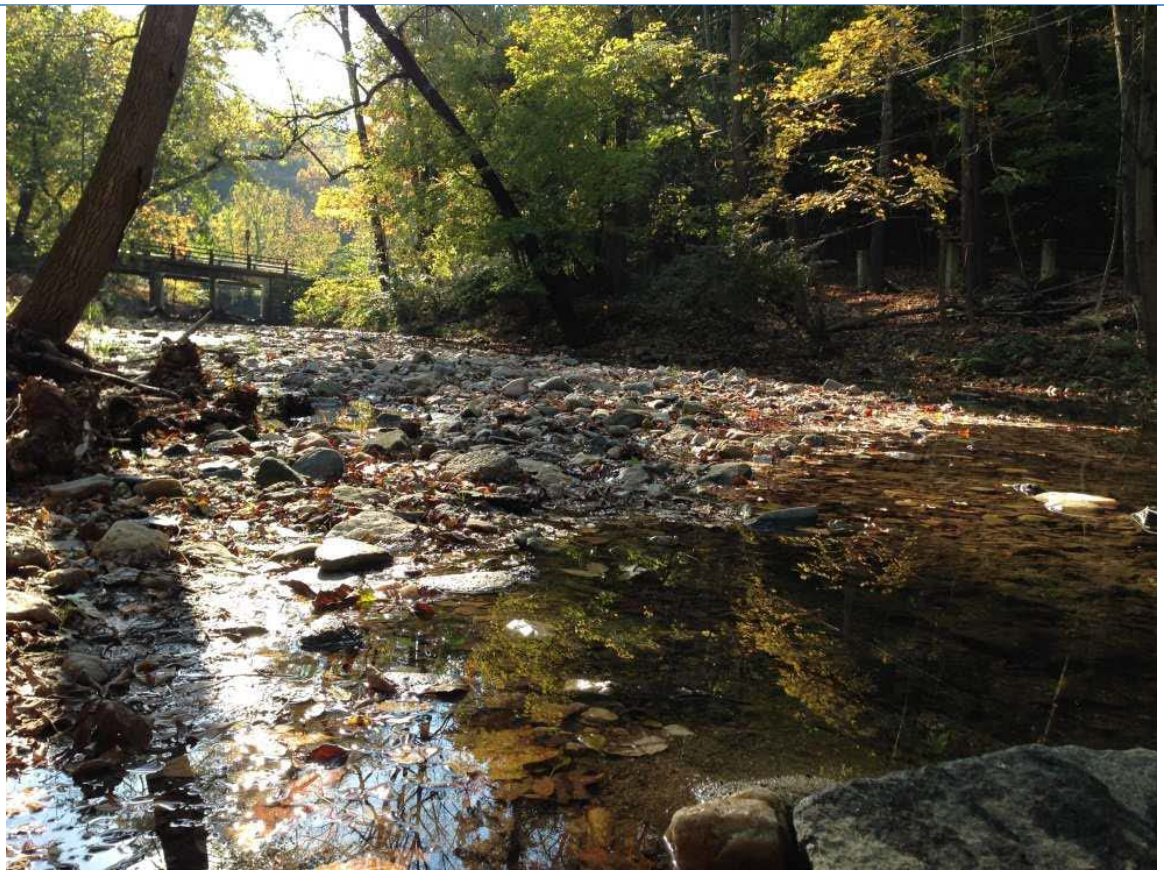
Total Maximum Daily Loads of Organochlorine Pesticides and Polychlorinated Biphenyls in Broad Branch, Dalecarlia Tributary, Dumbarton Oaks, Fenwick Branch, Klingle Valley Creek, Luzon Branch, Melvin Hazen Valley Branch, Normanstone Creek, Oxon Run, Piney Branch, Pinehurst Branch, Portal Branch, and Soapstone Creek in the District of Columbia



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DEPARTMENT OF ENERGY & ENVIRONMENT

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Chesapeake Bay Program

Maryland Department of the Environment

Maryland Department of Planning

Prince George's County Department of Environmental Protection

EXECUTIVE SUMMARY

This report, upon approval by the U.S. Environmental Protection Agency (EPA), establishes Total Maximum Daily Loads (TMDLs) for chlordane, dieldrin, 4,4'-dichlorodiphenyltrichloroethane (DDT), heptachlor epoxide, and total polychlorinated biphenyls (PCBs) in the small tributaries of the Rock Creek and Potomac River in the District of Columbia. Section 303(d) of the federal Clean Water Act (CWA) and EPA's implementing regulations direct each State to identify and list waters, known as water quality limited segments (WQLS), in which required technology-based controls of a specified substance are inadequate to achieve water quality standards (WQS). For each WQLS, the State is to either establish a TMDL for the specified substance that the waterbody can receive without violating WQSs, or demonstrate that WQSs are being met (CFR, 2016).

In 1998, the District characterized many of the tributaries to Rock Creek and the Potomac River as impaired for metals and organic pollutants on its 303(d) list of WQLSs. In order to address these impairments, TMDLs were developed for arsenic, copper, lead, mercury, chlordane, 4,4'-dichlorodiphenyldichloroethane (DDD), 4,4'-dichlorodiphenyldichloroethylene (DDE), DDT, dieldrin, heptachlor epoxide, polycyclic aromatic hydrocarbons (PAHs), and PCBs. The TMDLs in the report, "District of Columbia Final Total Maximum Daily Loads for Organics and Metals in Broad Branch, Dumbarton Oaks, Fenwick Branch, Klingle Valley Creek, Luzon Branch, Melvin Hazen Valley Branch, Normanstone Creek, Pinehurst Branch, Piney Branch, Portal Branch and Soapstone Creek," was approved on February 27, 2004 for tributaries to Rock Creek (hereafter referred to as "Rock Creek Tributaries TMDL"). For tributaries to the Potomac River, "District of Columbia Final Total Maximum Daily Loads for Organics and Metals in Battery Kemble Creek, Foundry Branch, and Dalecarlia Tributary" was approved on May 30, 2005 (referred to as "Potomac River Tributaries TMDL"). A separate report, "District of Columbia Total Maximum Daily Load for Organics, Metals, and Bacteria in Oxon Run," was approved on December 15, 2004 for impairments in Oxon Run (referred to as "Oxon Run TMDL").

In 2006, Friends of the Earth successfully challenged certain TMDLs because they did not include daily load expressions (*Friends of the Earth vs. the Environmental Protection Agency*, 446 F.3d 140, 144 (D.C. Cir. 2006)). The court ruled in favor of the plaintiffs, stating that 'daily means daily.' Following on that litigation, Anacostia Riverkeepers, Friends of the Earth, and Potomac Riverkeepers filed a complaint (Case No.: 1:09-cv-00098-JDB) on January 15, 2009 because certain District TMDLs did not have daily load expressions. EPA conceded that the TMDLs lacked daily loads and the court ordered that the TMDLs must be vacated, but stayed vacatur until January 1, 2017 to allow EPA and Department of Energy and Environment (DOEE) time to develop daily loads. The Rock Creek Tributaries TMDL, Potomac River Tributaries TMDL, and Oxon Run TMDL are being revised to incorporate daily loads as a result of this litigation.

Most of the original toxics impairments were based on very limited data and were based on fish tissue data collected from the mainstem Anacostia River and Potomac River and not the specific listed waterbody. Anacostia River and Potomac River fish tissue results were extrapolated

across the District to list most District waters as impaired for toxics. Both DOEE and EPA agreed that fish tissue collected from the Potomac and Anacostia Rivers, while indicative of fish consumption impairment in both Rivers and any tributaries that may allow fish passage, is not appropriate for all waters of the District. Therefore, EPA and DOEE reviewed available monitoring data for the existing impairments and collected additional data to clarify and identify the current impairments for each of the tributaries. Under contract with EPA, Tetra Tech collected samples in the listed tributaries on October 29, 2013 as part of a larger effort to confirm the impairments for metals and toxics across the District. The samples were analyzed for metals, pesticides, PAHs, and PCBs. PCBs and four pesticides were detected above the water quality criteria in Rock Creek and Potomac River tributaries: dieldrin, DDT, heptachlor epoxide, and chlordane. Table ES.1 shows which pesticides and PCBs were detected in each tributary and represents the new TMDLs that have been developed.

Table ES.1 Rock Creek and Potomac River Tributaries Revised TMDLs

Watershed	Tributary	Waterbody ID	Dieldrin	Heptachlor Epoxide	Chlordane	DDT	PCBs
Potomac River	Dalecarlia Tributary	DCTDA01R	X	X			X
	Oxon Run	DCTOR01R	X				
Rock Creek	Broad Branch	DCTBR01R	X	X	X		X
	Dumbarton Oaks	DCTDO01R	X	X	X		X
	Fenwick Branch	DCTFE01R	X	X		X	X
	Klingle Valley Creek	DCTKV01R	X	X			X
	Luzon Branch	DCTLU01R	X	X	X		X
	Melvin Hazen Valley Branch	DCTMH01R	X				X
	Normanstone Creek	DCTNS01R	X	X			X
	Pinehurst Branch	DCTPI01R	X	X			X
	Piney Branch	DCTPY01R	X	X	X		X
	Portal Branch	DCTPO01R	X	X			X
	Soapstone Creek	DCTSO01R	X	X	X		X

TMDLs must be developed to be protective of WQSs. Rock Creek and its tributaries and tributaries to the Potomac River are designated for the following beneficial uses:

Class A – primary contact recreation,
Class B – secondary contact recreation and aesthetic enjoyment,
Class C – protection and propagation of fish, shellfish, and wildlife,

Class D – protection of human health related to consumption of fish, shellfish, and;
Class E – navigation.

The District has set water quality criteria to protect the beneficial uses of its waterways. The District's Criteria Maximum Concentration (CMC) and the Criteria Continuous Concentration (CCC), protect aquatic life's acute and chronic exposure, respectively. The 30-day average concentration is applied for the protection of human health related to the consumption of fish and shellfish. It is established to protect human health (EPA, 2014 a, b, c and d). The applicable criteria for organochlorine pesticides and PCBs are shown in Table ES.2.

Table ES.2 Numeric Nutrient Water Quality Criteria for District Waters

Constituent (µg/L)	CAS Number	Criteria for Classes		
		C		D
		CCC 4-Day Average	CMC 1-Hour Average	30-Day Average
Chlordane	57-74-9	0.0043	2.4	0.00081,c
Dieldrin	60-57-1	0.056	0.24	0.000054,c
4,4'-DDT	50-29-3	0.001	1.1	0.00022,c
Heptachlor Epoxide	1024-57-3	0.0038	0.52	0.000039,c
PCBs (total)		0.014		0.000064,c

The letter "c" after the Class D Human Health Criteria numeric value means that the criterion is based on carcinogenicity of 10^{-6} risk level.

The District's water quality standards for these four pesticides and PCBs were revised and approved by EPA in 2006, after the original TMDLs were established. EPA and DOEE decided to revise the TMDLs rather than submit daily loads based on the original TMDLs. The original TMDLs had been developed using the DC Small Tributary TMDL Model (DCSTM) (ICPRB, 2003). DCSTM was a simple model. It calculated constituent loads in small tributaries based on (1) simulating storm flow and base flow in a tributary from the land uses in a watershed, and (2) associating a constituent concentration with storm flow or base flow from each land use. EPA and DOEE decided to update the model used to develop the TMDLs. The Small Tributaries Pesticide Model (STPM), the revised model, has the same structure as DCSTM, but the model

elements have been updated using the best information currently available. In particular, STPM incorporates the following new information:

- The simulation of daily flows is based on a recent version of the Chesapeake Bay Program's (CBP) Watershed Model, which allows the simulation period to be updated to 2001-2012;
- Land use classes and acreage in the District have been taken from the 2015 DC Consolidated TMDL Implementation Plan for its municipal separate storm sewer system (MS4); and
- Model input concentrations associated with land uses and flow paths have been estimated based on District MS4 monitoring data (2001-2013) and instream monitoring data (2013).

Land use was classified by land cover (impervious, pervious developed or turf, and forest) and regulatory status (MS4, combined sewer system (CSS), and direct drainage). Land use acreage for the small tributaries is shown in Table ES.3. Piney Branch is the only tributary with combined sewer overflow (CSO) outfalls. Portions of Fenwick Branch, Pinehurst Branch, Portal Branch, and Oxon Run watersheds lie in Maryland.

Table ES.3 Land Use Acreage (acres) in the Rock Creek and Potomac River Watershed Tributaries

Mainstem	Tributary	MS4			Direct Drainage			CSS	Maryland			Total
		Impervious	Turf	Forest	Impervious	Turf	Forest		Impervious	Turf	Forest	
Rock Creek	Broad Branch	367	495	39	22	46	176	-	-	-	-	1,145
	Dumbarton Oaks	8	3	1	25	52	47	-	-	-	-	136
	Fenwick Branch	60	93	9	11	25	22	-	150	243	0	612
	Klingle Valley Creek	55	57	14	7	13	26	-	-	-	-	172
	Luzon Branch	300	277	13	5	22	25	-	-	-	-	643
	Melvin Hazen Valley Branch	43	60	6	9	9	47	-	-	-	-	174
	Normanstone Creek	70	88	8	6	12	34	-	-	-	-	217
	Pinehurst Branch	89	151	6	12	28	160	-	59	160	0	664
	Piney Branch	18	18	9	2	7	46	2,406	-	-	-	2,506
	Portal Branch	22	37	2	0	1	7	-	80	50	0	201
	Soapstone Creek	202	202	7	22	30	52	-	-	-	-	514
Potomac	Dalecarlia Tributary	393	534	50	12	30	72	-	-	-	-	1,091
	Oxon Run	829	890	81	28	133	183	-	1,940	2,866	946	7,895

Sources: DOEE (MS4 and Direct Drainage); MDE (Maryland except for Oxon Run); and PGDEP (Maryland Oxon Run).

The TMDLs used an implicit margin of safety (MOS) that was justified by the conservative assumptions incorporated into STPM. The twelve-year simulation period (2001-2012) ensures that the TMDLs covered a variety of hydrological conditions and critical conditions, including seasonal variations. Moreover, it is assumed that all categories of sources discharge at the most stringent applicable water quality criteria concentration, and that no category of sources relies on dilution from another category of sources, in order that water quality standards be met.

The TMDLs are expressed as average annual loads, and maximum average daily loads. Tables ES.4, ES.5, ES.6, ES.7, and ES.8 give the maximum average daily load allocations (lbs/d) for chlordane, dieldrin, heptachlor epoxide, DDT, and PCBs, respectively.

Table ES.4 Chlordane Maximum Average Daily Load Allocations (lbs/d)

Mainstem	Tributary	District Regulated Stormwater	District Combined Sewer	District Nonpoint Source	Maryland	Total
Rock Creek	Broad Branch	5.18E-04	-	8.99E-05	-	6.08E-04
	Dumbarton Oaks	8.36E-06	-	5.43E-05	-	6.27E-05
	Luzon Branch	3.72E-04	-	2.30E-05	-	3.95E-04
	Piney Branch	2.27E-05	2.65E-05	1.77E-05	-	6.69E-05
	Soapstone Creek	2.56E-04	-	4.52E-05	-	3.01E-04

Table ES.5 Dieldrin Maximum Average Daily Load Allocations (lbs/d)

Mainstem	Tributary	District Regulated Stormwater	District Combined Sewer	District Nonpoint Source	Maryland	Total
Rock Creek	Broad Branch	3.45E-05	-	5.99E-06	-	4.05E-05
	Dumbarton Oaks	5.57E-07	-	3.62E-06	-	4.18E-06
	Fenwick Branch	5.98E-06	-	1.78E-06	9.12E-06	1.69E-05
	Klingle Valley Creek	4.69E-06	-	1.41E-06	-	6.10E-06
	Luzon Branch	2.48E-05	-	1.53E-06	-	2.63E-05
	Melvin Hazen Valley Branch	4.09E-06	-	1.63E-06	-	5.72E-06
	Normanstone Creek	6.41E-06	-	1.33E-06	-	7.73E-06
	Pinehurst Branch	9.20E-06	-	4.13E-06	3.92E-06	1.73E-05
	Piney Branch	1.51E-06	1.77E-06	1.18E-06	-	4.46E-06
	Portal Branch	2.30E-06	-	1.95E-07	4.40E-06	6.89E-06
	Soapstone Creek	1.71E-05	-	3.01E-06	-	2.01E-05
Potomac	Dalecarlia Tributary	3.71E-05	-	3.48E-06	-	4.06E-05
	Oxon Run	7.18E-05	-	9.51E-06	1.80E-04	2.61E-04

Table ES.6 Heptachlor Epoxide Maximum Average Daily Load Allocations (lbs/d)

