Total Maximum Daily Load of Polychlorinated Biphenyls in the Piscataway Creek and Mattawoman Creek Tidal Fresh Chesapeake Bay Segments, Prince George's and Charles Counties, MD

DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard, Suite 540
Baltimore MD 21230-1718

FINAL

Submitted to:

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

December 2018

EPA Submittal Date: December 6, 2018
EPA Approval Date: February 19, 2019

Table of Contents

List of Figures

List of Tables

List of Abbreviations

Adj-SediBAF	Adjusted Sediment Bioaccumulation Factor
Adj-tBAF	Adjusted Total Bioaccumulation Factor
BAF	Bioaccumulation Factor
BCF	Bioconcentration Factor
BMP	Best Management Practice
CBP	Chesapeake Bay Program
CFR	Code of Federal Regulations
COMAR	Code of Maryland Regulations
CSF	Cancer Slope Factor
CWA	Clean Water Act
DMR	Discharge Monitoring Report
DYNHD	Dynamic Hydrologic Model
EPA	U.S. Environmental Protection Agency
g	Gram
IR	Integrated Report
kg	Kilogram
km	Kilometer
km^2	Square Kilometer
L	Liter
lbs	Pounds
LA	Load Allocation
LMA	Land Management Administration
LRP-MAP	Land Restoration Program Geospatial Database
m	Meter
m^2	Square meter
MATTF	Mattawoman Creek Tidal Fresh Chesapeake Bay Segment
MD	Maryland
MDE	Maryland Department of the Environment
MDL	Maximum Daily Load
mg	Milligram
MGD	Million Gallons per Day
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer System
ng	Nanogram
NPDES	National Pollutant Discharge Elimination System
P5 CBWM	Phase 5 Chesapeake Bay Watershed Model
PCB	Polychlorinated Biphenyl

PISTF	Piscataway Creek Tidal Fresh Chesapeake Bay Segment
POTPCB	Tidal Potomac PCB TMDL Water Quality Model
ppb	Parts per billion
ppt	Parts per trillion
SediBAF	Sediment Bioaccumulation Factor
tBAF	Total Bioaccumulation Factor
TMDL	Total Maximum Daily Load
TOXI4	Toxic Chemical Model
TPAR	Tidal Potomac and Anacostia River
tPCB	Total PCB
TSS	Total Suspended Solids
US	The United States of America
USGS	United States Geological Survey
WASP 5	Water Quality Analysis Simulation Program (Version 5)
WLA	Wasteload Allocation
WQLS	Water Quality Limited Segment
WQS	Water Quality Standard
WWTP	Wastewater Treatment Plant
µg	Microgram

EXECUTIVE SUMMARY

Section 303(d) of the federal Clean Water Act (CWA) and the U.S. Environmental Protection Agency's (EPA's) implementing regulations direct each State to identify and list waters, known as water quality limited segments (WQLSs), in which current required controls of a specified substance are inadequate to achieve water quality standards (WQSs). For each WQLS, the State is to either establish a Total Maximum Daily Load (TMDL) for the specified substance that the waterbody can receive without violating WQSs, or demonstrate that WQSs are being met (CFR 2017a). This document, upon approval by the EPA, establishes a TMDL for polychlorinated biphenyls (PCBs) in the Piscataway Creek and Mattawoman Creek Tidal Fresh Chesapeake Bay Tidal Segments (AU-ID: MD-PISTF and MD-MATTF). From this point on in the Executive Summary the "Piscataway Creek Tidal Fresh and Mattawoman Creek Tidal Fresh Chesapeake Bay Tidal Segments" will be referred to as the "Piscataway Creek and Mattawoman Creek tidal segments."

Maryland WQSs 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 2017a). The designated use class of the waters of the Piscataway Creek and Mattawoman Creek tidal segments is Use Class II – *Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting* (COMAR 2017b). This class designation also includes all applicable uses identified for Use Class I (COMAR 2017b).

The Maryland Department of the Environment (MDE) has identified the waters of the Piscataway Creek and Mattawoman Creek tidal segments on the State's 2016 Integrated Report (IR) of Surface Water Quality as impaired for PCBs in fish tissue.

PCBs are a class of man-made compounds that were manufactured and used for a variety of industrial applications. There are 209 possible chemical arrangements of PCBs (known as congeners) which consist of two phenyl groups and one to ten chlorine atoms. The congeners differ in the number and position of chlorine atoms along the phenyl groups. From the 1940s to the 1970s, they were extensively used as heat transfer fluids, flame retardants, hydraulic fluids, and dielectric fluids because of their dielectric and flame resistant properties.
PCBs are a concern to human health, as regular consumption of fish containing elevated levels of PCBs will cause bioaccumulation within the fatty tissue of humans, which can potentially lead to the development of cancer.

Since the Piscataway Creek and Mattawoman Creek tidal segments have been identified as impaired for PCBs in fish tissue, the overall objective of the tPCB TMDL established in this document is to ensure that the "fishing" designated use, in particular the protection of human health related to the consumption of fish from the Piscataway Creek and Mattawoman Creek tidal segments, is supported.

This report establishes TMDLs for the Piscataway Creek and Mattawoman Creek tidal segments based on modeling from the 2007 TMDL of PCBs for Tidal Portions of the Potomac and Anacostia Rivers (TPAR TMDL) (Haywood 2007). The TPAR TMDL model included the Piscataway Creek and Mattawoman Creek tidal segments; however, these waters did not receive individual TMDLs as they were not listed as impaired in Maryland's IR at the time of the TPAR TMDL. In establishing the individual TMDLs, this report will demonstrate that the allocations assigned in the TPAR TMDL will result in the attainment of water quality standards in the Piscataway Creek and Mattawoman Creek tidal segments. This analysis has fully adopted the modeling and analytical framework from the TPAR TMDL and the TMDLs and allocations presented herein are fully consistent with those laid out in the TPAR TMDL.

TMDL endpoints developed under the TPAR TMDL are applied to the Piscataway Creek and Mattawoman Creek tidal segments to determine whether allocations assigned by the TPAR TMDL are protective of the "fishing" designated use within these tidal segments. At the time of development of the TPAR TMDL, Maryland's fish tissue tPCB listing threshold was 88 nanograms/gram (ng/g). Following development and approval of the TMDL, the listing threshold was lowered to 39 ng/g. The endpoints used to establish TMDLs for the Piscataway Creek and Mattawoman Creek tidal segments were calculated by applying the threshold of 39 ng/g to the endpoint calculations from the TPAR TMDL.

The CWA requires TMDLs to be protective of all the designated uses applicable to a particular waterbody. Within the Piscataway Creek and Mattawoman Creek tidal segments, these designated uses, include "water contact recreation," "fishing," "the protection of aquatic life and wildlife," and the "support of estuarine and marine aquatic life and shellfish harvesting." The TMDLs presented herein were developed specifically to be supportive of the "fishing" designated use, ensuring that the consumption of fish does not impact human health, thus addressing the impairment listings for "PCBs in fish tissue." This TMDL also ensures the protection of all other applicable designated uses within the Piscataway Creek and Mattawoman Creek tidal segments as the TMDL endpoints developed to support the "fishing" designated use are more stringent than the water quality standards supportive of the remaining use classes.

The water column and sediment TMDL endpoint tPCB concentrations applied in the Piscataway Creek and Mattawoman Creek PCB TMDL were derived from Maryland's IR fish tissue listing threshold tPCB concentration and site specific bioaccumulation factors (BAFs). The water column TMDL endpoint tPCB concentration for the Piscataway Creek and Mattawoman Creek tidal segments is lower than: 1) EPA's human health criterion tPCB water column concentration relative to fish consumption, and 2) both Maryland's freshwater and saltwater aquatic life chronic criteria tPCB water column concentrations (*i.e.*, water column TMDL endpoint tPCB concentrations < saltwater chronic tPCB criterion). This indicates that the TMDL is not only protective of the "fishing" designated use but also the "aquatic life" designated use, specifically the protection of "support of estuarine and marine aquatic life and shellfish harvesting." Lastly, the designated use for "water contact recreation" is not associated with any potential human health risks due to PCB exposure. Dermal contact and consumption of water from activities associated with "water contact recreation" are not significant pathways for the uptake of PCBs. The EPA human health criterion was developed solely based on organism consumption, as drinking water consumption does not pose any risk for cancer development at environmentally relevant levels. The only human health risk associated with PCB exposure is through the consumption of aquatic organisms, which is addressed by the water column and sediment endpoint tPCB concentrations applied within this TMDL developed to be supportive of the "fishing" designated use.

Both point and nonpoint sources of PCBs were identified within the Piscataway Creek and Mattawoman Creek watersheds. Nonpoint sources include direct atmospheric deposition to the tidal segments, runoff from non-regulated watershed areas, and a single contaminated site. Point sources include National Pollutant Discharge Elimination System (NPDES) regulated stormwater runoff within the watershed and two NPDES permitted municipal wastewater treatment plants (WWTPs).

The transport of PCBs from bottom sediments to the water column through re-suspension and diffusion can also be a major source of PCBs in estuarine systems. The water quality model (POTPCB model) developed for the TPAR TMDL simulates conditions within the water column and sediment as a single system, therefore exchanges between the sediment and water column are accounted for within the model as an internal load (Haywood 2007). However, only external sources to the system were assigned a baseline load within the TMDL. Thus, no baseline load or allocation was assigned to resuspension and diffusion of PCBs from the sediment.

The tidal exchanges between the Piscataway Creek and Mattawoman Creek tidal segments and the mainstem of the Tidal Potomac River can also be a major source of PCBs to these systems and are accounted for within the model as internal loads (Haywood 2007). The POTPCB model only defines a boundary condition between the mouth of the Tidal Potomac River and the mainstem of the Chesapeake Bay for which a baseline load and allocation has been assigned (Haywood 2007). Thus, the TPAR TMDL does not assign baseline loads or allocations at the boundaries between the Tidal Potomac River and the Piscataway Creek and Mattawoman Creek tidal segments.

All TMDLs need to be presented as a sum of Wasteload Allocations (WLAs) for the identified point sources, Load Allocations (LAs) for nonpoint source loads generated within the assessment unit, and where applicable, natural background, tributary, and adjacent segment loads. Furthermore, all TMDLs must include a margin of safety (MOS) to account for lack of knowledge and the many uncertainties in the understanding and simulation of water quality parameters in natural systems (*i.e.*, the relationship between modeled loads and water quality) (CFR 2017a). The MOS is intended to account for such uncertainties in a manner that is conservative from the standpoint of environmental protection. An explicit MOS of 5% was incorporated into the analysis to account for such uncertainty.

Summaries of the baseline loads, TMDL allocations, load reductions, and maximum daily loads (MDLs) for the Piscataway Creek and Mattawoman Creek tidal segments are presented in Table ES-1.

The TPAR TMDL demonstrated that load reductions were only required within the Potomac River watershed above chain bridge and the Anacostia River watershed, upstream of the Piscataway Creek and Mattawoman Creek tidal segments, in order to attain water quality standards within the impaired waters being addressed by the TMDL (Haywood 2007). No load reductions were required directly to sources within the Piscataway Creek and Mattawoman Creek watersheds. However, the upstream load reductions were also necessary in order to achieve TMDL endpoints within the Piscataway Creek and Mattawoman Creek, as they led to a reduction in loadings to the Piscataway Creek and Mattawoman Creek from tidal exchanges with the mainstem of the Potomac River.

Although reductions were unnecessary in the direct drainage of the Piscataway Creek and Mattawoman Creek watersheds for supporting the "fishing" designated use, the TPAR TMDL applied a reduction of 5% to PCB loads from non-regulated watershed runoff, contaminated sites, and NPDES regulated stormwater in the Piscataway Creek and Mattawoman Creek tidal segments (Haywood 2007). These reductions were required solely to provide a MOS for this TMDL. No additional reductions outside of the MOS were applied to these sources. A 93% reduction to PCB loads from atmospheric deposition was applied across all tidal segments within the TPAR TMDL in order to support the "fishing" designated use within the impaired waters addressed by the TMDL (Haywood 2007). The TPAR PCB TMDL states that "the proposed 93% reduction in atmospheric deposition of PCBs should yield the 5% reduction in loads represented by the MOS (Haywood 2007)." Therefore, reductions to PCB loads from non-regulated watershed runoff, contaminated sites, and NPDES regulated stormwater do not have to be addressed directly, as they will be achieved through reductions in atmospheric deposition.

Federal regulations require that TMDL analysis take into account the impact of critical conditions and seasonality on water quality (CFR 2017b). The intent of these requirements is to ensure that load reductions required by this TMDL, when implemented, will produce water quality conditions supportive of the designated use at all times. PCB levels in fish tissue become elevated due to long term exposure primarily through consumption of lower trophic level organisms, rather than a critical condition defined by acute exposure to temporary fluctuations in water column tPCB concentrations. EPA recommends applying the long-term harmonic mean flow as the critical condition for TMDLs for substances whose human health impact is derived from lifetime exposure (Haywood 2007). Seasonality and critical conditions are addressed in the TPAR TMDL through the use of daily surface flows and loads of total suspended solids and particulate carbon from calendar year 2005 which was selected as the hydrologic design year as it most closely matches the long-term harmonic mean flow of the Potomac River (Haywood 2007).

Despite the fact that PCB loads from re-suspension and diffusion are not considered to be directly controllable, these load contributions are still expected to decrease over time as the result of the natural attenuation of PCBs in the environment. In addition, discovering and remediating any existing PCB land sources throughout the Potomac River watershed via implementation of existing PCB TMDLs, established under the TPAR TMDL, and future TMDL development will further aid in meeting water quality goals in the Piscataway Creek and Mattawoman Creek tidal segments. MDE also monitors and evaluates concentrations of contaminants in recreationally caught fish, shellfish, and crabs throughout Maryland. MDE will use these monitoring programs to evaluate progress towards meeting the "fishing" designated use in the Piscataway Creek and Mattawoman Creek tidal segments.

Table ES-1: Summary of tPCB Baseline Loads, TMDL Allocations, Load Reductions, and MDLs in the Piscataway Creek and Mattawoman Creek Tidal Segments

Tidal Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)	MDL (g/day)
Piscataway Creek	Non-regulated Watershed Runoff	25.1	30.55%	23.9	5.0%	0.065
	Atmospheric Deposition	35.9	43.71%	2.4	93.4%	0.007
	Nonpoint Sources	***61.1***	***74.26%***	***26.3***	***45.3%***	***0.072***
	NPDES Regulated Stormwater [1]					
	Prince George's County	19.5	23.74%	18.5	5.0%	0.051
	WWTPs[2]	1.6	1.99%	10.8	-558.5%	0.039
	Point Sources	***21.2***	***25.74%***	***29.3***	***-27.9%***	***0.090***
	MOS (5%)	***-***	***-***	***2.4***		***0.009***
	Total	***82.2***	***100.00%***	***58.0***	***29.5%***	***0.170***
Mattawoman Creek	Non-regulated Watershed Runoff	35.6	40.38%	33.8	5.0%	0.093
	Atmospheric Deposition	37.3	42.32%	2.5	93.4%	0.007
	Contaminated Sites	0.1	0.11%	0.1	5.0%	0.000
	Nonpoint Sources	***73.0***	***82.82%***	***36.4***	***50.2%***	***0.100***
	NPDES Regulated Stormwater [1]					
	Prince George's County	3.1	3.55%	3.0	5.0%	0.008
	Charles County	11.9	13.55%	11.3	5.0%	0.031
	WWTPs[2]	0.1	0.08%	0.2	-163.2%	0.001
	Point Sources	***15.1***	***17.18%***	***14.5***	***4.3%***	***0.040***
	MOS (5%)	***-***	***-***	***2.7***	***-***	***0.007***
	Total	***88.1***	***100.00%***	***53.5***	***39.2%***	***0.147***

[1]NPDES regulated stormwater baseline loads and WLAs are an aggregate of loadings from areas covered under the following permits: (i) Phase I & II jurisdictional MS4 permits, (ii) the State Highway Administration's Phase I MS4 permit, (iii) industrial facilities permitted for stormwater discharges, and (iv) MDE general permit to construction sites.
Note: Columns may not precisely add to totals due to rounding.
[2]Negative load reduction percentage occurs due to WLA exceeding the baseline load. For additional information please refer to section 5.4.2.

