and direct drainage.

[2]Upstream loads from the MD portion of the Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF) watershed comprising the Northeast Branch, Northwest Branch, and MD-ANATF direct drainage, as well as upstream loads from the MD portion of the Lower Beaverdam Creek, Watts Branch, and Nash Run which drain directly to DC waters.

[3]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.

[4]Loads presented for the Anacostia #1 segment are cumulative. The loads for Anacostia #1 include cumulative loads from Anacostia #2, tributaries to Anacostia #1, and direct drainage.

Note 1: The MOS is implicit.
Note 2: Columns may not precisely add to totals due to rounding.

Table 5-19 Annual Allocations for DDT and its Degradants in the District

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Hickey Run[1]	DC MS4	1.4741	92.34	0.0130	99.12
	DC MSGP	0.1222	7.66	0.0009	99.26
	Point Sources/WLAs	**1.5963**	**100**	**0.0139**	**99.13**
	Total Hickey Run	**1.5963**	**100**	**0.0139**	**99.13**
Kingman Lake[1]	DC MS4	0.7384	100	0.0061	99.17
	Point Sources/WLAs	**0.7384**	**100**	**0.0061**	**99.17**
	Total Kingman Lake	**0.7384**	**100**	**0.0061**	**99.17**
Popes Branch[1]	DC MS4	0.3623	100	0.0027	99.25
	Point Sources/WLAs	**0.3623**	**100**	**0.0027**	**99.25**
	Total Popes Branch	**0.3623**	**100**	**0.0027**	**99.25**
Texas Avenue Tributary[1]	DC MS4	0.3331	100	0.0028	99.16
	Point Sources/WLAs	**0.3331**	**100**	**0.0028**	**99.16**
	Total Texas Avenue Tributary	**0.3331**	**100**	**0.0028**	**99.16**
Anacostia #2[2]	Upstream Loads				
	Cumulative Load from MD-ANATF[3]	83.3871	74.03	1.1602	98.61
	Cumulative Load from Tributaries	23.8418	21.17	0.1882	99.21
	Load from Kingman Lake	0.7384	0.66	0.0061	99.17
	Cumulative Upstream Load	**107.9673**	**95.86**	**1.3545**	**98.75**
	Anacostia #2 Direct Drainage				
	DC Contaminated Sites	0.8256	0.73	0.0020	99.76
	Nonpoint Sources/LAs	**0.8256**	**0.73**	**0.0020**	**99.76**
	Anacostia #2 Direct Drainage				
	DC MS4	2.3646	2.10	0.0187	99.21
	DC MSGP	0.0072	0.01	0.0001	98.61
	PEPCO (DC0000094)[4]	1.4705	1.31	0.0040	99.73
	Point Sources/WLAs	**3.8423**	**3.41**	**0.0228**	**99.41**
	Total Anacostia #2	**112.6352**	**100**	**1.3793**	**98.78**
Anacostia #1[5]	Upstream Loads				
	Cumulative Load from Anacostia #2	112.6352	83.02	1.3793	98.78
	Cumulative Load from Tributaries	0.4449	0.33	0.0038	99.15
	Cumulative Upstream Load	**113.0801**	**83.35**	**1.3831**	**98.78**
	Anacostia #1 Direct Drainage				
	DC Contaminated Sites	13.0264	9.60	0.0312	99.76
	Nonpoint Sources/LAs	**13.0264**	**9.60**	**0.0312**	**99.76**
	Anacostia #1 Direct Drainage				

Anacostia #1[5]	DC CSS	2.2479	1.66	0.0166	99.26
	DC MS4	4.1054	3.03	0.0309	99.25
	DC MSGP	0.1173	0.09	0.0009	99.23
	Blue Plains WWTP (DC0021199)	0.0307	0.02	0.0307	0
	Washington Navy Yard (DC0000141)[4]	3.0598	2.26	0.0075	99.75
	Point Sources/WLAs	**9.5611**	**7.05**	**0.0866**	**99.09**
	Total Anacostia #1	**135.6676**	**100**	**1.5009**	**98.89**

[1]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[2]Loads presented for the Anacostia #2 segment are cumulative. The loads for Anacostia #2 include loads from MD Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF), Kingman Lake, tributaries to Anacostia #2, and direct drainage.

[3]Upstream loads from the MD portion of the Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF) watershed comprising the Northeast Branch, Northwest Branch, and MD-ANATF direct drainage, as well as upstream loads from the MD portion of the Lower Beaverdam Creek, Watts Branch, and Nash Run which drain directly to DC waters.

[4]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.

[5]Loads presented for the Anacostia #1 segment are cumulative. The loads for Anacostia #1 include cumulative loads from Anacostia #2, tributaries to Anacostia #1, and direct drainage.

Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

Table 5-20 Annual Allocations for Dieldrin in the District

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Nash Run	MD Upstream Load[1]	0.8465	26.33	0	100
	DC Contaminated Sites	0.8106	25.22	0	100
	Nonpoint Sources/LAs	**1.6571**	**51.55**	**0**	**100**
	DC MS4	1.5574	48.45	0	100
	Point Sources/WLAs	**1.5574**	**48.45**	**0**	**100**
	Total Nash Run	**3.2145**	**100**	**0**	**100**
Watts Branch[2]	MD Upstream Load[3]	3.7154	37.04	0.0001	100
	DC Contaminated Sites	1.0276	10.24	0	100
	Nonpoint Sources/LAs	**4.7430**	**47.28**	**0.0001**	**100**
	DC MS4	4.5506	45.37	0	100
	PEPCO (DC0000094)[4]	0.7373	7.35	0	100
Watts Branch[2]	***Point Sources/WLAs***	**5.2879**	**52.72**	**0**	**100**
	Total Watts Branch	**10.03**	**100**	**0**	**100**
Texas Avenue Tributary[5]	DC MS4	0.8062	100	0	100
	Point Sources/WLAs	**0.8062**	**100**	**0**	**100**
	Total Texas Avenue Tributary	**0.8062**	**100**	**0**	**100**

Anacostia #2[6]	Upstream Loads				
	Cumulative Load from MD-ANATF[7]	199.8386	73.28	0.0047	100
	Cumulative Load from Tributaries	59.8845	21.96	0.0002	100
	Load from Kingman Lake	1.4418	0.53	0	100
	Cumulative Upstream Load	**261.1649**	**95.76**	**0.0049**	**100**
	Anacostia #2 Direct Drainage				
	DC Contaminated Sites	0.6279	0.23	0	100
	Nonpoint Sources/LAs	**0.6279**	**0.23**	**0**	**100**
	Anacostia #2 Direct Drainage				
	DC MS4	6.2627	2.30	0	100
	DC MSGP	0.0238	0.01	0	100
	PEPCO (DC0000094)[4]	4.6445	1.70	0	100
	Point Sources/WLAs	**10.9310**	**4.01**	**0**	**100**
	Total Anacostia #2	**272.7238**	**100**	**0.0049**	**100**
Anacostia #1[8]	Upstream Loads				
	Cumulative Load from Anacostia #2	272.7238	87.13	0.0049	100
	Cumulative Load from Tributaries	1.2066	0.39	0	100
	Cumulative Upstream Load	**273.9304**	**87.52**	**0.0049**	**100**
	Anacostia #1 Direct Drainage				
	DC Contaminated Sites	14.3807	4.59	0	100
	Nonpoint Sources/LAs	**14.3807**	**4.59**	**0**	**100**
	Anacostia #1 Direct Drainage				
	DC CSS	7.4047	2.37	0	100
	DC MS4	11.8655	3.79	0	100
	DC MSGP	0.5428	0.17	0	100
	Blue Plains WWTP (DC0021199)	0.0020	0	0.0020	0
	Washington Navy Yard (DC0000141)[4]	4.8805	1.56	0	100
	Point Sources/WLAs	**24.6955**	**7.89**	**0.0020**	**99.99**
	Total Anacostia #1	**313.0066**	**100**	**0.0069**	**100.00**

[1]Upstream land based loads from the MD portion of the Nash Run watershed.

[2]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

[3]Upstream land based loads from the MD portion of the Watts Branch watershed.

[4]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.

[5]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[6]Loads presented for the Anacostia #2 segment are cumulative. The loads for Anacostia #2 include loads from MD Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF), Kingman Lake, tributaries to Anacostia #2, and direct drainage.

[7]Upstream loads from the MD portion of the Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF) watershed comprising the Northeast Branch, Northwest Branch, and MD-ANATF direct drainage, as well as upstream loads from the MD portion of the Lower Beaverdam Creek, Watts Branch, and Nash Run which drain directly to DC waters.

[8]Loads presented for the Anacostia #1 segment are cumulative. The loads for Anacostia #1 include cumulative loads from Anacostia #2, tributaries to Anacostia #1, and direct drainage.

Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

Table 5-21 Annual Allocations for the PAH 1 Group in the District

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Nash Run	MD Upstream Load[1]	56.34	28.56	56.34	0
	DC Contaminated Sites	36.42	18.46	36.42	0
	Nonpoint Sources/LAs	**92.76**	**47.01**	**92.76**	**0**
	DC MS4	104.55	52.99	104.55	0
	Point Sources/WLAs	**104.55**	**52.99**	**104.55**	**0**
	Total Nash Run	**197.31**	**100**	**197.31**	**0**
Hickey Run[2]	DC MS4	283.93	89.33	283.93	0
	DC MSGP	33.93	10.67	33.93	0
	Point Sources/WLAs	**317.85**	**100**	**317.85**	**0**
	Total Hickey Run	**317.85**	**100**	**317.85**	**0**
Kingman Lake[2]	DC MS4	100.12	100	100.12	0
	Point Sources/WLAs	**100.12**	**100**	**100.12**	**0**
	Total Kingman Lake	**100.12**	**100**	**100.12**	**0**
Popes Branch[2]	DC MS4	54.44	100	54.44	0
	Point Sources/WLAs	**54.44**	**100**	**54.44**	**0**
	Total Popes Branch	**54.44**	**100**	**54.44**	**0**
Texas Avenue Tributary[2]	DC MS4	55.55	100	55.55	0
	Point Sources/WLAs	**55.55**	**100**	**55.55**	**0**
	Total Texas Avenue Tributary	**55.55**	**100**	**55.55**	**0**
Anacostia #2[3]	Upstream Loads				
	Cumulative Load from MD-ANATF[4]	13813.01	74.69	44163.19	0*
	Cumulative Load from Tributaries	3964.15	21.43	3964.15	0
	Load from Kingman Lake	100.12	0.54	100.12	0
	Cumulative Upstream Load	**17877.28**	**96.66**	**48227.46**	**0***
	Anacostia #2 Direct Drainage				
	DC Contaminated Sites	24.63	0.13	24.63	0
	Nonpoint Sources/LAs	**24.63**	**0.13**	**24.63**	**0**
Anacostia #2[3]	Anacostia #2 Direct Drainage				
	DC MS4	420.72	2.27	420.72	0
	DC MSGP	1.57	0.01	1.57	0
	PEPCO (DC0000094)[5]	170.49	0.92	996.34	0*
	Point Sources/WLAs	**592.78**	**3.21**	**1418.63**	**0***
	Total Anacostia #2	**18494.69**	**100**	**49670.72**	**0***

Fort Stanton Tributary[2]	DC MS4	79.42	100	79.4213	0
	Point Sources/WLAs	**79.42**	**100**	**79.42**	**0**
	Total Fort Stanton Tributary	**79.42**	**100**	**79.42**	**0**
Anacostia #1[6]	Upstream Loads				
	Cumulative Load from Anacostia #2	18494.69	89.36	49670.72	0*
	Cumulative Load from Tributaries	79.42	0.38	79.4213	0
	Cumulative Upstream Load	**18574.11**	**89.74**	**49750.14**	**0***
	Anacostia #1 Direct Drainage				
	DC Contaminated Sites	467.52	2.26	467.52	0
	Nonpoint Sources/LAs	**467.52**	**2.26**	**467.52**	**0**
	Anacostia #1 Direct Drainage				
	DC CSS	481.59	2.33	481.59	0
	DC MS4	867.25	4.19	867.25	0
	DC MSGP	35.50	0.17	35.50	0
	Blue Plains WWTP (DC0021199)	111.04	0.54	85414.92	0*
	Washington Navy Yard (DC0000141)[5]	159.72	0.77	159.72	0
	Point Sources/WLAs	**1655.09**	**8.00**	**86958.97**	**0***
	Total Anacostia #1	**20696.72**	**100**	**137176.63**	**0***

[1]Upstream land based loads from the MD portion of the Nash Run watershed.

[2]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[3]Loads presented for the Anacostia #2 segment are cumulative. The loads for Anacostia #2 include loads from MD Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF), Kingman Lake, tributaries to Anacostia #2, and direct drainage.

[4]Upstream loads from the MD portion of the Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF) watershed comprising the Northeast Branch, Northwest Branch, and MD-ANATF direct drainage, as well as upstream loads from the MD portion of the Lower Beaverdam Creek, Watts Branch, and Nash Run which drain directly to DC waters.

[5]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.

[6]Loads presented for the Anacostia #1 segment are cumulative. The loads for Anacostia #1 include cumulative loads from Anacostia #2, tributaries to Anacostia #1, and direct drainage.

*Due to the endpoint selected to represent the PAH 1 group, in some cases a negative percent reduction is called for but are presented as zero because the PAHs in the PAH 1 group do not need to be reduced from those sources.

Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

Table 5-22 Annual Allocations for the PAH 2 Group in the District

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Nash Run	MD Upstream Load[1]	133.48	27.83	0	100
	DC Contaminated Sites	99.33	20.71	0	100
	Nonpoint Sources/LAs	**232.81**	**48.54**	**0**	**100**

Nash Run	DC MS4	246.81	51.46	0	100
	Point Sources/WLAs	**246.81**	**51.46**	**0**	**100**
	Total Nash Run	**479.62**	**100**	**0**	**100**
Hickey Run[2]	DC MS4	666.17	89.23	0	100
	DC MSGP	80.37	10.77	0	100
	Point Sources/WLAs	**746.54**	**100**	**0**	**100**
	Total Hickey Run	**746.54**	**100**	**0**	**100**
Kingman Lake[2]	DC MS4	234.58	100	0	100
	Point Sources/WLAs	**234.58**	**100**	**0**	**100**
	Total Kingman Lake	**234.58**	**100**	**0**	**100**
Popes Branch[2]	DC MS4	127.78	100	0	100
	Point Sources/WLAs	**127.78**	**100**	**0**	**100**
	Total Popes Branch	**127.78**	**100**	**0**	**100**
Texas Avenue Tributary[2]	DC MS4	130.92	100	0	100
	Point Sources/WLAs	**130.92**	**100**	**0**	**100**
	Total Texas Avenue Tributary	**130.92**	**100**	**0**	**100**
Anacostia #2[3]	Upstream Loads				
	Cumulative Load from MD-ANATF[4]	32392.79	73.81	5.81	99.98
	Cumulative Load from Tributaries	9445.68	21.52	0.06	100
	Load from Kingman Lake	234.58	0.53	0	100
	Cumulative Upstream Load	**42073.05**	**95.87**	**5.87**	**99.99**
	Anacostia #2 Direct Drainage				
	DC Contaminated Sites	81.08	0.18	0	100
	Nonpoint Sources/LAs	**81.08**	**0.18**	**0**	**100**
	Anacostia #2 Direct Drainage				
	DC MS4	994.83	2.27	0	100
	DC MSGP	3.75	0.01	0	100
	PEPCO (DC0000094)[5]	735.08	1.67	0.02	100
	Point Sources/WLAs	**1733.67**	**3.95**	**0.02**	**100**
	Total Anacostia #2	**43887.80**	**100**	**5.89**	**99.99**
Fort Stanton Tributary[2]	DC MS4	188.52	100	0	100
	Point Sources/WLAs	**188.52**	**100**	**0**	**100**
	Total Fort Stanton Tributary	**188.52**	**100**	**0**	**100**
Anacostia #1[6]	Upstream Loads				
	Cumulative Load from Anacostia #2	43887.80	88.22	5.89	99.99
	Cumulative Load from Tributaries	188.52	0.38	0	100
	Cumulative Upstream Load	**44076.31**	**88.60**	**5.89**	**99.99**
	Anacostia #1 Direct Drainage				
	DC Contaminated Sites	1883.21	3.79	0	100
	Nonpoint Sources/LAs	**1883.21**	**3.79**	**0**	**100**
	Anacostia #1 Direct Drainage				
	DC CSS	1145.92	2.30	0	100

Anacostia #1[6]	DC MS4	1868.80	3.76	0	100
	DC MSGP	84.43	0.17	0	100
	Blue Plains WWTP (DC0021199)	2.22	0	2.22	0
	Washington Navy Yard (DC0000141)[5]	685.23	1.38	0	100
	Point Sources/WLAs	**3786.60**	**7.61**	**2.22**	**99.94**
	Total Anacostia #1	**49746.12**	**100**	**8.11**	**99.98**

[1]Upstream land based loads from the MD portion of the Nash Run watershed.

[2]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[3]Loads presented for the Anacostia #2 segment are cumulative. The loads for Anacostia #2 include loads from MD Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF), Kingman Lake, tributaries to Anacostia #2, and direct drainage.

[4]Upstream loads from the MD portion of the Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF) watershed comprising the Northeast Branch, Northwest Branch, and MD-ANATF direct drainage, as well as upstream loads from the MD portion of the Lower Beaverdam Creek, Watts Branch, and Nash Run which drain directly to DC waters.

[5]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.

[6]Loads presented for the Anacostia #1 segment are cumulative. The loads for Anacostia #1 include cumulative loads from Anacostia #2, tributaries to Anacostia #1, and direct drainage.

Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

Table 5-23 Annual Allocations for the PAH 3 Group in the District

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Nash Run	MD Upstream Load[1]	109.544	27.52	0	100
	DC Contaminated Sites	85.432	21.46	0	100
	Nonpoint Sources/LAs	**194.976**	**48.98**	**0**	**100**
	DC MS4	203.136	51.02	0	100
	Point Sources/WLAs	**203.136**	**51.02**	**0**	**100**
	Total Nash Run	**398.112**	**100**	**0**	**100**
Hickey Run[2]	DC MS4	548.047	89.33	0	100
	DC MSGP	65.433	10.67	0	100
	Point Sources/WLAs	**613.480**	**100**	**0**	**100**
	Total Hickey Run	**613.480**	**100**	**0**	**100**
Kingman Lake[2]	DC MS4	194.646	100	0	100
	Point Sources/WLAs	**194.646**	**100**	**0**	**100**
	Total Kingman Lake	**194.646**	**100**	**0**	**100**
Popes Branch[2]	DC MS4	105.882	100	0	100
	Point Sources/WLAs	**105.882**	**100**	**0**	**100**
	Total Popes Branch	**105.882**	**100**	**0**	**100**

Texas Avenue Tributary[2]	DC MS4	108.108	100	0	100
	Point Sources/WLAs	**108.108**	**100**	**0**	**100**
	Total Texas Avenue Tributary	**108.108**	**100**	**0**	**100**
Anacostia #2[3]	Upstream Loads				
	Cumulative Load from MD-ANATF[4]	26746.870	73.91	0.616	100
	Cumulative Load from Tributaries	7768.875	21.47	0.006	100
	Load from Kingman Lake	194.646	0.54	0	100
	Cumulative Upstream Load	**34710.390**	**95.91**	**0.622**	**100**
	Anacostia #2 Direct Drainage				
	DC Contaminated Sites	67.567	0.19	0	100
	Nonpoint Sources/LAs	**67.567**	**0.19**	**0**	**100**
	Anacostia #2 Direct Drainage				
	DC MS4	818.190	2.26	0	100
	DC MSGP	3.075	0.01	0	100
	PEPCO (DC0000094)[5]	590.125	1.63	0.002	100
	Point Sources/WLAs	**1411.390**	**3.90**	**0**	**100**
	Total Anacostia #2	**36189.346**	**100**	**0.624**	**100**
Fort Stanton Tributary[2]	DC MS4	154.676	100	0	100
	Point Sources/WLAs	**154.676**	**100**	**0**	**100**
	Total Fort Stanton Tributary	**154.676**	**100**	**0**	**100**
Anacostia #1[6]	Upstream Loads				
	Cumulative Load from Anacostia #2	36189.346	88.31	0.624	100
	Cumulative Load from Tributaries	154.676	0.38	0	100
	Cumulative Upstream Load	**36344.022**	**88.68**	**0.624**	**100**
	Anacostia #1 Direct Drainage				
	DC Contaminated Sites	1540.955	3.76	0	100
	Nonpoint Sources/LAs	**1540.955**	**3.76**	**0**	**100**
	Anacostia #1 Direct Drainage				
	DC CSS	936.299	2.28	0	100
	DC MS4	1533.128	3.74	0	100
	DC MSGP	68.740	0.17	0	100
	Blue Plains WWTP (DC0021199)	0.222	0	0.222	0
	Washington Navy Yard (DC0000141)[5]	558.308	1.36	0	100
	Point Sources/WLAs	**3096.698**	**7.56**	**0.222**	**100**
	Total Anacostia #1	**40981.675**	**100**	**0.846**	**100**

[1]Upstream land based loads from the MD portion of the Nash Run watershed.

[2]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[3]Loads presented for the Anacostia #2 segment are cumulative. The loads for Anacostia #2 include loads from MD Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF), Kingman Lake, tributaries to Anacostia #2, and direct drainage.

[4]Upstream loads from the MD portion of the Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF) watershed comprising the Northeast Branch, Northwest Branch, and MD-ANATF direct drainage, as well as upstream loads from the MD portion of the Lower Beaverdam Creek, Watts Branch, and Nash Run which drain directly to DC waters.

[5]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.
[6]Loads presented for the Anacostia #1 segment are cumulative. The loads for Anacostia #1 include cumulative loads from Anacostia #2, tributaries to Anacostia #1, and direct drainage.
Note 1: The MOS is implicit.
Note 2: Columns may not precisely add to totals due to rounding.

Table 5-24 Annual Allocations for Zinc in the District

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Anacostia #2[1]	Upstream Loads				
	Cumulative Load from MD-ANATF[2]	1855828.51	76.78	1855828.51	0
	Cumulative Load from Tributaries	479789.86	19.85	471703.62	1.69
	Load from Kingman Lake	12530.61	0.52	12530.61	0
	Cumulative Upstream Load	**2348148.98**	**97.15**	**2340062.74**	**0.34**
	Anacostia #2 Direct Drainage				
	DC Contaminated Sites	2625.83	0.11	778.48	70.35
	Nonpoint Sources/LAs	**2625.83**	**0.11**	**778.48**	**70.35**
	Anacostia #2 Direct Drainage				
	DC MS4	50552.34	2.09	50552.34	0
	DC MSGP	183.70	0.01	183.70	0
	PEPCO (DC0000094)[3]	15646.72	0.65	11970.34	23.50
	Point Sources/WLAs	**66382.76**	**2.75**	**62706.38**	**5.54**
	Total Anacostia #2	**2417157.57**	**100**	**2403547.60**	**0.56**
Anacostia #1[4]	Upstream Loads				
	Cumulative Load from Anacostia #2	2417157.57	84.90	2403547.60	0.56
	Cumulative Load from Tributaries	9627.02	0.34	9627.02	0
	Cumulative Upstream Load	**2426784.59**	**85.24**	**2413174.63**	**0.56**
	Anacostia #1 Direct Drainage				
	DC Contaminated Sites	50298.08	1.77	21807.81	56.64
	Nonpoint Sources/LAs	**50298.08**	**1.77**	**21807.81**	**56.64**
	Anacostia #1 Direct Drainage				
	DC CSS	57035.19	2.00	57035.19	0
	DC MS4	93921.19	3.30	93921.19	0
	DC MSGP	3997.18	0.14	3997.18	0
	Blue Plains WWTP (DC0021199)	200178.41	7.03	200178.41	0
	Washington Navy Yard (DC0000141)[3]	14809.86	0.52	10038.46	32.22
	Point Sources/WLAs	**369941.84**	**12.99**	**365170.44**	**1.29**
	Total Anacostia #1	**2847024.51**	**100**	**2800152.88**	**1.65**

[1]Loads presented for the Anacostia #2 segment are cumulative. The loads for Anacostia #2 include loads from MD Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF), Kingman Lake, tributaries to Anacostia #2, and direct drainage.
[2]Upstream loads from the MD portion of the Anacostia Tidal Fresh Chesapeake Bay Segment (MD-ANATF) watershed comprising the Northeast Branch, Northwest Branch, and MD-ANATF direct drainage, as well as upstream loads from the MD portion of the Lower Beaverdam Creek, Watts Branch, and Nash Run which drain directly to DC waters.
[3]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.
[4]Loads presented for the Anacostia #1 segment are cumulative. The loads for Anacostia #1 include cumulative loads from Anacostia #2, tributaries to Anacostia #1, and direct drainage.

Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

5.7 Margin of Safety

The margin of safety (MOS) is the portion of the pollutant loading reserved to account for any uncertainty in the load estimates and the simulation process affecting pollutant fate and transport. There are two ways to incorporate the MOS (U.S. EPA 1991): (1) implicitly by using conservative model assumptions to develop allocations or (2) explicitly by specifying a portion of the TMDL as the MOS and using the remainder for allocations. The modeling framework applied to develop these TMDLs was calibrated against monitoring data collected throughout the watershed and impaired waterbodies. Although these monitoring data represented actual conditions, they were not of a continuous time series and might not have captured the full range of in-stream conditions that occurred during the simulation period. An implicit MOS was selected to account for those cases where monitoring might not have captured the full range of in-stream conditions.

There is an implicit margin of safety achieved through the adoption of conservative analyses and modeling assumptions. Conservative assumptions include the following:

- Represented regulated WWTPs' WLAs at the maximum allowable permitted concentration as opposed to actual discharges from the WWTP.
- Modeled total DDT and used the most stringent of the degradate criteria (DDE) as the TMDL endpoint for allocations. Using the most stringent of the degradate criteria as the endpoint ensures that the criterion for that individual most stringent degradate is met, but further, is more protective than required for the other DDT degradates with less stringent criteria. The TMDL ensures that the sum of all degradates of DDT will not exceed the criteria associated with the most stringent degradate, meaning that the degradates individually will be below their criteria threshold, especially those degradates with less stringent criteria.
- Grouped the 13 PAHs in three groups based on ring structure and used the most stringent criterion within each group as the TMDL endpoint for allocations. Using the most stringent criterion to represent an entire PAH group as the TMDL endpoint ensures that the criterion for that individual most stringent PAH is met, but further, is more protective than required for the other individual PAHs within that group with less stringent criteria. Similar to above, the TMDL ensures that the sum of all PAHs within each group will not exceed the criterion associated with the most stringent PAH, meaning that each PAH individually will be below their criteria

threshold, especially those with criteria that are less stringent than the most stringent PAH in that group.