Mainstem	Tributary	District Regulated Stormwater	District Combined Sewer	District Nonpoint Source	Maryland	Total
Rock Creek	Broad Branch	2.49E-05	-	4.33E-06	-	2.93E-05
	Dumbarton Oaks	4.02E-07	-	2.62E-06	-	3.02E-06
	Fenwick Branch	4.32E-06	-	1.29E-06	6.58E-06	1.22E-05
	Klingle Valley Creek	3.39E-06	-	1.02E-06	-	4.40E-06
	Luzon Branch	1.79E-05	-	1.11E-06	-	1.90E-05
	Normanstone Creek	4.63E-06	-	9.57E-07	-	5.58E-06
	Pinehurst Branch	6.65E-06	-	2.98E-06	2.83E-06	1.25E-05
	Piney Branch	1.09E-06	1.28E-06	8.53E-07	-	3.22E-06
	Portal Branch	1.66E-06	-	1.41E-07	3.18E-06	4.98E-06
	Soapstone Creek	1.23E-05	-	2.18E-06	-	1.45E-05
Potomac	Dalecarlia Tributary	2.68E-05	-	2.51E-06	-	2.93E-05

Table ES.7 DDT Maximum Average Daily Load Allocations (lbs/d)

Mainstem	Tributary	District Regulated Stormwater	District Combined Sewer	District Nonpoint Source	Maryland	Total
Rock Creek	Fenwick Branch	2.44E-05	-	7.26E-06	3.71E-05	6.88E-05

Table ES.8 Total PCB Maximum Average Daily Load Allocations (lbs/d)

Tributary	District Regulated Stormwater	District Combined Sewer	District Nonpoint Source	Maryland	Total
Broad Branch	4.09E-05	-	7.10E-06	-	4.80E-05
Dumbarton Oaks	6.60E-07	-	4.29E-06	-	4.95E-06
Fenwick Branch	7.09E-06	-	2.11E-06	1.08E-05	2.00E-05
Klingle Valley Creek	5.56E-06	-	1.67E-06	-	7.23E-06
Luzon Branch	2.94E-05	-	1.82E-06	-	3.12E-05
Melvin Hazen Valley Branch	4.85E-06	-	1.93E-06	-	6.78E-06
Normanstone Creek	7.59E-06	-	1.57E-06		9.16E-06
Pinehurst Branch	1.09E-05	-	4.89E-06	4.64E-06	2.04E-05
Piney Branch	1.79E-06	2.09E-06	1.40E-06	-	5.29E-06
Portal Branch	2.73E-06	-	2.31E-07	5.21E-06	8.17E-06
Soapstone Creek	2.02E-05	-	3.57E-06	-	2.38E-05

EPA has recommended changes to the 30-day average criteria to protect human health related to fish and shellfish consumption. Those changes include updated criteria for chlordane, dieldrin, heptachlor epoxide, and DDT. DOEE is considering adopting those changes in its 2016 triennial review. Table ES.9 contrasts the current and proposed 30-day average human health criteria. Appendix A sets forth informational TMDLs calculated to achieve the recommended criteria utilizing the same methodologies as the TMDLs set forth in the main report. DOEE is seeking comment on these informational TMDLs. In the event that DOEE adopts the recommended

criteria and the recommended criteria is approved by EPA as the applicable water quality standards for the District, DOEE intends to submit the informational TMDLs to EPA for approval.

Table ES.9 Comparison of Current and Recommended Human Health Criteria (µg/L)

Constituent	CAS Number	Class D: Fish Consumption Use Human Health (30-day average)		Percent Change
		Current	Recommended	
Chlordane	57-74-9	0.00081	0.00032	-60%
DDT	50-29-3	0.00022	0.000030	-86%
Dieldrin	60-57-1	0.000054	0.0000012	-98%
Heptachlor Epoxide	1024-57-3	0.000039	0.000032	-18%

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ABBREVIATIONS

ac	acres
ATSDR	Agency for Toxic Substances and Disease Registry
BMP	Best Management Practice
CAS	Chemical Abstract Service
CBP	Chesapeake Bay Program
CBPO	Chesapeake Bay Program Office
CBRAP	Chesapeake Bay Regulatory and Accountability Program
CCC	Criteria Continuous Concentration
CMC	Criteria Maximum Concentration
COG	Council of Governments
CSO	Combined Sewer Overflow
CSGP	Construction Stormwater General Permit
CSS	Combined Sewer System
d	days
DC	District of Columbia
DCSTM	DC Small Tributary TMDL Model
DDOE	District of Columbia Department of Environment
DOEE	District of Columbia Department of Energy and Environment
DDOH	District of Columbia Department of Health
DDT	Dichlorodiphenyltrichloroethane
DL	Detection limit
EMC	Event Mean Concentration
EOP	End-of-Pipe
EOS	Edge-of-Stream
EPA	U. S. Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
g	grams
GLEC	Great Lakes Environmental Center
HSPF	Hydrological Simulation Program-Fortran
IADN	Integrated Atmospheric Deposition Network
ICPRB	Interstate Commission on the Potomac River Basin
IP	Implementation Plan
L	Liters
LA	Load Allocation
LTCP	Long-term Control Plan
m	meter
MD	Maryland
MDE	Maryland Department of the Environment
MDP	Maryland Department of Planning

mg	milligrams
MG	million gallons
MGDS	million gallons per day
µg	micrograms
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer System
MSGP	Multi-Sector General Permit
ng	nanograms
NHD	National Hydrography Dataset
NLDAS	North American Land Data Assimilation System
NOAA	National Oceanic and Atmospheric Administration
NPS	Nonpoint Source
P5	Phase 5 Watershed Model
P54	Phase 5.4 Watershed Model
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
PCB3+	PCBs homolog 3 or greater
PGDEP	Prince George's County Department of Environmental Protection
POP	Persistent Organic Pollutant
RI/FS	Remedial Investigation/Feasibility Study
RCRA	Resource Conservation and Recovery Act
STPM	Small Tributary Pesticide Model
SWO	Storm Water Outfalls
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USGS	U. S. Geological Survey
WLA	Wasteload Allocation
WQLS	Water Quality Limited Segments
WWTP	Wastewater Treatment Plant
yr	Year

1 INTRODUCTION

Section 303(d) of the federal Clean Water Act (CWA) and the US Environmental Protection Agency's (EPA) implementing regulations direct each state to identify and list waterbodies, or Water Quality Limited Segments (WQLS), in which required technology-based controls of a specified substance are inadequate to achieve water quality standards. For each WQLS, the State is required to either establish a Total Maximum Daily Load (TMDL) of the specified substance that the waterbody can receive without violating Water Quality Standards (WQSs), or demonstrate that WQSs are being met (CFR, 2016). The TMDL needs to take into account seasonal variations, critical conditions, and a protective margin of safety (MOS) to account for uncertainty.

A TMDL reflects the loading of an impairing substance that a waterbody can receive and still meet 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, as well as fish and shellfish propagation and harvest. Water quality criteria consist of narrative statements and numeric values designed to protect the designated uses. Criteria may differ in waters with different designated uses.

1.1 HISTORY OF IMPAIRMENT

In 1998, the District of Columbia (District) characterized many of the tributaries to Rock Creek and the Potomac River as impaired for metals and organic pollutants on its 303(d) list of WQLSs. In order to address these impairments, TMDLs were developed for arsenic, copper, lead, mercury, chlordane, 4,4'-dichlorodiphenyldichloroethane (DDD), 4,4'-dichlorodiphenyldichloroethylene (DDE), and 4,4'-dichlorodiphenyltrichloroethane (DDT), dieldrin, heptachlor epoxide, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs). The TMDLs in the report, "District of Columbia Final Total Maximum Daily Loads for Organics and Metals in Broad Branch, Dumbarton Oaks, Fenwick Branch, Klingle Valley Creek, Luzon Branch, Melvin Hazen Valley Branch, Normanstone Creek, Pinehurst Branch, Piney Branch, Portal Branch and Soapstone Creek," were approved on February 27, 2004 for tributaries to Rock Creek (hereafter referred to as "Rock Creek Tributaries TMDL"). For tributaries to the Potomac River, "District of Columbia Final Total Maximum Daily Loads for Organics and Metals in Battery Kemble Creek, Foundry Branch, and Dalecarlia Tributary" was approved on May 30, 2005 (referred to as "Potomac River Tributaries TMDL"). A separate report, "District of Columbia Total Maximum Daily Load for Organics, Metals, and Bacteria in Oxon Run," was approved on December 15, 2004 for impairments in Oxon Run (referred to as "Oxon Run TMDL").

In 2006, Friends of the Earth successfully challenged TMDLs because they did not include a daily load expression (*Friends of the Earth vs. the Environmental Protection Agency,* 446 F.3d 140, 144 (D.C. Cir. 2006)). The court ruled in favor of the plaintiffs, stating that 'daily means daily.' Following on that litigation, Anacostia Riverkeepers, Friends of the Earth, and Potomac Riverkeepers filed a complaint (Case No.: 1:09-cv-00098-JDB) on January 15, 2009 because

certain District TMDLs did not have daily load expressions. EPA conceded that the TMDLs lacked daily loads and the court ordered that the TMDLs must be vacated, but stayed vacatur until January 1, 2017 to allow EPA and Department of Energy and Environment (DOEE) time to develop daily loads. The Rock Creek Tributaries TMDL, Potomac River Tributaries TMDL, and Oxon Run TMDL are being revised to incorporate daily loads as a result of this litigation.

Most of the original toxics impairments were based on very limited data and were based on fish tissue data collected from the mainstem Anacostia River and Potomac River and not the specific listed waterbody. Anacostia River and Potomac River fish tissue results were extrapolated across the District to list most District waters as impaired for toxics. Both DOEE and EPA agreed that fish tissue collected from the Potomac and Anacostia Rivers, while indicative of fish consumption impairment in both Rivers and any tributaries that may allow fish passage, is not appropriate for all waters of the District. Therefore, EPA and DOEE reviewed available monitoring data for the existing impairments and collected additional data to clarify and identify the current impairments for each of the tributaries. Under contract with EPA, Tetra Tech collected samples in the listed tributaries on October 29, 2013 as part of a larger effort to confirm the impairments for metals and toxics across the District. The samples were analyzed for metals, pesticides, PAHs, and PCBs. PCBs and four pesticides were detected above the water quality criteria in Rock Creek and Potomac River tributaries: dieldrin, DDT, heptachlor epoxide, and chlordane. Table 1.1 shows which pesticides and PCBs were detected above the water quality criteria in which tributaries.

Table 1.1 Rock Creek and Potomac River Tributaries with Revised Pesticide and PCB TMDLs

Watershed	Tributary	Waterbody ID	Dieldrin	Heptachlor Epoxide	Chlordane	DDT	PCBs
Potomac River	Dalecarlia Tributary	DCTDA01R	X	X			X
	Oxon Run	DCTOR01R	X				
Rock Creek	Broad Branch	DCTBR01R	X	X	X		X
	Dumbarton Oaks	DCTDO01R	X	X	X		X
	Fenwick Branch	DCTFE01R	X	X		X	X
	Klingle Valley Creek	DCTKV01R	X	X			X
	Luzon Branch	DCTLU01R	X	X	X		X
	Melvin Hazen Valley Branch	DCTMH01R	X				X
	Normanstone Creek	DCTNS01R	X	X			X
	Pinehurst Branch	DCTPI01R	X	X			X
	Piney Branch	DCTPY01R	X	X	X		X
	Portal Branch	DCTPO01R	X	X			X
	Soapstone Creek	DCTSO01R	X	X	X		X

For each tributary where a pesticide exceeded a numeric water quality criterion, a revised TMDL has been developed, including a daily load expression. These pollutant/waterbody combinations remained in Category 4a (waterbody is impaired and a TMDL has been developed) in the District's 2014 Integrated Report (DDOE, 2014). Rather than revise the existing TMDLs for the pesticides that were detected, EPA and DOEE decided to develop new TMDLs for these pesticides for the following reasons:

- Since the original TMDLs had been established in 2004-2005, the water quality standards changed for these toxic chemicals. These changes are described in more detail in Section 1.2.
- Additional monitoring data had been collected under the District's municipal separate storm sewer system (MS4) permit in the Rock Creek and Potomac River watersheds and could be used for purposes of modeling.
- EPA and DOEE wanted to update the model used to develop the TMDLs. This will be discussed in more detail in Section 4.

New TMDLs were also developed for PCB impairments in the Rock Creek watershed as described above for pesticide impairments. In 2007, EPA approved the "Total Maximum Daily

Loads of Polychlorinated Biphenyls (PCBs) for Tidal Portions of the Potomac and Anacostia Rivers in the District of Columbia, Maryland, and Virginia," which adequately addressed PCB impairments in direct tributaries to the Potomac River and Anacostia River. These TMDLs included daily load expressions, therefore no additional TMDLs are required for tributaries to the Potomac, such as Dalecarlia Tributary.

Conversely, TMDLs were not developed for pollutant(s)-waterbody combinations that did not exceed any numeric water quality criteria. For tributaries hydrologically connected to the Anacostia or Potomac Rivers, where there was no data other than fish tissue data from the mainstem Anacostia or Potomac Rivers, the toxic pollutant(s)-waterbody combinations were placed in Category 3(insufficient data). For waters that are not hydrologically connected to the Anacostia or Potomac River and have no evidence of a toxic pollutant present, those waters are no longer considered impaired for the specific parameter (although they remain identified as impaired based upon the District-wide fish consumption advisory). One such example where a TMDL is no longer required is for DDT in Broad Branch. For more information on specific listings, consult the 2014 Integrated Report (DDOE, 2014). Because no TMDL is necessary, the TMDLs developed for those parameters will not be replaced prior to vacatur by the Court on January 1, 2017.

1.2 DESIGNATED USES AND APPLICABLE WATER QUALITY STANDARDS

Categories of District surface water beneficial uses and water quality standards are contained in District of Columbia Water Quality Standards, Title 21 of District of Columbia Municipal Regulations, Chapter 11 (DCMR, Effective November 1, 2013). Section 1101.1 states:

Rock Creek and its tributaries and tributaries to the Potomac River are designated for the following beneficial uses:

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

The classification of the District's waters are listed in Table 1.2 (DCMR), which indicates the beneficial uses that apply to each waterbody.

Table 1.2 Classification of the District's Waters

Surface waters of the District	Use classes	
	Current use	**Designated use**
Potomac River	B, C, D, E	A, B, C, D, E
Potomac River tributaries (except as listed below)	B, C, D	A, B, C, D
Rock Creek	B, C, D, E	A, B, C, D, E
Rock Creek tributaries	B, C, D, E	A, B, C, D, E
Oxon Run	B, C, D	A, B, C, D

The District of Columbia's Water Quality Standards include narrative and numeric criteria that were written to protect existing and designated uses. Section 1104.1 states several narrative criteria designed to protect the existing and designated uses:

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

(a) Settle to form objectionable deposits;
(b) Float as debris, scum, oil, or other matter to form nuisances;
(c) Produce objectionable odor, color, taste, or turbidity;
(d) Cause injury to, are toxic to or produce adverse physiological or behavioral changes in humans, plants, or animals;
(e) Produce undesirable or nuisance aquatic life or result in the dominance of nuisance species; or
(f) Impair the biological community which naturally occurs in the waters or depends on the waters for their survival and propagation.

The TMDL revisions will protect all the designated uses of the tributaries to the Potomac River and Rock Creek. The District's Criteria Maximum Concentration (CMC) and the Criteria Continuous Concentration (CCC) protect aquatic life's acute and chronic exposure, respectively. The CMC is the highest concentration of a pollutant to which aquatic life can be exposed for a short period of time (one-hour average) without deleterious effects at a frequency that does not exceed more than once every three years. The CCC is the highest concentration of a pollutant to which aquatic life can be exposed for an extended period of time (four-day average) without deleterious effects at a frequency that does not exceed more than once every three years. The 30-day average concentration is applied for the protection of human health related to the consumption of fish and shellfish. It is established to protect human health. It represents the

maximum 30-day average water column concentration of a pollutant that would result in a fish tissue pollutant concentration which would not raise an individual's lifetime risk of contracting cancer from the consumption of fish by more than one in one million. It is based on average body weight, fish consumption rates, and bioaccumulation rates of the pollutant in the food chain (EPA, 2014 a, b, c and d).

Since the original TMDLs were developed, numerical criteria for organic pollutants have changed. These updates were approved by EPA in 2006 and have been unchanged since that time. These revised TMDLs were developed using the current water quality standards, as noted in Table 1.3 (DCMR).

Table 1.3 Numeric Water Quality Criteria for District Waters

Constituent (µg/L)	CAS Number	Criteria for Classes		
		C		D
		CCC 4-Day Average	CMC 1-Hour Average	30-Day Average
Chlordane	57-74-9	0.0043	2.4	0.00081,c
Dieldrin	60-57-1	0.056	0.24	0.000054,c
4,4'-DDT	50-29-3	0.001	1.1	0.00022,c
Heptachlor Epoxide	1024-57-3	0.0038	0.52	0.000039,c
PCBs (total)		0.014		0.000064,c

The letter "c" after the Class D Human Health Criteria numeric value means that the criterion is based on carcinogenicity of 10^{-6} risk level.

2 WATERSHED CHARACTERIZATION

All of the small tributaries in the Rock Creek and Potomac River watersheds, except Oxon Run, are located in the Northwest Quadrant of the District. Figure 2.1 shows the location of the watersheds of these tributaries. A portion of Portal Branch, Fenwick Branch, and Broad Run lies in Montgomery County, MD. Figure 2.1 also shows the District combined sewer system (CSS). Piney Run is the only watershed with combined sewer overflow (CSO) outfalls in it.