1.0 INTRODUCTION

Section 303(d) of the federal Clean Water Act (CWA) and the U.S. Environmental Protection Agency's (EPA's) implementing regulations direct each State to identify and list waters, known as water quality limited segments (WQLSs), in which current required controls of a specified substance are inadequate to achieve water quality standards (WQSs). For each WQLS, the State is to either establish a Total Maximum Daily Load (TMDL) for the specified substance that the waterbody can receive without violating WQSs, or demonstrate that WQSs are being met (CFR 2017a).

This document, upon approval by EPA, establishes a TMDL for polychlorinated biphenyls (PCBs) in the Piscataway Creek and Mattawoman Creek Tidal Fresh Chesapeake Bay Segments. From this point on in the report, the "Piscataway Creek and Mattawoman Creek Tidal Fresh Chesapeake Bay Segments" will be referred to as the "Piscataway Creek and Mattawoman Creek tidal segments."

TMDLs are established to determine the pollutant load reductions required to achieve and maintain WQSs. A WQS is the combination of a designated use for a particular body of water and the water quality criteria designed to protect that use. Designated uses include activities such as swimming, drinking water supply, protection of aquatic life, fish and shellfish propagation and harvest, etc. Water quality criteria consist of narrative statements and numeric values designed to protect the designated uses. Criteria may differ between waters with different designated uses.

Maryland WQSs 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 2017a). The designated use class of the waters of the Piscataway Creek and Mattawoman Creek tidal segments is Use Class II – *Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting* (COMAR 2017b). This class designation also includes all applicable uses identified for Use Class I (COMAR 2017b).

The Maryland Department of the Environment (MDE) has identified the waters of the Piscataway Creek and Mattawoman Creek tidal segments on the State's 2016 Integrated Report (IR) of Surface Water Quality as impaired for the pollutants summarized in Table 1. The table includes the watershed, 8-digit basin code, tidal/non-tidal designation, designated use class, identified pollutant, and listing category.

This report establishes TMDLs for the Piscataway Creek and Mattawoman Creek tidal segments based on modeling from the 2007 TMDL of PCBs for Tidal Portions of the Potomac and Anacostia Rivers (TPAR TMDL) (Haywood 2007). The TPAR TMDL model included the Piscataway Creek and Mattawoman Creek tidal segments however these waters did not receive individual TMDLs as they were not listed as impaired in Maryland's IR at the time of the TPAR TMDL. In establishing the individual TMDLs, this report will demonstrate that the allocations assigned in the TPAR TMDL will result in the attainment of water quality standards in the Piscataway Creek and Mattawoman Creek tidal segments. This analysis has fully adopted the modeling and analytical framework from the TPAR TMDL and the TMDLs and allocations presented herein are fully consistent with those laid out in the TPAR TMDL. The location of the Piscataway Creek and Mattawoman Creek tidal segments are displayed in Figure 1.

Table 1: Piscataway Creek and Mattawoman Creek Tidal Segment Impairment Listings (2016 IR)

Watershed	8-digit Basin Code	Tidal/Non-tidal	Designated Use Class	Year Listed	Identified Pollutant	Listing Category
Piscataway Creek	02140203	Non-tidal	I - Water Contact Sports	2002	Bacteria (E. Coli)	4a
			I - Aquatic Life and Wildlife	2016	Chlorides	5
					Total Suspended Solids	5
Piscataway Creek Tidal Fresh (PISTF)		Tidal	I - Fishing	-	Mercury in Fish Tissue	2
				2014	PCBs in Fish Tissue	5
			II - Seasonal Migratory Fish Spawning and Nursery Subcategory	1996	Nitrogen (Total)	4a
					Phosphorus (Total)	
			II - Open- Water Fish and Shellfish Subcategory	1996	Nitrogen (Total)	4a
					Phosphorus (Total)	
			II - Seasonal Shallow-Water Submerged Aquatic Vegetation Subcategory	1996	Total Suspended Solids (TSS)	4a
Mattawoman Creek	02140111	Non-tidal	I - Aquatic Life and Wildlife	2014	Chlorides	5
				2014	Low pH	5
Mattawoman Creek Tidal Fresh (MATTF)		Tidal	I - Fishing	-	Mercury in Fish Tissue	2
				2014	PCBs in Fish Tissue	5
			I - Aquatic Life and Wildlife	-	Impact to Biological Communities	3
			II - Seasonal Migratory Fish Spawning and Nursery Subcategory	1996	Nitrogen (Total)	4a
					Phosphorus (Total)	
			II - Open- Water Fish and Shellfish Subcategory	1996	Nitrogen (Total)	4a
					Phosphorus (Total)	
			II - Seasonal Shallow-Water Submerged Aquatic Vegetation Subcategory	-	Total Suspended Solids (TSS)	3
Myrtle Grove Lake		Non-tidal	I - Fishing	-	Mercury in Fish Tissue	2
			I - Aquatic Life and Wildlife	-	Phosphorus	3

Note:
- Category 2 indicates the waterbody is meeting water quality standards for the identified substance
- Category 3 indicates insufficient data to make a listing category determination
- Category 4a indicates a TMDL has been completed and approved by EPA
- Category 4c indicates the cause of the impairment is pollution and not a pollutant
- Category 5 indicates that the waterbody is impaired and a TMDL or water quality analysis (WQA) is needed.

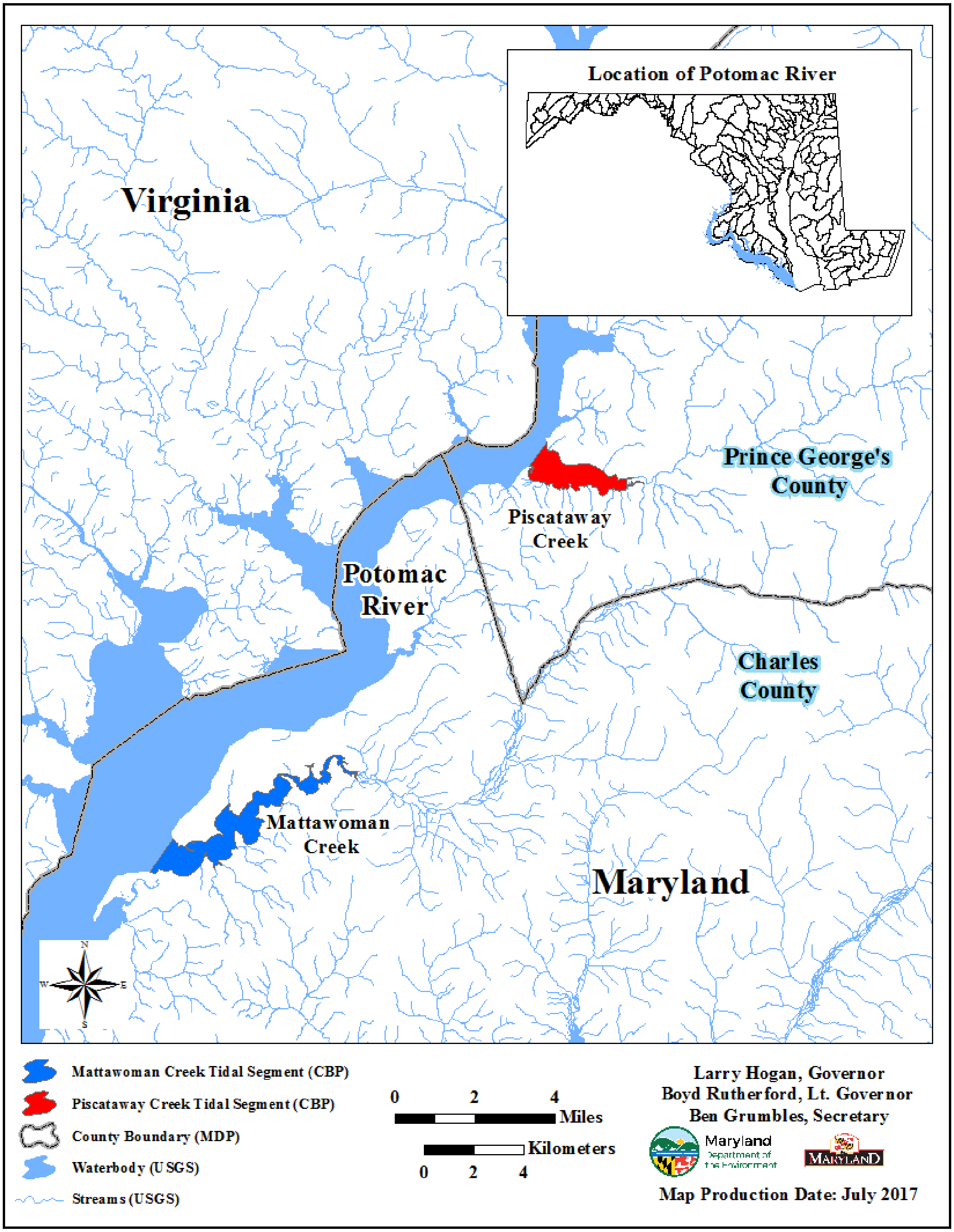

Figure 1: Location Map of the Piscataway Creek and Mattawoman Creek Tidal Segments

PCBs are a class of man-made compounds that were manufactured and used for a variety of industrial applications. They consist of 209 related chemical compounds (congeners) that were manufactured and sold as mixtures under various trade names, commonly referred to as Aroclors (sixteen different Aroclor mixtures were produced, each formulated based on a specific chlorine composition by mass) (QEA 1999). Each of the 209 possible PCB compounds consists of two phenyl groups and one to ten chlorine atoms. The congeners differ in the number and position of the chlorine atoms along the phenyl group. From the 1940s to the 1970s, they were extensively used as heat transfer fluids, flame retardants, hydraulic fluids, and dielectric fluids because of their dielectric and flame resistant properties. They have been identified as a pollutant of concern due to the following:

1. They are bioaccumulative and can cause both acute and chronic toxic effects;
2. They have carcinogenic properties;
3. They are persistent organic pollutants that do not readily breakdown in the environment.

In the late 1970s, concerns regarding potential human health effects led the United States (US) government to take action to cease PCB production, restrict PCB use, and regulate the storage and disposal of PCBs. Despite these actions, PCBs are still being released into the environment through fires or leaks from old PCB containing equipment, accidental spills, burning of PCB containing oils, leaks from hazardous waste sites, or the inadvertent production during manufacturing processes. Since PCBs tend to bioaccumulate in aquatic organisms, including fish, people who consume fish may become exposed to PCBs. In fact, elevated levels of PCBs in edible parts of fish tissue are one of the leading causes of fish consumption advisories in the US.

MDE lists waters as impaired for PCBs in fish tissue in the State's IR when tPCB fish tissue concentrations exceed the tPCB fish tissue listing threshold of 39 nanograms/gram (ng/g), or parts per billion (ppb) (wet weight), based on 4 meals per month by a 76 kg individual (MDE 2016). The Piscataway Creek and Mattawoman Creek were first listed for PCBs in fish tissue in Maryland's 2014 IR. In addition to identifying impaired waterbodies in the State's IR, MDE also issues statewide and site specific fish consumption advisories (ranging from 0 to 4 meals per month) and recommendations (ranging from 4 to 8 meals per month). Current recreational fish consumption advisories for the Piscataway Creek and Mattawoman Creek tidal segments are presented in Table 2 (MDE 2014).

Table 2: Piscataway Creek and Mattawoman Creek Tidal Segment Fish Consumption Advisories

Tidal Segment	Fish Consumption Advisory Waterbody	Fish Species	Fish Consumption Advisory (General Population)
Piscataway Creek & Mattawoman Creek	Potomac River (tidal) - 301 Bridge to DC Line	American Eel	1 every other month
		Blue Catfish	12"-15" (4 meals per month) 15"-24" (2 meals per month) 24"-30" (1 meal per month) > 30" (none)
		Channel Catfish	< 18" (1 meal per month) > 18" (none)
		Common Carp	none
		Sunfish	2 meals per month
		Smallmouth Bass	2 meals per month
		Largemouth Bass	2 meals per month
		White Catfish	none
		White Perch	4 meals per month

2.0 SETTING AND WATER QUALITY DESCRIPTION

2.1 General Setting

Location

The Piscataway Creek and Mattawoman Creek tidal segments are tributaries of the Tidal Potomac River which drain portions of Prince George's and Charles Counties. The Potomac River extends for 117 miles (188 kilometers [km]) from its mouth at Pt. Lookout in St. Mary's County to its head-of-tide located approximately 0.4 miles (0.64 km) upstream of Chain Bridge in the District of Columbia.

The Piscataway Creek and Mattawoman Creek watershed areas are 180 square kilometers (km^2) and 251 km^2, respectively. The location of the Piscataway Creek and Mattawoman Creek watersheds are displayed in Figure 2 and Figure 3.

Land Use

The land use distribution for the Piscataway Creek and Mattawoman Creek watersheds are displayed in Figure 4 and Figure 5 and presented in Table 3. The table includes the watershed; and distribution of urban, forest, agriculture, and water/wetland land uses. The land use distribution was calculated using the United States Geological Survey's (USGS) 2006 land cover data (USGS 2006), which was specifically developed to be applied within the Chesapeake Bay Program's (CBP) Phase 5.3.2 watershed model.