- Developed the TMDLs based on the entire simulated period of 2014-2017 to incorporate the widest range in environmental conditions, rather than a shorter period of time which may not include relatively wet or dry periods. A review of the associated weather data showed that the 2014-2017 simulation period captured a wide range of conditions and included high and low river flow periods.
- Used one set of TMDL endpoints across the entire watershed, even though MD's criteria (expressed at 10^{-5}) are an order of magnitude less stringent than those in DC (expressed at 10^{-6}). This was necessary to ensure that the endpoints were met in downstream DC waters, but also resulted in more stringent allocations in MD.
- For NPDES facilities that had no DMR monitoring data for use in setting existing conditions, represented all pollutant concentrations at criteria except for PAH 1[1].
- When water quality monitoring data recorded a non-detect, concentrations were applied at half the detection limit during model setup and calibration. This overestimates baseline concentrations when toxicant values fell below half the detection limit.

5.8 Critical Conditions and Seasonal Variations

EPA regulations [40 C.F.R. 130.7(c)(1)] require TMDLs to take into account critical conditions for stream flow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality and designated uses of the waterbodies are protected during periods when they are most vulnerable. Critical conditions include combinations of environmental factors that result in attaining and maintaining the endpoints and have an acceptably low frequency of occurrence (U.S. EPA 2001). Critical conditions for stream flow, loading, and water quality parameters are captured in the modeling framework for these TMDLs.

Toxic pollutant TMDLs for the Anacostia River watershed adequately address critical conditions for flow through the use of a dynamic model and analysis of all flow conditions in the basin. Available water quality and flow data show that critical conditions for toxic parameters in the watershed occur under all conditions (i.e., under both low flow and high flow scenarios). For example, during wet periods with high flow, stormwater runoff results in water quality exceedances while during dry periods, flux from contaminated bed sediments result in water quality exceedances. Therefore, the use of a dynamic modeling application capable of representing conditions resulting from both low and high flow regimes is appropriate. In addition, the dynamic modeling platform simulates water quality on an hourly time step, ensuring that acute conditions, as well as long-term conditions, are considered.

The linkage of the tidal Anacostia River to a dynamic watershed loading model ensures that nonpoint and stormwater source loads from the watershed delivered at times other than the critical period were also considered in the analysis. The TMDLs are based on the entire modeled period of 2014 through 2017.

[1] Criteria for PAH1 is sufficiently high (5 orders of magnitude higher than other parameters) that setting it to criteria had a disproportional effect on the model results. Consequently, facilities with no PAH1 monitoring data were set to the maximum detection limit of 0.065 µg/L.

Critical conditions for toxic pollutant loads were also considered by determining WLAs based on maximum flows from dischargers set by design flows specified in NPDES permits for each facility. Use of design flows in TMDL determination provides additional assurance that when design flows are reached, the water quality in the stream will meet the TMDL endpoints.

Model simulation of multiple complete years accounted for seasonal variations. Continuous simulation (modeling over a period of several years that captured precipitation extremes) inherently considers seasonal hydrologic and source loading variability. The pollutant concentrations were simulated on a sub-daily time step, capturing seasonal variation, and allowing for evaluation of critical conditions.

6 PUBLIC PARTICIPATION

This section will be updated after the public comment period and prior to final submission to EPA.

The availability of draft TMDLs was advertised in the D.C. Register beginning on _____, 2021 and the Washington Post on _____, 2021. The electronic documents were also posted on DOEE's and MDE's internet sites at https://doee.dc.gov/service/total-maximum-daily-load-tmdl-documents and https://mde.maryland.gov/programs/Water/TMDL/DraftTMDLforPublicComment/Pages/index.aspx, respectively. Interested parties are invited to submit comments during the public comment period, which began on ____, 2021, and will end on _____, 2021.

In addition to the formal public comment period to present the draft TMDLs, DOEE, MDE, and EPA presented on TMDL development progress to the Metropolitan Washington Council of Government's Anacostia Watershed Restoration Partnership (AWRP) on September 25, 2018. Attendees included federal, state, and local government agencies as well as local non-profit environmental organizations.

Furthermore, at several AWRP Management Committee and Anacostia Toxic Source Workgroup meetings, on November 27, 2018, June 6, 2019, June 27, 2019, and March 8, 2021, DOEE, MDE, and EPA provided brief updates to AWRP regarding the progress of TMDL development to inform stakeholders. Lastly, MDE identified and contacted stakeholders about the heptachlor epoxide TMDLs within the Maryland portion of the watershed and hosted an informational meeting with stakeholders at their request.

7 REASONABLE ASSURANCE FOR TMDL IMPLEMENTATION

Section 303(d) of the Clean Water Act (CWA) requires that a TMDL be "established at a level necessary to implement the applicable water quality standard". According to 40 C.F.R. § 130.2(i), "[i]f best management practices or other nonpoint source pollution controls make more stringent load allocations practicable, then wasteload allocations can be made less stringent". Providing reasonable assurance that nonpoint source control measures will achieve expected load reductions increases the probability that the pollution reduction levels specified in the TMDL will be achieved and, therefore, applicable WQS will be attained. Neither the CWA nor current EPA regulations direct states to develop a detailed implementation plan as part of the TMDL development and approval process.

When a TMDL is developed for waters impaired by point sources, the issuance of a NPDES permit(s) provides the reasonable assurance that the wasteload allocations contained in the TMDL will be achieved. This is because 40 C.F.R. § 122.44(d)(1)(vii)(B) requires that effluent limits in permits be consistent with "the assumptions and requirements of any available wasteload allocation" in an EPA-approved TMDL. As the EPA Environmental Appeals Board has recognized, "WLAs are not permit limits per se; rather they still require translation into permit limits" In re City of Moscow, NPDES Appeal No. 00-10 (July 27, 2001). In providing such translation, the Environmental Appeals Board said that "[w]hile the governing regulations require consistency, they do not require that the permit limitations that will finally be adopted in a final NPDES permit be identical to any of the WLAs that may be provided in a TMDL." *Id*. Accordingly, depending on the facts of a situation, a permit limit that is consistent with (but not identical to) a given WLA is appropriate provided that the permit limit is consistent with the operative assumptions (e.g., about the applicable WQS, the sum of the delivered point source loads) that informed the decision to establish that particular WLA. While the applicable permit effluent limits need not be identical to the WLA, it is expected that future permits will include appropriate limits and other best management practices and controls on toxicants discharged.

The reasonable assurance for the nonpoint source load allocations are presented in the following sections. These sections highlight several programs aimed to address toxic contamination within the Anacostia River watershed. In addition, these sections highlight existing and future monitoring efforts, which will aid in refining the understanding and characterization of toxic pollutant loadings in the Anacostia River watershed.

7.1 Chesapeake Bay Agreement

A new Chesapeake Bay Watershed Agreement was signed on June 16, 2014 which includes goals and outcomes for toxic contaminants (CBP 2014). The toxic contaminant goal is to "ensure that the Bay and its rivers are free of effects of toxic contaminants on living resources and human health" (CBP 2014). Objectives for the toxic contaminant outcomes regarding PCBs or pesticides include 1) characterizing the occurrence, concentrations, sources and effects of PCBs, 2) identifying best management practices (BMPs) that may provide benefits for reducing toxic contaminants in waterways, 3) improving practices and controls that reduce and prevent effects of toxic contaminants, and 4) building on existing programs to reduce the amount and effects of PCBs in the Bay and watershed. Implementation of the toxic contaminant goal and outcomes under the new Bay agreement could aid in progress toward attainment of the TMDL endpoints identified herein.

The climate resiliency goal of the Chesapeake Bay Watershed Agreement is to "increase the resiliency of the Chesapeake Bay watershed, including its living resources, habitats, public infrastructure and communities, to withstand adverse impacts from changing environmental and climate conditions" (CBP 2014). This goal addresses the impact that climate change may have on aquatic systems and acknowledges that climate change must be considered to achieve the other Watershed Agreement goals, like the toxic contaminant goal.

The Chesapeake Bay Program (CBP) also promotes water quality improvements in the basin in many ways, including monitoring, publishing water quality studies, supporting studies on or providing framework for managing toxic chemicals, and hosting numerous workshops on water-related issues. CBP's continued actions related to toxics contaminants will further aid progress towards the attainment of water quality goals in the Anacostia River.

7.2 Anacostia River Sediment Project

DOEE's ARSP, which includes about 9 miles of the tidal portion of the Anacostia River, aims to identify sediment contamination in the tidal Anacostia River, Kingman Lake, and Washington Channel. The project is following a process similar to the "Superfund Process." DOEE is remediating the river under the District's Brownfields Revitalization Amendment Act, which requires that DOEE select a remedy in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The ARSP study area, however, is not a CERCLA site.

Earlier phases of the ARSP included a Remedial Investigation and Feasibility Study (RI/FS). Through the RI, it was determined that elevated concentrations of contaminants, specifically PCBs (but also included PAHs, dioxins, heavy metals, and pesticides) from industrial, urban, and human activities, exist in sediment throughout the Anacostia River. After feedback from stakeholders on the proposed plan, DOEE released the Interim Record of Decision (ROD) in September 2020. This Interim ROD identifies and describes early actions to clean up hotspots, or the areas most contaminated by PCBs in the river. The Interim ROD estimates that cleaning up the 11 early action areas will greatly reduce contamination in the system. The ROD, however, also targets other constituents in addition to PCBs, specifically dioxin, chlordane, and dioxin-like PCBs. Areas will be remediated through a combination of carbon amendments, capping and sediment dredging, followed by post-remedial monitoring. It is expected that the remediation efforts will begin in Kingman Lake in 2023 and the Anacostia River mainstem in 2025. Estimated costs for remediating those areas is $35.5 million. More information can be found on the ARSP website: Anacostia River Sediment Project.

This large-scale ARSP will also beneficially reduce other pollutants (e.g., metals, organochlorine pesticides, and PAHs) that concurrently exist in the PCB-contaminated sediment. It is reasonable to conclude that the remediation of contaminated sediment at the 11 early actions areas that include the mainstem of the river will decrease the time it will take for water quality to approach the TMDL endpoints.

7.3 Reasonable Assurance of TMDL Implementation for the District of Columbia

This section provides the reasonable assurance that the 61 TMDLs for the various impaired segment/pollutant combinations within the Anacostia River watershed in DC will be achieved and maintained.

7.3.1 Point Source Reductions

7.3.1.1 Stormwater Load Reductions

As part of the NPDES permit requirements, the District MS4 program is required to develop a TMDL implementation plan. In May 2015, the District submitted to EPA the draft Consolidated TMDL Implementation Plan. The draft Implementation Plan was revised in response to stakeholder and EPA comments and was submitted as final in July 2016 as the DC Total Maximum Daily Load (TMDL) Consolidated Implementation Plan, hereinafter referred to simply as the DC TMDL-CIP. Because the original Anacostia River toxic pollutants TMDLs were approved by EPA in 2003, the DC TMDL-CIP incorporates the below activities, which work to address toxic contamination.

There are several ongoing initiatives throughout the District to reduce stormwater runoff, which in turn, will reduce arsenic, chlordane, copper, DDT, dieldrin, heptachlor epoxide, PAH 1, PAH 2, PAH 3, and zinc in the Anacostia River. Because the toxic pollutants bind to sediment and are transported to the Anacostia River and its tributaries during rain events, reducing stormwater runoff represents an effective strategy to reduce toxic contamination. The centerpiece of these stormwater runoff initiatives is captured in the DC TMDL-CIP and includes the retention of 1.2” rain events from new development and redevelopment projects. The impact of these regulations will be amplified through the District’s direct investment in green infrastructure and programs to promote voluntary retrofits, expand urban tree canopy, and incorporate green infrastructure features into the District capital projects, which are all programs that will all aid in reducing toxic contamination.

Under the MS4 Permit, the District implements several stormwater management and source control activities, including illicit discharge detection and elimination, enhanced street sweeping, construction site and industrial facility inspections and enforcement, and household hazardous waste collections. Implementation approaches, including BMPs that reduce loading of total suspended solids (TSS), such as structural BMPs, street sweeping, erosion and sediment control, and other practices, will be effective in reducing the pollutant loads associated with sedimentation, including the toxic pollutants addressed in these TMDLs.

In addition to these BMPs typically designed for developed areas, DOEE’s Watershed Protection Division (WPD) has developed several projects in the Anacostia watershed (e.g., Kingman Lake, Nash Run, and Pope Branch stream restoration) to restore damaged riparian areas and to educate the public on the role of riparian buffers in reducing pollution. These efforts will directly support the implementation of these TMDLs in less developed areas such as the subwatersheds east of the river by reducing pollutant loading from stormwater and sediment.

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 DC. Later in 2019, the Limitations on Products Containing Polycyclic Aromatic Hydrocarbons Amendment Act of 2018 expanded the law to include sealants containing steam cracked asphalt and any other products with PAH concentrations greater than 0.1 percent by weight on the list of banned sealant products. Violators of this ban are subject to a daily fine of up to $2,500. Contractors, property owners, and businesses that sell pavement sealant are regulated by the law. DOEE routinely inspects properties for compliance and there is a coal tar tip form that can be filled out online if a violation is suspected.

Also, if it is determined that the applicable BMPs are not being implemented and DOEE reasonably believes that individual sites or facilities are causing pollution, DOEE may use enforcement action to achieve compliance with the District’s WQS. The combination of both regulatory initiatives and BMP installation should ensure continued reduction of arsenic, chlordane, copper, DDT, dieldrin, heptachlor epoxide, PAH 1, PAH 2, PAH 3, and zinc in the District’s waters.