Oxon Run is in the Southeast Quadrant of the District. Figure 2.2 shows its location. Oxon Run is the largest of the tributary watersheds. More than half of Oxon Run lies in Prince George's County, MD.

All of the tributary watersheds are highly developed, although substantial sections of some of the watersheds are in parklands. Section 6 provides additional description of each of the individual watersheds.

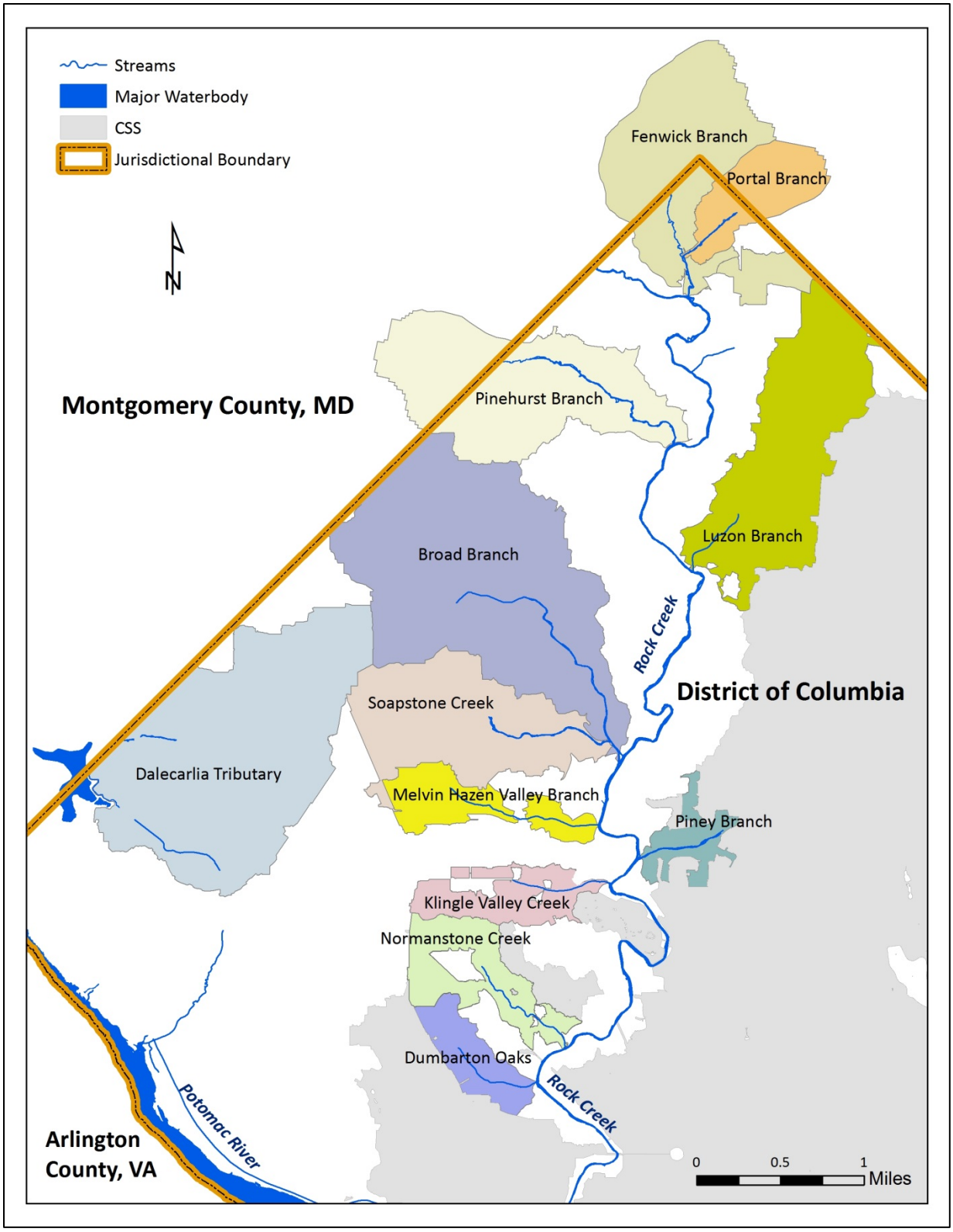

Figure 2.1 Location of Small Tributary Watersheds in Northwest District of Columbia

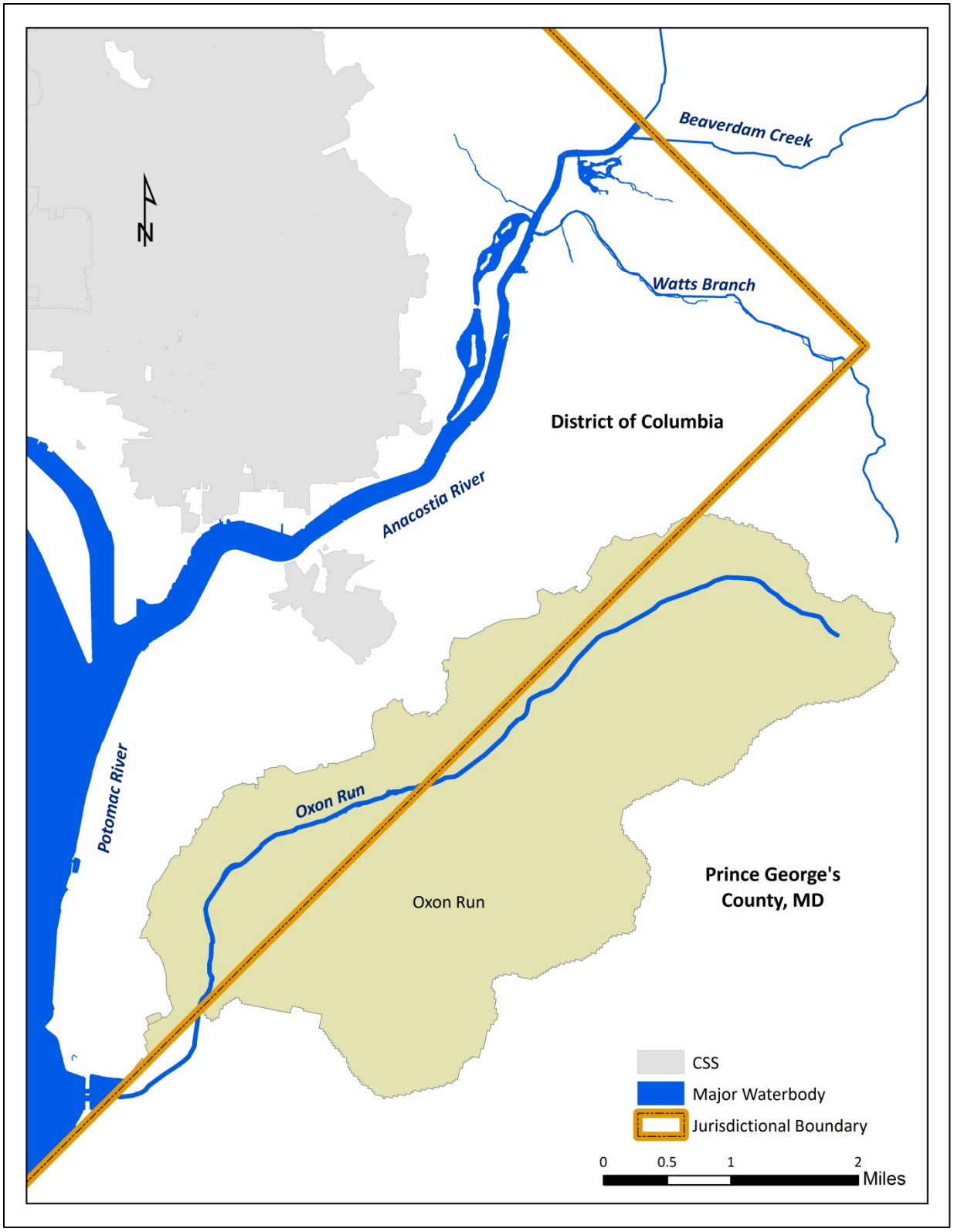

Figure 2.2 Location of Oxon Run Watershed

3 SOURCE ASSESSMENT

3.1 BACKGROUND

3.1.1 Organochlorine Pesticides

Chlordane, DDT, dieldrin, and heptachlor epoxide are all organochlorine insecticides or insecticide degradation products. Heptachlor epoxide is the degradation product of the pesticide heptachlor; dieldrin, while an insecticide in its own right, is also a degradation product of aldrin. Chlordane, on the other hand, was marketed as a mixture of compounds, including heptachlor. Technical chlordane (CAS no. 12789-03-6) can contain over 120 different compounds. In this report chlordane will refer to CAS no. 57-74-9, which is a mixture containing approximately 95% cis- and trans- chlordane isomers. These isomers are also known as α- and γ- chlordane, respectively (EPA, 1997). Table 3.1 shows the uses of these pesticides and the period of their use.

Organochlorine insecticides have been shown to have a wide variety of harmful effects on aquatic organisms and humans (Nowell *et al.*, 1999, ATSDR, 1994, 2002a, 2002b, 2007). As a result, aside from a handful of specialized uses, all uses of chlordane, DDT, dieldrin, and heptachlor epoxide have either been banned by EPA or voluntarily withdrawn by their manufacturers. Therefore, these pesticides are no longer actively used in the District. Table 3.1 shows the year in which a pesticide's registration for use was terminated. These pollutants are on the Clean Water Act's Priority Pollutant List and EPA recommends the adoption of water quality criteria for these chemicals to protect aquatic life and human health.

Table 3.1 Uses and Period of Use of Organochlorine Pesticides

Pesticide	Year Introduced	Uses	Year Use Registration Canceled
Chlordane	1948	Before 1974: 28% used on corn, citrus 35% used on termites 30% used home lawn and garden 7% used on turf and ornamentals	1974: most crops 1983: All uses except termite control 1988: termite control
DDT	1939	Control malaria and typhus Control gypsy moth and other forest pests Mothproofing and control lice Used on cotton (67-90%) but also peanuts and soybeans	1973: All uses except for public health emergencies
Aldrin Dieldrin	1948	Corn and citrus Termite control	1970: crops 1988:Termite control
Heptachlor	1952	Corn, small grain, and sorghum Termite control	1974: crops 1980: termite control Still registered for control of fire ants in underground transformers

3.1.2 PCBs

PCBs are a group of 209 different compounds, which differ in the number and location of chlorine atoms attached to the two benzene rings that make up the biphenyl molecule. There can be as many as ten chlorine atoms attached to the biphenyl structure. PCBs containing the same number of chlorine atoms are referred to as homologs and a specific compound is a congener. PCBs can also be analyzed and reported as Aroclors, which are mixtures of congeners manufactured by Monsanto.

Commercial production and use of PCBs began in 1929. PCBs were used in a wide variety of applications, including the following:

- Transformers, capacitors, and other electrical equipment;
- Hydraulic fluids and lubricants;
- Plasticizers;
- Fire-retarding paint, tiles, textiles;
- Carbonless copy paper and printing inks.

The key property of PCBs that made them useful commercially is their stability. They do not readily react with acids or bases and they do not break down easily with increasing temperature. This made them ideal for use as insulators or as fire-retarding additives to plastics or other materials. They are also good dielectrics, which explains their widespread use in electrical equipment.

The toxicity of PCBs to birds, mammals, fish, and aquatic organisms have been well-documented in laboratory studies and PCBS have been linked to the disruption of reproductive functions and birth defects in humans (Eisler, 1986, ATSDR, 2000). In 1979, EPA banned the production, import, and distribution of PCBs, as well as their use outside of closed systems, with a few exceptions. As with the organochlorine pesticides, PCB Aroclors are on the Priority Pollutant List and EPA recommends adoption of water quality criteria to protect human health and aquatic life.

3.2 ENVIRONMENTAL PERSISTENCE

Organochlorine pesticides and PCBs share a range of physical and chemical properties, including (Smith *et al.*, 1988):

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

These properties help explain the persistence of organochlorine insecticides and PCBs in the environment, even after their use has been banned for decades. Their limited solubility in water prevents them from being rapidly flushed from a watershed, and their resistance to physical or biological degradation prevents them from diminishing quickly *in situ*. Chlordane can persist in soils for longer than 20 years after it is applied (ATSDR, 1994). Nevertheless, concentrations of organochloride pesticides are decreasing in sediments and in fish tissue over time (Gilliom *et al.*, 2006, Van Metre *et al.*, 1997, Van Metre and Mahler, 2005). PCBs have been shown to have an exponential decline in urban reservoirs and natural lakes, which suggests a declining trend in PCBs from the influent rivers and streams (Van Metre and Mahler, 2005).

3.3 POTENTIAL SOURCES OF ORGANOCHLORINE PESTICIDES AND PCBS IN THE ROCK CREEK AND POTOMAC RIVER TRIBUTARIES

3.3.1 Organochlorine Pesticides

The Rock Creek and Potomac River tributaries in the District are heavily developed watersheds and were so during the time chlordane, DDT, dieldrin, and heptachlor were in use. These pesticides were used in developed areas for control of insects on lawns and gardens, and for control of termites. Chlordane, dieldrin, and heptachlor were used for termite control and were likely to be applied to soils surrounding houses and other structures. The District lies in a moderate-to-heavy termite density zone, so the use of chlordane and dieldrin for termite control is an explanatory factor in the elevated chlordane and dieldrin concentrations observed in the District's waters (Nowell *et al.*, 2009). These pesticides attach to soils and can be transported in erosion and instream sediment.

As was mentioned in Section 3.1.1, chlordane, DDT, dieldrin, and heptachlor are not actively used in the District, so the presence of these pesticides in the Rock Creek and Potomac River tributaries can be attributed to legacy sources. They are conveyed to the waterbodies through stormwater. During wet weather events, there is a combination of direct stormwater runoff from land neighboring the tributaries and stormwater being carried through the MS4 system. There are no wastewater treatment plants (WWTPs) in any of the Rock Creek and Potomac River tributaries, but Piney Branch does have CSO outfalls, a potential source of pesticides in Piney Branch. Organochlorine pesticides have been found in similar concentrations in CSOs and stormwater outfalls (SWOs) (GLEC, 2008).

Air deposition cannot be ruled out as a possible source of these pesticides, particularly DDT and chlordane. Although they generally have low volatility, because of their low solubility in water these pesticides still can volatilize. They also can be transported attached to particulates in air. Air transport of dieldrin and heptachlor epoxide is limited by photolysis (ATSDR, 2002a, 2007), but DDT and chlordane can be transported long distances through the atmosphere.

Given that chlordane, dieldrin, DDT, and heptachlor epoxide are no longer actively used in DC, the concentration of each pesticide in the aquatic environment is expected to decline with time.

3.3.2 PCBs

There are a number of potential sources of PCBs to the Rock Creek watershed. PCBs can enter the environment through leaks from transformers and other closed applications; export from manufacturing or disposal sites contaminated with PCBs; or released from landfills or scrapyards where products containing PCBs have been disposed of improperly. There were no identified sites of PCB releases or soil contaminated with PCBs in the Rock Creek watershed (Haywood and Buchanan, 2007) nor are there any sites listed on the National Priorities List[1], undergoing Resource Conservation and Recovery Act corrective actions[2], or undergoing redevelopment

[1] https://www.epa.gov/superfund/search-superfund-sites-where-you-live
[2] https://www3.epa.gov/reg3wcmd/ca/dc.htm

under the Brownfields Program[3]. PCBs have been detected in bed sediments in Rock Creek (Anderson et al., 2002), however they have not been detected in shallow groundwater in the District using a method with a detection limit of 1 µg/L (Korterba et al., 2010). It should be noted, however, that this method detection limit may not be adequate to determine whether shallow groundwater is a potential source of PCBs to waterbodies, since PCB concentrations in the water column have also been consistently below this detection limit.

Additionally, air deposition is an important source of PCBs. Although they generally have low volatility, because of their very low solubility in water, significant volatilization of PCBs can occur (Smith *et al*., 1988). PCBs also can be transported attached to particulates in air. PCB concentrations in the atmosphere and PCB deposition rates tend to be higher in urban areas (Offenberg and Baker, 1997; Offenberg and Baker, 1999). Baker (1999) estimated wet and dry deposition of PCBs for the Chesapeake Bay Program's (CBP's) Chesapeake Bay Basin Toxics Loading and Release Inventory (CBP, 1999). Based on a study of atmospheric deposition of PCB's in Baltimore, MD (Offenberg and Baker, 1999), Baker estimated that PCB deposition rates over urban areas were ten times the regional background deposition rates, as measured at three rural stations in the basin. The urban rate for wet deposition was 8.3 $\mu g/m^2/yr$, and the rate for dry deposition was 8.0 $\mu g/m^2/yr$.