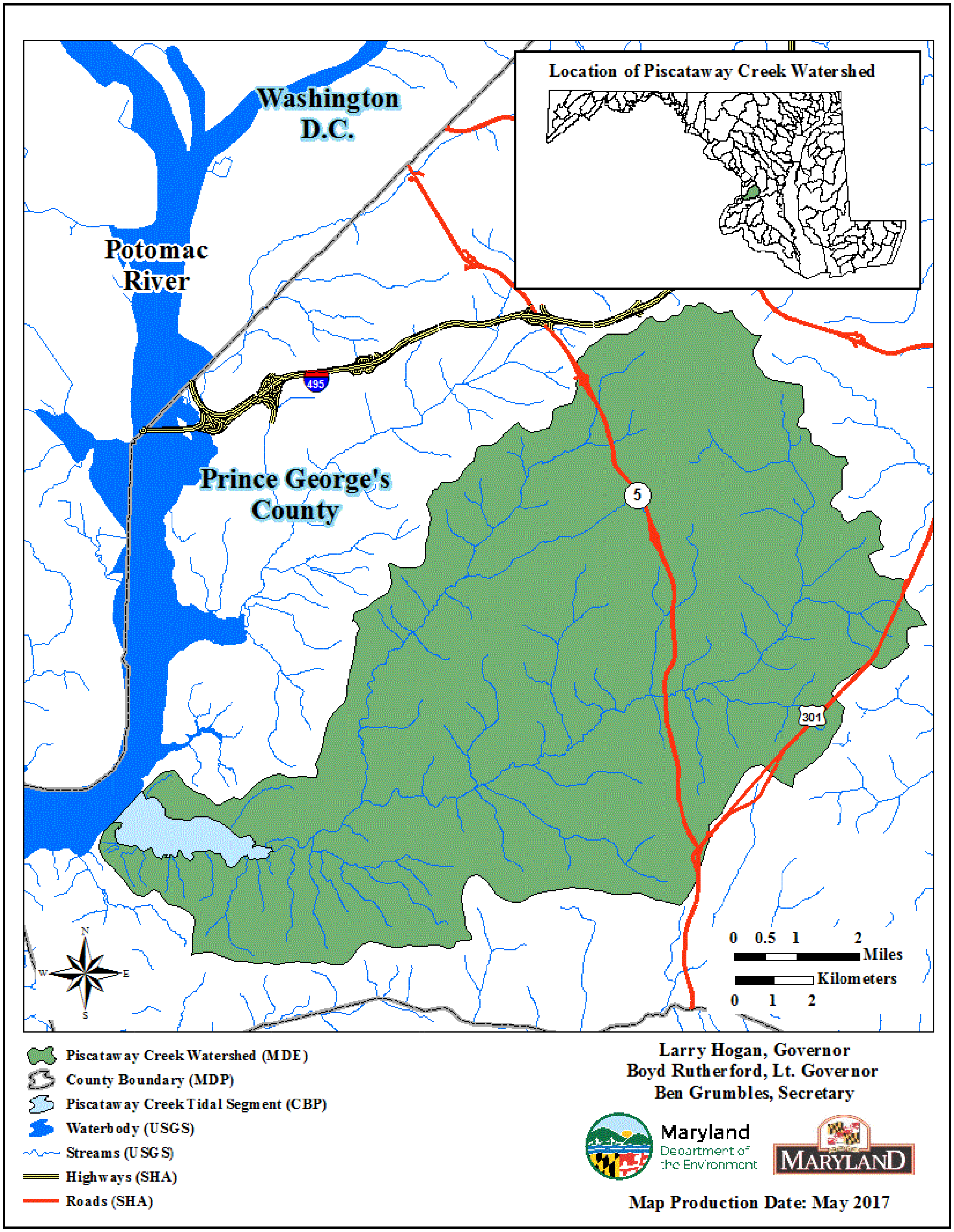

Figure 2: Location Map of the Piscataway Creek Watershed

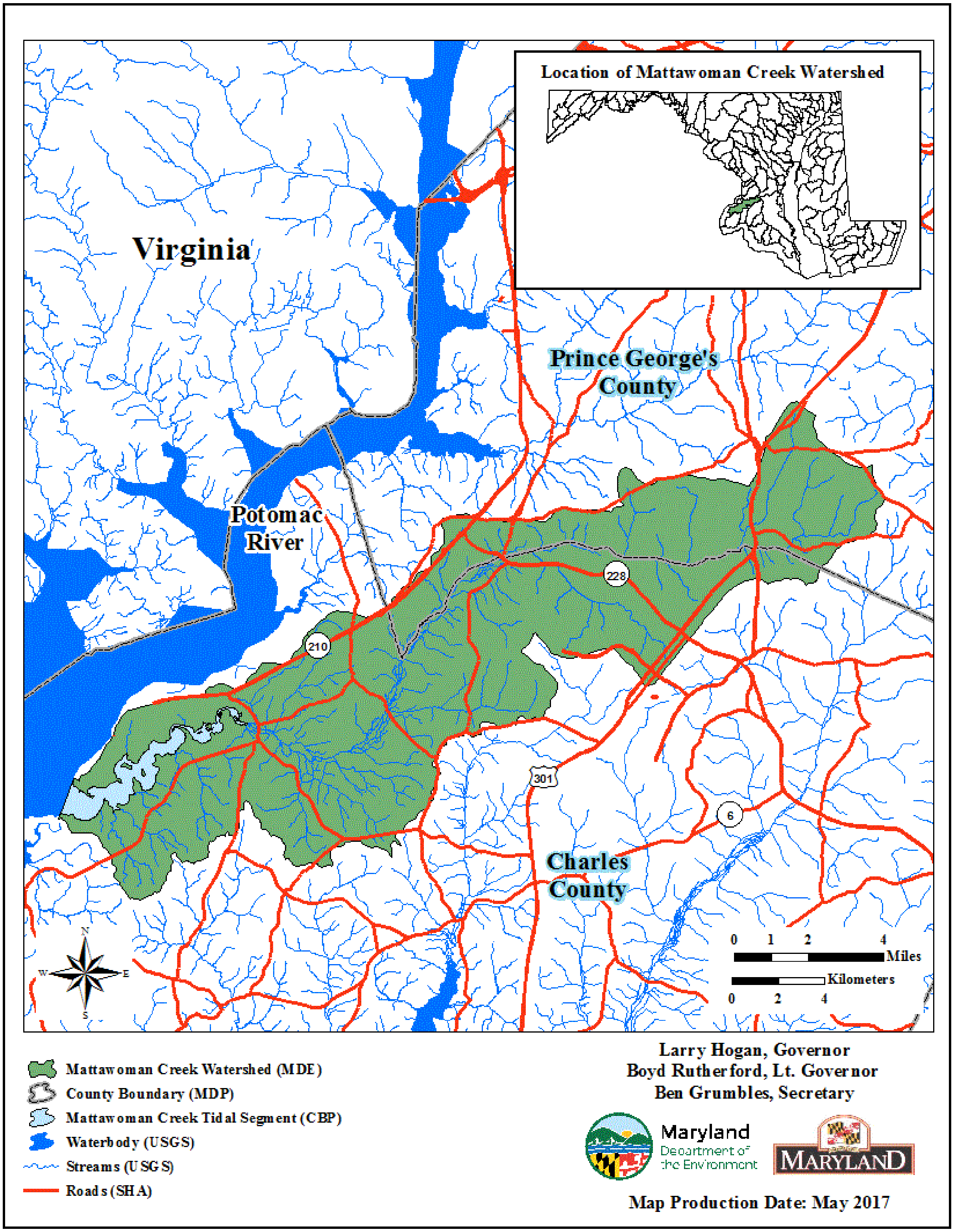

Figure 3: Location Map of the Mattawoman Creek Watershed

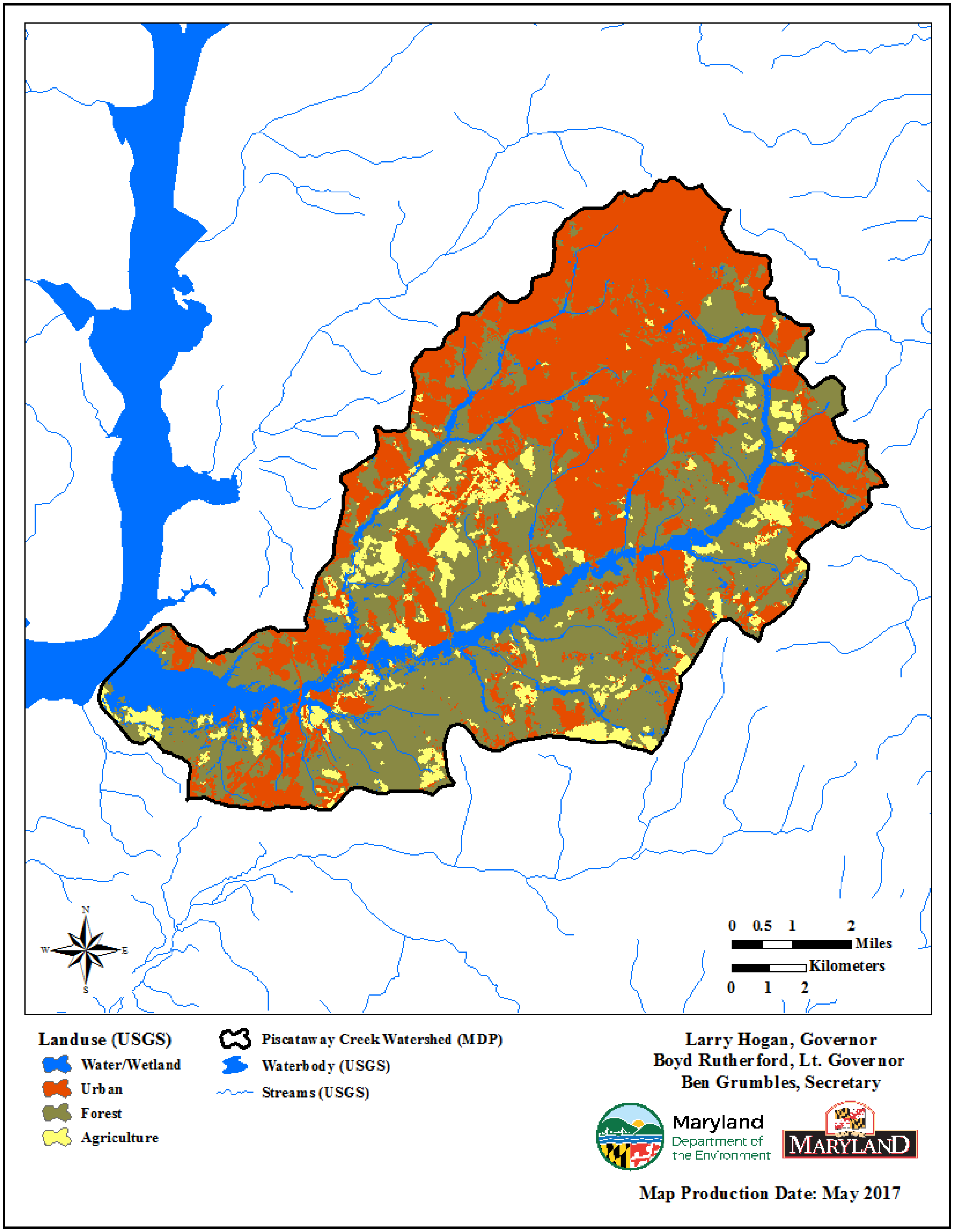

Figure 4: Land Use in the Piscataway Creek Watershed

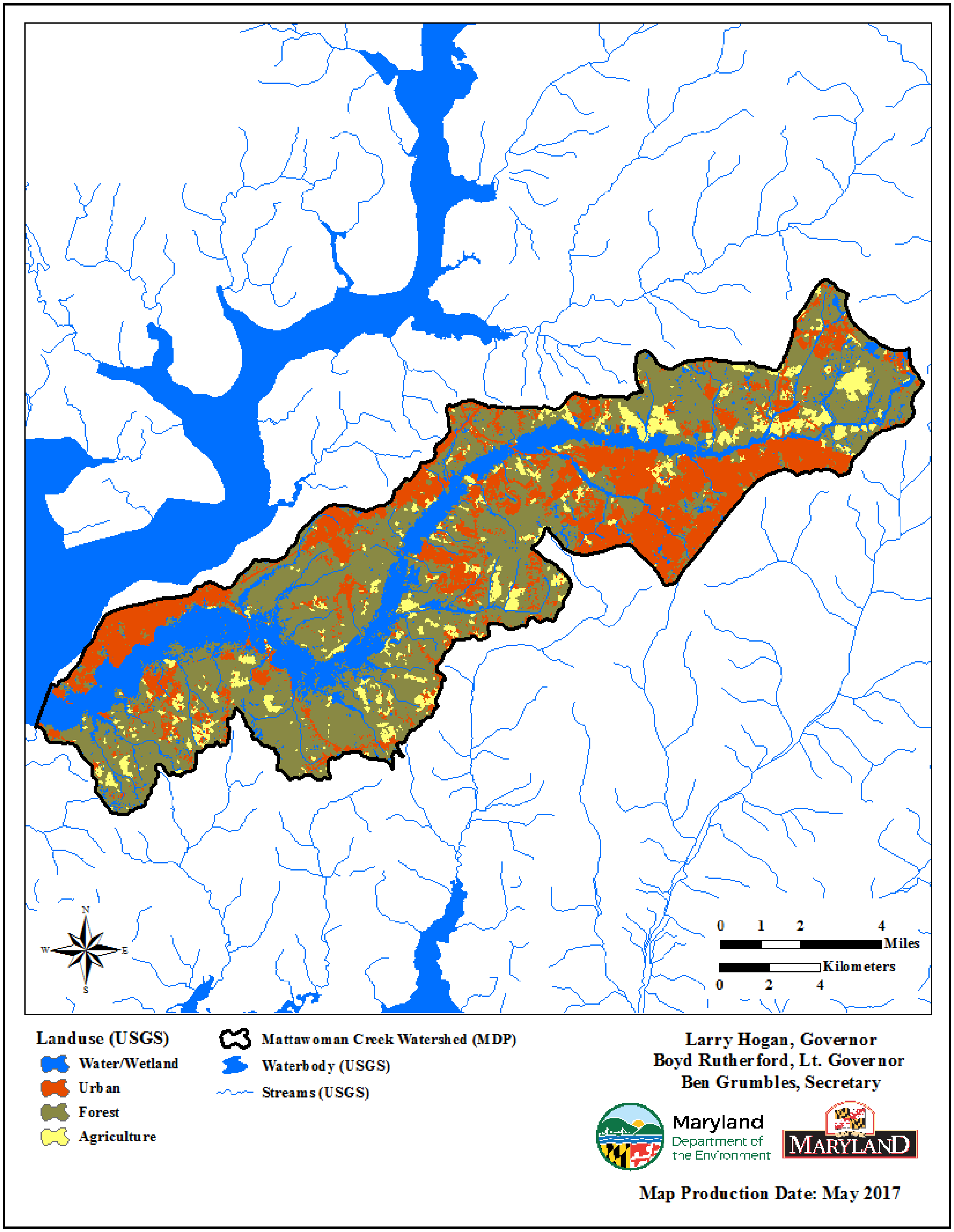

Figure 5: Land Use in the Mattawoman Creek Watershed

Table 3: Land Use Distribution in the Piscataway Creek and Mattawoman Creek Watersheds

Watershed	Land Use	Urban	Forest	Agriculture	Water/Wetland
Piscataway Creek	Area (km^2)	76	74	14	16
	Area (%)	42.2%	41.1%	7.8%	8.9%
Mattawoman Creek	Area (km^2)	63	129	18	41
	Area (%)	25.1%	51.4%	7.2%	16.3%

2.2 Water Quality Characterization and Impairment

Maryland WQSs specify that all surface waters of the State shall be protected for water contact recreation, fishing, and protection of aquatic life and wildlife (COMAR 2017a). The designated use class of the waters of the Piscataway Creek and Mattawoman Creek tidal segments is Use Class II – *Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting* (COMAR 2017b).