7.3.1.2 CSO Load Reductions

To comply with its Long-Term Control Plan (LTCP), DC Water is implementing the DC Clean Rivers Project, a large (about $2.7 billion) infrastructure project to upgrade the District’s water and sewer systems to reduce nutrient discharges and CSOs to local rivers. The Clean Rivers Project is comprised of a variety of projects to control CSOs, including pumping station rehabilitations, green infrastructure, and a system of underground storage and conveyance tunnels. Construction of a 2.4 mile long storage and conveyance tunnel for the Anacostia River (the Anacostia River Tunnel) was completed in 2018. Between March 2018 and early December 2019, the Anacostia tunnel system captured about 7 billion gallons of combined sewer overflow (about 90 percent capture rate of CSOs). A second tunnel in the Anacostia watershed, the Northeast Boundary Tunnel, is expected to be completed in 2023. Upon completion, the overall tunnel system will capture 98 percent of the CSO volume that would have otherwise entered the Anacostia River and treat that water at the Blue Plains Advanced Wastewater Treatment Plant. Although intended to control CSOs, the tunnel system will also reduce the loadings of toxic pollutants to the Anacostia River.

7.3.2 Nonpoint Source Reductions

Load allocations within DC are prescribed only for the identified contaminated sites. The District has several legacy contaminated sites (Table 3-1), several of which are federal facilities, in its portion of the Anacostia River watershed whose remediation will result in a reduction of toxic pollutant loads to the Anacostia River. For example, environmental investigations at Poplar Point found that soils were contaminated with metals, pesticides, PCBs, and PAHs. A remedial investigation and feasibility study is being conducted by the District with oversight from the National Park Service. RI field activities begun in 2018 and the report is scheduled to be complete in 2021. The feasibility study and a proposed plan to clean up the site will follow in future years. It is expected that the plan will be beneficial to TMDL endpoints. Other site studies that may be beneficial to TMDL endpoints include ongoing work at PEPCO, Washington Gas and Light East Station, and the Navy Yard. These sites are being investigated under regulatory agreements. Clean up at CSX Benning Yard is covered by a separate legal agreement (DOEE 2020) and that work may result in reducing toxic pollutant loads to the river.

For areas that do not have ongoing studies, the Interim Record of Decision associated with DOEE's ARSP (See Section 7.2) has identified 11 early action areas where PCB and associated pollutant (e.g., chlordane) contamination will be reduced using carbon amendments, dredging and capping of contaminated sediments. DOEE is undertaking remediation in accordance with the District's Brownfields Revitalization Amendment Act, CERCLA, as amended by the Superfund Amendments and Reauthorization Act, and the National Oil and Hazardous Substances Pollution Contingency Plan (DOEE 2020).

7.3.3 Monitoring

To refine the contribution of each of the addressed pollutants (i.e., arsenic, chlordane, copper, DDT, dieldrin, heptachlor epoxide, PAH 1, PAH 2, PAH 3, and zinc) from each source for purposes of improving control actions and management, DOEE will undertake additional post-TMDL monitoring. This will include compiling and analyzing data to evaluate progress toward attaining the TMDL endpoints. Post-TMDL monitoring will help DOEE determine whether planned control actions are performing as intended, or whether further measures need to be implemented as described below. Post-TMDL monitoring also supports adaptive management (see Section 7.5).

DOEE monitors the concentrations of arsenic, chlordane, copper, DDT, dieldrin, heptachlor epoxide, PAH 1, PAH 2, PAH 3, and zinc in fish tissue as funding is available and uses the results to determine use support for Class D Waters (protection of human health, as it relates to fish consumption) including issuing new fish consumption advisories, if necessary. Currently, there are no species of fish in the

District's waters having action-level (i.e., elevated) DDT; eight species with elevated dieldrin; and 12 species with elevated heptachlor epoxide.

DOEE's continued monitoring of these toxic pollutants provides, and will continue to provide, important information to stakeholders and District residents from a public health perspective. At the same time, given that the legacy pollutants are no longer actively used in the District and are expected to decline over time, data will be analyzed to assess trends and/or progress toward the associated TMDL endpoints.

In total, there are four individual process water NPDES permits (i.e., DC0000094, DC0000141, DC0000175 and DC0021199) in the District that are directly relevant to this TMDL. The District also has an additional 49 industrial facilities covered under the MSGP which may or may not have a direct impact on these TMDLs. Each of these NPDES permits has associated monitoring requirements, some of which include a subset of the pollutants that are addressed in these TMDLs. For example, DOEE monitors for metals as required by DC's NPDES MS4 permit (DC0000221). Monitoring data collected under these NPDES permits can be used to further assess trends in the Anacostia River and progress towards the implementation of these TMDLs.

7.4 Reasonable Assurance of TMDL Implementation for Maryland

This section provides the basis for reasonable assurance that the heptachlor epoxide TMDL for the Northwest Branch and MD-ANATF tidal segment will be achieved and maintained.

7.4.1 Point Source Reductions

Aggregated NPDES regulated stormwater WLA reduction has been allocated to Prince George's and Montgomery County, respectively. Phase I MS4 permittees for these counties as well State Highway Administration (SHA) will be required to develop heptachlor epoxide MS4 WLA implementation plans within one year of TMDL approval by EPA for land area regulated under their respective MS4 permits. The success of the implementation process will depend in large part on the feasibility of locating and evaluating opportunities to control on-land sources of heptachlor epoxide, such as unidentified contaminated sites and contaminated soil or sediment. MDE will assist the counties and SHA in the development of source trackdown studies to identify on-land areas of heptachlor epoxide contamination that is being transported through their stormwater conveyance system, responsible for polluting downstream water quality. MDE will be required to identify the entities responsible for the contamination and determine through which regulatory programs (i.e., NPDES, CERCLA) the sources will be addressed.

In addition, Phase I MS4 permits include an impervious surface restoration requirement to address WLAs for nutrients and sediments. The counties have been implementing BMPs to reduce stormwater loadings of TSS and nutrients to address this requirement. Heptachlor epoxide is known to adsorb to sediments, specifically the organic carbon fraction. Therefore, BMPs which capture sediments will also provide a secondary benefit in reducing heptachlor epoxide loadings into the Northwest Branch of the Anacostia River and ANATF tidal segment.

While heptachlor and technical chlordane are no longer being applied, there is still the possibility that it is being applied illicitly by residential homeowners or commercial/industrial operations where the pesticides remain in storage. Counties may develop an outreach program under their implementation plan to inform the public not to apply these pesticides and to dispose of them properly. County programs are already in place for disposal of household hazardous wastes, including pesticides, either at drop-off locations or during annual collection events.

7.4.2 Nonpoint Source Reductions

The Chesapeake Bay Trust (CBT) Pooled Monitoring Initiative's Restoration Research Program requested that the scientific community develop proposals to research the removal effectiveness of traditional and innovative stormwater practices on pollutants of emerging concern. While the focus of the research to date has primarily been on PCBs, the innovative stormwater practices being investigated under this program also have the potential to address heptachlor epoxide as the two pollutants are both organochlorinated compounds and have similar chemical activity as they adsorb strongly to the organic carbon fraction of sediments. This research could inform the stormwater management decisions by the counties to incorporate innovative practices in their BMP design to enhance the capture of organic contaminants such as PCBs, heptachlor epoxide, and other toxic pollutants. Innovative practices currently being researched by the scientific community include activated carbon and biological amendments of stormwater practices and in-situ sediments to capture and enhance microbial degradation of these contaminants thus eliminating their transport and bioavailability in aquatic systems.

7.4.3 Monitoring

Given the persistent nature of heptachlor epoxide and significant watershed load reductions necessary to achieve water quality goals in the Northwest Branch of the Anacostia River and ANATF segments, effectiveness of the implementation effort will need to be reevaluated throughout the process to ensure progress is being made towards reaching the TMDLs. MDE periodically monitors and evaluates concentrations of contaminants in recreationally caught fish throughout Maryland to inform fish consumption advisories and listing assessment under Maryland's IR. MDE will use this monitoring program to evaluate progress towards meeting the "fishing" designated use within the Northwest Branch of the Anacostia River and ANATF tidal segment.

7.5 Adaptive Management

The presence of heptachlor epoxide contamination throughout the Anacostia River watershed and the other contaminants throughout the DC portion of the watershed coupled with the significant load reductions required to meet TMDL endpoints, makes an adaptive approach of implementation feasible and reasonable, with subsequent monitoring to assess the effectiveness of the ongoing implementation efforts to support the "fishing" designated use. Based on these evaluations, the jurisdictions may choose to modify the programs and BMPs as necessary to ensure that TMDL endpoints are met.

7.6 Natural Attenuation

Given that legacy pollutants such as chlordane, dieldrin, DDT, and heptachlor epoxide are banned and therefore are no longer actively applied within the watershed legally, it is reasonable to expect that the concentrations of these pollutants will decline in the environment over time through natural attenuation. A decline in soil concentrations over time will lead to lower water concentrations (dissolved and particulate fractions) in waterbodies. Instream processes such as burial of contaminated sediments with newer, less contaminated material, scour and export of sediments during periods of high stream flow, and natural degradation will also contribute to the decline of these pollutants over time. These processes occur naturally within the environment. However, natural attenuation often requires decades before a significant improvement is observable. For this reason, there will be a complementary focus on BMPs implementation and source control efforts.

Aside from the processes of natural attenuation, remediation of contaminated sediments (i.e., dredging, capping, carbon amendments) is an alternative approach that can reduce the concentrations of these legacy pollutants in the water column resulting from resuspension and diffusion of contamination in the bed sediments. Watershed load reductions would still be called for under the TMDL, as ongoing sources from the Anacostia River watershed, regardless of sediment concentrations, will continue to cause TMDL endpoints in the impaired segments to be exceeded. It may be appropriate to consider remediation when current watershed loadings will not cause recontamination of sediments at levels that exceed TMDL endpoints. Under these conditions, sediment remediation could result in a shorter time frame to meet water quality criteria. Nothing in this TMDL precludes the use of dredging or other remediation efforts as a tool for achieving TMDL endpoints. In fact, it is reasonable to anticipate that instream remediation efforts will aid implementation of these TMDLs and decrease the amount of time it takes for water quality to approach the TMDL endpoints. When considering dredging and other remediation alternatives as an option, the risk versus benefit must be weighed, as the remediation of contaminated sediment may potentially damage the habitat and health of the existing benthic community in the short-term, but provide long-term benefits to habitat and water quality. This TMDL effort is unique in that a separate yet concurrent process to develop a plan for the remediation of contaminated sediment in the tidal Anacostia River is ongoing under the ARSP (see Section 7.2). The ARSP calls for sediment remediation efforts in certain toxic pollutant hotspots. These efforts will aid TMDL implementation and make progress towards achieving and maintaining applicable WQS.

8 REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR). (1995). Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. https://www.atsdr.cdc.gov/toxprofiles/tp69.pdf

ATSDR. (2002). Toxicological profile for aldrin/dieldrin. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. https://www.atsdr.cdc.gov/toxprofiles/tp1.pdf

ATSDR. (2004). Toxicological profile for copper. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. https://www.atsdr.cdc.gov/ToxProfiles/tp12.pdf

ATSDR. (2005). Toxicological profile for zinc. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. https://www.atsdr.cdc.gov/ToxProfiles/tp12.pdf

ATSDR. (2007a). Toxicological profile for arsenic. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. https://www.atsdr.cdc.gov/ToxProfiles/tp12.pdf

ATSDR. (2007b). Toxicological profile for heptachlor and heptachlor epoxide. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. https://www.atsdr.cdc.gov/ToxProfiles/tp12.pdf

ATSDR. (2018). Toxicological profile for chlordane. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. https://www.atsdr.cdc.gov/ToxProfiles/tp31.pdf

ATSDR. (2019). Toxicological profile for DDT, DDE, DDD (Draft for public comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. https://www.atsdr.cdc.gov/toxprofiles/tp35.pdf

Anacostia Watershed Restoration Partnership (AWRP). (2010). Anacostia River watershed restoration plan and report. https://ddoe.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/Appendix_C_Anacostia_Restoration_Plan_Report.pdf

Chesapeake Bay Program (CBP). (2014). Chesapeake Bay Watershed Agreement. http://www.chesapeakebay.net/documents/FINAL_Ches_Bay_Watershed_Agreement.withsignatures-HIres.pdf

Code of Federal Regulations (C.F.R.). (2016). Title 40. https://ecfr.federalregister.gov/current/title-40

Code of Maryland Regulations (COMAR). 2020a. 26.08.02.07. http://www.dsd.state.md.us/comar/comarhtml/26/26.08.02.07.htm .

COMAR. 2020b. 26.08.02.08 (O)(2)(a). http://www.dsd.state.md.us/comar/comarhtml/26/26.08.02.08.htm.

COMAR. 2020c. 26.08.02.08 (O)(5)(b). http://www.dsd.state.md.us/comar/comarhtml/26/26.08.02.08.htm

COMAR. 2020d. 26.08.02.03-2. http://www.dsd.state.md.us/comar/comarhtml/26/26.08.02.03-2.htm

COMAR. 2020e. 26.08.02.03-1 (B)(3)(n). http://www.dsd.state.md.us/comar/comarhtml/26/26.08.02.03-2.htm

District of Columbia Municipal Regulations (DCMR). (2020). Title 21-1104. https://www.dcregs.dc.gov/Common/DCMR/SectionList.aspx?SectionNumber=21-1104

District Department of the Environment (DDOE). (2012). Anacostia River watershed implementation plan (WIP). https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/Anacostia_WIP_2012_Final.pdf

District of Columbia Department of Health (DOH). (2003). Final 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. https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/ftmdl_org_metals_ana_trib_1.pdf

District of Columbia Department of Energy and Environment (DOEE). (2020). District of Columbia Water quality assessment 2020 integrated report to the Environmental Protection Agency and Congress pursuant to Sections 305(b) and 303(d) Clean Water Act (P.L. 97-117).