4 MODELING APPROACH

4.1 MODEL FRAMEWORK

The Small Tributary Pesticide Model (STPM) was developed to determine the TMDLs for the small tributaries in the District's portion of the Rock Creek and Potomac River watersheds. This model is similar in structure to the DC Small Tributary Model (DCSTM), which was used to develop the original TMDLs, however it has been updated using the best information currently available. In particular, STPM incorporates the following new information:

- The simulation of daily flows is based on a recent version of the Chesapeake Bay Program's (CBP's) Watershed Model, which allows the simulation period to be updated to 2001-2012;
- Land use classes and acreage in the District have been taken from the 2015 DC Consolidated TMDL Implementation Plan for its MS4; and
- Model input concentrations associated with land uses and flow paths have been estimated based on District MS4 monitoring data (2001-2013) and instream monitoring data (2013).

The STPM is a loading function model (McElroy *et al.*, 1976) which divides a watershed into the following land uses: forest, regulated pervious land, and regulated impervious land. Daily simulated runoff, interflow, and baseflow are determined for each land use on a per acre basis. Daily stormflow (runoff and interflow) and the total flow at the outlet of the watershed are then

[3] https://www.epa.gov/cleanups/cleanups-my-community

calculated from the daily per acre simulated flow for each land use and the land use acreage. Finally, the daily load of a constituent at the watershed outlet is calculated by associating a concentration with each land use and flow path. For more information on the model structure, please refer to the Section 2.1 of the Small Tributaries Modeling Reports (Mandel and Nagel, 2016a, b).

4.2 LAND USE

Land use information in the model was provided using a few sources. The DC MS4 TMDL Consolidated Implementation Plan was used to delineate the watershed in the District. Two land uses were relevant to the small tributary watersheds: MS4 area contributing to open channel and direct drainage to the waterbody. While one of the watersheds (Piney Branch) includes discharges of the CSS, that land area is not needed to calculate CSO flow or loads because CSO flows are input as a flow rate rather than land area. Within those land uses, the land cover types that were used in the model were impervious surface, forest, and turf (including yards, fields, grassed areas, and rights-of-way). The forest and turf land covers were also classified by soil hydrological group. To represent the Maryland portions of the small tributary watersheds, the National Hydrography Dataset (NHD) Plus version 2 was used along with adjustments to match the delineations in the District portions of the watersheds. The Maryland Office of Planning's 2010 land use and impervious cover data was used to represent impervious cover and to calculate forest and water acreage. Turf acreage was calculated in Maryland and the District as the difference between total watershed acreage and forest, water, and impervious acreage.

4.3 REPRESENTING FLOW

The Chesapeake Bay Program Watershed Model was used to represent daily flows by land cover type. An intermediate phase of the model, P5.4, Scenario NLDc814Hyd, was applied so a more recent simulation period (2001-2012) could be used for modeling the tributaries. The Watershed Model is an adaptation of the Hydrological Simulation Program FORTRAN (HSPF) for use in the Chesapeake Bay basin. The model simulates land and river processes. Land simulations are performed by land use and land segment on a per acre basis. Thirty land uses are represented. Each land use is simulated on over 360 land segments, which are assumed to be homogeneous and can be simulated by one land simulation per type. The P5 land segments are generally at the county level. The District, Montgomery County, and Prince George's County are each represented by a single land segment. The land simulation represents all phases of the hydrological cycle, including precipitation, runoff, infiltration, interflow, percolation and groundwater discharge. See Figure 4.1 for a simplified picture of the HSPF hydrological simulation for each land use. The output from land use simulations are input into a river network of over 1,100 river reaches.

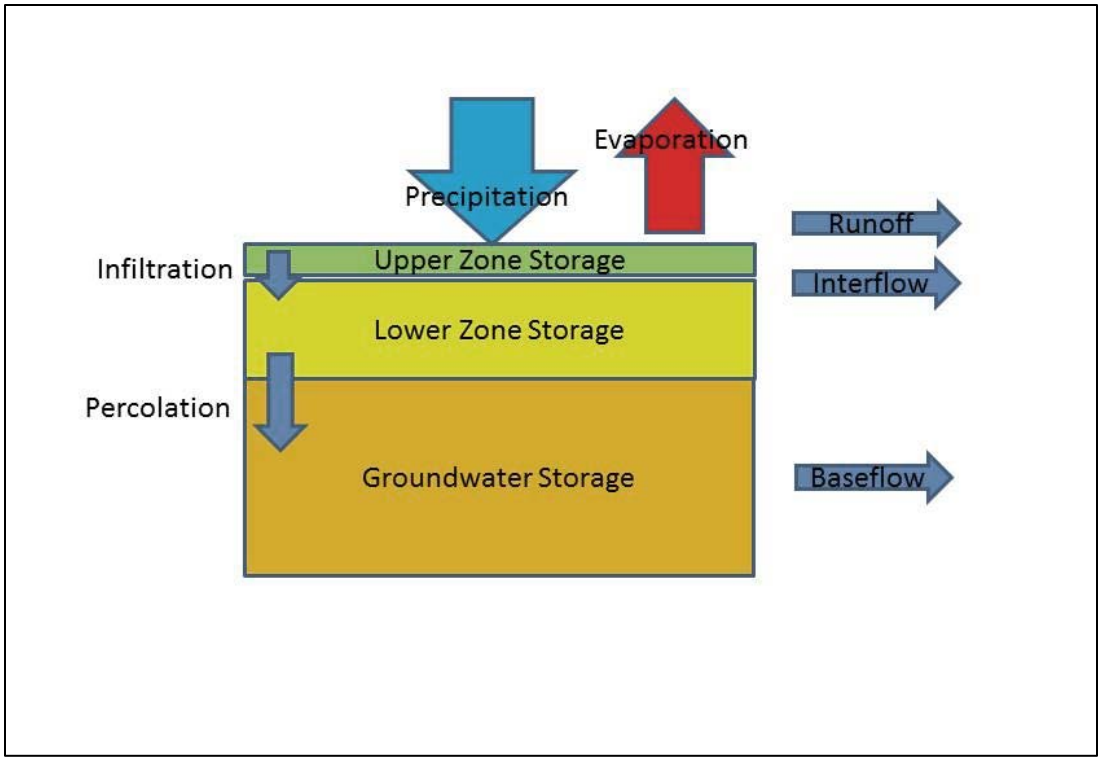

Figure 4.1 Simplified Diagram of HSPF

The Watershed Model is calibrated using an automated calibration procedure to set key land simulation parameters, such as infiltration rate or baseflow recession rate, by comparing simulated flow in river reaches to flows observed at U.S. Geological Survey (USGS) gauges. The District land segment was calibrated primarily against the USGS gauges on Rock Creek at Sherrill Drive (01648000) and the Northwest Branch of the Anacostia River (01650500).

For each jurisdiction, the daily time series of runoff, interflow, and baseflow (in/d) were extracted for the following land uses from the model output:

- Forest
- Regulated impervious land
- Regulated pervious land

Developed land was represented by the regulated impervious land and regulated pervious land, whereas forest was used primarily to represent forested parkland.

4.4 Combined Sewer Overflow Flows

Piney Branch is the only small tributary in the District with CSOs in its watershed. As was mentioned previously, flow from CSOs were not simulated using land use information. Rather, the District Water and Sewer Authority (DC Water) provided simulated CSOs from their MIKE URBAN model for a simulation period from 1988-1990 for baseline conditions and

implementation of the Long-term Control Plan (LTCP). Since the flow inputs were from 2001-2012, the CSO flow simulations could not be used directly for the model. Moreover, a relationship could not be constructed by analyzing occurrence of CSO events and previous 24 hour rainfall. Instead, the rate and distribution of CSOs as simulated by the MIKE URBAN model was kept consistent over the twelve-year simulation period. For example, the MIKE URBAN model predicts six CSOs in a three-year period under the LTCP, therefore, it was assumed that 24 CSOs would occur during the twelve-year period from 2001-2012. A time series was constructed as follows:

- For each hour in the simulation period 2001-2012, calculate precipitation in previous 24 hours
- For each day, find maximum 24-hour precipitation
- Assign simulated LTCP flows on a daily basis to the 24 largest daily maximum 24-hour precipitation totals by size (largest flow to the 4 largest precipitation events, next largest flow to the next 4, etc.)

This process was used to determine CSO flows under baseline conditions. The MIKE URBAN model estimates that 84 CSO events occur under the baseline scenario. Therefore, it was estimated that 336 CSOs would occur from 2001-2012. CSO events were assigned to the 336 days with largest 24-hour precipitation totals, according to the same distribution of volumes in the MIKE URBAN 1988-1990 simulation of baseline conditions.

For all model scenarios except the baseline, the time series constructed from the LTCP output was used to represent CSO flows.

4.5 MONITORING DATA ANALYSIS AND MODEL INPUT CONCENTRATIONS

The STPM needs to assign input concentrations for storm flow and base flow for each land use. There are limited concentration data for pesticides and PCBs in the Rock Creek and Potomac tributaries. From 2001-2013, the District collected wet-weather samples as part of their MS4 permit, which was used to represent the storm flow concentrations for the pesticides[4]. This sampling was inconclusive for PCB analyses, so the storm flow concentration for PCBs were calculated using the analysis of PCB monitoring data collected for the tidal Potomac/Anacostia PCB TMDL (Haywood and Buchanan, 2007). In 2013, Tetra Tech collected in-stream, dry weather samples in Rock Creek and the Potomac tributaries, which was used to represent base flow concentrations for pesticides and PCBs.

4.5.1 Stormwater Baseline Pesticide Concentration

As mentioned above, MS4 data was used to estimate the mean storm flow concentration for pesticides. The MS4 data was separated geographically into a Piedmont Group, Anacostia/Coastal Plain Group, and Other to set the mean concentration of each pesticide. The Piedmont Group was used to represent concentrations in all the small tributaries in Rock Creek and Dalecarlia Tributary, whereas the Anacostia/Coastal Plain Group was used to represent

[4] Martin Hurd (DOEE). 2015. Personal communication.

concentrations in Oxon Run. The Other Group did not apply to any of the small tributary watersheds.

Many of the samples that were analyzed for pesticides were below the detection limit (DL). Samples that were below the detection limit were categorized as censored observations whereas samples above the detection limit were uncensored. The following procedure was used to refine the data set for each pesticide:

1. Determine the largest uncensored observation.
2. Remove from the data set any censored observations whose DL is above the largest uncensored observation.
3. Assign the remaining censored data values equal to half their DL.

A mean concentration was estimated for each of the four pesticides in the Piedmont Group and for dieldrin in the Coastal Plain for Oxon Run, which can be found in Table 4.3. These concentrations were used to represent stormwater concentrations (except from forest) and CSOs. Since forest represents minimally disturbed conditions, the concentration of pesticides in forest storm flow was set at the instream concentrations used to represent base flow pesticide concentrations.

4.5.2 Stormwater Baseline PCBs Concentration

From 2001 – 2007, the District analyzed their wet weather samples for PCBs using 1) total PCBs, 2) Aroclors, and 3) individual congeners. Most of the analyses were below the detection limit and the individual congeners detected were not sufficient to estimate total PCBs. Therefore, the data was not useful for estimating total PCBs and an approach was developed using the tidal Potomac/Anacostia PCB TMDL (Haywood and Buchanan, 2007). This TMDL developed regression equations based on PCB and total suspended solid (TSS) monitoring data to model the relationship between those two variables. The DC Urban Regression equation was chosen to represent the Rock Creek tributaries storm flow concentration because those monitoring stations are closest in proximity to the Rock Creek watershed. The TSS concentration was taken from the Consolidated Implementation TMDL Implementation Plan, which estimates an event mean concentration (EMC) of TSS in Rock Creek of 60 mg/L (Limno Tech, 2015).The relationship is based on PCB homologs three through ten, and is converted to total PCBs by dividing by 0.92. The process to represent the total PCB concentration is shown in Table 4.1.

Table 4.1 Elements in the Calculation of Total PCB Concentration in Storm Flow in the STPM

Element	Value	Source
DC Urban Regression Model	$[PCB3+] = 0.855*[TSS]^{0.9702}$	Tidal Potomac/Anacostia PCB TMDL
Rock Creek EMC TSS Concentration	60 mg/l	DC Consolidated Implementation Plan
Conversion to Total PCBs	1/0.92	Tidal Potomac/Anacostia PCB TMDL
Input STPM Storm Flow PCB Concentration		49 ng/l

The estimated STPM stormwater total PCB concentration was used to represent the concentration of PCBs in stormwater from all land uses in STPM, with the exception of forest.

The baseline concentration to represent CSOs from Piney Branch were calculated in much the same way as the method used to estimate stormwater concentrations. The DC Urban Equation was used along with a TSS EMC, which was estimated from monitoring data collected for the DC LTCP. Table 4.2 outlines the approach.

Table 4.2 Elements for Calculation in the Total PCB Concentration in CSO Flow in the STPM

Element	Value	Source
DC Urban Regression Model	$[PCB3+] = 0.855*[TSS]^{0.9702}$	Tidal Potomac/Anacostia PCB TMDL
Rock Creek EMC TSS Concentration	156 mg/l	DC Long-Term Control Plan
Conversion to Total PCBs	1/0.96	Tidal Potomac/Anacostia PCB TMDL
Input STPM CSO Flow PCB Concentration		120 ng/l

4.5.3 Base Flow Baseline Concentration

Instream samples collected in 2013 were used to estimate mean base flow concentrations from all land uses and storm flow from forest. The samples were divided into two groups, Piedmont and Coastal Plain, with any samples taken in tidal waters excluded. As with the stormwater baseline concentration, the Piedmont Group represented Rock Creek small tributaries and Dalecarlia Tributary, whereas the Coastal Plain Group was used for Oxon Run concentrations.

The method used to handle non-detects in pesticide storm flow data was also used to refine instream data to represent base flow. Table 4.3 summarizes the input concentrations that were used for storm flow and base flow.

The 2013 sampling was used to represent base flow concentration for total PCBs as well. That sampling analyzed for 20 PCB congeners, 19 of which were in NOAA's status and trends report (Lauenstein and Cantillo, 1993). Samples taken in the Piedmont group were used to estimate the baseline concentration. Congeners that were non-detect in a sample were estimated by substituting using half of the detection limit. Total PCBs were calculated by adding the congeners and multiplying by two, as recommended in the NOAA guidance. For more information on this approach, see Mandel and Nagel (2016b).

Table 4.3 Baseline Input Concentrations used in STPM

Constituent	Base flow Concentration (µg/L)	Storm flow Concentration (µg/L)
Chlordane	0.0016	0.19
DDT	0.00039	0.0098
Dieldrin (Piedmont)	0.0025	0.0012
Dieldrin (Coastal Plain)	0.00066	0.00026
Heptachlor Epoxide	0.002	0.00061
PCBs (total)	0.010	0.049

4.5.4 Uncertainty in Baseline Concentrations

There is high level of uncertainty in the baseline concentrations in each watershed due to the lack of a robust dataset in these small tributaries. The approach that was chosen incorporates conservative assumptions, such as setting the concentration of non-detect data to half of the detection limit, and likely provides the best estimate possible with the available dataset.

4.6 SOURCE CLASSIFICATION

In order to make reductions to sources of pesticides and PCBs, sources that discharge at storm sewer outlets are distinguished from diffuse sources. The former are referred to as "end-of-pipe" (EOP) sources, while the latter are referred to as "nonpoint sources" (NPS). Table 4.4 shows the classification of sources. EOP sources include all storm discharges within District MS4 boundaries as well as storm discharges from developed land in Maryland. All other sources are considered NPS, including base flow discharges from the District MS4 and surface discharges from developed land outside of the District MS4 boundaries. The distinction between EOP and NPS does not fully match how input concentrations were assigned in the STPM, which was presented in Table 4.1.

Table 4.4 Classification of Sources in Scenarios

Land Cover	Flow Type	MS4	Direct Drainage	Maryland
Impervious	Storm	EOP	NPS	EOP
Turf	Storm	EOP	NPS	EOP
	Base	NPS	NPS	NPS
Forest	Storm	EOP	NPS	NPS
	Base	NPS	NPS	NPS

These source classifications were used primarily in the scoping scenarios for TMDL reductions. The scoping scenarios are discussed in depth in Section 3.1 of the modeling reports (Mandel and Nagel, 2016a,b).

5 TOTAL MAXIMUM DAILY LOAD (TMDL) ALLOCATIONS

5.1 GENERAL/BACKGROUND

The purpose of a TMDL is to allocate allowable loads among different pollutant sources that achieve water quality standards (EPA, 1991). This TMDL considers all significant sources contributing to pesticides in the impaired streams. The sources can be separated into point and nonpoint sources.

The TMDL was calculated using the following equation:

TMDL = WLA + LA + MOS

Where WLA = sum of the wasteload (permitted) allocations

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

MOS = margin of safety

5.2 BASELINE SCENARIO

Under baseline or current conditions, CMCs for dieldrin, heptachlor epoxide, chlordane, and DDT are always met, reflecting the fact that the data indicates no observed concentrations of these pesticides have exceeded the CMCs. Under the baseline conditions, CCCs are always met for dieldrin and heptachlor epoxide, but are not met for chlordane, DDT or PCBs. The Class D human health criteria are not met under baseline conditions for dieldrin, heptachlor epoxide, chlordane, DDT, and PCBs. This TMDL provides loading reductions required to meet the human health criteria, which based on the data, would appear generally to be the most stringent of the three criteria as it is the most frequently exceeded, thus ensuring compliance with the CMC and CCC. Daily maximum loads, however, are also bounded by the CMC and CCC as set forth below.