Water Column Characterization

The State of Maryland has adopted three separate water column tPCB criteria to account for different aspects of water quality. There is (1) a human health criterion of 0.64 nanograms/liter (ng/L) or parts per trillion (ppt) that addresses the consumption of PCB-contaminated fish, (2) a freshwater chronic criterion of 14 ng/L that is protective of aquatic life in non-tidal systems, and (3) a saltwater chronic criterion of 30 ng/L that is protective of aquatic life in tidal systems (COMAR 2017c). Maryland's water quality criteria are presented in Table 4. Since the human health criterion is more stringent than the fresh water and saltwater aquatic life criteria, if the human health criterion is met, all applicable water quality criteria would be satisfied.

The human health tPCB criterion is based on a cancer slope factor (CSF) of 2 milligrams/kilogram-day (mg/kg-day), a bioconcentration factor (BCF) of 31,200 liters/kilogram (L/kg), a cancer risk level of 10^{-5}, a lifetime risk level and exposure duration of 70 years, and fish intake of 17.5 g/day. A CSF is a toxicity value for evaluating the probability of an individual developing cancer from exposure to a chemical substance over a lifetime through ingestion or inhalation. A BCF is the ratio of the concentration of a chemical (i.e. tPCBs) in an aquatic organism to the concentration of the chemical in the water column. The cancer risk level provides an estimate of the additional incidence of cancer that may be expected in an exposed population. A risk level of 10^{-5} indicates a probability of one additional case of cancer for every 100,000 people exposed.

The State defines the waters of the "Washington Metropolitan Area" (MD 6-Digit Code: 021402), which includes the Piscataway Creek tidal segment, as freshwater; and the waters of the "Lower Potomac Area" (MD 6-Digit Code: 021401), which includes the Mattawoman Creek, as fresh water for all Maryland tributaries of the Potomac River upstream from St. Catherine Island (COMAR 2017d). The Mattawoman Creek tidal segment is upstream of St. Catherine Island. Thus the freshwater aquatic life criterion will be applicable to the Piscataway Creek and Mattawoman Creek tidal segments when assessing water quality.

Table 4: Water Column tPCB Criteria

tPCB Criteria/Threshold	Concentration (ng/L)
Fresh Water Chronic Aquatic Life Criterion	14
Salt Water Chronic Aquatic Life Criterion	30
Human Health Criterion	0.64

For the TPAR TMDL, historical data collected after 1999 and monitoring conducted in 2005 and 2006 specifically for this study were applied in development of the TMDL. The dataset included 270 water column samples, 250 sediment samples, and 350 fish tissue samples (Haywood 2007). This dataset included water column monitoring data in the Piscataway Creek and Mattawoman Creek tidal segments which is presented in Table 5. The table includes the tidal segment, sample media, sample type, sample size, year in which samples were collected; and mean, maximum, and minimum tPCB concentrations for water column samples. Monitoring station locations are presented in Figure 6.

Table 5: Water Quality Data Summary for the Piscataway Creek and Mattawoman Creek Tidal Segments

Tidal Segment	Sample Media	Sample Type	Sample Years	Sample Size	tPCB Concentration (ng/L)		
					Mean	Max	Min
Mattawoman Creek	Water Column	Tidal	2005/2006	4	0.92	1.25	0.72
		Non-Tidal	2006	2	0.32	0.33	0.32
Piscataway Creek	Water Column	Non-Tidal	2006	2	0.53	0.70	0.37

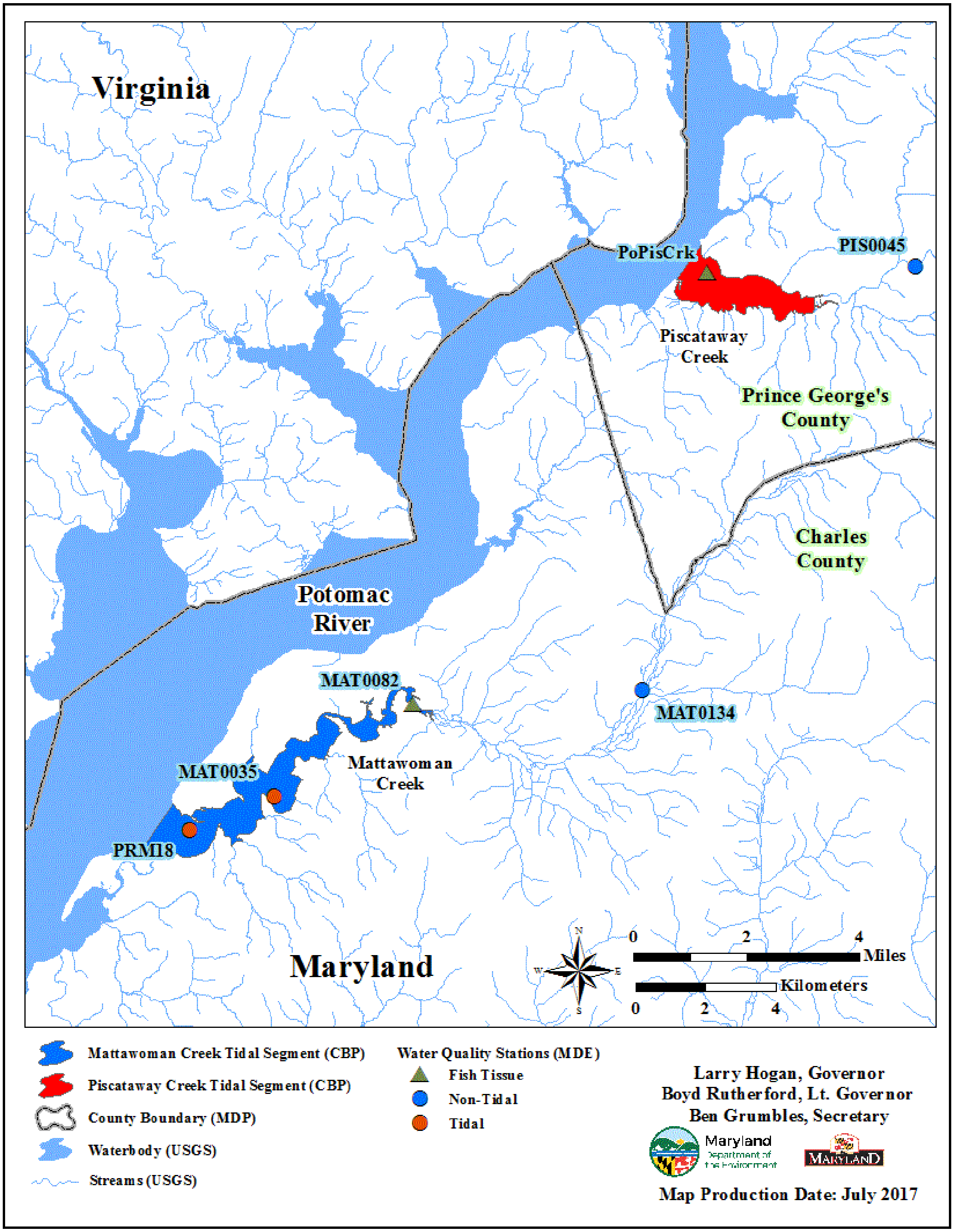

Figure 6: Water Quality Monitoring Stations in the Piscataway Creek and Mattawoman Creek Watersheds

Water quality data analysis indicates that the mean water column tPCB concentration for tidal samples in the Mattawoman Creek tidal segment exceeds the human health tPCB criterion of 0.64 ng/L; but does not exceed the fresh water chronic aquatic life tPCB criterion of 14 ng/L.

Fish Tissue Characterization

In addition to the water column criteria described above, fish tissue monitoring is also used as an indicator of PCB water quality conditions. Maryland regularly collects and analyzes fish tissue data in order to issue fish consumption advisories and recommendations, and determine whether Maryland waterbodies are meeting the "fishing" designated use. The State's tPCB fish tissue listing threshold of 39 ng/g is based on a fish consumption limit of four 8-ounce meals per month and is applied to the skinless fillet of the fish, the edible portion typically consumed by humans. When tPCB fish tissue concentrations exceed this threshold, the waterbody is listed as impaired for PCBs in fish tissue in Maryland's IR as it is not supportive of the "fishing" designated use (MDE 2016).

MDE has collected 4 fish tissue composite samples (20 total fish) in the Piscataway Creek tidal segment and 3 fish tissue composite samples (15 total fish) in the Mattawoman Creek tidal segment. Samples were collected in March 2009 and July & August 2011 and analyzed for tPCBs. The fish tissue tPCB data for the Piscataway Creek and Mattawoman Creek tidal segments is summarized in Table 6. The table includes the tidal segment, year in which samples were collected, fish species, number of composites (individual fish tissue samples); and mean, maximum, and minimum tPCB concentrations for fish tissue samples. Appendix B contains a table of all the fish tissue tPCB concentration data.

Table 6: Fish Tissue Data Summary for the Piscataway Creek and Mattawoman Creek Tidal Segments

Tidal Segment	Sample Years	Fish Species	Composites (Individual Fish)	tPCB Concentration (ng/g)		
				Mean	Max	Min
Piscataway Creek	2011	Blue Catfish	2 (10)	730.6	1,059.0	402.2
	2011	Northern Snakehead	2 (10)	53.1	75.2	31.0
Mattawoman Creek	2009	Yellow Perch	1 (5)	6.4	6.4	6.4
	2011	Blue Catfish	2 (10)	120.5	135.7	105.2

The mean tPCB concentrations of composites of blue catfish and northern snakehead in the Piscataway Creek tidal segment, and blue catfish in the Mattawoman Creek tidal segment, exceed the listing threshold of 39 ng/g, indicating that there is a tPCB impairment in the tidal segments.

3.0 TARGETED WATER COLUMN AND SEDIMENT TMDL ENDPOINTS

As described in Section 2.2, MDE evaluates whether a waterbody meets PCB related WQSs based on four criteria: 1) the IR fish tissue tPCB listing threshold (39 ng/g), 2) the human health water column tPCB criterion (0.64 ng/L), 3) the freshwater chronic tPCB criterion for protection of aquatic life (14 ng/L), and 4) the saltwater chronic tPCB criterion for protection of aquatic life (30 ng/L). Since the Piscataway Creek and Mattawoman Creek tidal segments were identified as impaired for PCBs in fish tissue, the overall objective of the tPCB TMDLs established in this document is to ensure that the "fishing" designated use, which is protective of human health related to the consumption of fish, is supported. However, this TMDL will also ensure the protection of all other applicable designated uses.

TMDL endpoints developed for the TPAR TMDL are applied to the Piscataway Creek and Mattawoman Creek tidal segments to determine whether allocations assigned by this TMDL are protective of the "fishing" designated use within these tidal segments. At the time of development of this TMDL, Maryland's fish tissue tPCB listing threshold was 88 ng/g. Following development and approval of this TMDL the listing threshold was lowered to 39 ng/g. All current PCB TMDLs developed in Maryland apply this threshold in calculating TMDL endpoints. Therefore, for the TMDLs established in this document, the TMDL endpoints developed under the TPAR TMDL have been recalculated based on the current listing threshold.

TMDL endpoints are developed by translating the fish tissue tPCB listing threshold concentration into an associated water column tPCB threshold concentration, as the water quality model only simulates water column and sediment tPCB concentration and does not incorporate a food web model to predict fish tissue tPCB concentrations (see Equation 3.1). This is accomplished using Adjusted Total Bioaccumulation Factors (Adj-tBAFs). 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 Appendix D of the TPAR TMDL for further details on calculating the Adj-tBAF) (Haywood 2007).

$$C_{WCLT} = \frac{C_{FTLT}}{\text{Adj-tBAF} \times \text{Unit Conversion}} \qquad \text{(Equation 3.1)}$$

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

The most environmentally conservative of the Adj-tBAFs is then selected to calculate the water column tPCB threshold concentration. The Adj-tBAF for channel catfish was selected for TMDL endpoint development in the TPAR TMDL. While the impairment listings for the Piscataway Creek and Mattawoman Creek tidal segments are based upon tPCB concentrations in blue catfish and white perch, the Adj-tBAF for channel catfish is greater.

The Adj-tBAFs for channel catfish, blue catfish, and white perch are 341,000, 38,800, and 82,000 L/kg, respectively. Thus, the water column tPCB threshold concentration calculated based upon the Adj-tBAF for channel catfish will be also protective of the "fishing" designated use associated with the consumption of blue catfish and white perch in the Piscataway Creek and Mattawoman Creek tidal segments.

The water column tPCB threshold concentration is subsequently compared to the water column tPCB criteria concentrations, as described in Section 2.2, to identify the most stringent concentration which is selected as the TMDL endpoint to ensure that all applicable criteria within the tidal segments are attained. The water column tPCB threshold concentration for the Piscataway Creek and Mattawoman Creek tidal segments is presented in Table 7. The table includes the tidal segment, Adj-tBAF, fish tissue tPCB listing threshold concentration, water column tPCB threshold concentrations, and water quality criteria.

Table 7: Water Column tPCB Threshold Concentrations for the Piscataway Creek and Mattawoman Creek Tidal Segments

Tidal Segment	Adj-tBAF (L/kg)	Fish Tissue tPCB Listing Threshold Concentration (ng/g)	Water Column tPCB Threshold Concentration (ng/L) [1]	Aquatic Life Chronic tPCB Criterion (ng/L) [2]	Human Health tPCB Criterion (ng/L)
Piscataway Creek and Mattawoman Creek	341,000	39	0.12	14	0.64

[1]Water column tPCB threshold concentration is applied as TMDL endpoint for the water column
[2]Freshwater Aquatic Life Criterion is applied to the Piscataway Creek and Mattawoman Creek tidal segments

The water column tPCB threshold concentration (0.12 ng/L) for the Piscataway Creek and Mattawoman Creek tidal segments is more stringent than the aquatic life chronic and human health criterion and is thus selected as the TMDL endpoint.

A similar method is used to relate fish tissue tPCB concentrations to a tPCB endpoint for the sediment (see Equation 3.2). This is accomplished using the Adjusted Sediment Bioaccumulation Factors (Adj-SediBAFs). 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 tPCB sediment concentration in their home range to produce the Adj-SediBAF per species (see Appendix D of the TPAR TMDL for further details on calculating the Adj-SediBAF) (Haywood 2007). The most environmentally conservative of the Adj-SediBAFs is then selected to calculate the sediment tPCB threshold concentration which is applied as the TMDL endpoint for sediment.

$$C_{SLT} = \frac{C_{FTLT}}{Adj\text{-}SediBAF} \qquad \text{(Equation 3.2)}$$

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

The Adj-SediBAF for channel catfish was selected for TMDL endpoint development in the TPAR TMDL. While the impairment listings for the Piscataway Creek and Mattawoman Creek tidal segments are based upon tPCB concentrations in blue catfish and white perch, the Adj-SediBAF for channel catfish is greater. The Adj-SediBAFs for channel catfish, blue catfish, and white perch are 7.52, 1.27, and 1.79 (dimensionless), respectively. Thus, the sediment tPCB threshold concentration calculated based upon the Adj-SediBAF for channel catfish will also be protective of the "fishing" designated use associated with the consumption of blue catfish and white perch in the Piscataway Creek and Mattawoman Creek tidal segments.