DOEE. (2016). Consolidated total maximum daily load (TMDL) implementation plan report. http://dcstormwaterplan.org/wp-content/uploads/0_TMDL_IP_080316_Draft_updated.pdf

DOEE. (2020). For a cleaner Anacostia River- Anacostia River Sediment Project. https://doee.dc.gov/publication/cleaner-anacostia-river-anacostia-river-sediment-project

DOEE. (2020). Interim Record of Decision. Early Action Areas in the Main Stem, Kingman Lake, and Washington Channel. Anacostia River Sediment Project. September 30, 2020.

https://www.dropbox.com/s/iunneje3g7a8l8n/Anacostia%20River%20Sediment%20Project_Interim%20Record%20of%20Decision_2020Sept30.pdf?dl=0

District Department of the Environment (DDOE). (2014). The District of Columbia water quality assessment 2014 integrated report to the Environmental Protection Agency and U.S. Congress pursuant to Sections 305(b) and 303(d) Clean Water Act (P.L. 97-117).

Environmental Appeals Board. (2001). re City of Moscow, NPDES Appeal No. 00-10.

Friends of the Earth vs. the Environmental Protection Agency, 446 F.3d 140, 144 (D.C. Cir. 2006).

Gilliom, R. J., J.E. Barbash, C.G. Crawford, P.A. Hamilton, J.D. Martin, N. Nakagaki, L.H. Nowell, J.C. Scott, P.E. Stackelberg, G.P. Thelin, and D.M Wolock. (2006). Pesticides in the nation's streams and ground water, 1992-2001. USGS. http://pubs.usgs.gov/circ/2005/1291/pdf/circ1291.pdf

Hamrick, J. M. (1992). A three-dimensional environmental fluid dynamics computer code: theoretical and computational aspects. Special report in applied marine science and ocean engineering, no. 317. Virginia Institute of Marine Science, William & Mary.

Haywood, H. C., and Buchanan, C. 2007. Total maximum daily loads of polychlorinated biphenyls (PCBs) for tidal portions of the Potomac and Anacostia Rivers in the District of Columbia, Maryland, and Virginia. Rockville, MD: Interstate Commission on the Potomac River Basin.

Maryland Department of the Environment (MDE). 2018. The 2018 Integrated Report of Surface Water Quality in Maryland. Baltimore, MD: Maryland Department of the Environment. https://mde.maryland.gov/programs/Water/TMDL/Integrated303dReports/Pages/2018IR.aspx

MDE. 2021. Land Restoration Program's Geospatial Database (LRP-MAP). Baltimore, MD: Maryland Department of the Environment. http://mdewin64.mde.state.md.us/LRP/index.html

Nowell, L. H., P. D. Capel, and P. D. Dileanis. (1999). Pesticides in stream sediment and aquatic biota. Distribution, trends, and governing factors. Pesticides in the Hydrologic System, vol. 4. New York: Lewis.

Smith, J.A., P.J. Witkowski, and T.V. Fusillo. (1998). Manmade organic compounds in the surface waters of the United States- a review of current understanding. USGS Survey Circular 1007. https://pubs.usgs.gov/circ/1988/1007/report.pdf

Tetra Tech. (2021). Draft Final Anacostia River Toxic Constituents TMDL Modeling Report. Fairfax, VA.

U.S. Environmental Protection Agency (U.S. EPA). (1991). Guidance for water quality-based decisions: The TMDL process. EPA 440/4-91-001. Washington, D.C.: Office of Water, U.S. EPA.

U.S. EPA. (1997). Toxicological review of chlordane (technical). Washington, D.C.: Office of Research and Development, U.S. EPA.

U.S. EPA. (2001). Protocol for developing pathogen TMDLs. EPA 841-R-00-002. Washington, D.C.: Office of Water, U.S. EPA.

U.S. EPA. (2002). Establishing total maximum daily load (TMDL) wasteload allocations (WLAs) for storm water sources and NPDES permit requirements based on those WLAs. Memorandum. Washington, D.C.: Office of Water, U.S. EPA.

U.S. EPA. (2006). Establishing TMDL “daily” loads in light of the decision by the U.S. Court of Appeals for the D.C. Circuit in *Friends of the Earth, Inc. v. EPA, et al.,* No. 05-5015, (April 25, 2006) and implications for NPDES permits. Washington, D.C.: Office of the Administrator, U.S. EPA.

U.S. EPA. (2009). Loading Simulation Program in C++ (LSPC) Version 3.1, EPA Region 3 and 4 User's Manual. U.S. EPA.

U.S. EPA. (2014). Estimated fish consumption rates for the U.S. population and selected subpopulations (NHANES 2003-2010). EPA-820-R-14-002. Final Report.

U.S. EPA. (2015). Human health ambient water quality criteria: 2015 update. EPA 820-F-15-001. Washington, D.C.: Office of Water, U.S. EPA.

U.S. EPA. (2014). Water Quality Standards Handbook. EPA 820-B-14-008. Washington, D.C.: Office of Water, U.S. EPA.

Van Metre, P. C., E. Callendar, and C. Fuller. (1997). Historical trends in organochlorine compounds in river basins using sediment cores from reservoirs. Environmental Science and Technology 31, 2339–2344.

Van Metre, P. C., and Mahler, B. J. (2005). Trends in hydrophobic organic contaminants in urban and reference lake sediments across the United States, 1970-2001. Environmental Science and Technology, 39(15), 5567–5574.

APPENDIX A: APPLICABLE WATER QUALITY CRITERIA

Table A-1 Applicable Numeric WQC for Metals

Criteria class	Criteria period	Criteria class category	Jurisdiction	Arsenic, dissolved (µg/L)	Copper, dissolved (µg/L)	Zinc, dissolved (µg/L)
Aquatic life	4-day avg.	CCC	DC [a]	150	8.96[b]	118.14[c]
			MD	150[d]	9[d]	120[d]
	1-hr avg.	CMC	DC [a]	340	13.44[b]	117.18[c]
			MD	340[d]	13[d]	120[d]
Human health	30-day avg. or 10 sample mean[k]	Organism	DC [a, f]	0.14[g]	—	26000
			MD	1.4[g, i]	—	26000
		DW + organism	MD	0.18[g]	1300	7400
		DW	MD	100	1300[j]	

Notes:
Header shading color indicates type of applicable criteria: Yellow = The most stringent applicable criteria for each Criteria Period; Medium blue = Applicable MD criteria that are less stringent than the downstream DC criteria; Green = Applicable MD criteria that are more stringent than the downstream DC criteria.

[a] DC Water Quality Standards (Effective May 22, 2020). The criteria for the hardness dependent pollutants (copper and zinc) calculated using the applicable formulas below.

[b] CCC CF=0.960; CMC CF=0.960; $CCC=e^{(0.8545[\ln(hardness)]-1.702)}x0.960$; $CMC=e^{(0.9422[\ln(hardness)]-1.700)}x0.960$; assuming mean hardness 100 mg/L.

[c] CCC CF=0.986; CMC CF=0.978; $CCC=e^{(0.8473[\ln(hardness)]+0.884)}x0.986$; $CMC=e^{(0.8473[\ln(hardness)]+0.844)}x0.978$; assuming mean hardness 100 mg/L.

[d] The toxicity of these pollutants is increased or decreased by hardness or pH and are subject to §D of MD regulation for determining site specific criteria.

[e] Freshwater criteria calculated using the biotic ligand model.

[f] DC Class D human health criteria for metals based on total recoverable metals.

[g] This criterion is based on carcinogenicity of 10^{-6} risk.

[h] This chemical has a criterion for organoleptic (taste and order) effects. In some cases, the organoleptic criterion may be more stringent.

[i] Criterion will be applied against the actual measurement of inorganic arsenic (As+3), rather than total arsenic.

[j] Copper is regulated by a treatment technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the action level, water systems must take additional steps.

[k] The long-term exposure component of applicable human health criteria is expressed as a 30-day average for DC and as a mean of 10 samples collected over a representative temporal period and spatial extent for MD criteria.

Table A-2 Applicable Numeric WQC for Organochlorine Pesticides

Criteria class	Criteria period	Criteria class category	Juris.	4,4 DDD (µg/L)	4,4 DDE (µg/L)	4,4 DDT (µg/L)	Chlordane (µg/L)	Dieldrin (µg/L)	Heptachlor Epoxide (µg/L)
Aquatic life	4-day avg.	CCC	DC	0.001	0.001	0.001	0.0043	0.056	0.0038
			MD	—	—	—	0.0043	0.056	0.0038
	1-hr avg.	CMC	DC	1.1	1.1	1.1	2.4	0.24	0.52
			MD	—	—	—	2.4	0.24	0.52
Human health	30-day Avg. or 10 sample mean[a]	Organism[a]	DC	0.00012	0.000018	0.000030	0.00032	0.0000012	0.000032
			MD	0.0031	0.0022	0.0022	0.0081	0.00054	0.00039
		DW + Organism[b]	MD	0.0031	0.0022	0.0022	0.008	0.00052	0.00039
		DW	MD	—	—	—	2	—	0.2

Notes:
Cell shading color indicates type of applicable criteria: Yellow = The most stringent applicable criteria for each Criteria Period; Medium blue = Applicable MD criteria that are less stringent than the downstream DC criteria.
[a] This criterion is based on carcinogenicity of 10^{-6} risk.

Table A-3 Applicable Numeric WQC for PAHs

PAH group	PAH pollutant	Aquatic life	Human health			
		4-day avg.	30-day average or 10-sample mean[a]			
		CCC	Organism		DW + organism	DW
		DC	DC	MD	MD	MD
PAH 1 (2 + 3 ring) (µg/L)	Acenaphthene	50	90	990	670	—
	Acenapthylene	—	—	—	—	—
	Anthracene	—	400	40000	8300	—
	Fluorene	—	70	5300	1100	—
	Naphthalene	600	—	—	—	—
PAH 2 (4 ring) (µg/L)	Benzo[a]anthracene	—	0.0013[c]	0.18[c]	0.038[c]	—
	Chrysene	—	0.13[c]	0.18[c]	0.038[c]	—
	Fluoranthene	400	20	140	130	—
	Pyrene	—	30	4000	830	—
PAH 3 (5 + 6 ring) (µg/L)	Benzo[a]pyrene	—	0.00013[c]	0.18[c]	0.038[c]	0.2
	Benzo[b]fluoranthene	—	0.0013[c]	0.18[c]	0.038[c]	—
	Benzo[k]fluoranthene	—	0.013[c]	0.18[c]	0.038[c]	—
	Dibenzo[a,h]anthracene	—	0.00013[c]	0.18[c]	0.038[c]	—
	Indeno[1,2,3-c,d]pyrene	—	0.0013[c]	0.18[c]	0.038[c]	—

Notes:

Cell shading color indicates type of applicable criteria: Yellow = The most stringent applicable criteria for each Criteria Period; Medium blue = Applicable MD criteria that are less stringent than the downstream DC criteria.

[a] The long-term exposure component of applicable human health criteria is expressed as a 30-day average for DC and EPA criteria and as a mean of 10 samples collected over a representative temporal period and spatial extent for MD criteria.

[b] This chemical has a criterion for organoleptic (taste and order) effects. In some cases, the organoleptic criterion may be more stringent.

[c] This criterion is based on carcinogenicity of 10^{-6} risk.

APPENDIX B: MD NPDES STORMWATER PERMITS

Table B-1 NPDES Regulated Stormwater Permit Summary in the Northwest Branch, Northeast Branch and MD-ANATF Direct Drainage[1]

MDE Permit	NPDES Permit	Facility	County	Watershed
11DP3313	MD0068276	State Highway Administration (MS4)	All Phase I	All
09GP0000	MDR100000	MDE General Permit to Construct	All	All
11DP3314	MD0068284	Prince George's County Phase I MS4	Prince George's	All
11DP3320	MD0068349	Montgomery County Phase I MS4	Montgomery	Northwest Branch & MD-ANATF Direct Drainage
03IM5500	MDR055500	Tacoma Park Phase II MS4	Montgomery	Northwest Branch
12NE0007	MDR000007	Stone Industrial Precision Products	Prince George's	Northeast Branch
12SW0267	MDR000267	Montgomery County - Colesville Depot	Montgomery	Northeast Branch
12SR0316	MDR000316	Eaton Corporation	Prince George's	Northeast Branch
12SW0338	MDR000338	MNCPPC - Martin Luther King, Jr. Park	Montgomery	Northeast Branch
12SR0466	MDR000466	The Sherwin-Williams Company - Beltsville	Prince George's	Northeast Branch
12SR0648A	MDR000648	Prince George's Scrap, Inc.	Prince George's	Northeast Branch
12SW1103	MDR001103	US Postal Service - Riverdale VMF	Prince George's	Northeast Branch
12SR1242	MDR001242	WMATA - Greenbelt Rail Yard	Prince George's	Northeast Branch
12SW1258	MDR001258	Montgomery County Schools - West Farm Depot	Montgomery	Northeast Branch
12SW1320	MDR001320	MD State Hwy Admin - Fairland Depot	Montgomery	Northeast Branch
12SW1829	MDR001829	Halle Enterprises, Inc.	Prince George's	Northeast Branch
12SW1864	MDR001864	Rolling Frito-Lay Sales - Beltsville DC	Prince George's	Northeast Branch