5.3 REDUCTION SCENARIO

As illustrated in Figures 5.1, 5.2, 5.3, 5.4 and 5.5, the TMDL allocation scenario was based on the Class D human health criteria concentration being met at all times (not a 30-day average). Reductions required to meet the pesticide and PCB human health criteria concentration are shown in Table 5.1. Because of the uncertainty around the estimation of the baseline load, there is uncertainty associated with the percentage reductions provided in Table 5.1. The baseline

loads and percent reductions, therefore, are provided for information only and do not form an assumption and requirement of the TMDL. Because of this uncertainty, the TMDL goal is the concentration of the most conservative criteria (the human health criterion) being met in a tributary at a constant value. TMDL loads for each source (as discussed in greater detail in the sections below) are calculated by using the human health criteria concentration and the flow of the tributaries as calculated by the model (as discussed in Section 4). Since, for each pesticide, the concentration of the human health criterion is less than the CCC and CMC, those criteria will also be met under the TMDL Scenario. Figure 5.1 shows these relationships for dieldrin. The relationships hold for each tributary modeled, and therefore Figure 5.1 could represent any tributary. Figure 5.1 also demonstrates that the TMDL Scenario meets the human health and the acute and chronic aquatic life use criteria. Figures 5.2, 5.3, 5.4, and 5.5 show the same relationships for heptachlor epoxide, chlordane, DDT, and PCBs, respectively.

Table 5.1 Percent Reductions Required to Meet Current Class D Human Health Criteria, TMDL Scenario

Watershed	Tributary	Dieldrin		Heptachlor Epoxide		Chlordane		DDT		PCBs	
		EOP	NPS	EOP	NPS	EOP	NPS	EOP	NPS	EOP	NPS
Rock Creek	Broad	95.5%	97.8%	93.6%	98.1%	99.6%	49%			99.87%	99.36%
	Dumbarton	95.5%	97.8%	93.6%	98.1%	99.6%	49%			99.87%	99.36%
	Fenwick	95.5%	97.8%	93.6%	98.1%			97.8%	43.6%	99.87%	99.36%
	Klingle Valley	95.5%	97.8%	93.6%	98.1%					99.87%	99.36%
	Luzon	95.5%	97.8%	93.6%	98.1%	99.6%	49%			99.87%	99.36%
	Melvin Hazen	95.5%	97.8%							99.87%	99.36%
	Normanstone	95.5%	97.8%	93.6%	98.1%					99.87%	99.36%
	Pinehurst	95.5%	97.8%	93.6%	98.1%					99.87%	99.36%
	Piney	95.5%	97.8%	93.6%	98.1%	99.6%	49%			99.87%	99.36%
	Portal	95.5%	97.8%	93.6%	98.1%					99.87%	99.36%
	Soapstone	95.5%	97.8%	93.6%	98.1%	99.6%	49%			99.87%	99.36%
Potomac River	Dalecarlia	95.5%	97.8%	93.6%	98.1%						
	Oxon	79.2%	91.8%								

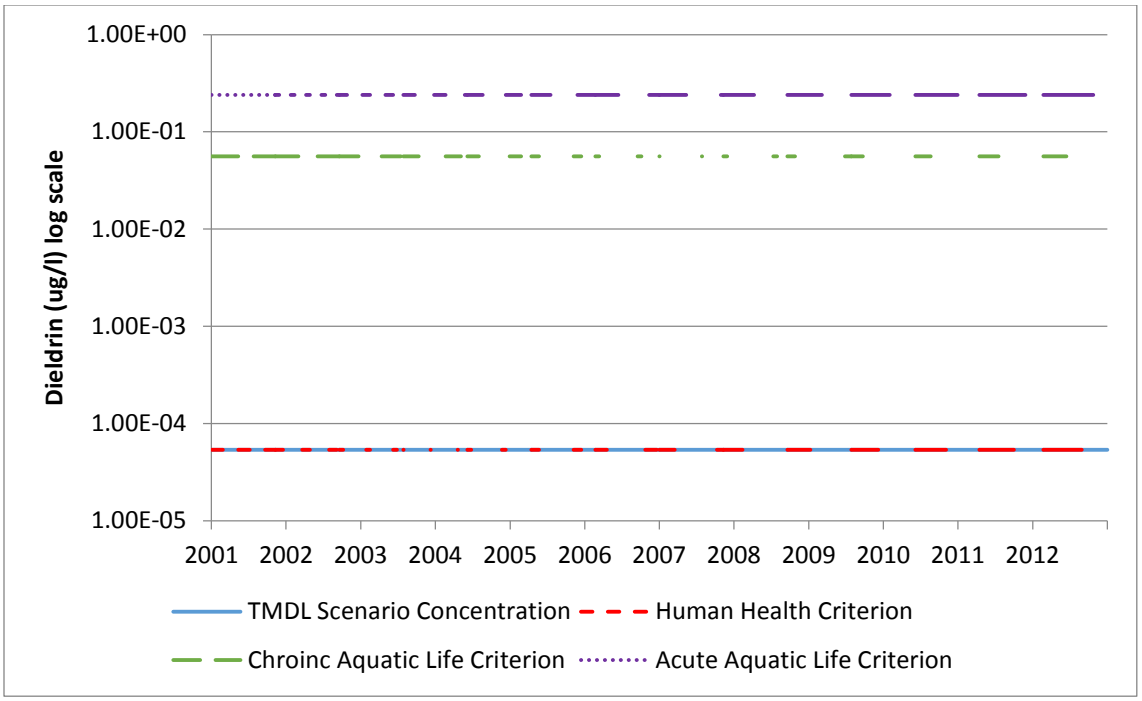

Figure 5.1 Simulated Dieldrin Concentration (µg/L), TMDL Scenario, and Dieldrin Human Health Criterion, Chronic Aquatic Life Criterion, and Acute Aquatic Life Criterion

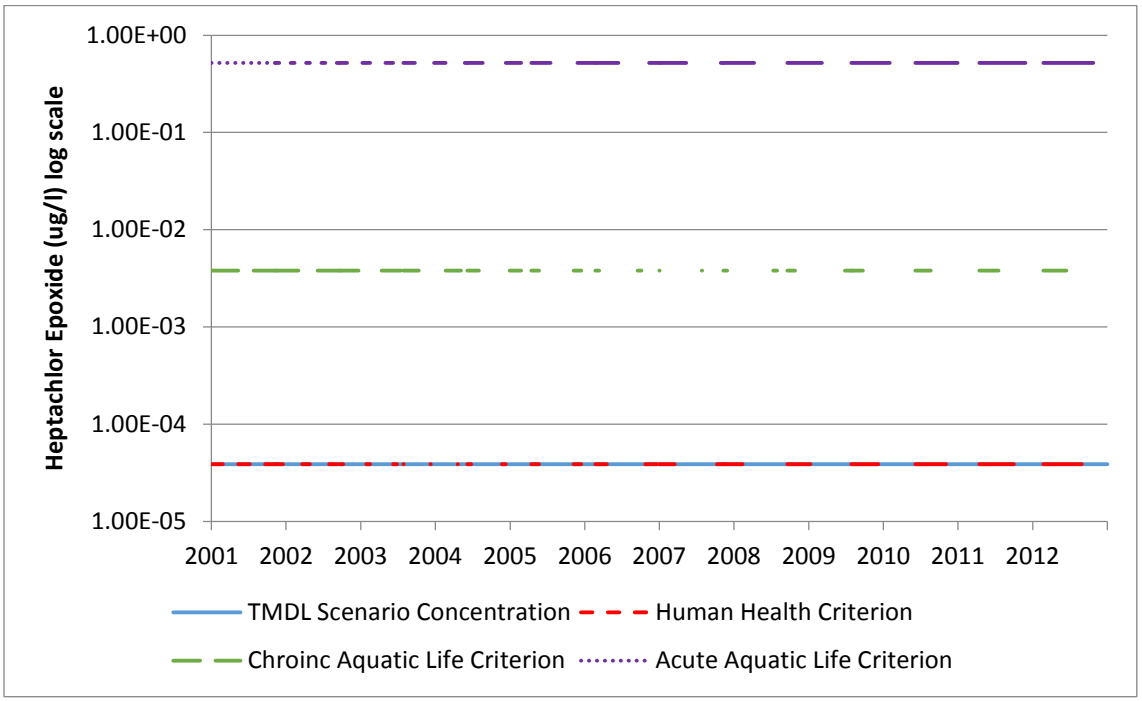

Figure 5.2 Simulated Heptachlor Epoxide Concentration (µg/L), TMDL Scenario, and Heptachlor Epoxide Human Health Criterion, Chronic Aquatic Life Criterion, and Acute Aquatic Life Criterion

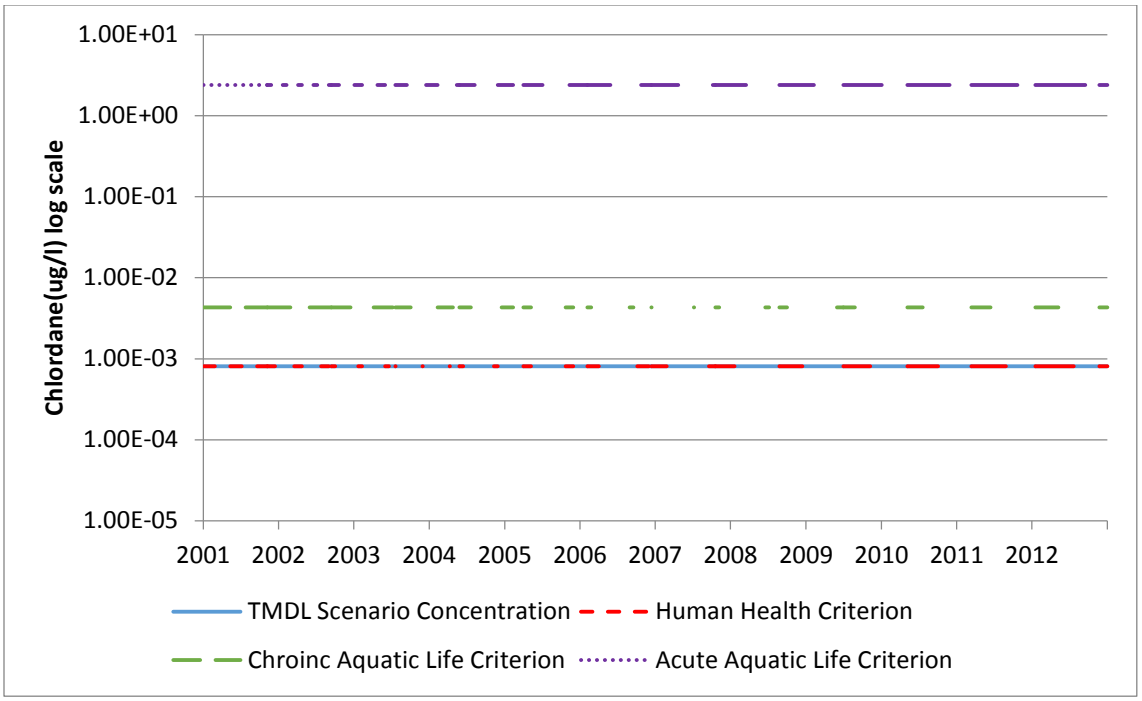

Figure 5.3 Simulated Chlordane Concentration (µg/L), TMDL Scenario, and Chlordane Human Health Criterion, Chronic Aquatic Life Criterion, and Acute Aquatic Life Criterion

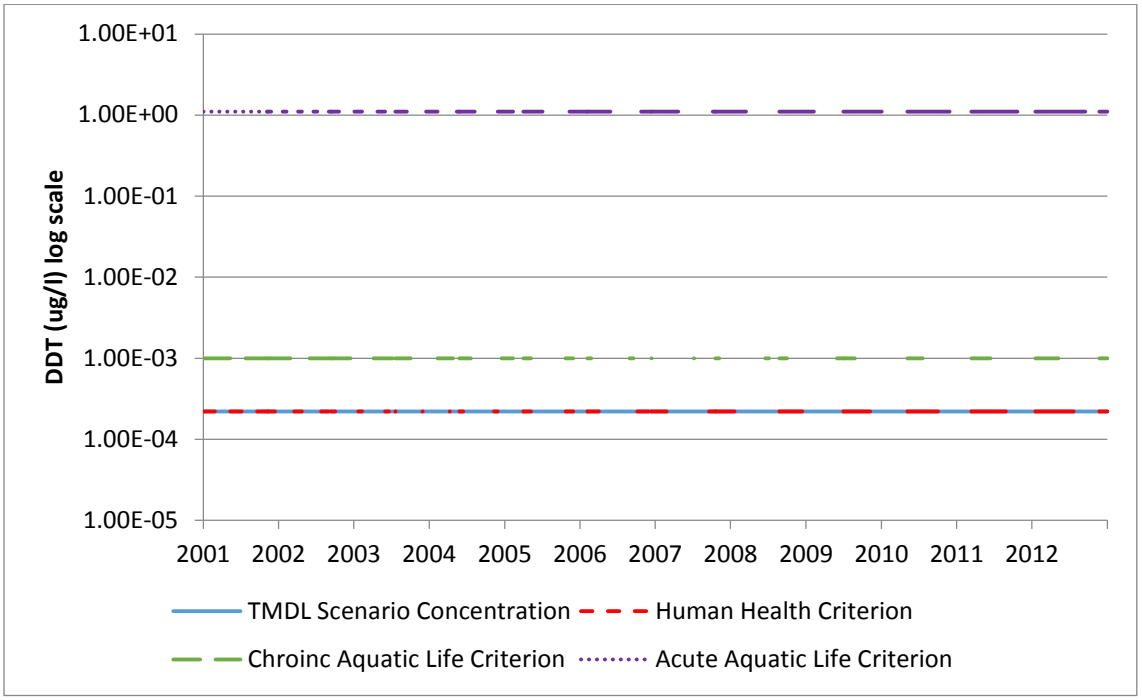

Figure 5.4 Simulated DDT Concentration (µg/L), TMDL Scenario, and DDT Human Health Criterion, Chronic Aquatic Life Criterion, and Acute Aquatic Life Criterion

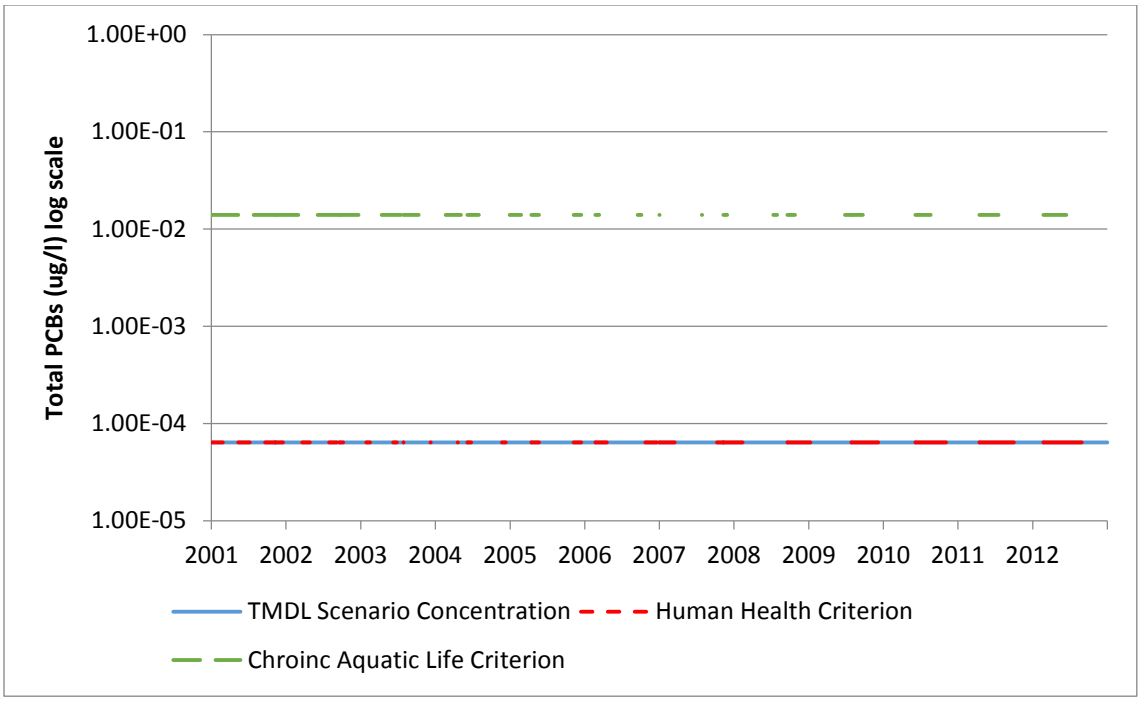

Figure 5.5 Simulated Total PCB Concentration (µg/L), TMDL Scenario, and PCB Human Health Criterion and Chronic Aquatic Life Criterion

5.4 WASTELOAD ALLOCATION

The wasteload allocation portion of a TMDL is comprised of permitted point sources. In the Rock Creek watershed and Potomac tributaries, the permitted sources include the District MS4, multi-sector general permits (MSGP), construction stormwater general permits (CSGP), and CSOs.