The sediment tPCB threshold concentration for the Piscataway Creek and Mattawoman Creek tidal segments is presented in Table 8. The table includes the tidal segment, Adj-SediBAF, fish tissue tPCB listing threshold concentration, and sediment tPCB threshold concentrations.

Table 8: Sediment tPCB Threshold Concentrations for the Piscataway Creek and Mattawoman Creek Tidal Segments

Tidal Segment	Adj-SediBAF	Fish Tissue tPCB Listing Threshold Concentration (ng/g)	Sediment tPCB Threshold Concentration (ng/g)[1]
Piscataway Creek and Mattawoman Creek	7.52	39	5.2

[1]Sediment tPCB threshold concentration is applied as the TMDL endpoint for sediment

The sediment tPCB threshold concentration (5.2 ng/g) for the Piscataway Creek and Mattawoman Creek tidal segments is selected as the sediment 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, as described in Sections 1.0 and 2.2. These include "marine and estuarine aquatic life", "shellfish harvesting," and "water contact recreation." The water column tPCB TMDL endpoint concentration, whose derivation is described above, is applied in this TMDL analysis and is more stringent than Maryland's saltwater and freshwater aquatic life chronic tPCB criteria. This indicates that the TMDL endpoint is protective of the "aquatic life" designated use, specifically the protection of “marine and estuarine aquatic life and shellfish harvesting.”

Lastly, the designated use for "water contact recreation" is not associated with any potential human health risks due to PCB exposure. Dermal contact and accidental consumption of water from activities associated with "water contact recreation" is not a significant pathway for the uptake of PCBs. 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.

4.0 SOURCE ASSESSMENT

PCBs do not occur naturally in the environment. Therefore, unless existing or historical anthropogenic sources are present, their natural background levels are expected to be zero. Although PCBs are no longer manufactured in the U.S., they are still being released to the environment via accidental fires, leaks, and spills from PCB-containing equipment; potential leaks from hazardous waste sites that contain PCBs; illegal or improper dumping; disposal of PCB-containing products (*e.g.*, transformers, old fluorescent lighting fixtures, electrical devices or appliances containing PCB capacitors, old microscope oil, and old hydraulic oil) into landfills not designed to handle hazardous waste; and through inadvertent production during manufacturing processes. Once in the environment, PCBs do not readily break down and tend to cycle between various environmental media such as air, water, and soil.

PCBs exhibit low water solubility, are moderately volatile, strongly adsorb to organics, and preferentially partition to upland and bottom sediments. The major fate process for PCBs in water is adsorption to sediment or other organic matter. Adsorption and subsequent sedimentation may immobilize PCBs for relatively long periods of time. However, desorption into the water column may also occur; PCBs contained in layers near the sediment surface may be slowly released over time, while concentrations present in the lower layers may be effectively sequestered from environmental distribution (RETEC 2002).

The linkage between the “fishing” designated use and PCB concentrations in the water column is via the uptake and bioaccumulation of PCBs by aquatic organisms. Bioaccumulation occurs when the combined uptake rate of a given chemical from food, water, and sediment by an organism exceeds the organism’s ability to remove the chemical through metabolic functions, dilution, or excretion, resulting in excess concentrations of the chemical being stored in the body of the organism. Depending on the life cycle and feeding patterns, aquatic organisms can bioaccumulate PCBs via exposure to concentrations present in the water column (in dissolved and particulate form) and sediments, as well as from consumption of other organisms resulting in the biomagnification of PCBs within the food chain (RETEC 2002). Humans can be exposed to PCBs via consumption of aquatic organisms, which over time have bioaccumulated PCBs.

A simplified conceptual model of PCB fate and transport in the Piscataway Creek and Mattawoman Creek tidal segments is diagrammed in Figure 7. PCB sources, resulting primarily from historical uses of these compounds and potential releases to the environment as described above, include both point and nonpoint sources. This section provides a summary of these existing sources that have been identified in the TPAR TMDL as contributing tPCB loads to the impaired waters.

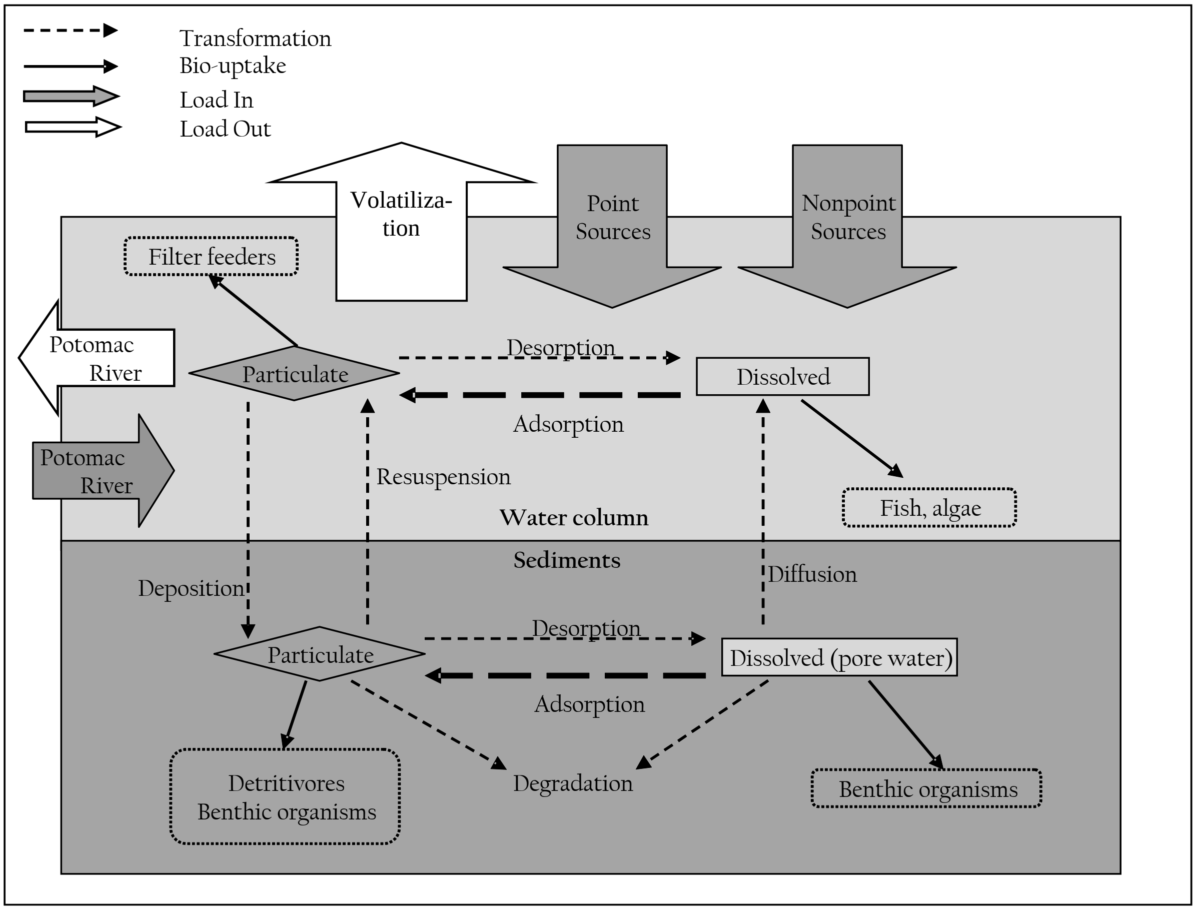

Figure 7: Conceptual Model of the Key Transport and Transformation Processes of PCBs in Surface Water and Bottom Sediments of the Piscataway Creek and Mattawoman Creek Tidal Segments and Entry Points to the Food Chain

4.1 Nonpoint Sources

The TPAR TMDL identified the following nonpoint sources of PCBs within the Piscataway Creek and Mattawoman Creek tidal segments: 1) direct atmospheric deposition to the surface water of the tidal segments, 2) contaminated sites (areas with known PCB soil contamination, as documented by state or federal hazardous waste cleanup programs), and 3) runoff from non-regulated watershed areas.

The transport of PCBs from bottom sediments to the water column through re-suspension and diffusion can also be a major source of PCBs in estuarine systems. The water quality model (POTPCB model) developed for the TPAR TMDL simulates conditions within the water column and sediment as a single system, therefore, exchanges between the sediment and water column are accounted for within the model as an internal load (Haywood 2007). Only external sources to the system are assigned a baseline load within the TMDL. Thus, no baseline load or allocation is assigned to resuspension and diffusion of PCBs from the sediment.

The tidal exchanges between the Piscataway Creek and Mattawoman Creek tidal segments and the mainstem of the Tidal Potomac River can also be a major source of PCBs to these systems and are accounted for within the model as internal loads (Haywood 2007). The POTPCB model only defines a boundary condition between the mouth of the Tidal Potomac River and the mainstem of the Chesapeake Bay for which a baseline load and allocation has been assigned (Haywood 2007). Thus, the TPAR TMDL does not assign baseline loads or allocations at the boundaries between the Tidal Potomac River and the Piscataway Creek and Mattawoman Creek tidal segments.

Atmospheric Deposition

PCBs enter the atmosphere through volatilization. An Atmospheric Deposition Study by CBP estimated a net deposition of 16.3 micrograms/square meter/year (μg/m^2/year) of tPCBs for urban areas and a net deposition of 1.6 μg/m^2/year of tPCBs for regional (non urban) areas (US EPA 1999). The TPAR TMDL applied rates from this study in estimating loads for atmospheric deposition of PCBs to the surface area of the Piscataway Creek and Mattawoman Creek tidal segments. The urban deposition rate defined in CBP's study is a result of heavily urbanized areas comprised primarily of high density residential, industrial and commercial land uses. The TMDL divided the Tidal Potomac River into three zones of atmospheric deposition: Urban, Regional, and Transition (Haywood 2007). Tidal segments within the Urban zone receive an atmospheric deposition rate of 16.3 μg/m^2/year and tidal segments within the Regional zone receive an atmospheric deposition rate of 1.6 μg/m^2/year (Haywood 2007). Deposition rates in the Transition zone were linearly interpolated between the Urban and Regional rates (Haywood 2007). The Piscataway Creek and Mattawoman Creek tidal segments are located in the Transition zone.

The direct atmospheric deposition tPCB baseline loads to the surface of the Piscataway Creek and Mattawoman Creek tidal segments were calculated by multiplying the surface area of the tidal segments and the deposition rate applicable to the zone in which the tidal segments are located (See Appendix A of the TPAR TMDL for further details on calculating atmospheric deposition tPCB baseline loads) (Haywood 2007). The atmospheric deposition tPCB baseline loads to the Piscataway Creek and Mattawoman Creek tidal segments are presented in Table 9. The table includes the tidal segment, surface water area, atmospheric deposition rate, and atmospheric deposition tPCB baseline loads.

Table 9: Atmospheric Deposition tPCB Baseline Loads to the Piscataway Creek and Mattawoman Creek Tidal Segments

Tidal Segment	Atmospheric Deposition Rate (ug/m^2/year)	Surface Water Area (km^2)	Atmospheric Deposition tPCB Load (g/year)
Piscataway Creek	9.7	3.7	35.9
Mattawoman Creek	5.1	7.3	37.3

Contaminated Sites

'Contaminated sites' refer to areas with known PCB soil contamination, as documented by state or federal hazardous waste cleanup programs (*i.e.*, state or federal Superfund programs). When compared against the human health screening criteria for soil and groundwater exposure pathways, PCBs are not necessarily a contaminant of concern at these sites, but they have been screened for, reported, and detected during formal site investigations.

Potentially contaminated sites are identified based on information gathered from MDE's Land Restoration Program Geospatial Database (LRP-MAP) (MDE 2017). The TPAR TMDL identified one site within the Piscataway Creek and Mattawoman Creek watersheds, the U.S. Naval Surface Warfare Center – Indian Head Division (located in the Mattawoman Creek watershed), with tPCB soil contamination. No additional contaminated sites with PCB soil contamination have been identified by MDE in the Piscataway Creek and Mattawoman Creek watersheds since the establishment of the TPAR TMDL. Soil concentration data was obtained from MDE Land Management Administration (LMA) contaminated site surveys and investigation records. The location of the contaminated site is displayed in Figure 8.

The median soil tPCB concentration was multiplied by the soil loss rate, which is a function of soil type, pervious area, and land cover, to estimate the tPCB baseline load (See Appendix A of the TPAR TMDL for further details on calculating contaminated site tPCB baseline loads) (Haywood 2007). The contaminated site tPCB baseline load for the U.S. Naval Surface Warfare Center site is presented in Table 10. The table includes the site name, MDE site ID, median tPCB soil concentration, soil loss rate, and tPCB baseline load.

Table 10: Contaminated Site tPCB Baseline Load in the MATTF Watershed

Site Name	MDE LRP Site ID	Median tPCB Concentration (ng/g)	Soil Loss Rate (lbs/year)	tPCB Baseline Load (g/year)
U.S. Naval Surface Warfare Center - Indian Head	MD-064	480	473	0.1

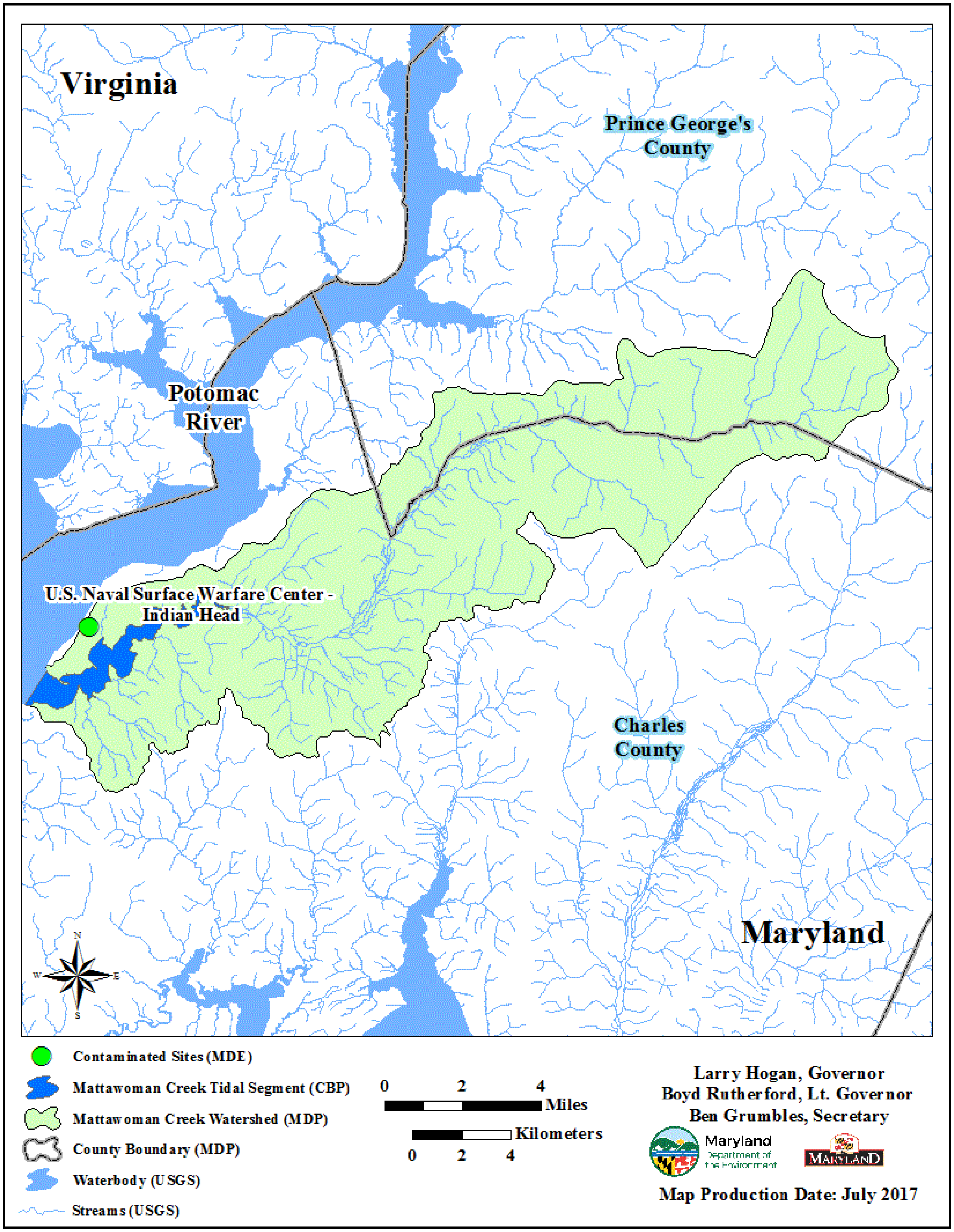

Figure 8: Location of PCB Contaminated Site in the Mattawoman Creek Watershed

Watershed Sources: Non-regulated Watershed Runoff

The non-regulated watershed runoff tPCB load corresponds to the non-urbanized areas (*i.e.*, primarily agriculture and forest) of the watershed. The load associated with the regulated urbanized area of the watershed represents the National Pollutant Discharge Elimination System (NPDES) Regulated Stormwater tPCB load which is presented in Section 4.2 under Point Sources.