12SW1926A	MDR001926	Venator Materials Corporation	Prince George's	Northeast Branch
12SR2125	MDR002125	Grant County Mulch Laurel Facility	Prince George's	Northeast Branch
12SW2144	MDR002144	New Carrollton Public Works	Prince George's	Northeast Branch
12SW2145	MDR002145	City of Greenbelt-Greenbelt Lake	Prince George's	Northeast Branch
12SW2146	MDR002146	Town of Riverdale Park DPW	Prince George's	Northeast Branch
12SW2148	MDR002148	City of College Park DPW	Prince George's	Northeast Branch
12SW2150	MDR002150	City of Hyattsville	Prince George's	Northeast Branch
12SW2221	MDR002221	PCM Construction, Inc	Prince George's	Northeast Branch
12SW2318	MDR002318	Greenlight Biofuels	Prince George's	Northeast Branch
12SW2415	MDR002415	Intercounty Connector (ICC) Eastern Operations Facility	Prince George's	Northeast Branch
12SW2492	MDR002492	Martin Luther King Jr. Maintenance Yard	Montgomery	Northeast Branch
12SW2530A	MDR002530	Sun Services on Somerset Ave	Prince George's	Northeast Branch
12SW3130	MDR003130	East-West Motors	Prince George's	Northeast Branch
12SW3138	MDR003138	Cohen Recycling	Prince George's	Northeast Branch
12SW3198	MDR003198	Encore Recycling	Prince George's	Northeast Branch
12SW3281	MDR003281	University of Maryland, College Park	Prince George's	Northeast Branch
12SW3292	MDR003292	Storm Oil, LLC	Prince George's	Northeast Branch
12SW3335	MDR003335	Bates Trucking Company	Prince George's	Northeast Branch
12SW3350	MDR003350	Washington Air Compressor Rental	Prince George's	Northeast Branch
12SW0289	MDR000289	Montgomery College - Takoma Park	Montgomery	Northwest Branch
12SW0341	MDR000341	MNCPPC - Olney Manor Park Maintenance Yard	Montgomery	Northwest Branch
12SW0343	MDR000343	MNCPPC - Wheaton Regional Park	Montgomery	Northwest Branch

12SW0389	MDR000389	MNCPPC - Brookside Gardens Maintenance Yard	Montgomery	Northwest Branch
12SW0522	MDR000522	Silver Spring Maint Transp Depoit Facil	Montgomery	Northwest Branch
12SW1234	MDR001234	Coca-Cola Silver Spring	Montgomery	Northwest Branch
12SR1241	MDR001241	WMATA - Glenmont Yard	Montgomery	Northwest Branch
12SW3410	MDR003410	City of Takoma Park Department of Public Works	Montgomery	Northwest Branch
12SR0008	MDR000008	Airgas East, Inc.	Prince George's	MD-ANATF Direct Drainage
12SW1093	MDR001093	Lawrence Street Industry, LLC	Prince George's	MD-ANATF Direct Drainage
12SW1357	MDR001357	Metro Re-Uz-It Company, Inc.	Prince George's	MD-ANATF Direct Drainage
12SR1735	MDR001735	WSSC - Anacostia Equipment Shop	Prince George's	MD-ANATF Direct Drainage
12SR1736	MDR001736	WSSC - Anacostia Garage	Prince George's	MD-ANATF Direct Drainage
12SW1745	MDR001745	D C Materials	Prince George's	MD-ANATF Direct Drainage
12SW2352	MDR002352	Recycle One Processing & Transfer Station	Prince George's	MD-ANATF Direct Drainage
12SW3346	MDR003346	IESI MD Corp	Prince George's	MD-ANATF Direct Drainage

[1]Although not listed in this table, some individual process water permits incorporate stormwater requirements and are accounted for within the NPDES Stormwater WLA, as well as additional Phase II permitted MS4s, such as military bases, hospitals, etc.

APPENDIX C: UNIMPAIRED SEGMENTS

Allocations are presented for the below unimpaired segments for heptachlor epoxide in MD and for all toxic pollutants in DC. These unimpaired waters do not require TMDLs because they are not listed as impaired for the associated pollutants; however, the allocations presented below are incorporated into the TMDLs provided in Section 5 in the above TMDL report. Therefore, the reductions presented below are required to meet downstream water quality in the tidal mainstem Anacostia River (and are also included within the TMDL allocation tables in Section 5 of the TMDL report).

Table C-1 Daily Loads for Unimpaired Maryland Segments for Heptachlor Epoxide

Segment	LA (g/day)	WLA (g/day)	Heptachlor Epoxide TMDL (g/day)
MD Northeast Branch Anacostia River	0.0109	0.5527	0.5637

Note: The MOS is implicit.

Table C-2 Daily Loads for Unimpaired District of Columbia Segments for Heptachlor Epoxide

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	Heptachlor Epoxide TMDL (g/day)
Lower Beaverdam Creek	N/A	0.0010	0.0650	0.0660
Hickey Run[1]	DCTHR01R_00	0	0.0084	0.0084
Watts Branch[2]	DCTWB00R_01, DCTWB00R_02	0.0002	0.0163	0.0166
Kingman Lake[1]	DCAKL00L_00	0	0.0045	0.0045
Fort Chaplin Run[1]	DCTFC01R_00	0	0.0025	0.0025
Fort Dupont Creek	DCTDU01R_00	0.0001	0.0039	0.0041
Fort Davis Tributary[1]	DCTFD01R_00	0	0.0020	0.0020
Fort Stanton Tributary[1]	DCTFS01R_00	0	0.0015	0.0015

[1]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[2]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

Note: The MOS is implicit.

Table C-3 Daily Loads for Unimpaired District of Columbia Segments for Arsenic

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	Arsenic TMDL (g/day)
Lower Beaverdam Creek	N/A	3.99	183.14	187.12
Hickey Run[1]	DCTHR01R_00	0	17.34	17.34

Watts Branch[2]	DCTWB00R_01, DCTWB00R_02	0.27	36.13	36.40
Popes Branch[1]	DCTPB01R_00	0	6.34	6.34

[1]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[1]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

Note: The MOS is implicit.

Table C-4 Daily Loads for Unimpaired District of Columbia Segments for Chlordane

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	Chlordane TMDL (g/day)
Lower Beaverdam Creek	N/A	0.007	0.348	0.355
Fort Chaplin Run[1]	DCTFC01R_00	0	0.012	0.012
Fort Dupont Creek	DCTDU01R_00	0.001	0.019	0.020
Fort Davis Tributary[1]	DCTFD01R_00	0	0.009	0.009
Fort Stanton Tributary[1]	DCTFS01R_00	0	0.005	0.005

[1]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

Note: The MOS is implicit.

Table C-5 Daily Loads for Unimpaired District of Columbia Segments for Copper

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	Copper TMDL (g/day)
Lower Beaverdam Creek	N/A	827.73	40814.71	41642.44
Nash Run	DCTNA01R_00	40.31	3284.78	3325.09
Hickey Run[1]	DCTHR01R_00	0	5511.16	5511.16
Watts Branch[2]	DCTWB00R_01, DCTWB00R_02	58.26	8989.97	9048.23
Kingman Lake[1]	DCAKL00L_00	0	3241.45	3241.45
Fort Chaplin Run[1]	DCTFC01R_00	0	1502.56	1502.56
Fort Dupont Creek	DCTDU01R_00	29.34	2697.59	1201.46
Popes Branch[1]	DCTPB01R_00	0	1557.63	1557.63
Fort Davis Tributary[1]	DCTFD01R_00	0	1201.46	1201.46
Texas Avenue Tributary[1]	DCTTX27R_00	0	1269.53	1269.53
Fort Stanton Tributary[1]	DCTFS01R_00	0	850.50	850.50

[1]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[2]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

Note: The MOS is implicit.

Table C-6 Daily Loads for Unimpaired District of Columbia Segments for DDT and its Degradants

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	DDT TMDL (g/day)
Lower Beaverdam Creek	N/A	0.0004	0.0220	0.0224
Nash Run	DCTNA01R_00	0.0014	0.0034	0.0048
Watts Branch[1]	DCTWB00R_01, DCTWB00R_02	0.0012	0.0083	0.0095
Fort Chaplin Run[2]	DCTFC01R_00	0	0.0009	0.0009
Fort Dupont Creek	DCTDU01R_00	0.0002	0.0019	0.0021
Fort Davis Tributary[2]	DCTFD01R_00	0	0.0007	0.0007
Fort Stanton Tributary[2]	DCTFS01R_00	0	0.0004	0.0004

[1]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

[2]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

Note: The MOS is implicit.

Table C-7 Daily Loads for Unimpaired District of Columbia Segments for Dieldrin

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	Dieldrin TMDL (g/day)
Lower Beaverdam Creek	N/A	0	0.0001	0.0001
Hickey Run[1]	DCTHR01R_00	0	0	0
Kingman Lake[1]	DCAKL00L_00	0	0	0
Fort Chaplin Run[1]	DCTFC01R_00	0	0	0
Fort Dupont Creek	DCTDU01R_00	0	0	0
Popes Branch[1]	DCTPB01R_00	0	0	0
Fort Davis Tributary[1]	DCTFD01R_00	0	0	0
Fort Stanton Tributary[1]	DCTFS01R_00	0	0	0

[1]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

Note: The MOS is implicit.

Table C-8 Daily Loads for Unimpaired District of Columbia Segments for the PAH 1 Group

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	PAH 1 TMDL (g/day)
Lower Beaverdam Creek	N/A	6.29	305.49	311.78
Watts Branch[1]	DCTWB00R_01, DCTWB00R_02	5.82	77.43	83.26
Fort Chaplin Run[2]	DCTFC01R_00	0	9.80	9.80
Fort Dupont Creek	DCTDU01R_00	3.63	11.33	14.96
Fort Davis Tributary[2]	DCTFD01R_00	0	7.72	7.72

[1]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

[2]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

Note: The MOS is implicit.

Table C-9 Daily Loads for Unimpaired District of Columbia Segments for the PAH 2 Group

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	PAH 2 TMDL (g/day)
Lower Beaverdam Creek	N/A	0.005	0.056	0.061
Watts Branch[1]	DCTWB00R_01, DCTWB00R_02	0	0.010	0.010
Fort Chaplin Run[2]	DCTFC01R_00	0	0	0
Fort Dupont Creek	DCTDU01R_00	0	0	0
Fort Davis Tributary[2]	DCTFD01R_00	0	0	0

[1]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

[2]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

Note: The MOS is implicit.

Table C-10 Daily Loads for Unimpaired District of Columbia Segments for the PAH 3 Group

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	PAH 3 TMDL (g/day)
Lower Beaverdam Creek	N/A	0.0004	0.0057	0.0061
Watts Branch[1]	DCTWB00R_01, DCTWB00R_02	0	0.0010	0.0010
Fort Chaplin Run[2]	DCTFC01R_00	0	0	0
Fort Dupont Creek	DCTDU01R_00	0	0	0
Fort Davis Tributary[2]	DCTFD01R_00	0	0	0

[1]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

[2]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

Note: The MOS is implicit.

Table C-11 Daily Loads for Unimpaired District of Columbia Segments for Zinc

Segment	Assessment Unit ID	LA (g/day)	WLA (g/day)	Zinc TMDL (g/day)
Lower Beaverdam Creek	N/A	928.04	44578.49	45506.53
Nash Run	DCTNA01R_00	169.18	3748.62	3917.80
Hickey Run[1]	DCTHR01R_00	0	5931.06	5931.06

Watts Branch[2]	DCTWB00R_01, DCTWB00R_02	171.30	10459.71	10631.00
Kingman Lake[1]	DCAKL00L_00	0	3042.12	3042.12
Fort Chaplin Run[1]	DCTFC01R_00	0	1495.19	1495.19
Fort Dupont Creek	DCTDU01R_00	256.53	2198.98	2455.51
Popes Branch[1]	DCTPB01R_00	0	1463.03	1463.03
Fort Davis Tributary[1]	DCTFD01R_00	0	1184.34	1184.34
Texas Avenue Tributary[1]	DCTTX27R_00	0	1264.35	1264.35
Fort Stanton Tributary[1]	DCTFS01R_00	0	852.92	852.92

[1]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[2]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

Note: The MOS is implicit.