5.4.1 Regulated Stormwater

"Stormwater discharges that are regulated under Phase I or Phase II of the National Pollutant Discharge Elimination System (NPDES) stormwater program are point sources that must be included in the WLA portion of a TMDL" (EPA, 2002). Phase I and II permits can include the following types of discharges:

- Small, medium, and large MS4s – these can be owned by local jurisdictions, municipalities, and state and federal entities (i.e., departments of transportation, hospitals, military bases, etc.),
- General industrial stormwater permitted facilities, and
- Small and large construction sites.

The District's MS4 system discharges into the Rock Creek and Potomac River tributaries (NPDES Permit Number DC0000221). EPA recognizes that available data and information are usually not detailed enough to determine WLAs for NPDES regulated stormwater discharges on an outfall-specific basis (EPA, 2002). Therefore, in the Rock Creek and Potomac tributaries,

loads from the MS4 outfalls will be expressed as a single stormwater WLA for each impaired waterbody. Allocations to the MS4 were based on flow from the land area serviced by the MS4 multiplied by the applicable human health criterion. All of the small tributary TMDLs include wasteload allocations to the MS4.

The MSGP regulates stormwater discharges associated with industrial activity. There are two MSGPs in these small tributary watersheds: one in Broad Branch (DCR05AA17) and one in Melvin Hazen Valley Branch (DCR05A471). Both facilities are within the delineated MS4 area and are therefore aggregated under the MS4 WLAs.

CSGPs are transient due to the nature of construction activities. Therefore, CSGPs are also aggregated under the MS4 WLA because they are included within the MS4 area.

5.4.2 Combined Sewer Overflows

CSOs discharge into Piney Branch when stormwater exceeds the WWTP capacity and is included as part of the WLA in this tributary. The process for representing flows from CSOs was discussed in Section 4.4. CSOs under the TMDL scenario will be based on the LTCP with the distribution of CSO flows being an extrapolation of frequency under the LTCP. As with all other sources, the WLA contribution from CSOs was based on flow multiplied by the human health criteria.

5.5 LOAD ALLOCATION

The load allocation (LA) represents contributions from nonpoint sources. In the small tributaries, the LA represented direct drainage to the waterbody, and where applicable, upstream loading from Maryland. Fenwick Branch, Pinehurst Branch, Portal Branch, and Oxon Run all have a portion of their watersheds in Maryland and include upstream LAs in their TMDLs. Loading from Maryland and direct drainage were determined based on the flow from the land area in each category multiplied by the human health criteria.

5.6 AVERAGE ANNUAL LOADS

Average annual loads were developed for each waterbody/pollutant combination by taking the total loading model output of each source category over the 2001-2012 simulation period and dividing it by twelve. Average annual loads are presented in Section 6 of this report.

5.7 DAILY LOADS

In November 2006, EPA released the memorandum *Establishing TMDL Daily Loads in Light of the Decision by the U.S. Court of Appeals for the D.C. Circuit in Friends of the Earth, Inc. v. EPA et. al., No. 05-5015 (April 25, 2006) and Implications for NPDES permits*, which recommends that all TMDLs and associated load allocations and wasteload allocations include a daily time increment in conjunction with other appropriate temporal expressions that might be necessary to implement the relevant WQS. In compliance with that recommendation, this report presents corresponding daily load expressions for the long-term load allocations for tributaries to Rock Creek and the Potomac River. These daily loads were developed in a manner consistent

with the following assumptions in EPA's Draft Options for Expressions of Daily Loads in TMDLs (EPA, 2007):

1. Methods and information used to develop the daily load should be consistent with the approach used to develop the loading analysis.
2. The analysis should avoid added analytical burden without providing added benefit.
3. The daily load expression should incorporate terms that address acceptable variability in loading under the long-term loading allocation. Because many TMDLs are developed for precipitation-driven parameters, one number will often not represent an adequate daily load value. Rather, a range of values might need to be presented to account for allowable differences in loading due to seasonal or flow-related conditions (e.g., daily maximum and daily median).
4. The methodologies are applicable to a wide variety of TMDL situations; however, the specific application (e.g., data used, values selected) should be based on knowledge and consideration of site-specific characteristics and priorities.
5. The TMDL analysis on which the daily load expression is based fully meets the EPA requirements for approval, is appropriate for the specific pollutant and waterbody type, and results in attainment of water quality criteria in a manner that is consistent with the underlying analysis that was used to develop the original TMDLs.

5.7.1 Daily Load Approach

Maximum average daily loads were calculated for each waterbody/pollutant combination in order to comply with the court's decision in Friends of the Earth vs. EPA. The maximum average daily load was calculated for each source category using the maximum load that source could discharge in a single day (calculated as maximum daily flow identified in the 12-year simulation multiplied by the criteria concentration) during the 12 year simulation period and be assured that the applicable water quality standards would not be exceeded. Because compliance with the applicable water quality standard (here the human health criterion) is measured by whether an average instream concentration is achieved over a 30-day period and not on a daily basis, it is possible for a higher concentration of each parameter to enter the waters on any given day and still achieve water quality standards. The precise maximum daily load to achieve a 30-day average instream concentration, of course, depends upon the loads each day of the 30-day period. By providing the daily load expression as the maximum average daily load, the allocations account for day-to-day variability while still assuring that the standard is achieved. It should be noted that the upper boundary of the daily load expression on any given day also would be formed by the CCC and CMC.

5.8 MARGIN OF SAFETY

A Margin of Safety (MOS) accounts for uncertainties in the load estimates and in the simulation process affecting pollutant fate and transport. The MOS may be either explicit, as an additional load reduction requirement, or implicit, which incorporates conservative assumptions within the application of the TMDL model. An implicit MOS was used for these TMDLs since it incorporated a number of conservative assumptions. First, a 12-year simulation period, 2001-

2012, was used in the STPM. This simulation period includes a variety of hydrological conditions, including a very wet year (2003) and a very dry year (2002). The use of a long simulation period with a variety of hydrological conditions ensures that critical conditions are addressed by the TMDLs. Second, although there is uncertainty in baseline load estimates, the uncertainty in baseline concentrations and loads have no impact on the loads calculated under the TMDL scenario and meeting water quality standards. The loads under the TMDL scenario were not determined from the limited available data, but directly from the most stringent applicable water quality criteria concentration and a robust 12 year flow data set. Third, the TMDLs are calculated for all categories of sources to discharge at no more than the most stringent applicable water quality criteria concentration at any time. Each criteria includes a magnitude (the concentration), the frequency (no more than once every 3 years) and a duration (1 hour for the CMC, 4 hour average for the CCC and 30 day average for human health). The TMDL was calculated so that the most stringent concentration (human health criteria) would be met at all time. This is conservative assumption since a 30 day average criteria would allow for exceedances of the numeric concentration over the course of 30 days, as long as the average does not exceed the numeric concentration. An additional conservative assumption of the TMDL is that no category of sources relies on dilution from another category of sources, in order that water quality standards be met.

5.9 CRITICAL CONDITIONS AND SEASONAL VARIATIONS

EPA regulations [40 CFR 130.7(c)(1)] require TMDLs to take into account critical conditions for stream flow, loading, and water quality parameters. Doing so ensures that when TMDLs are implemented, they will not result in violations of water quality criteria under a wide variety of flow regimes that affect pollutant concentrations.

Critical conditions for stream flow, loading, and water quality parameters are captured in the model. Based on monitoring data, the Class D criteria for chlordane, DDT, and PCBs are most likely to be exceeded during periods with frequent storm flow inputs, whereas dieldrin and heptachlor epoxide criteria are more likely to be exceeded during dry weather conditions. The reason for this stems from the storm flow and base flow concentrations used to represent the baseline of each pesticide. Existing storm flow concentrations are higher than base flow for chlordane, DDT, and PCBs, making the criteria more likely to be exceeded during high flow events. In contrast, existing base flow concentrations are higher than storm flow concentrations for heptachlor epoxide and dieldrin, leading to more exceedances during dry periods. The STPM simulates a variety of hydrological conditions over a 12-year simulation period, including periods of dry weather (2002) and periods of frequent storm events (2003).

EPA regulations [40 CFR 130(c)(1)] also require TMDLs to take into account seasonal environmental variations. Seasonal variations have been incorporated into the STPM. STPM uses daily output from HSPF, a continuous simulation model on an hourly time-step to simulate flows over a 12-year simulation period, so the model takes into account hourly variation precipitation, temperature, and potential evapotranspiration. The model parameter for surface roughness varies monthly (EPA 2010).

5.10 TMDLS FOR EPA RECOMMENDED HUMAN HEALTH CRITERIA

DOEE is considering revising its Class D criteria for the protection of human health related to the consumption of fish in its 2016 triennial review of its Water Quality Standards. These criteria would be based on the EPA Recommended Human Health Criteria that were revised in 2016 (see Table 5.2). In the event that the new criteria are adopted by DOEE and approved by EPA, TMDLs were developed to meet the revised criteria. These TMDLs require all sources to discharge at the recommended human health criteria and can be found in Appendix A. In the event that the new criteria are adopted by DOEE and approved by EPA, the TMDLs for each pollutant and each tributary in Appendix A will be submitted to EPA for approval as superseding TMDLs.

Table 5.2 EPA 2016 Recommended Human Health Criteria (µg/L)

Constituent	CAS Number	Class D: Fish Consumption Use Human Health (30-day average)
Chlordane	57-74-9	0.00032
DDT	50-29-3	0.000030
Dieldrin	60-57-1	0.0000012
Heptachlor Epoxide	1024-57-3	0.000032

6 TMDLS FOR INDIVIDUAL SMALL TRIBUTARIES

In this section, the results of the application of STPM to develop pesticide and PCB TMDLs for each small tributary will be discussed individually. Each section below will present results for an individual tributary, including:

- A brief description of the tributary and its watershed;
- Map of the tributary watershed;
- Land use acreage;
- Average annual baseline conditions and TMDL Scenario loads for each pollutant; and
- Maximum average daily loads for baseline conditions and TMDL Scenario for each pollutant.

Figures for the time series of simulated daily flows, simulated daily concentrations for 2005, 30-day average simulated concentrations under baseline conditions, and daily loads for each pollutant under baseline conditions and TMDL Scenario can be found in Section 4 of the modeling reports (Mandel and Nagel 2016a,b).

The TMDLs were calculated using current water quality standards. Appendix A contains the same tables calculated using the same methods but with the proposed revisions to the human health criteria.

6.1 BROAD BRANCH

Broad Branch is an approximately two-mile long western tributary of Rock Creek. Figure 6.1 shows the location of Broad Branch and its watershed. It is joined by Soapstone Creek about 800 feet before it discharges into Rock Creek. Broad Branch begins near Nebraska and Connecticut Avenues. For half of its length, Broad Branch is bordered on one side by National Park Service parkland and on the other side by Broad Branch Road which directly abuts it. The lower reach of the stream travels through Rock Creek Park and is bordered by an approximately 200-foot buffer of tree and shrubs. The stream is about 25 feet wide (DDOH, 2004a).

Table 6.1 gives the land use acreage in the Broad Branch watershed. The watershed encompasses 1,145 acres. The watershed is 34% impervious and 79% lies within the District MS4. About 15% percent of the watershed is parkland, while the remaining area is residential and retail commercial. There is one MSGP in the watershed, 5333 Connecticut Avenue NW (DCR05AA17), as shown in Figure 6.1. The loading from this MSGP is aggregated under the MS4 WLA.

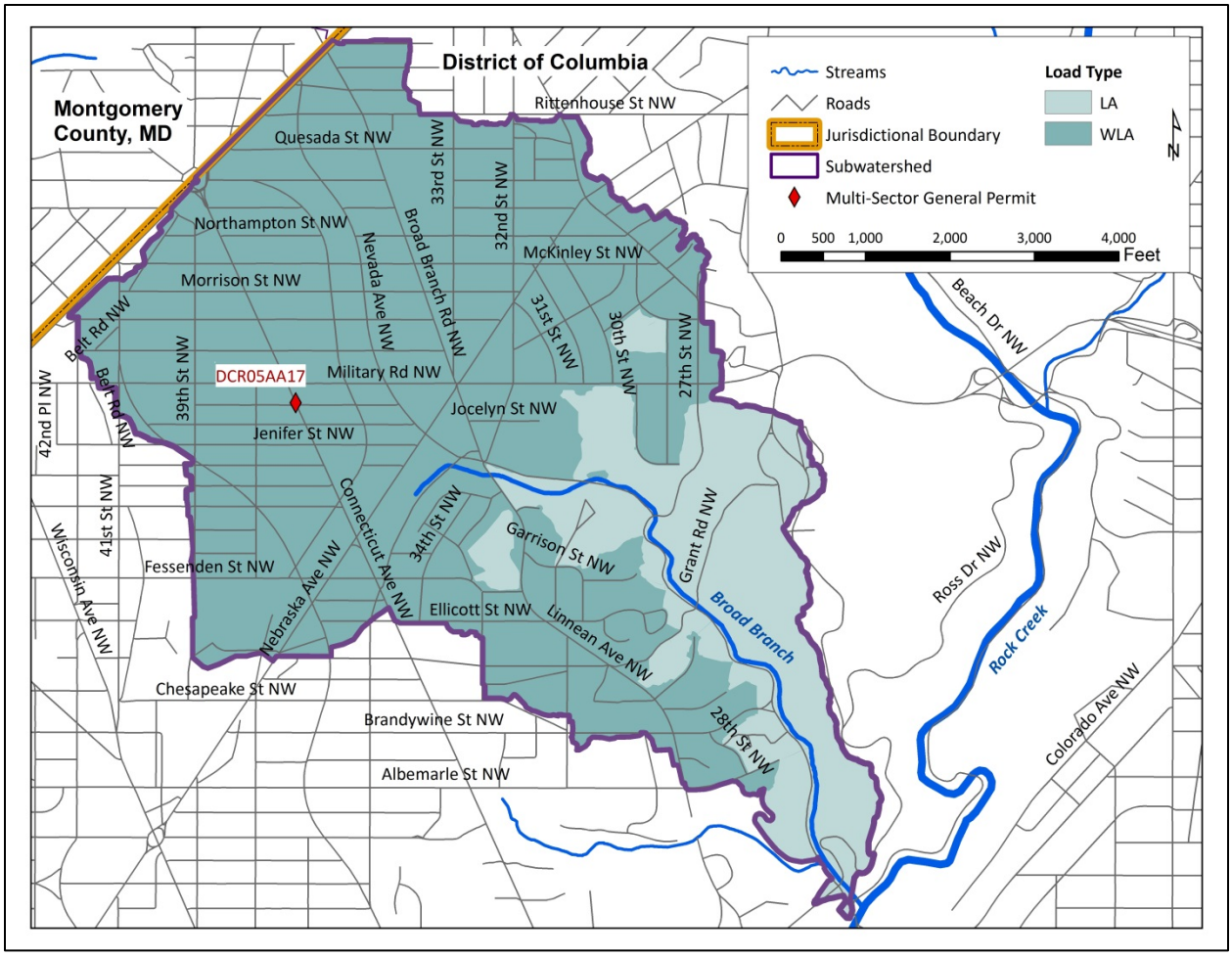

Figure 6.1 Broad Branch and its Watershed

Table 6.1 Broad Branch Land Use (acres)

Type	Impervious	Pervious	Forest	Total
District MS4	367	495	39	900
District Non-MS4	22	46	176	245
Maryland	-	-	-	-
Total	389	541	215	1,145

6.1.1 Dieldrin TMDLs

Table 6.2 presents the average annual baseline dieldrin loads and TMDL allocations. Table 6.3 presents maximum average daily baseline dieldrin loads and TMDL allocations. Baseline loads and allocations for MSGP DCR05AA17 are included in the District stormwater baseline loads

and allocations. Since the concentration of dieldrin in storm flow is less than the concentration in base flow, concentrations decrease in storm events.

Table 6.2 Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Broad Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	4.13E-03	1.86E-04	95.5%
	Total	4.13E-03	1.86E-04	95.5%
Load Allocation	Direct Drainage	2.73E-03	7.06E-05	97.4%
	Upstream Maryland	-	-	-
	Total	2.73E-03	7.06E-05	97.4%
Margin of Safety		-	Implicit	-
Total		6.86E-03	2.56E-04	96.3%

Table 6.3 Dieldrin Maximum Average Daily Loads (lbs/d), Broad Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	7.67E-04	3.45E-05	95.5%
	Total	7.67E-04	3.45E-05	95.5%
Load Allocation	Direct Drainage	1.35E-04	5.99E-06	95.6%
	Upstream Maryland	-	-	-
	Total	1.35E-04	5.99E-06	95.6%
Margin of Safety		-	Implicit	-
Total		9.02E-04	4.05E-05	95.5%

6.1.2 Heptachlor Epoxide TMDLs

Table 6.4 presents the average annual baseline heptachlor epoxide loads and TMDL allocations. Table 6.5 presents maximum average daily baseline heptachlor epoxide loads and TMDL allocations. Baseline loads and allocations for MSGP DCR05AA17 are included in the District stormwater baseline loads and allocations.