The TPAR TMDL applies the following process in estimating the non regulated watershed runoff tPCB loads from the Piscataway Creek and Mattawoman Creek watersheds:

1) Baseline flow and total suspended solids (TSS) loads from the Piscataway Creek and Mattawoman Creek watersheds are estimated from the output of the Phase 5 Chesapeake Bay Watershed Model (P5 CBWM);

2) A linear regression of observed water column concentration data for TSS and PCBs was calculated to establish a statistical relationship between the two parameters;

3) The baseline tPCB loads from the Piscataway Creek and Mattawoman Creek watersheds is estimated by applying the regression equation to the estimated TSS loading from the output of the P5 CBWM model;

4) Land use percentages within each watershed are calculated from the 2006 USGS spatial land cover; and

5) The non-regulated watershed runoff tPCB baseline loads from the Piscataway Creek and Mattawoman Creek watersheds were estimated by multiplying the percentage of non-urban land use within the watersheds and the corresponding watershed baseline tPCB loads (See Appendix A of the TPAR PCB TMDL for further details on calculating non-regulated watershed runoff tPCB baseline loads) (Haywood 2007).

The P5 CBWM model segmentation defines each segment within the Potomac River watershed as either direct drainage or a tributary. The Piscataway Creek and Mattawoman Creek watersheds each contain both direct drainage and tributary P5 CBWM model segments. When the TPAR TMDL was established only the tPCB baseline watershed loads for direct drainage segments were apportioned between non-regulated watershed runoff and NPDES regulated stormwater. The entire tPCB baseline watershed load for tributary segments was assigned as a tributary load. For the purposes of this TMDL, tPCB baseline loads for the entire watershed including the tributary and direct drainage model segments will be apportioned between non-regulated watershed runoff and NPDES regulated stormwater.

The non-regulated watershed runoff tPCB baseline loads from the Piscataway Creek and Mattawoman Creek watersheds are presented in Table 11. The table includes the watershed, non-urban and non-regulated urban land use percentage, and non-regulated watershed runoff tPCB baseline loads.

Table 11: Non-regulated Watershed Runoff tPCB Baseline Loads in the Piscataway Creek and Mattawoman Creek Watersheds

Watershed	Total Watershed tPCB Load (g/year)	Non-Urban and Non-Regulated Urban Land Use (%)	Non-Regulated Watershed Runoff tPCB Load (g/year)
Piscataway Creek	44.6	56.3%	25.1
Mattawoman Creek	50.7	70.2%	35.6

4.2 Point Sources

The TPAR TMDL identified the following point sources of PCBs within the Piscataway Creek and Mattawoman Creek tidal segments: 1) NPDES-regulated municipal wastewater treatment plants (WWTPs) and 2) NPDES Regulated Stormwater. This section provides detailed explanations regarding the calculation of the point source tPCB baseline loads.

Municipal WWTPs

The TPAR TMDL includes all WWTPs with discharge flow greater than 0.1 million gallons per day (MGD) (Haywood 2007). Facilities which discharge below 0.1 MGD were determined to contribute "de mimimus" PCB loads and were not assigned baseline loads or allocations within the framework of the TMDL (Haywood 2007). There are two municipal WWTPs, with discharge flows greater than 0.1 MGD, located in the Piscataway Creek and Mattawoman Creek watersheds. The locations of the WWTPs are displayed in Figure 9. The tPCB baseline loads from the WWTPs are calculated by multiplying the average discharge flow and tPCB effluent concentration (See Appendix A of the TPAR TMDL for further details on calculating WWTP tPCB baseline loads) (Haywood 2007). WWTP facility outfalls were sampled for tPCBs in 2006 (MDE 2006). The average discharge flows from the facilities were calculated based on Discharge Monitoring Report (DMR) flow records from 2006. The WWTP tPCB baseline loads are presented in Table 12. The table includes the facility name, NPDES permit, tidal segment, average flow, average effluent tPCB concentration, and tPCB baseline load.

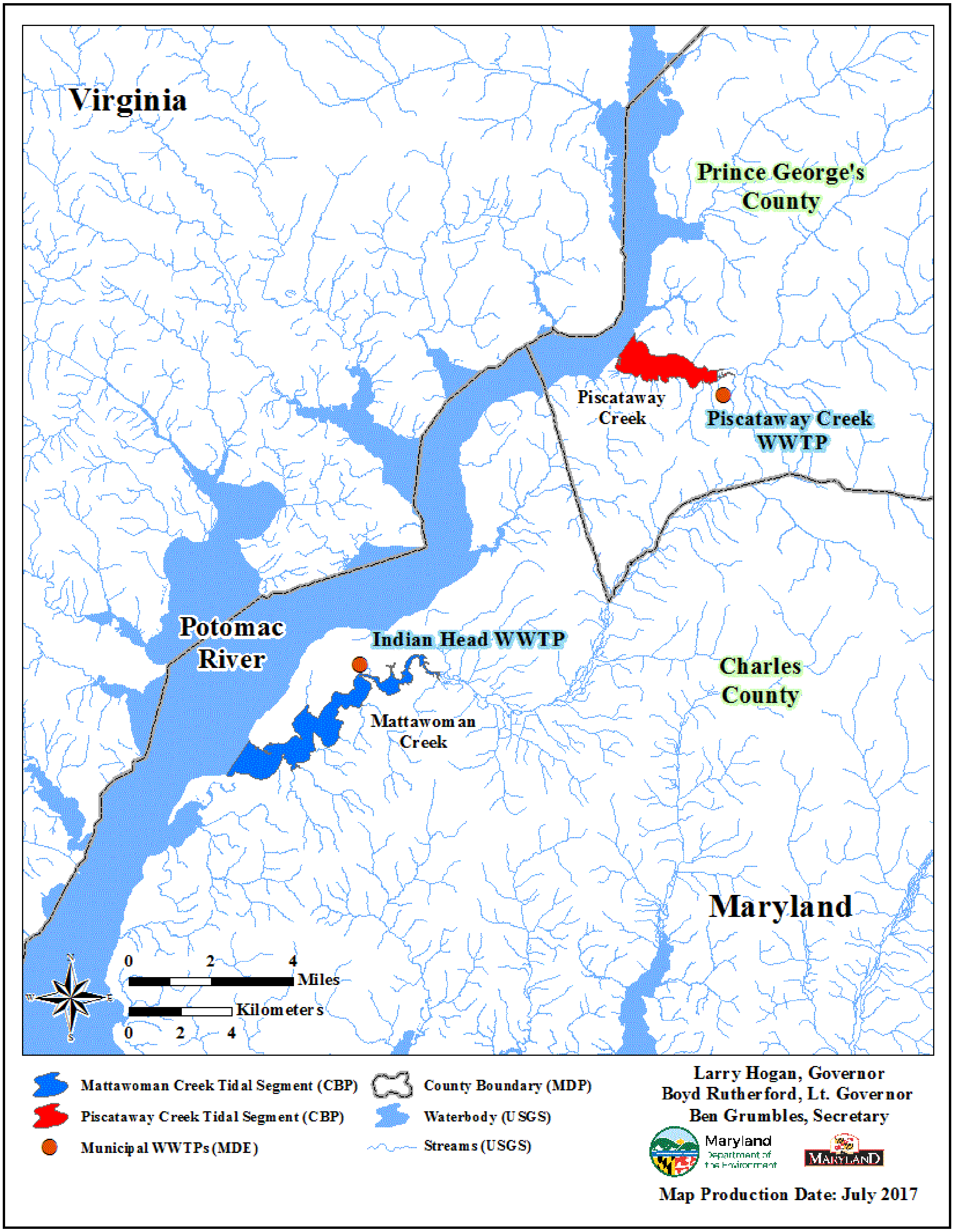

Figure 9: NPDES Municipal WWTPs in the Piscataway Creek and Mattawoman Creek Watersheds

Table 12: Municipal WWTP tPCB Baseline Loads in the Piscataway Creek and Mattawoman Creek Watersheds

Watershed	NPDES Permit	Facility Name	Average Flow (MGD[1])	Average tPCB Effluent Concentration (ng/L)	WWTP tPCB Load (g/year)
Piscataway Creek	MD0021539	Piscataway WWTP	21.4	0.06	1.6
Mattawoman Creek	MD0020052	Indian Head WWTP	0.3	0.16	0.1

[1]Million gallons per day

NPDES Regulated Stormwater

The Department 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" (US 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.

The list of NPDES regulated stormwater permits within the Piscataway Creek and Mattawoman Creek watersheds that could potentially convey tPCB loads to the tidal segments is presented in Appendix A.

The Piscataway Creek and Mattawoman Creek watersheds are located within the following counties regulated under Phase I of the NPDES stormwater program: Prince George's and Charles County, Maryland. The NPDES stormwater permits within the watersheds include: (i) the area covered under Phase I & II jurisdictional MS4 permit for these counties, (ii) the State Highway Administration's Phase I MS4 permit, (iii) industrial facilities permitted for stormwater discharges, and (iv) MDE general permit to construction sites (see Appendix A for a list of all NPDES regulated stormwater permits). The loads from NPDES regulated stormwater, including Phase I and Phase II MS4 permits, were aggregated by county for the Piscataway Creek and Mattawoman Creek watersheds.

The TPAR TMDL applies the same process for calculating NPDES regulated stormwater tPCB baseline loads as was done for calculating the non-regulated watershed runoff tPCB baseline loads. Land use percentages within each county were calculated from the 2006 USGS spatial land cover. The NPDES regulated stormwater tPCB baseline loads were estimated by multiplying the percentage of regulated urban land use area within the regulated county portions of the Piscataway Creek and Mattawoman Creek watersheds by the corresponding county portions of the watershed tPCB baseline loads (See Appendix A of the TPAR TMDL for further details on calculating the NPDES regulated stormwater tPCB baseline loads) (Haywood 2007). The NPDES regulated stormwater tPCB baseline loads from the Piscataway Creek and Mattawoman Creek watersheds are presented in Table 13. The table includes the watershed, county, total watershed tPCB load, county portion of total watershed tPCB load, urban land use percentage, and NPDES regulated stormwater tPCB baseline load.

Table 13: Aggregate Regulated Stormwater tPCB Baseline Loads in the Piscataway Creek and Mattawoman Creek Watersheds

Watershed	County	Watershed tPCB Load (g/year)	Watershed tPCB Load by County (g/year)	Regulated Urban Landuse (%)	NPDES Regulated Stormwater tPCB Load (g/year) [1]
Piscataway Creek	Prince George's	44.64	44.64	43.7%	19.52
Mattawoman Creek	Prince George's	50.66	17.02	18.4%	3.13
	Charles		33.64	35.5%	11.94

[1]NPDES regulated stormwater baseline loads are an aggregate of loadings from areas covered under the following permits: (i) Phase I & II jurisdictional MS4 permits, (ii) the State Highway Administration's Phase I MS4 permit, (iii) industrial facilities permitted for stormwater discharges, and (iv) MDE general permit to construction sites.

4.3 Source Assessment Summary

The TPAR TMDL identified and characterized all known point and nonpoint sources of PCBs in the Piscataway Creek and Mattawoman Creek watersheds and tidal segments. The following nonpoint sources of PCBs were identified: 1) direct atmospheric deposition to the Piscataway Creek and Mattawoman Creek tidal segments; 2) a single contaminated site in the Mattawoman Creek watershed; and 3) runoff from non-regulated watershed areas. Point sources included NPDES regulated municipal WWTP facilities and NPDES regulated stormwater. Estimated tPCB loads from these point and nonpoint sources represent the baseline conditions for the watershed.

A summary of the tPCB baseline loads for the Piscataway Creek and Mattawoman Creek tidal segments is presented in Table 14. As explained in Section 4.1, loads associated with re-suspension and diffusion from sediments, and tidal exchanges between the impaired waters and mainstem of the Tidal Potomac River are accounted for within the framework of the TMDL as internal loads and are not assigned baseline loads or allocations.

Table 14: Summary of tPCB Baseline Loads in the Piscataway Creek and Mattawoman Creek Tidal Segments

Tidal Segment	Source	Baseline Load (g/year)	Baseline Load (%)
Piscataway Creek	Non-regulated Watershed Runoff	25.1	30.55%
	Atmospheric Deposition	35.9	43.71%
	Nonpoint Sources	***61.1***	***74.26%***
	NPDES Regulated Stormwater[1]		
	Prince George's	19.5	23.74%
	WWTPs	1.6	1.99%
	Point Sources	***21.2***	***25.74%***
	Total	***82.2***	***100.00%***
Mattawoman Creek	Non-regulated Watershed Runoff	35.6	40.38%
	Atmospheric Deposition	37.3	42.32%
	Contaminated Sites	0.1	0.11%
	Nonpoint Sources	***73.0***	***82.82%***
	NPDES Regulated Stormwater[1]		
	Prince George's	3.1	3.55%
	Charles	11.9	13.55%
	WWTPs	0.1	0.08%
	Point Sources	***15.1***	***17.18%***
	Total	***88.1***	***100.00%***

[1]NPDES regulated stormwater baseline loads are an aggregate of loadings from areas covered under the following permits: (i) Phase I & II jurisdictional MS4 permits, (ii) the State Highway Administration's Phase I MS4 permit, (iii) industrial facilities permitted for stormwater discharges, and (iv) MDE general permit to construction sites.