Table C-12 Annual Loads for Unimpaired Maryland Segments for Heptachlor Epoxide

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
MD Northeast Branch Anacostia River	MD Non-regulated Watershed Runoff[1]	1.4962	1.48	0.0258	98.28
	Nonpoint Sources/LAs	**1.4962**	**1.48**	**0.0258**	**98.28**
	MD NPDES Regulated Stormwater[1,2]				
	Montgomery County	27.9280	27.66	0.2497	99.11
	Prince George's County	71.5301	70.85	1.0529	98.53
	Point Sources/WLAs	**99.4581**	**98.52**	**1.3026**	**98.69**
	Total Northeast Branch Anacostia	**100.9543**	**100**	**1.3284**	**98.68**

[1]Loads from the MD portion of the Northeast Branch Anacostia River watershed.
[2]NPDES regulated stormwater baseline loads and WLAs are an aggregate of loadings from areas covered under the following permits: (i) Phase I jurisdictional MS4 permits, (ii) the State Highway Administration’s Phase I MS4 permit, (iii) Phase II MS4 permits for municipalities, (iv) Phase II MS4 permits for State and Federal Agencies, (v) industrial facilities permitted for stormwater discharges, and (vi) MDE’s general permit for construction sites.
Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

Table C-13 Annual Loads for Unimpaired District of Columbia Segments for Heptachlor Epoxide

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Lower Beaverdam Creek	MD Upstream Load[1]	30.5058	99.69	0.3089	98.99
	Nonpoint Sources/LAs	**30.5058**	**99.69**	**0.3089**	**98.99**
	DC MS4	0.095	0.31	0.0012	98.74
	Point Sources/WLAs	**0.095**	**0.31**	**0.0012**	**98.74**
	Total Lower Beaverdam Creek	**30.6008**	**100**	**0.3101**	**98.99**

Hickey Run[2]	DC MS4	3.4984	90.93	0.0327	99.07
	DC MSGP	0.3491	9.07	0.0033	99.05
	Point Sources/WLAs	**3.8475**	**100**	**0.036**	**99.06**
	Total Hickey Run	**3.8475**	**100**	**0.036**	**99.06**
Watts Branch[3]	MD Upstream Load[4]	3.3330	34.12	0.0371	98.89
	DC Contaminated Sites	2.2233	22.76	0.0009	99.96
	Nonpoint Sources/LAs	**5.5563**	**56.88**	**0.0380**	**99.32**
	DC MS4	3.9569	40.51	3.9569	0
	PEPCO (DC0000094)[5]	0.2554	2.61	0.2554	0
	Point Sources/WLAs	**4.2123**	**43.12**	**4.2123**	**0**
	Total Watts Branch	**9.7686**	**100**	**4.2503**	**56.49**
Kingman Lake[2]	DC MS4	1.5733	100	0.0132	99.16
	Point Sources/WLAs	**1.5733**	**100**	**0.0132**	**99.16**
	Total Kingman Lake	**1.5733**	**100**	**0.0132**	**99.16**
Fort Chaplin Run[2]	DC MS4	0.8972	100	0.0089	99.01
	Point Sources/WLAs	**0.8972**	**100**	**0.0089**	**99.01**
	Total Fort Chaplin Run	**0.8972**	**100**	**0.0089**	**99.01**
Fort Dupont Creek	DC Contaminated Sites	0.2366	20.29	0.0003	99.87
	Nonpoint Sources/LAs	**0.2366**	**20.29**	**0.0003**	**99.87**
	DC MS4	0.9296	79.71	0.0083	99.11
	Point Sources/WLAs	**0.9296**	**79.71**	**0.0083**	**99.11**
	Total Fort Dupont Creek	**1.1662**	**100**	**0.0086**	**99.26**
Fort Davis Tributary[2]	DC MS4	0.6827	100	0.0071	98.96
	Point Sources/WLAs	**0.6827**	**100**	**0.0071**	**98.96**
	Total Fort Davis Tributary	**0.6827**	**100**	**0.0071**	**98.96**
Fort Stanton Tributary[2]	DC MS4	1.0621	100	0.0097	99.09
	Point Sources/WLAs	**1.0621**	**100**	**0.0097**	**99.09**
	Total Fort Stanton Tributary	**1.0621**	**100**	**0.0097**	**99.09**

[1]Upstream land based load from the MD portion of the Lower Beaverdam Creek watershed.

[2]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[3]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

[4]Upstream land based loads from the MD portion of the Watts Branch watershed.

[5]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.

Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

Table C-14 Annual Loads for Unimpaired District of Columbia Segments for Arsenic

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Lower Beaverdam Creek	MD Upstream Load[1]	492.79	85.80	17.64	96.42
	Nonpoint Sources/LAs	**492.79**	**85.80**	**17.64**	**96.42**
	DC MS4	81.58	14.20	2.22	97.28
	Point Sources/WLAs	**81.58**	**14.20**	**2.22**	**97.28**
	Total Lower Beaverdam Creek	**574.36**	**100**	**19.86**	**96.54**
Hickey Run[2]	DC MS4	2647.22	91.49	56.31	97.87
	DC MSGP	246.27	8.51	5.65	97.71
	Point Sources/WLAs	**2893.49**	**100**	**61.96**	**97.86**
	Total Hickey Run	**2893.49**	**100**	**61.96**	**97.86**
Watts Branch[3]	MD Upstream Load[4]	2591.50	35.20	95.55	96.31
	DC Contaminated Sites	1481.18	20.12	0.95	99.94
	Nonpoint Sources/LAs	**4072.68**	**55.32**	**96.50**	**97.63**
	DC MS4	3063.37	41.61	64.13	97.91
	PEPCO (DC0000094)[5]	225.67	3.07	0.38	99.83
	Point Sources/WLAs	**3289.04**	**44.68**	**64.52**	**98.04**
	Total Watts Branch	**7361.72**	**100**	**161.01**	**97.81**
Popes Branch[2]	DC MS4	622.62	100	15.87	97.45
	Point Sources/WLAs	**622.62**	**100**	**15.87**	**97.45**
	Total Popes Branch	**622.62**	**100**	**15.87**	**97.45**

[1]Upstream land based load from the MD portion of the Lower Beaverdam Creek watershed.
[2]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.
[3]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.
[4]Upstream land based loads from the MD portion of the Watts Branch watershed.
[5]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.
Note 1: The MOS is implicit.
Note 2: Columns may not precisely add to totals due to rounding.

Table C-15 Annual Loads for Unimpaired District of Columbia Segments for Chlordane

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Lower Beaverdam Creek	MD Upstream Load[1]	187.601	99.74	2.476	98.68
	Nonpoint Sources/LAs	**187.601**	**99.74**	**2.476**	**98.68**
	DC MS4	0.487	0.26	0.015	96.96
	Point Sources/WLAs	**0.487**	**0.26**	**0.015**	**96.96**
	Total Lower Beaverdam Creek	**188.088**	**100**	**2.491**	**98.68**

Fort Chaplin Run[2]	DC MS4	5.329	100	0.073	98.63
	Point Sources/WLAs	**5.329**	**100**	**0.073**	**98.63**
	Total Fort Chaplin Run	**5.329**	**100**	**0.073**	**98.63**
Fort Dupont Creek	DC Contaminated Sites	0.758	13.02	0.003	99.62
	Nonpoint Sources/LAs	**0.758**	**13.02**	**0.003**	**99.62**
	DC MS4	5.066	86.98	0.077	98.49
	Point Sources/WLAs	**5.066**	**86.98**	**0.077**	**98.49**
	Total Fort Dupont Creek	**5.825**	**100**	**0.080**	**98.63**
Fort Davis Tributary[2]	DC MS4	4.094	100	0.053	98.72
	Point Sources/WLAs	**4.094**	**100**	**0.053**	**98.72**
	Total Fort Davis Tributary	**4.094**	**100**	**0.053**	**98.72**
Fort Stanton Tributary[2]	DC MS4	6.138	100	0.081	98.67
	Point Sources/WLAs	**6.138**	**100**	**0.081**	**98.67**
	Total Fort Stanton Tributary	**6.138**	**100**	**0.081**	**98.67**

[1]Upstream land based load from the MD portion of the Lower Beaverdam Creek watershed.

[2]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

Table C-16 Annual Loads for Unimpaired District of Columbia Segments for Copper

Segment	**Source**	**Baseline Load (g/year)**	**Baseline Load (%)**	**TMDL (g/year)**	**Load Reduction (%)**
Lower Beaverdam Creek	MD Upstream Load[1]	194094.55	99.72	194094.55	0
	Nonpoint Sources/LAs	**194094.55**	**99.72**	**194094.55**	**0**
	DC MS4	541.49	0.28	541.49	0
	Point Sources/WLAs	**541.49**	**0.28**	**541.49**	**0**
	Total Lower Beaverdam Creek	**194636.04**	**100**	**194636.04**	**0**
Nash Run	MD Upstream Load[2]	4238.37	23.38	4238.37	0
	DC Contaminated Sites	5311.76	29.30	157.31	97.04
	Nonpoint Sources/LAs	**9550.13**	**52.67**	**4395.68**	**53.97**
	DC MS4	8580.47	47.33	8580.47	0
	Point Sources/WLAs	**8580.47**	**47.33**	**8580.47**	**0**
	Total Nash Run	**18130.60**	**100**	**12976.15**	**28.43**
Hickey Run[3]	DC MS4	21680.40	90.40	21680.40	0
	DC MSGP	2301.90	9.60	2301.90	0
	Point Sources/WLAs	**23982.30**	**100**	**23982.30**	**0**
	Total Hickey Run	**23982.30**	**100**	**23982.30**	**0**
Watts Branch[4]	MD Upstream Load[5]	19959.86	38.04	19959.86	0
	DC Contaminated Sites	6762.41	12.89	202.87	97.00
	Nonpoint Sources/LAs	**26722.26**	**50.92**	**20162.73**	**24.55**

Watts Branch[4]	DC MS4	23661.01	45.09	23661.01	0
	PEPCO (DC0000094)[6]	2092.12	3.99	62.76	97.00
	Point Sources/WLAs	**25753.13**	**49.08**	**23723.77**	**7.88**
	Total Watts Branch	**52475.39**	**100**	**43886.50**	**16.37**
Kingman Lake[3]	DC MS4	9083.76	100	8745.12	3.73
	Point Sources/WLAs	**9083.76**	**100**	**8745.12**	**3.73**
	Total Kingman Lake	**9083.76**	**100**	**8745.12**	**3.73**
Fort Chaplin Run[3]	DC MS4	5240.77	100	5240.77	0
	Point Sources/WLAs	**5240.77**	**100**	**5240.77**	**0**
	Total Fort Chaplin Run	**5240.77**	**100**	**5240.77**	**0**
Fort Dupont Creek	DC Contaminated Sites	1379.82	21.38	55.19	96.00
	Nonpoint Sources/LAs	**1379.82**	**21.38**	**55.19**	**96.00**
	DC MS4	5075.35	78.62	5075.35	0
	Point Sources/WLAs	**5075.35**	**78.62**	**5075.35**	**0**
	Total Fort Dupont Creek	**6455.17**	**100**	**5130.54**	**20.52**
Popes Branch[3]	DC MS4	4529.63	100	4529.63	0
	Point Sources/WLAs	**4529.63**	**100**	**4529.63**	**0**
	Total Popes Branch	**4529.63**	**100**	**4529.63**	**0**
Fort Davis Tributary[3]	DC MS4	3943.71	100	3943.71	0
	Point Sources/WLAs	**3943.71**	**100**	**3943.71**	**0**
	Total Fort Davis Tributary	**3943.71**	**100**	**3943.71**	**0**
Texas Avenue Tributary[3]	DC MS4	4351.93	100	4351.93	0
	Point Sources/WLAs	**4351.93**	**100**	**4351.93**	**0**
	Total Texas Avenue Tributary	**4351.93**	**100**	**4351.93**	**0**
Fort Stanton Tributary[3]	DC MS4	6302.04	100	6302.04	0
	Point Sources/WLAs	**6302.04**	**100**	**6302.04**	**0**
	Total Fort Stanton Tributary	**6302.04**	**100**	**6302.04**	**0**

[1]Upstream land based load from the MD portion of the Lower Beaverdam Creek watershed.

[2]Upstream land based loads from the MD portion of the Nash Run watershed.

[3]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[4]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

[5]Upstream land based loads from the MD portion of the Watts Branch watershed.

[6]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.

Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

Table C-17 Annual Loads for Unimpaired District of Columbia Segments for DDT and its Degradants

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Lower Beaverdam Creek	MD Upstream Load[1]	12.4905	99.62	0.1073	99.14
	Nonpoint Sources/LAs	**12.4905**	**99.62**	**0.1073**	**99.14**
	DC MS4	0.0472	0.38	0.0009	98.09
	Point Sources/WLAs	**0.0472**	**0.38**	**0.0009**	**98.09**
	Total Lower Beaverdam Creek	**12.5377**	**100**	**0.1082**	**99.14**
Nash Run	MD Upstream Load[2]	0.2944	12.45	0.0022	99.25
	DC Contaminated Sites	1.4498	61.32	0.0036	99.75
	Nonpoint Sources/LAs	**1.7442**	**73.77**	**0.0058**	**99.67**
	DC MS4	0.6201	26.23	0.0065	98.95
	Point Sources/WLAs	**0.6201**	**26.23**	**0.0065**	**98.95**
	Total Nash Run	**2.3643**	**100**	**0.0123**	**99.48**
Watts Branch[3]	MD Upstream Load[4]	1.4619	28.02	0.0158	98.92
	DC Contaminated Sites	1.8287	35.05	0.0045	99.75
	Nonpoint Sources/LAs	**3.2906**	**63.07**	**0.0203**	**99.38**
	DC MS4	1.6704	32.01	0.0157	99.06
	PEPCO (DC0000094)[5]	0.2566	4.92	0.0006	99.77
	Point Sources/WLAs	**1.9270**	**36.93**	**0.0163**	**99.15**
	Total Watts Branch	**5.2176**	**100**	**0.0366**	**99.30**
Fort Chaplin Run[6]	DC MS4	0.3990	100	0.0036	99.10
	Point Sources/WLAs	**0.3990**	**100**	**0.0036**	**99.10**
	Total Fort Chaplin Run	**0.3990**	**100**	**0.0036**	**99.10**
Fort Dupont Creek	DC Contaminated Sites	0.2193	30.29	0.0005	99.77
	Nonpoint Sources/LAs	**0.2193**	**30.29**	**0.0005**	**99.77**
	DC MS4	0.5047	69.71	0.0050	99.01
	Point Sources/WLAs	**0.5047**	**69.71**	**0.0050**	**99.01**
	Total Fort Dupont Creek	**0.7240**	**100**	**0.0055**	**99.24**
Fort Davis Tributary[6]	DC MS4	0.3075	100	0.0026	99.15
	Point Sources/WLAs	**0.3075**	**100**	**0.0026**	**99.15**
	Total Fort Davis Tributary	**0.3075**	**100**	**0.0026**	**99.15**
Fort Stanton Tributary[6]	DC MS4	0.4449	100	0.0038	99.15
	Point Sources/WLAs	**0.4449**	**100**	**0.0038**	**99.15**
	Total Fort Stanton Tributary	**0.4449**	**100**	**0.0038**	**99.15**

[1]Upstream land based load from the MD portion of the Lower Beaverdam Creek watershed.