[5] Percent reductions are meant to be illustrative due uncertainty in baseline load, as discussed in Section 4.5.4.

Table 6.4 Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Broad Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	2.10E-03	1.34E-04	93.6%
	Total	2.10E-03	1.34E-04	93.6%
Load Allocation	Direct Drainage	2.04E-03	5.10E-05	97.5%
	Upstream Maryland	-	-	-
	Total	2.04E-03	5.10E-05	97.5%
Margin of Safety		-	Implicit	-
Total		4.14E-03	1.85E-04	95.5%

Table 6.5 Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), Broad Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	3.90E-04	2.49E-05	93.6%
	Total	3.90E-04	2.49E-05	93.6%
Load Allocation	Direct Drainage	6.97E-05	4.33E-06	93.8%
	Upstream Maryland	-	-	-
	Total	6.97E-05	4.33E-06	93.8%
Margin of Safety		-	Implicit	-
Total		4.60E-04	2.93E-05	93.6%

6.1.3 Chlordane TMDLs

Table 6.6 presents the average annual baseline chlordane loads and TMDL allocations. Table 6.7 presents maximum average daily baseline chlordane loads and TMDL allocations. Baseline loads and allocations for MSGP DCR05AA17 are included in the District stormwater baseline loads and allocations. Unlike dieldrin, the concentration of chlordane in storm flow is greater than the concentration in base flow, so concentrations increase in storm events.

Table 6.6 Average Annual Chlordane Baseline Loads and TMDL Allocations (lbs/yr), Broad Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	6.54E-01	2.79E-03	99.6%
	Total	6.54E-01	2.79E-03	99.6%
Load Allocation	Direct Drainage	4.58E-02	1.06E-03	97.7%
	Upstream Maryland	-	-	-
	Total	4.58E-02	1.06E-03	97.7%
Margin of Safety		-	Implicit	-
Total		7.00E-01	3.85E-03	99.5%

Table 6.7 Chlordane Maximum Average Daily Loads (lbs/d), Broad Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.21E-01	5.18E-04	99.6%
	Total	1.21E-01	5.18E-04	99.6%
Load Allocation	Direct Drainage	9.02E-03	8.99E-05	99.0%
	Upstream Maryland	-	-	-
	Total	9.02E-03	8.99E-05	99.0%
Margin of Safety		-	Implicit	-
Total		1.30E-01	6.08E-04	99.5%

6.1.4 PCB TMDLs

Table 6.8 presents the average annual baseline total PCB loads and TMDL allocations. Table 6.9 presents maximum average daily baseline dieldrin loads and TMDL allocations. Baseline loads and allocations for MSGP DCR05AA17 are included in the District stormwater baseline loads and allocations. Since the concentration of PCBs in storm flow is greater than the concentration in base flow, concentrations increase during storm events.

Table 6.8 Average Annual PCB Baseline Loads and TMDL Allocations (lbs/yr), Broad Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.69E-01	2.20E-04	99.87%
	Total	1.69E-01	2.20E-04	99.87%
Load Allocation	Direct Drainage	2.21E-02	8.37E-05	99.62%
	Upstream Maryland	-	-	-
	Total	2.21E-02	8.37E-05	99.62%
Margin of Safety		-	Implicit	-
Total		1.91E-01	3.04E-04	99.84%

Table 6.9 PCB Maximum Average Daily Loads (lbs/d), Broad Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	3.13E-02	4.09E-05	99.87%
	Total	3.13E-02	4.09E-05	99.87%
Load Allocation	Direct Drainage	2.94E-03	7.10E-06	99.76%
	Upstream Maryland	-	-	-
	Total	2.94E-03	7.10E-06	99.76%
Margin of Safety		-	Implicit	-
Total		3.43E-02	4.80E-05	99.86%

6.2 DUMBARTON OAKS

Dumbarton Oaks is a minor western tributary whose confluence with Rock Creek is about 100 yards south of Massachusetts Avenue over Rock Creek. Figure 6.2 shows the location of Dumbarton Oaks and its watershed. The Dumbarton Oaks watershed drains mostly National Park Service parkland, including about a quarter of the grounds of the US Naval Observatory and Dumbarton Oaks Gardens. Approximately two-thirds of the watershed is landscaped or forested parkland, with the remainder area as residential. Dumbarton Oaks is a little more than a half-mile long and is buffered with varying widths of landscaped parkland as it flows eastward to Rock Creek. The channel is about 22 feet wide. It is very steep, dropping 200 feet from the head of its watershed to its mouth near Rock Creek (DDOH, 2004a).

Table 6.10 gives the land use acreage in the Dumbarton Oaks watershed. The watershed encompasses 136 acres. The watershed is 25% impervious but only 9% lies within the District MS4.

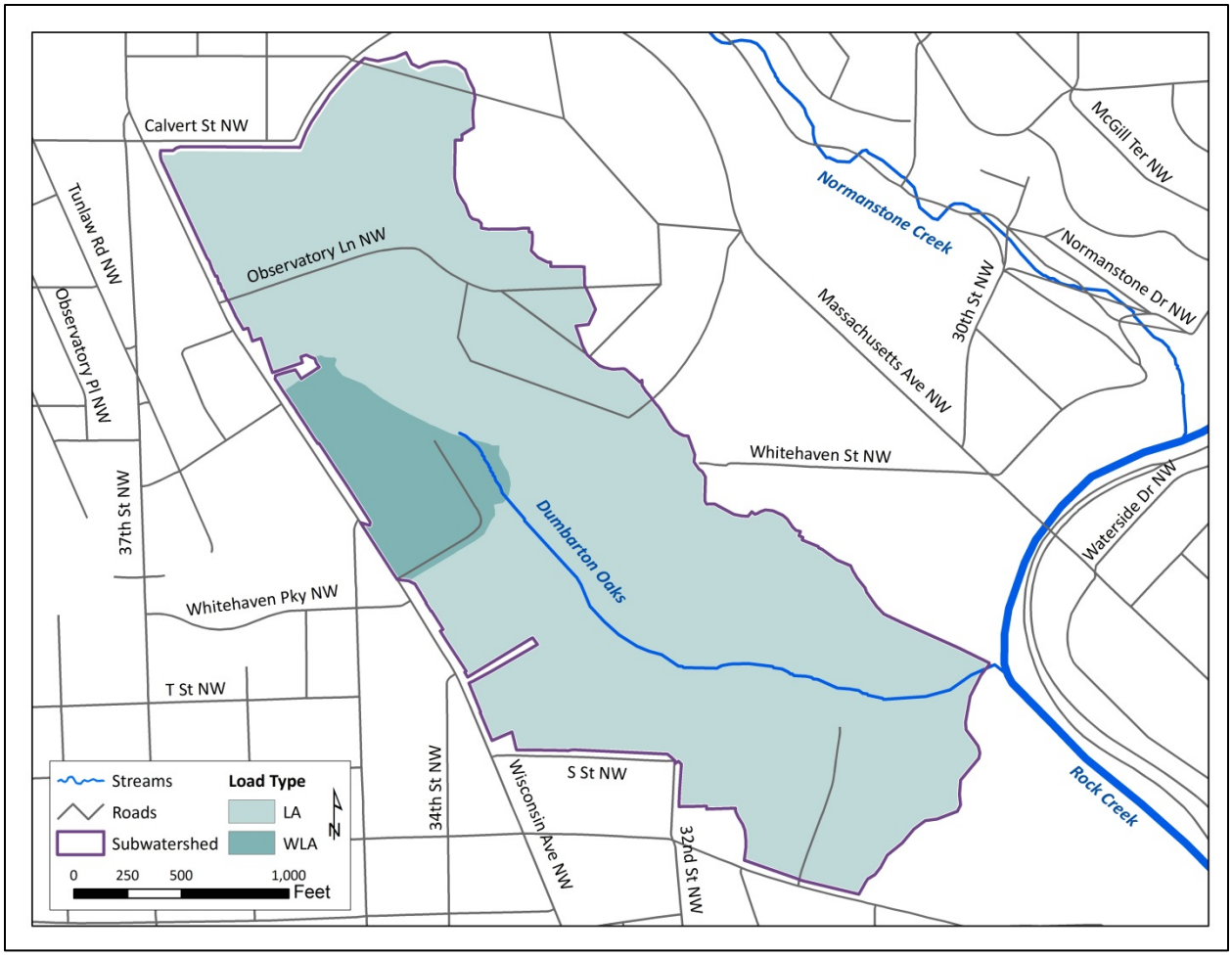

Figure 6.2 Dumbarton Oaks and its Watershed

Table 6.10 Dumbarton Oaks Land Use (acres)

Type	Impervious	Pervious	Forest	Total
District MS4	8	3	1	12
District Non-MS4	25	52	47	124
Maryland	-	-	-	-
Total	34	54	48	136

6.2.1 Dieldrin TMDLs

Table 6.11 presents the average annual baseline dieldrin loads and TMDL allocations. 6.12 presents maximum average daily baseline dieldrin loads and TMDL allocations.

Table 6.11 Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Dumbarton Oaks

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	7.91E-05	3.56E-06	95.5%
	Total	7.91E-05	3.56E-06	95.5%
Load Allocation	Direct Drainage	6.87E-04	2.34E-05	96.6%
	Upstream Maryland	-	-	-
	Total	6.87E-04	2.34E-05	96.6%
Margin of Safety		-	Implicit	-
Total		7.66E-04	2.69E-05	96.5%

Table 6.12 Dieldrin Maximum Average Daily Loads (lbs/d), Dumbarton Oaks

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.24E-05	5.57E-07	95.5%
	Total	1.24E-05	5.57E-07	95.5%
Load Allocation	Direct Drainage	8.08E-05	3.62E-06	95.5%
	Upstream Maryland	-	-	-
	Total	8.08E-05	3.62E-06	95.5%
Margin of Safety		-	Implicit	-
Total		9.31E-05	4.18E-06	95.5%

6.2.2 Heptachlor Epoxide

Table 6.13 presents the average annual baseline heptachlor epoxide loads and TMDL allocations. Table 6.14 presents maximum average daily baseline heptachlor epoxide loads and TMDL allocations.

Table 6.13 Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Dumbarton Oaks

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	4.02E-05	2.57E-06	93.6%
	Total	4.02E-05	2.57E-06	93.6%
Load Allocation	Direct Drainage	4.43E-04	1.69E-05	96.2%
	Upstream Maryland	-	-	-
	Total	4.43E-04	1.69E-05	96.2%
Margin of Safety		-	Implicit	-
Total		4.84E-04	1.95E-05	96.0%

Table 6.14 Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), Dumbarton Oaks

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	6.29E-06	4.02E-07	93.6%
	Total	6.29E-06	4.02E-07	93.6%
Load Allocation	Direct Drainage	4.12E-05	2.62E-06	93.7%
	Upstream Maryland	-	-	-
	Total	4.12E-05	2.62E-06	93.7%
Margin of Safety		-	Implicit	-
Total		4.75E-05	3.02E-06	93.6%

6.2.3 Chlordane TMDLs

Table 6.15 presents the average annual baseline chlordane loads and TMDL allocations. Table 6.16 presents maximum average daily baseline chlordane loads and TMDL allocations.

Table 6.15 Average Annual Chlordane Baseline Loads and TMDL Allocations (lbs/yr), Dumbarton Oaks

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.25E-02	5.34E-05	99.6%
	Total	1.25E-02	5.34E-05	99.6%
Load Allocation	Direct Drainage	5.03E-02	3.51E-04	99.3%
	Upstream Maryland	-	-	-
	Total	5.03E-02	3.51E-04	99.3%
Margin of Safety		-	Implicit	-
Total		6.28E-02	4.04E-04	99.4%

Table 6.16 Chlordane Maximum Average Daily Loads (lbs/d), Dumbarton Oaks

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.96E-03	8.36E-06	99.6%
	Total	1.96E-03	8.36E-06	99.6%
Load Allocation	Direct Drainage	1.01E-02	5.43E-05	99.5%
	Upstream Maryland	-	-	-
	Total	1.01E-02	5.43E-05	99.5%
Margin of Safety		-	Implicit	-
Total		1.20E-02	6.27E-05	99.5%

6.2.4 PCB TMDLs

Table 6.17 presents the average annual baseline total PCB loads and TMDL allocations. Table 6.18 presents maximum average daily baseline dieldrin loads and TMDL allocations. Since the concentration of PCBs in storm flow is greater than the concentration in base flow, concentrations increase during storm events.

Table 6.17 Average Annual PCB Baseline Loads and TMDL Allocations (lbs/yr), Dumbarton Oaks

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	3.23E-03	4.22E-06	99.87%
	Total	3.23E-03	4.22E-06	99.87%
Load Allocation	Direct Drainage	1.46E-02	2.77E-05	99.81%
	Upstream Maryland	-	-	-
	Total	1.46E-02	2.77E-05	99.81%
Margin of Safety		-	Implicit	-
Total		1.78E-02	3.19E-05	99.82%

Table 6.18 PCB Maximum Average Daily Loads (lbs/d), Dumbarton Oaks

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	5.05E-04	6.60E-07	99.87%
	Total	5.05E-04	6.60E-07	99.87%
Load Allocation	Direct Drainage	2.73E-03	4.29E-06	99.84%
	Upstream Maryland	-	-	-
	Total	2.73E-03	4.29E-06	99.84%
Margin of Safety		-	Implicit	-
Total		3.24E-03	4.95E-06	99.85%

6.3 FENWICK BRANCH

Fenwick Branch is a second-order eastern tributary of Rock Creek originating in Maryland just outside the Northeastern District border. Figure 6.3 shows the location of Fenwick Branch and its watershed. Fenwick Branch's watershed measures approximately 612 acres, but only 219 acres are within District boundaries, the rest being in Montgomery County, MD. The watershed is primarily urbanized, including residential areas inside the District and some commercial and light industrial in MD. The tributary runs a little more than half a mile before joining Portal Branch, approximately 120 feet north of its confluence with Rock Creek. Throughout the length of the stream it is buffered by approximately 100 feet of forested parkland on both sides. The stream channel is about 6 feet wide (DDOH, 2004a).

Table 6.19 gives the land use acreage in the Fenwick Branch watershed. The District's portion of the watershed is 32% impervious and 74% lies within the District MS4.

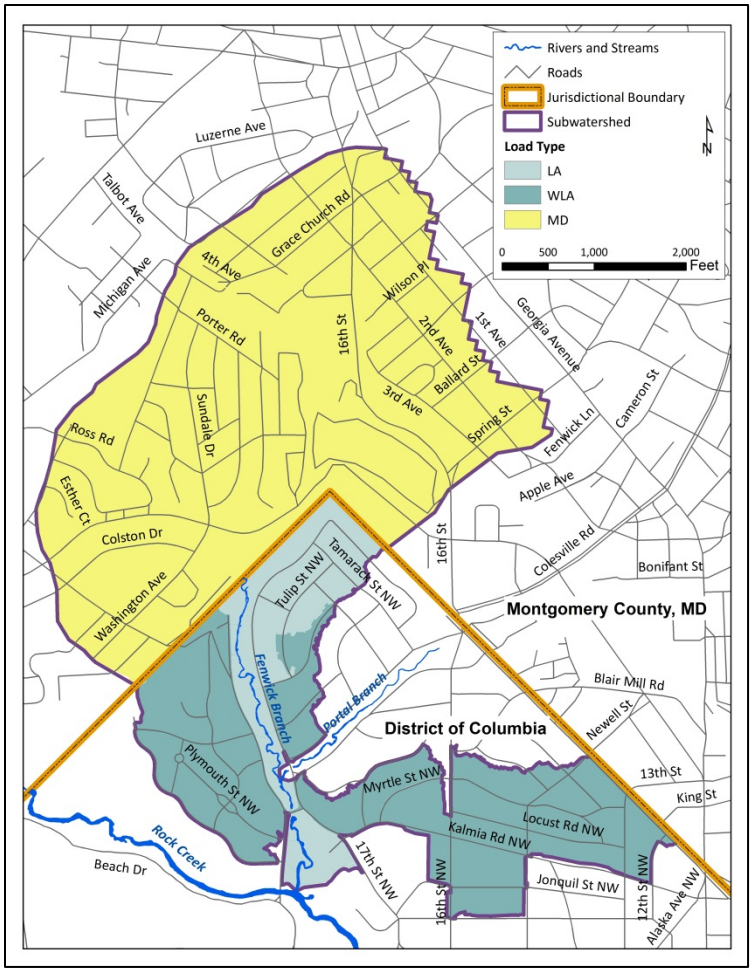

Figure 6.3 Fenwick Branch and its Watershed

Table 6.19 Fenwick Branch Land Use (acres)

Type	Impervious	Pervious	Forest	Total
District MS4	60	93	9	162
District Non-MS4	11	25	22	57
Maryland	150	243	0	393
Total	221	361	30	612

6.3.1 Dieldrin TMDLs

Table 6.20 presents the average annual baseline dieldrin loads and TMDL allocations. Table 6.21 presents maximum average daily baseline dieldrin loads and TMDL allocations.