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

5.0 TOTAL MAXIMUM DAILY LOADS AND LOAD ALLOCATIONS

5.1 Overview

A TMDL is the total amount of an impairing substance that a waterbody can receive and still meet WQSs. The TMDL may be expressed as a mass per unit time, toxicity, or other appropriate measure and should be presented in terms of WLAs, load allocations (LAs), and either an implicit or explicit margin of safety (MOS) (CFR 2017a):

$$TMDL = WLAs + LAs + MOS \quad \text{(Equation 5.1)}$$

This section describes how the tPCB TMDL and the corresponding LAs, WLAs, MOSs, and maximum daily loads (MDLs) have been developed for the Piscataway Creek and Mattawoman Creek tidal segments.

5.2 Analysis Framework

This report establishes TMDLs for the Piscataway Creek and Mattawoman Creek tidal segments based on modeling from the TPAR TMDL (Haywood 2007). The TPAR TMDL model included the Piscataway Creek and Mattawoman Creek tidal segments; however, these waters did not receive individual TMDLs as they were not listed as impaired in Maryland's IR at the time of the TPAR TMDL. This analysis has fully adopted the modeling and analytical framework from the TPAR TMDL and the TMDLs and allocations presented herein are fully consistent with those laid out in the TPAR TMDL.

The water quality model (POTPCB model) developed for the TPAR TMDL is a coupled hydrodynamic, salinity, sorbent dynamics, and PCB mass balance model developed by LimnoTech (Haywood 2007). The hydrodynamic simulations are based on a version of the Dynamic Hydrologic Model (DYNHD), and sorbent dynamics and PCB mass balance are simulated with a version of the Water Quality Analysis Simulation Program 5 (WASP5)/Toxic chemical (TOXI4) Model (Haywood 2007). A complete description of the model is found in a separate document (LimnoTech 2007).

The POTPCB model contains 257 model segments of which the segments representing the Piscataway Creek and Mattawoman Creek tidal segments are 200-202 and 174-178, respectively (Haywood 2007). The model segmentation for these tidal segments is displayed in Figure 10.

<u>Baseline Scenario</u>

The POTPCB model applies a hydrologic year of 2005 (calendar) to represent the baseline scenario (Haywood 2007). The year 2005 was selected as sufficient data was available for model calibration and the flow distribution for the representative USGS gage within the system (Little Falls - 01646502) was closest to the long term harmonic mean flow (Haywood 2007). EPA recommends using the harmonic mean flow as the critical flow condition for TMDLs for substance whose human health impact is derived from life time exposure (Haywood 2007).

The POTPCB model simulates daily PCB water column and sediment concentrations in each of the 257 model segments (Haywood 2007). The baseline scenario is run using hydrologic year 2005 flows and associated loads on a cyclical basis until a dynamic equilibrium is achieved between the sediment and water column thus providing the baseline PCB concentrations (Haywood 2007).

TMDL Scenario

The TMDL scenario is determined through iterative diagnostic runs applying the same hydrologic year flows as the baseline scenario with incremental load reductions until the sediment and water column tPCB concentrations (median daily) achieve the TMDL endpoints (Haywood 2007).

The water column and sediment tPCB concentrations (median daily) from the TMDL scenario for the Piscataway Creek and Mattawoman Creek tidal segments are compared with the revised TMDL endpoints, to determine whether the existing TMDL allocations from the TPAR TMDL are sufficient for protecting the "fishing" designated use in the tidal segments (See Table 15). The water column and sediment tPCB concentrations for the tidal segments fall below the revised TMDL endpoints. Thus, the TMDL allocations established in the TPAR TMDL are supportive of the "fishing" designated use for the Piscataway Creek and Mattawoman Creek tidal segments.

Table 15: Evaluation of Piscataway Creek and Mattawoman Creek PCB TMDLs

Tidal Segment	POTPCB Model Segment	Sediment		Water Column	
		tPCBs (ng/g) (Median Daily)	tPCB TMDL Endpoint[1] (ng/g)	tPCBs (ng/L) (Median Daily)	tPCB TMDL Endpoint[1] (ng/L)
Mattawoman Creek	174	0.55	5.2	0.04	0.12
	175	0.69	5.2	0.05	0.12
	176	0.84	5.2	0.06	0.12
	177	1.12	5.2	0.07	0.12
	178	1.35	5.2	0.07	0.12
	Average	**0.91**	**5.2**	**0.06**	**0.12**
Piscataway Creek	200	0.72	5.2	0.04	0.12
	201	1.36	5.2	0.07	0.12
	202	1.78	5.2	0.09	0.12
	Average	**1.29**	**5.2**	**0.07**	**0.12**

[1]In establishing this TMDL, the TMDL endpoints from the TPAR TMDL were revised based on the current Fish Consumption PCB Listing Threshold of 39 ng/g (See Section 3.0 for more information on TMDL endpoint development).

The TPAR TMDL demonstrated that load reductions were only required within the Potomac River watershed above chain bridge and the Anacostia River watershed, upstream of the Piscataway Creek and Mattawoman Creek tidal segments, in order to attain water quality standards within the impaired waters being addressed by the TMDL (Haywood 2007). No load reductions were required directly to sources within the Piscataway Creek and Mattawoman Creek watersheds. However, the upstream load reductions were also necessary in order to achieve TMDL endpoints within the Piscataway Creek and Mattawoman Creek, as they led to a reduction in loadings to the Piscataway Creek and Mattawoman Creek from tidal exchanges with the mainstem of the Potomac River.

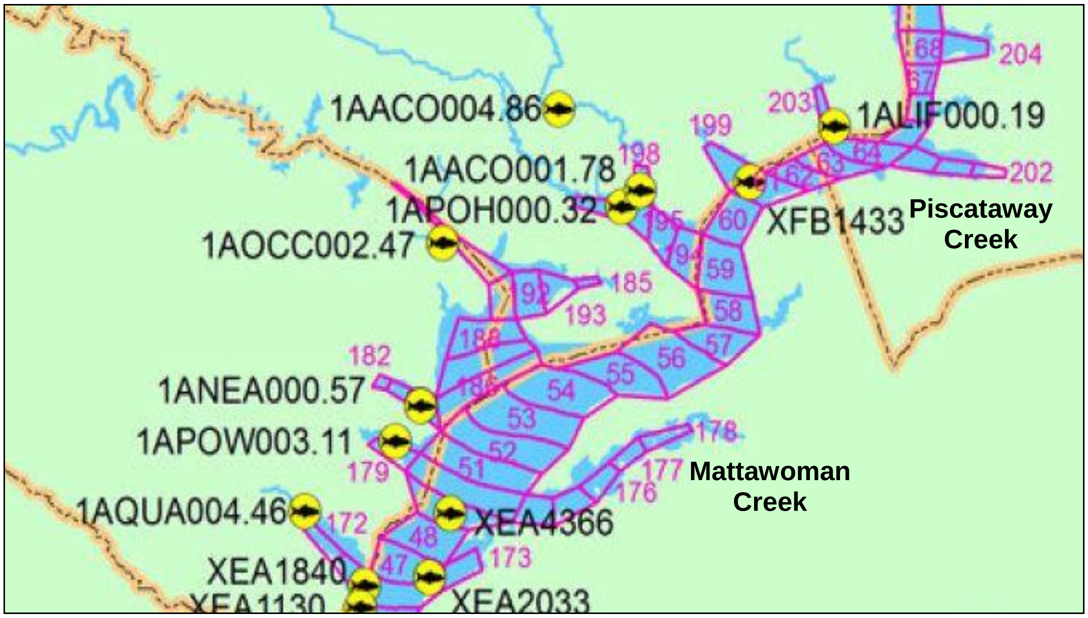

Figure 10: POTPCB Model Segmentation for the Piscataway Creek and Mattawoman Creek Tidal Segments

5.3 Critical Condition and Seasonality

Federal regulations require TMDL analysis to take into account the impact of critical conditions and seasonality on water quality (CFR 2017b). The intent of this requirement is to ensure that water quality is protected when it is most vulnerable.

Bioaccumulation of PCBs in fish is driven by long-term exposure through respiration, dermal contact, and consumption of lower order trophic level organisms. The critical condition defined by acute exposure to temporary fluctuations in PCB water column concentrations during storm events is not a significant pathway for uptake of PCBs. PCB levels in fish tissue become elevated due to long-term exposure. EPA recommends applying the long-term harmonic mean flow as the critical condition for TMDLs for substances whose human health impact is derived from lifetime exposure (Haywood 2007). Seasonality and critical conditions are addressed in the TPAR TMDL through the use of daily surface flows and loads of total suspended solids and particulate carbon from calendar year 2005 which was selected as the hydrologic design year as it most closely matches the long-term harmonic mean flow of the Potomac River (See Appendix C of the TPAR TMDL for more information) (Haywood 2007). Furthermore, the water column tPCB TMDL endpoint is also supportive of the "protection of aquatic life" designated use at all times as it is more stringent than the freshwater chronic aquatic life tPCB criteria.

5.4 TMDL Allocations

All TMDLs need to be presented as a sum of WLAs for point sources and LAs for nonpoint source loads generated within the assessment unit, and if applicable LAs for the natural background, tributary, and adjacent segment loads (CFR 2017a). The State reserves the right to revise these allocations provided the revisions are consistent with achieving WQSs. The allocations described in this section summarize the tPCB TMDL established to meet the "fishing" designated use in the Piscataway Creek and Mattawoman Creek tidal segments. These allocations are also supportive of the 'protection of aquatic life" designated use as explained in Section 3.

5.4.1 Load Allocations

LAs have been assigned to the following nonpoint sources in order to support the "fishing" designated use:

1) non-regulated watershed runoff from the Piscataway Creek and Mattawoman Creek watersheds;
2) direct atmospheric deposition to the surface of the tidal segments; and
3) a single PCB contaminated site.

The TPAR TMDL applied a reduction of 5% to PCB loads from non-regulated watershed runoff and contaminated sites (See Section 5.2 of the TPAR TMDL for more information on load allocations) (Haywood 2007). These reductions were required solely to provide a MOS for this TMDL. No additional reductions outside of the MOS are required for non-regulated watershed runoff and contaminated sites. A 93% reduction to PCB loads from atmospheric deposition was applied across all tidal segments within the TPAR TMDL in order to support the "fishing" designated use within the impaired waters addressed in the TMDL. The TPAR TMDL states that "the proposed 93% reduction in atmospheric deposition of PCBs should yield the 5% reduction in loads represented by the MOS." Therefore, reductions to PCB loads from non-regulated watershed runoff and contaminated sites do not have to be addressed directly as they will be achieved through reductions in atmospheric deposition.

As explained in Section 4.1, loads associated with re-suspension and diffusion from sediments and tidal exchanges between the tidal segments and the Potomac River mainstem are accounted for within the model as an internal load under the framework of the TPAR TMDL and only external sources to the system are assigned baseline loads and allocations.

5.4.2 Wasteload Allocations

Municipal WWTPs

There are two municipal WWTPs located in the Piscataway Creek and Mattawoman Creek watersheds. As discussed in Section 4.2, the tPCB baseline loads were calculated based on their DMR average discharge flows and the average tPCB effluent concentration. The WLAs are calculated based on the water column tPCB TPAR TMDL endpoint concentration of 0.26 ng/L and design flows for the WWTPs (See Section 5.1 of the TPAR TMDL for more further details on calculating the WWTP tPCB WLAs) (Haywood 2007). The WLAs are presented in Table 16. The table includes the watershed, facility name, NPDES Permit, WWTP tPCB baseline load, tPCB water column TMDL endpoint, facility design flow, and WWTP tPCB WLA.

Table 16: Municipal WWTP tPCB WLAs in the Piscataway Creek and Mattawoman Creek Watersheds

Watershed	Facility Name	NPDES Permit	WWTP tPCB Baseline Load (g/year)	tPCB Water Column TMDL Endpoint (ng/L)	Design Flow (MGD)	WWTP tPCB WLA (g/year)
Piscataway Creek	Piscataway WWTP	MD0021539	1.6	0.26	30	10.8
Mattawoman Creek	Indian Head WWTP	MD0020052	0.1	0.26	0.5	0.18

NPDES Regulated Stormwater

The TPAR TMDL also applied a reduction of 5% to PCB loads from NPDES Regulated Stormwater (See Section 5.2 of the TPAR TMDL for more information) (Haywood 2007). This reduction was required solely to provide an MOS for this TMDL. No additional reductions outside of the MOS are required from NPDES Regulated Stormwater PCB loads. As previously stated, the proposed 93% reduction in atmospheric deposition of PCBs should yield the 5% reduction in loads represented by the MOS. Therefore, reductions to PCB loads from NPDES Regulated Stormwater also do not have to be addressed directly as they will be achieved through reductions in atmospheric deposition.

The NPDES regulated stormwater WLA may include any or all of the NPDES stormwater discharges listed in Section 4.2 (see Appendix A for a complete list of stormwater permits). As stormwater assessment or other program monitoring efforts result in a more refined source assessment, MDE reserves the right to revise the current NPDES regulated stormwater WLA provided the revisions are protective of the “fishing” designated use in the Piscataway Creek and Mattawoman Creek tidal segments.

5.5 Margin of Safety

All TMDLs must include a MOS to account for the lack of knowledge and the many uncertainties in the understanding and simulation of water quality parameters in natural systems (*i.e.*, the relationship between modeled loads and water quality). The MOS is intended to account for such uncertainties in a manner that is conservative from the standpoint of environmental protection. The TPAR TMDL used conservative assumptions in estimating loads and in developing the POTPCB model (Haywood 2007). To provide further assurance an explicit MOS of 5% was applied to each source category with the exception of WWTPs (Haywood 2007). The explicit MOS was applied to account for uncertainty in load estimation methods for these sources (See Section 3 of the TPAR TMDL for more information) (Haywood 2007).

5.6 Maximum Daily Loads

All TMDLs must include MDLs consistent with the average annual TMDL. The TPAR TMDL includes MDLs for the following non-point and point source categories: non-regulated watershed runoff, atmospheric deposition, contaminated sites, NPDES regulated stormwater, and WWTPs. For non-regulated watershed runoff and NPDES regulated stormwater, the MDL is expressed as the annual maximum daily loads in the daily load time series for the TMDL year (Haywood 2007). For atmospheric deposition and contaminated sites, the MDL is expressed as the annual load divided by 365 (Haywood 2007). For WWTPs, the MDL is expressed as the average daily load times 1.31 (Haywood 2007). This multiplier was based on a statistical procedure that relates the maximum daily concentration to the long term average (See Section 4 of the TPAR TMDL for further detail on calculating the MDLs) (Haywood 2007). The MDLs are presented in Table 17.

5.7 TMDL Summary

Table 17 summarizes the tPCB baseline loads, TMDL allocations, load reductions, and MDLs for the Piscataway Creek and Mattawoman Creek tidal segments.