[2]Upstream land based loads from the MD portion of the Nash Run watershed.

[3]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

[4]Upstream land based loads from the MD portion of the Watts Branch watershed.

[5]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.

[6]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

Table C-18 Annual Loads for Unimpaired District of Columbia Segments for Dieldrin

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Lower Beaverdam Creek	MD Upstream Load[1]	37.5649	99.81	0.0001	100
	Nonpoint Sources/LAs	**37.5649**	**99.81**	**0.0001**	**100**
	DC MS4	0.0723	0.19	0	100
	Point Sources/WLAs	**0.0723**	**0.19**	**0**	**100**
	Total Lower Beaverdam Creek	**37.6372**	**100**	**0.0001**	**100**
Hickey Run[2]	DC MS4	4.1655	88.84	0	100
	DC MSGP	0.5231	11.16	0	100
	Point Sources/WLAs	**4.6886**	**100**	**0**	**100**
	Total Hickey Run	**4.6886**	**100**	**0**	**100**
Kingman Lake[2]	DC MS4	1.4418	100	0	100
	Point Sources/WLAs	**1.4418**	**100**	**0**	**100**
	Total Kingman Lake	**1.4418**	**100**	**0**	**100**
Fort Chaplin Run[2]	DC MS4	0.9656	100	0	100
	Point Sources/WLAs	**0.9656**	**100**	**0**	**100**
	Total Fort Chaplin Run	**0.9656**	**100**	**0**	**100**
Fort Dupont Creek	DC Contaminated Sites	0.4201	40.61	0	100
	Nonpoint Sources/LAs	**0.4201**	**40.61**	**0**	**100**
	DC MS4	0.6144	59.39	0	100
	Point Sources/WLAs	**0.6144**	**59.39**	**0**	**100**
	Total Fort Dupont Creek	**1.0345**	**100**	**0**	**100**
Popes Branch[2]	DC MS4	0.7788	100	0	100
	Point Sources/WLAs	**0.7788**	**100**	**0**	**100**
	Total Popes Branch	**0.7788**	**100**	**0**	**100**
Fort Davis Tributary[2]	DC MS4	0.7282	100	0	100
	Point Sources/WLAs	**0.7282**	**100**	**0**	**100**
	Total Fort Davis Tributary	**0.7282**	**100**	**0**	**100**
Fort Stanton Tributary[2]	DC MS4	1.2066	100	0	100
	Point Sources/WLAs	**1.2066**	**100**	**0**	**100**
	Total Fort Stanton Tributary	**1.2066**	**100**	**0**	**100**

[1]Upstream land based load from the MD portion of the Lower Beaverdam Creek watershed.

[2]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

Table C-19 Annual Loads for Unimpaired District of Columbia Segments for the PAH 1 Group

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Lower Beaverdam Creek	MD Upstream Load[1]	2524.57	99.80	2524.57	0
	Nonpoint Sources/LAs	**2524.57**	**99.80**	**2524.57**	**0**
	DC MS4	5.16	0.20	5.16	0
	Point Sources/WLAs	**5.16**	**0.20**	**5.16**	**0**
	Total Lower Beaverdam Creek	**2529.73**	**100**	**2529.73**	**0**
Watts Branch[2]	MD Upstream Load[3]	254.23	40.52	254.23	0
	DC Contaminated Sites	42.71	6.81	42.71	0
	Nonpoint Sources/LAs	**296.94**	**47.33**	**296.94**	**0**
	DC MS4	303.58	48.39	303.58	0
	PEPCO (DC0000094)[4]	26.85	4.28	26.85	0
	Point Sources/WLAs	**330.43**	**52.67**	**330.43**	**0**
	Total Watts Branch	**627.37**	**100**	**627.37**	**0**
Fort Chaplin Run[5]	DC MS4	66.25	100	66.25	0
	Point Sources/WLAs	**66.25**	**100**	**66.25**	**0**
	Total Fort Chaplin Run	**66.25**	**100**	**66.25**	**0**
Fort Dupont Creek	DC Contaminated Sites	15.81	24.24	15.81	0
	Nonpoint Sources/LAs	**15.81**	**24.24**	**15.81**	**0**
	DC MS4	49.39	75.76	49.39	0
	Point Sources/WLAs	**49.39**	**75.76**	**49.39**	**0**
	Total Fort Dupont Creek	**65.20**	**100**	**65.20**	**0**
Fort Davis Tributary[5]	DC MS4	50.45	100	50.45	0
	Point Sources/WLAs	**50.45**	**100**	**50.45**	**0**
	Total Fort Davis Tributary	**50.45**	**100**	**50.45**	**0**

[1]Upstream land based load from the MD portion of the Lower Beaverdam Creek watershed.

[2]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

[3]Upstream land based loads from the MD portion of the Watts Branch watershed.

[4]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.

[5]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

Table C-20 Annual Loads for Unimpaired District of Columbia Segments for the PAH 2 Group

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Lower Beaverdam Creek	MD Upstream Load[1]	5941.26	99.80	0.03	100
	Nonpoint Sources/LAs	**5941.26**	**100**	**0.03**	**100**
	DC MS4	11.98	0.20	0	100
	Point Sources/WLAs	**11.98**	**0**	**0**	**100**
	Total Lower Beaverdam Creek	**5953.24**	**100**	**0.03**	**100**
Watts Branch[2]	MD Upstream Load[3]	600.10	38.58	0.03	99.99
	DC Contaminated Sites	120.58	7.75	0	100
	Nonpoint Sources/LAs	**720.68**	**46.33**	**0.03**	**100**
	DC MS4	718.85	46.22	0	100
	PEPCO (DC0000094)[4]	115.84	7.45	0	100
	Point Sources/WLAs	**834.69**	**53.67**	**0**	**100**
	Total Watts Branch	**1555.37**	**100**	**0.03**	**100**
Fort Chaplin Run[5]	DC MS4	156.20	100	0	100
	Point Sources/WLAs	**156.20**	**100**	**0**	**100**
	Total Fort Chaplin Run	**156.20**	**100**	**0**	**100**
Fort Dupont Creek	DC Contaminated Sites	64.38	36.34	0	100
	Nonpoint Sources/LAs	**64.38**	**36.34**	**0**	**100**
	DC MS4	112.78	63.66	0	100
	Point Sources/WLAs	**112.78**	**63.66**	**0**	**100**
	Total Fort Dupont Creek	**177.16**	**100**	**0**	**100**
Fort Davis Tributary[5]	DC MS4	118.85	100	0	100
	Point Sources/WLAs	**118.85**	**100**	**0**	**100**
	Total Fort Davis Tributary	**118.85**	**100**	**0**	**100**

[1]Upstream land based load from the MD portion of the Lower Beaverdam Creek watershed.

[2]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

[3]Upstream land based loads from the MD portion of the Watts Branch watershed.

[4]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.

[5]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

Table C-21 Annual Loads for Unimpaired District of Columbia Segments for the PAH 3 Group

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Lower Beaverdam Creek	MD Upstream Load[1]	4876.808	99.79	0.003	100
	Nonpoint Sources/LAs	**4876.808**	**99.79**	**0**	**100**
	DC MS4	10.020	0.21	0	100
	Point Sources/WLAs	**10.020**	**0.21**	**0**	**100**
	Total Lower Beaverdam Creek	**4886.828**	**100**	**0.003**	**100**
Watts Branch[2]	MD Upstream Load[3]	494.783	38.61	0.003	100
	DC Contaminated Sites	102.996	8.04	0	100
	Nonpoint Sources/LAs	**597.779**	**46.65**	**0.003**	**100**
	DC MS4	590.534	46.09	0	100
	PEPCO (DC0000094)[4]	93.051	7.26	0	100
	Point Sources/WLAs	**683.585**	**53.35**	**0**	**100**
	Total Watts Branch	**1281.364**	**100**	**0.003**	**100**
Fort Chaplin Run[5]	DC MS4	128.931	100	0	100
	Point Sources/WLAs	**128.931**	**100**	**0**	**100**
	Total Fort Chaplin Run	**128.931**	**100**	**0**	**100**
Fort Dupont Creek	DC Contaminated Sites	52.087	35.21	0	100
	Nonpoint Sources/LAs	**52.087**	**35.21**	**0**	**100**
	DC MS4	95.849	64.79	0	100
	Point Sources/WLAs	**95.849**	**64.79**	**0**	**100**
	Total Fort Dupont Creek	**147.936**	**100**	**0**	**100**
Fort Davis Tributary[5]	DC MS4	98.234	100	0	100
	Point Sources/WLAs	**98.234**	**100**	**0**	**100**
	Total Fort Davis Tributary	**98.234**	**100**	**0**	**100**

[1]Upstream land based load from the MD portion of the Lower Beaverdam Creek watershed.

[2]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

[3]Upstream land based loads from the MD portion of the Watts Branch watershed.

[4]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.

[5]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

Table C-22 Annual Loads for Unimpaired District of Columbia Segments for Zinc

Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)
Lower Beaverdam Creek	MD Upstream Load[1]	307985.24	99.78	307985.24	0
	Nonpoint Sources/LAs	**307985.24**	**99.78**	**307985.24**	**0**
	DC MS4	674.53	0.22	674.53	0
	Point Sources/WLAs	**674.53**	**0.22**	**674.53**	**0**
	Total Lower Beaverdam Creek	**308659.76**	**100**	**308659.76**	**0**
Nash Run	MD Upstream Load[2]	6732.03	28.72	6732.03	0
	DC Contaminated Sites	4012.47	17.12	876.82	78.15
	Nonpoint Sources/LAs	**10744.49**	**45.84**	**7608.85**	**29.18**
	DC MS4	12696.59	54.16	12696.59	0
	Point Sources/WLAs	**12696.59**	**54.16**	**12696.59**	**0**
	Total Nash Run	**23441.09**	**100**	**20305.44**	**13.38**
Hickey Run[3]	DC MS4	33824.98	89.56	33824.98	0
	DC MSGP	3941.20	10.44	3941.20	0
	Point Sources/WLAs	**37766.17**	**100**	**37766.17**	**0**
	Total Hickey Run	**37766.17**	**100**	**37766.17**	**0**
Watts Branch[4]	MD Upstream Load[5]	31505.52	42.02	31505.52	0
	DC Contaminated Sites	5033.68	6.71	998.72	80.16
	Nonpoint Sources/LAs	**36539.20**	**48.73**	**32504.24**	**11.04**
	DC MS4	36440.34	48.60	36440.34	0
	PEPCO (DC0000094)[6]	2003.65	2.67	1602.92	20
	Point Sources/WLAs	**38443.99**	**51.27**	**38043.26**	**1.04**
	Total Watts Branch	**74983.20**	**100**	**70547.50**	**5.92**
Kingman Lake[3]	DC MS4	12530.61	100	12530.61	0
	Point Sources/WLAs	**12530.61**	**100**	**12530.61**	**0**
	Total Kingman Lake	**12530.61**	**100**	**12530.61**	**0**
Fort Chaplin Run[3]	DC MS4	7974.86	100	7974.86	0
	Point Sources/WLAs	**7974.86**	**100**	**7974.86**	**0**
	Total Fort Chaplin Run	**7974.86**	**100**	**7974.86**	**0**
Fort Dupont Creek	DC Contaminated Sites	1255.86	16.51	740.96	41
	Nonpoint Sources/LAs	**1255.86**	**16.51**	**740.96**	**41.00**
	DC MS4	6351.38	83.49	6351.38	0
	Point Sources/WLAs	**6351.38**	**83.49**	**6351.38**	**0**
	Total Fort Dupont Creek	**7607.24**	**100**	**7092.34**	**6.77**
Popes Branch[3]	DC MS4	6632.15	100	6632.15	0
	Point Sources/WLAs	**6632.15**	**100**	**6632.15**	**0**
	Total Popes Branch	**6632.15**	**100**	**6632.15**	**0**

Fort Davis Tributary[3]	DC MS4	6059.05	100	6059.05	0
	Point Sources/WLAs	**6059.05**	**100**	**6059.05**	**0**
	Total Fort Davis Tributary	**6059.05**	**100**	**6059.05**	**0**
Texas Avenue Tributary[3]	DC MS4	6666.34	100	6666.34	0
	Point Sources/WLAs	**6666.34**	**100**	**6666.34**	**0**
	Total Texas Avenue Tributary	**6666.34**	**100**	**6666.34**	**0**
Fort Stanton Tributary[3]	DC MS4	9627.02	100	9627.02	0
	Point Sources/WLAs	**9627.02**	**100**	**9627.02**	**0**
	Total Fort Stanton Tributary	**9627.02**	**100**	**9627.02**	**0**

[1]Upstream land based load from the MD portion of the Lower Beaverdam Creek watershed.

[2]Upstream land based loads from the MD portion of the Nash Run watershed.

[3]No LA is given for these segments because all stormwater runoff is captured by the DC MS4.

[4]DC delineates Watts Branch as two assessment units, but for the purposes of this TMDL, Watts Branch #1 and #2 were combined.

[5]Upstream land based loads from the MD portion of the Watts Branch watershed.

[6]The loads for these individual dischargers include both the land based loads attributed to the contaminated land and the loads attributed to their discharges.

Note 1: The MOS is implicit.

Note 2: Columns may not precisely add to totals due to rounding.

APPENDIX D: RESPONSE TO PUBLIC COMMENT

This section will be updated after the public comment period and prior to final submittal to EPA.