Table 17: Summary of tPCB Baseline Loads, TMDL Allocations, Load Reductions and MDLs in the Piscataway Creek and Mattawoman Creek Tidal Segments

Tidal Segment	Source	Baseline Load (g/year)	Baseline Load (%)	TMDL (g/year)	Load Reduction (%)	MDL (g/day)
Piscataway Creek	Non-regulated Watershed Runoff	25.1	30.55%	23.9	5.0%	0.065
	Atmospheric Deposition	35.9	43.71%	2.4	93.4%	0.007
	Nonpoint Sources	***61.1***	***74.26%***	***26.3***	***45.3%***	***0.072***
	NPDES Regulated Stormwater [1]					
	Prince George's County	19.5	23.74%	18.5	5.0%	0.051
	WWTPs[2]	1.6	1.99%	10.8	-558.5%	0.039
	Point Sources	***21.2***	***25.74%***	***29.3***	***-27.9%***	***0.090***
	MOS (5%)	***-***	***-***	***2.4***		***0.009***
	Total	***82.2***	***100.00%***	***58.0***	***29.5%***	***0.170***
Mattawoman Creek	Non-regulated Watershed Runoff	35.6	40.38%	33.8	5.0%	0.093
	Atmospheric Deposition	37.3	42.32%	2.5	93.4%	0.007
	Contaminated Sites	0.1	0.11%	0.1	5.0%	0.000
	Nonpoint Sources	***73.0***	***82.82%***	***36.4***	***50.2%***	***0.100***
	NPDES Regulated Stormwater [1]					
	Prince George's County	3.1	3.55%	3.0	5.0%	0.008
	Charles County	11.9	13.55%	11.3	5.0%	0.031
	WWTPs[2]	0.1	0.08%	0.2	-163.2%	0.001
	Point Sources	***15.1***	***17.18%***	***14.5***	***4.3%***	***0.040***
	MOS (5%)	***-***	***-***	***2.7***	***-***	***0.007***
	Total	***88.1***	***100.00%***	***53.5***	***39.2%***	***0.147***

[1]NPDES regulated stormwater baseline loads and WLAs are an aggregate of loadings from areas covered under the following permits: (i) Phase I & II jurisdictional MS4 permits, (ii) the State Highway Administration's Phase I MS4 permit, (iii) industrial facilities permitted for stormwater discharges, and (iv) MDE general permit to construction sites.
Note: Columns may not precisely add to totals due to rounding.
[2]Negative load reduction percentage occurs due to WLA exeeding the baseline load. For additional information please refer to section 5.4.2.

6.0 ASSURANCE OF IMPLEMENTATION

This section provides the basis for reasonable assurance that the tPCB TMDL for the Piscataway Creek and Mattawoman Creek tidal segments will be achieved and maintained.

Given that PCBs are no longer manufactured, and their use has been substantially restricted, it is reasonable to expect that with time tPCB concentrations in the aquatic environment will decline. Processes, such as the burial of contaminated sediments with newer, less contaminated materials, flushing of sediments during periods of high stream flow, and biodegradation will contribute to the natural attenuation of PCBs in the aquatic environment.

The TPAR TMDL applied a reduction of 5% to PCB loads from non-regulated watershed runoff, contaminated sites, and NPDES regulated stormwater. These reductions were required solely to provide a MOS for this TMDL. No additional reductions outside of the MOS are required for these sources. A 93% reduction to PCB loads from atmospheric deposition was applied across all tidal segments within the TPAR TMDL in order to support the "fishing" designated use within the impaired waters addressed by the TMDL. The TPAR TMDL states that "the proposed 93% reduction in atmospheric deposition of PCBs should yield the 5% reduction in loads represented by the MOS." Therefore, reductions to PCB loads from non-regulated watershed runoff, contaminated sites, and NPDES regulated stormwater do not have to be addressed directly as they will be achieved through reductions in atmospheric deposition.

A new Chesapeake Bay Watershed Agreement was signed on June 16, 2014 which includes goals and outcomes for toxic contaminants including PCBs (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." Objectives for the toxic contaminant outcomes regarding PCBs 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 the effects of toxic contaminants, and 4) building on existing programs to reduce the amount and effects of PCBs in the Bay and its watershed. Implementation of the toxic contaminant goal and outcomes under the new Bay agreement as well as discovering and remediating any existing PCB land sources throughout the Potomac River watershed via implementation of existing PCB TMDLs established under the TPAR TMDL and future TMDL development will further aid in meeting water quality goals in the Piscataway Creek and Mattawoman Creek tidal segments.

Aside from the processes of natural attenuation, there are other approaches that can assist in reducing the tPCB concentrations in the water column, such as the physical removal of the PCB-contaminated sediments (*i.e.*, dredging). This process would minimize one of the primary, potential sources of tPCBs to the water column. If the PCB-contaminated sediments were removed, load reductions would still be required under the TPAR TMDL for watersheds which influence water quality within the Piscataway Creek and Mattawoman Creek tidal segments, since PCBs would continue to enter through tidal exchanges with the mainstem of the Potomac River. However, the removal of these sediments could also mean that water quality supportive of the "fishing" designated use could be achieved in a shorter time frame. When considering dredging as an option, the risk versus benefit must be weighed, as the removal of contaminated sediment may potentially damage the habitat and health of the existing benthic community. The process of stirring up suspended sediments during dredging may damage the gills and sensory organs of benthic macroinvertebrates and fish. Suspended sediments can also affect the prey gathering ability of sight-feeding fish during dredging operations.   In addition, the re-suspension of contaminated sediments causes additional exposure of PCBs to aquatic organisms.

Currently no PCB contaminant removal projects are underway or being planned within the Piscataway Creek and Mattawoman Creek. However, the District of Columbia's (DC's) Department of Energy and Environment (DOEE) is conducting a remedial investigation of sediment contamination within the tidal portion of the Anacostia River. Implementation measures to reduce sediment contamination within the Anacostia River through this effort could reduce the downstream transport of contaminants, potentially improving water quality within the Piscataway Creek and Mattawoman Creek.

MDE's Phase I MS4 permits require restoration targets for impervious surfaces (i.e., restore 20% of a jurisdiction's total impervious cover with no stormwater management/BMPs) which are known to result in TSS reductions. Since PCBs adsorb to sediments and their concentrations correlate with TSS concentrations, any significant restoration requirements, which will lead to a reduction in sediment loads entering the Piscataway Creek and Mattawoman Creek tidal segments, will also contribute toward tPCB load reductions and meeting PCB water quality goals. The Piscataway Creek and Mattawoman Creek watersheds are located within Prince George's and Charles Counties which are currently implementing actions to achieve restoration targets within their Phase I MS4 permits. In addition, the Potomac River watershed and the Anacostia River watershed upstream of the Piscataway Creek and Mattawoman Creek are located within Montgomery and Frederick Counties which are also implementing restoration actions under their Phase I MS4 permits.

PCBs are still being released to the environment via accidental fires, leaks, or spills from older PCB-containing equipment; potential leaks from hazardous waste sites that contain PCBs; illegal or improper dumping; and disposal of PCB containing products (*e.g.*, transformers, old fluorescent lighting fixtures, electrical devices, or appliances containing PCB capacitors, old microscope oil, and old hydraulic oil) into landfills that are not designed to handle hazardous waste. The success of any implementation measures depend in large part on the feasibility of locating and evaluating opportunities to control on-land PCB sources, such as unidentified contaminated sites, leaky equipment, and contaminated soil or sediment.

Prince George's and Montgomery County as Phase I MS4s have developed PCB TMDL implementation plans to address stormwater WLAs assigned by the TPAR TMDL. These plans include strategies to track and identify sources of PCB contamination within the Anacostia River watershed. MDE is also providing assistance to Phase I MS4 counties in the development of PCB TMDL implementation plans and source tracking/identification monitoring strategies. Individual PCB TMDL implementation plans will not be required for the Piscataway Creek and the Mattawoman Creek watersheds as the PCB load reductions from NPDES regulated stormwater due to the MOS will not have to be addressed directly as they will be achieved through reductions in atmospheric deposition.

MDE also periodically monitors and evaluates concentrations of contaminants in recreationally caught fish, shellfish, and crabs throughout Maryland. MDE will use these monitoring programs to evaluate progress towards meeting the “fishing” designated use. Any monitoring should include congener specific analytical methods. Ideally, the most current version of EPA Method 1668 should be used, or other equivalent methods capable of providing low-detection level, congener specific results.

REFERENCES

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

CFR (Code of Federal Regulations). 2017a. 40 CFR 130.2. https://www.gpo.gov/fdsys/pkg/CFR-2011-title40-vol22/pdf/CFR-2011-title40-vol22-sec130-2.pdf.

_____________. 2017b. 40 CFR 130.7. https://www.gpo.gov/fdsys/pkg/CFR-2011-title40-vol22/pdf/CFR-2011-title40-vol22-sec130-7.pdf.

COMAR (Code of Maryland Regulations). 2017a. 26.08.02.07. http://www.dsd.state.md.us/comar/comarhtml/26/26.08.02.07.htm (Accessed September, 2017).

_____________. 2017b. 26.08.02.08 N (f)(g). http://www.dsd.state.md.us/comar/comarhtml/26/26.08.02.08.htm (Accessed September, 2017).

_____________. 2017c. 26.08.02.03-2. http://www.dsd.state.md.us/comar/comarhtml/26/26.08.02.03-2.htm (Accessed September, 2017).

_____________. 2017d. 26.08.02.03-1 (B) (3) (l). http://www.dsd.state.md.us/comar/comarhtml/26/26.08.02.03-1.htm (Accessed September, 2017).

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.

LimnoTech. 2007. PCB TMDL Model for Potomac River Estuary. Combined Report on Hydrodynamic/Salinity and PCB Transport and Fate Models. Prepared for U.S. Environmental Protection Agency, Region 3, Philadelphia, PA, through Battelle, Applied Coastal and Environmental Services, Duxbury, MA.

MDE (Maryland Department of the Environment). 2006. Maryland Wastewater Treatment Plant PCB Survey Dataset. Baltimore, MD: Maryland Department of the Environment.

_____________. 2014. Statewide Fish Consumption Guidelines for All Ages: Table. http://www.mde.state.md.us/programs/Marylander/fishandshellfish/Documents/Fish%20Consumption%20Docs/Maryland_Fish_Advisories_2014_March17.pdf (Accessed September, 2017).

_____________. 2016. The 2016 Integrated Report of Surface WateR Quality in Maryland. Baltimore, MD: Maryland Department of the Environment. Also Available at: http://www.mde.state.md.us/programs/Water/TMDL/Integrated303dReports/Pages/2016IR.aspx (Accessed September, 2017).

____________. 2017. Land Restoration Program's Geospatial Database (LRP-MAP). Baltimore, MD: Maryland Department of the Environment. http://mdewin64.mde.state.md.us/LRP/index.html (Accessed September, 2017).

QEA (Quantitative Environmental Analysis, LLC). 1999. PCBs in the Upper Hudson River – Volume I, Historical Perspective and Model Overview. Albany, NY: Quantitative Environmental Analysis, LLC.

RETEC (The RETEC Group, Inc.). 2002. Remedial Investigation Report Lower Fox River and Green Bay, Wisconsin - Prepared for Wisconsin Department of Natural Resources.

US EPA (United States Environmental Protection Agency). 1999. Chesapeake Bay Basin Toxics Load and Release Inventory. Annapolis, MD: U.S. Environmental Protection Agency with Chesapeake Bay Program.

____________. 2002. Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs. Washington, DC: U.S. Environmental Protection Agency.

USGS (United States Geological Survey). 2006. 2006 National Land Cover Dataset Chesapeake Bay Area, Modified Version 2.0. Annapolis, MD: United States Geological Survey, Chesapeake Bay Program Office.

Appendix A: List of NPDES Regulated Stormwater Permits

Table A-1: NPDES Regulated Stormwater Permit Summary for the Piscataway Creek and Mattawoman Creek Watersheds[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
11DP3322	MD0068365	Charles County Phase I MS4	Charles	Mattawoman Creek
11DP3314	MD0068284	Prince George's County Phase I MS4	Prince George's	Piscataway Creek & Mattawoman Creek
03IM5500	MDR055500	Indian Head Phase II MS4	Charles	Mattawoman Creek
12SW0667	MDR000667	Accokeek Auto Parts	Prince George's	Mattawoman Creek
12SW1223	MDR001223	Pr. Geo. County Dept. Of Public Works - Brandywine	Prince George's	Mattawoman Creek
12SW1214	MDR001214	Mattawoman WWTP	Charles	Mattawoman Creek
12SR0590	MDR000590	Beretta USA Corp	Prince George's	Mattawoman Creek
12SR0847	MDR000847	Brandywine Auto Parts, Inc.	Prince George's	Mattawoman Creek
12SR1173	MDR001173	KMC Thermo-Brandywine Power Facility	Prince George's	Mattawoman Creek
12SR1681	MDR001681	Soil Safe, Inc.	Prince George's	Mattawoman Creek
12SW0981	MDR000981	O & A Used Auto Parts LLC	Prince George's	Piscataway Creek
12SR0119	MDR000119	Piscataway WWTP	Prince George's	Piscataway Creek
12SR3062	MDR003062	ABC Distribution LLC	Prince George's	Piscataway Creek
12SR0161	MDR000161	Potomac Airfield	Prince George's	Piscataway Creek

[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 B: Total PCB Concentration Data

Table B-1 and Table B-2 list the tPCB concentrations for water column and fish tissue samples collected in the Piscataway Creek and Mattawoman Creek tidal segments.

Table B-1: Water Column tPCB Concentrations in the Piscataway Creek and Mattawoman Creek Tidal Segments

Tidal Segment	Station	Station Type	Date	tPCBs (ng/L)
Mattawoman Creek	PRM18	Tidal	7/26/2005	1.250
Mattawoman Creek	PRM18	Tidal	10/28/2005	0.906
Mattawoman Creek	MAT0035	Tidal	7/13/2006	0.723
Mattawoman Creek	MAT0035	Tidal	7/31/2006	0.786
Piscataway Creek	PIS0045	Non-Tidal	7/13/2006	0.698
Piscataway Creek	PIS0045	Non-Tidal	7/31/2006	0.367
Mattawoman Creek	MAT0134	Non-Tidal	7/13/2006	0.323
Mattawoman Creek	MAT0134	Non-Tidal	7/31/2006	0.326

Table B-2: Fish Tissue tPCB Concentrations in the Piscataway Creek and Mattawoman Creek Tidal Segments

Tidal Segment	Station	Date	Fish Species	Fish per Composite (#)	tPCB Concentration (ng/g)	Mean Length (cm)	Mean Weight (g)
Mattawoman Creek	MAT0082	3/9/09	Yellow Perch	5	6.41	31.6	-
Mattawoman Creek	MAT0082	8/1/11	Blue Catfish	5	105.24	48.4	1,227.4
Mattawoman Creek	MAT0082	8/1/11	Blue Catfish	5	135.72	54.7	1,684.4
Piscataway Creek	PoPisCrk	8/1/11	Blue Catfish	5	402.19	90.3	10,365.6
Piscataway Creek	PoPisCrk	8/1/11	Blue Catfish	5	1,058.95	107.7	19,855.8
Piscataway Creek	PoPisCrk	7/1/11	Northern Snakehead	5	75.16	71.3	3,986.4
Piscataway Creek	PoPisCrk	7/1/11	Northern Snakehead	5	31.01	42.5	755.4