Table 6.20 Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Fenwick Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	7.00E-04	3.15E-05	95.5%
	Total	7.00E-04	3.15E-05	95.5%
Load Allocation	Direct Drainage	5.93E-04	1.68E-05	97.2%
	Upstream Maryland	2.64E-03	9.61E-05	96.4%
	Total	3.23E-03	1.13E-04	96.5%
Margin of Safety		-	Implicit	-
Total		3.93E-03	1.44E-04	96.3%

Table 6.21 Dieldrin Maximum Average Daily Loads (lbs/d), Fenwick Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.33E-04	5.98E-06	95.5%
	Total	1.33E-04	5.98E-06	95.5%
Load Allocation	Direct Drainage	4.00E-05	1.78E-06	95.5%
	Upstream Maryland	2.03E-04	9.12E-06	95.5%
	Total	2.43E-04	1.09E-05	95.5%
Margin of Safety		-	Implicit	-
Total		3.76E-04	1.69E-05	95.5%

6.3.2 Heptachlor Epoxide TMDLs

Table 6.22 presents the average annual baseline heptachlor epoxide loads and TMDL allocations. Table 6.23 presents maximum average daily baseline heptachlor epoxide loads and TMDL allocations.

Table 6.22 Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Fenwick Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	3.56E-04	2.27E-05	93.6%
	Total	3.56E-04	2.27E-05	93.6%
Load Allocation	Direct Drainage	4.25E-04	1.21E-05	97.2%
	Upstream Maryland	1.62E-03	6.94E-05	95.7%
	Total	2.05E-03	8.15E-05	96.0%
Margin of Safety		-	Implicit	-
Total		2.41E-03	1.04E-04	95.7%

Table 6.23 Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), Fenwick Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	6.76E-05	4.32E-06	93.6%
	Total	6.76E-05	4.32E-06	93.6%
Load Allocation	Direct Drainage	2.05E-05	1.29E-06	93.7%
	Upstream Maryland	1.04E-04	6.58E-06	93.7%
	Total	1.24E-04	7.87E-06	93.7%
Margin of Safety		-	Implicit	-
Total		1.92E-04	1.22E-05	93.6%

6.3.3 DDT TMDLs

Table 6.24 presents the average annual baseline DDT loads and TMDL allocations. 6.25 presents maximum average daily baseline DDT loads and TMDL allocations. Unlike dieldrin, the concentration of DDT in storm flow is greater than the concentration in base flow, so concentrations increase in storm events.

Table 6.24 Average Annual DDT Baseline Loads and TMDL Allocations (lbs/yr), Fenwick Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	5.71E-03	1.28E-04	97.8%
	Total	5.71E-03	1.28E-04	97.8%
Load Allocation	Direct Drainage	1.20E-03	6.83E-05	94.3%
	Upstream Maryland	1.38E-02	3.91E-04	97.2%
	Total	1.50E-02	4.60E-04	96.9%
Margin of Safety		-	Implicit	-
Total		2.07E-02	5.88E-04	97.2%

Table 6.25 DDT Maximum Average Daily Loads (lbs/d), Fenwick Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.09E-03	2.44E-05	97.8%
	Total	1.09E-03	2.44E-05	97.8%
Load Allocation	Direct Drainage	2.37E-04	7.26E-06	96.9%
	Upstream Maryland	1.65E-03	3.71E-05	97.7%
	Total	1.89E-03	4.44E-05	97.6%
Margin of Safety		-	Implicit	-
Total		2.97E-03	6.88E-05	97.7%

6.3.4 PCB TMDLs

Table 6.26 presents the average annual baseline total PCB loads and TMDL allocations. Table 6.27 presents maximum average daily baseline dieldrin loads and TMDL allocations. Since the concentration of PCBs in storm flow is greater than the concentration in base flow, concentrations increase during storm events.

Table 6.26 Average Annual PCB Baseline Loads and TMDL Allocations (lbs/yr), Fenwick Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	2.86E-02	3.73E-05	99.87%
	Total	2.86E-02	3.73E-05	99.87%
Load Allocation	Direct Drainage	7.59E-03	1.99E-05	99.74%
	Upstream Maryland	7.20E-02	1.14E-04	99.84%
	Total	7.96E-02	1.34E-04	99.83%
Margin of Safety		-	Implicit	-
Total		1.08E-01	1.71E-04	99.84%

Table 6.27 PCB Maximum Average Daily Loads (lbs/d), Fenwick Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	5.43E-03	7.09E-06	99.87%
	Total	5.43E-03	7.09E-06	99.87%
Load Allocation	Direct Drainage	1.26E-03	2.11E-06	99.83%
	Upstream Maryland	8.25E-03	1.08E-05	99.87%
	Total	9.51E-03	1.29E-05	99.86%
Margin of Safety		-	Implicit	-
Total		1.49E-02	2.00E-05	99.87%

6.4 KLINGLE VALLEY CREEK

Klingle Valley Creek flows through a residential area and discharges into Rock Creek from the west near the Porter Street Bridge. Figure 6.4 shows the location of Klingle Valley Creek and its watershed[6]. The stream's reach parallels the south side of Klingle Road. A wooded buffer of a few hundred feet covers one side of the stream. The stream channel is about 30 feet wide. The creek itself is an approximately half a mile long stream and falls at a grade of about 5% from its headwaters to its confluence with Rock Creek (DDOH, 2004a).

The watershed comprises about 172 acres and is primarily residential. Table 6.28 gives the land use acreage in the Klingle Valley Creek watershed. The watershed is 36% impervious and 73% lies within the District MS4.

[6] Areas in white surrounded by the Klingle Valley Creek watershed discharge directly to Rock Creek through separate storm sewers.

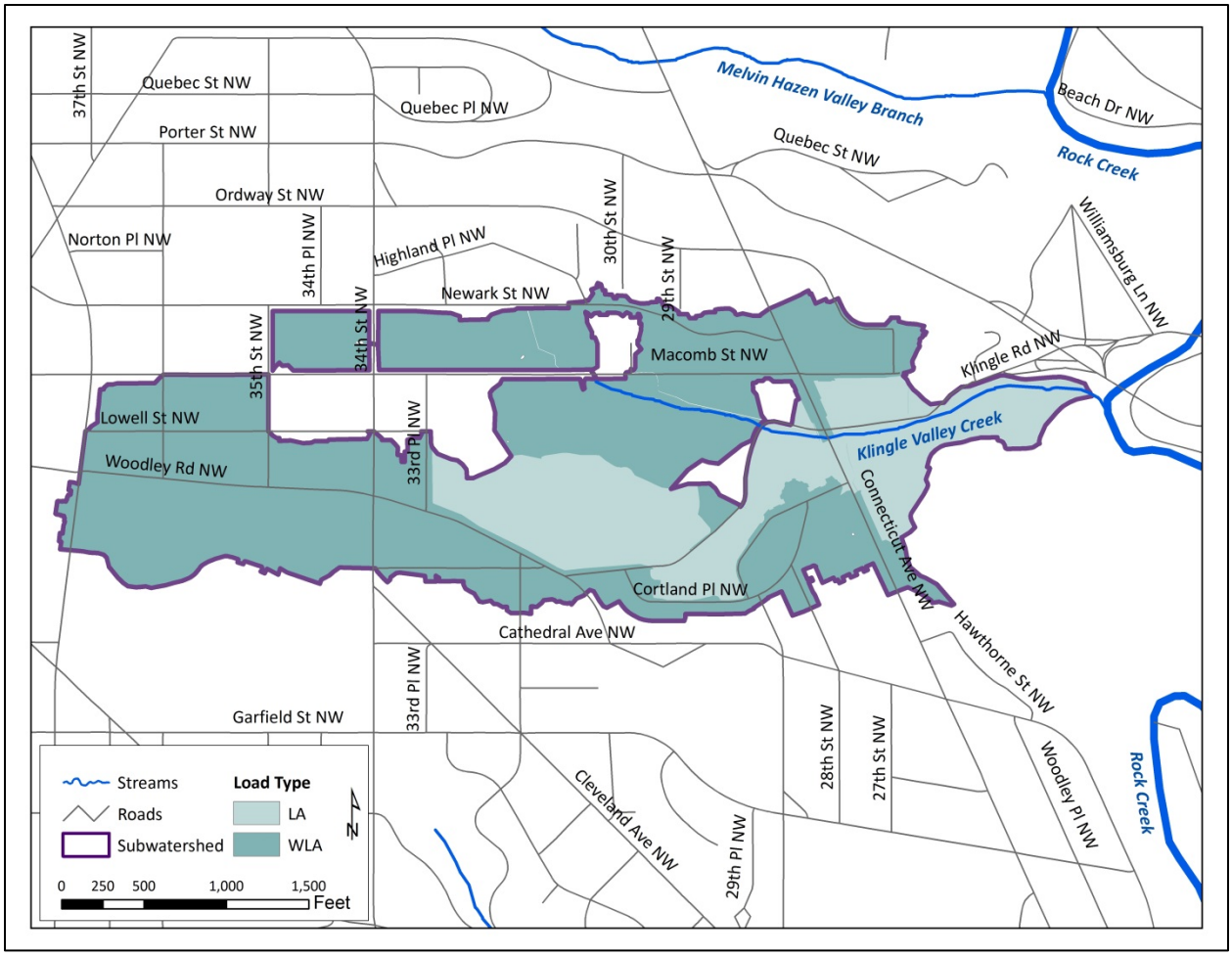

Figure 6.4 Klingle Valley Creek and its Watershed

Table 6.28 Klingle Valley Creek Land Use (acres)

Type	Impervious	Pervious	Forest	Total
District MS4	55	57	14	125
District Non-MS4	7	13	26	46
Maryland	-	-	-	-
Total	62	70	40	172

6.4.1 Dieldrin TMDLs

Table 6.29 presents the average annual baseline dieldrin loads and TMDL allocations. Table 6.30 presents maximum average daily baseline dieldrin loads and TMDL allocations. Since the concentration of dieldrin in storm flow is less than the concentration in base flow, concentrations decrease in storm events.

Table 6.29 Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Klingle Valley Creek

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	5.86E-04	2.64E-05	95.5%
	Total	5.86E-04	2.64E-05	95.5%
Load Allocation	Direct Drainage	4.62E-04	1.30E-05	97.2%
	Upstream Maryland	-	-	-
	Total	4.62E-04	1.30E-05	97.2%
Margin of Safety		-	Implicit	-
Total		1.05E-03	3.94E-05	96.2%

Table 6.30 Dieldrin Maximum Average Daily Loads (lbs/d), Klingle Valley Creek

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.04E-04	4.69E-06	95.5%
	Total	1.04E-04	4.69E-06	95.5%
Load Allocation	Direct Drainage	3.16E-05	1.41E-06	95.5%
	Upstream Maryland	-	-	-
	Total	3.16E-05	1.41E-06	95.5%
Margin of Safety		-	Implicit	-
Total		1.36E-04	6.10E-06	95.5%

6.4.2 Heptachlor Epoxide TMDLs

Table 6.31 presents the average annual baseline heptachlor epoxide loads and TMDL allocations. Table 6.32 presents maximum average daily baseline heptachlor epoxide loads and TMDL allocations. Like dieldrin, the concentration of heptachlor epoxide in storm flow is less than the concentration in base flow, so concentrations decrease in storm events.

Table 6.31 Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Klingle Valley Creek

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	2.98E-04	1.90E-05	93.6%
	Total	2.98E-04	1.90E-05	93.6%
Load Allocation	Direct Drainage	3.32E-04	9.39E-06	97.2%
	Upstream Maryland	-	-	-
	Total	3.32E-04	9.39E-06	97.2%
Margin of Safety		-	Implicit	-
Total		6.30E-04	2.84E-05	95.5%

Table 6.32 Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), Klingle Valley Creek

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	5.30E-05	3.39E-06	93.6%
	Total	5.30E-05	3.39E-06	93.6%
Load Allocation	Direct Drainage	1.62E-05	1.02E-06	93.7%
	Upstream Maryland	-	-	-
	Total	1.62E-05	1.02E-06	93.7%
Margin of Safety		-	Implicit	-
Total		6.92E-05	4.40E-06	93.6%

6.4.3 PCB TMDLs

Table 6.33 presents the average annual baseline total PCB loads and TMDL allocations. Table 6.34 presents maximum average daily baseline dieldrin loads and TMDL allocations. Since the concentration of PCBs in storm flow is greater than the concentration in base flow, concentrations increase during storm events.

Table 6.33 Average Annual PCB Baseline Loads and TMDL Allocations (lbs/yr), Klingle Valley Creek

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	2.39E-02	3.12E-05	99.87%
	Total	2.39E-02	3.12E-05	99.87%
Load Allocation	Direct Drainage	5.26E-03	1.54E-05	99.71%
	Upstream Maryland	-	-	-
	Total	5.26E-03	1.54E-05	99.71%
Margin of Safety		-	Implicit	-
Total		2.92E-02	4.66E-05	99.84%

Table 6.34 PCB Maximum Average Daily Loads (lbs/d), Klingle Valley Creek

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	4.25E-03	5.56E-06	99.87%
	Total	4.25E-03	5.56E-06	99.87%
Load Allocation	Direct Drainage	8.15E-04	1.67E-06	99.80%
	Upstream Maryland	-	-	-
	Total	8.15E-04	1.67E-06	99.80%
Margin of Safety		-	Implicit	-
Total		5.07E-03	7.23E-06	99.86%

6.5 LUZON BRANCH

Luzon Branch is an eastern tributary of Rock Creek. It travels roughly half a mile southwest and empties into Rock Creek at Joyce Road. Figure 6.5 shows the location of Luzon Branch and its watershed. Luzon Branch is approximately 26 feet wide. The stream is buffered by 100-1000 feet of parkland (DDOH, 2004a).

The Luzon Branch watershed measures about 643 acres. About 90 percent of the watershed is residential and light commercial, and the rest is parkland. Table 6.35 gives the land use acreage in the Luzon Branch watershed. The watershed is 47% impervious and 92% lies within the District MS4.

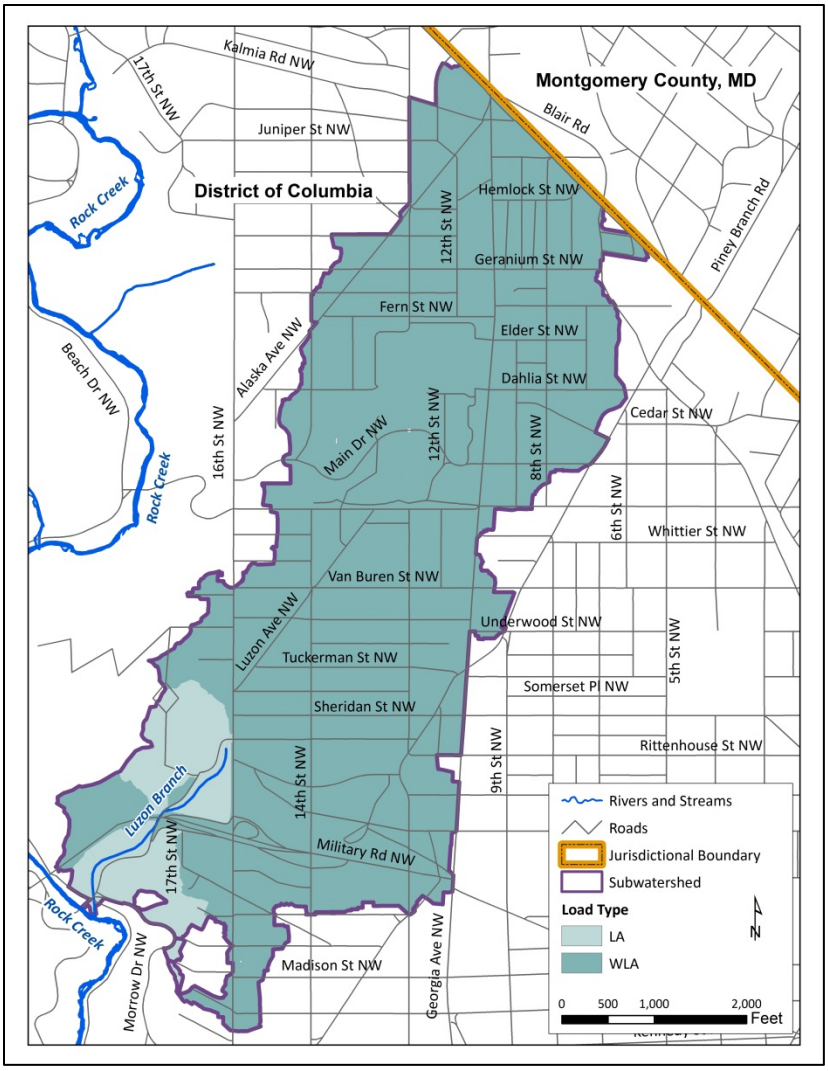

Figure 6.5 Luzon Branch and its Watershed

Table 6.35 Luzon Branch Land Use (acres)

Type	Impervious	Pervious	Forest	Total
District MS4	300	277	13	590
District Non-MS4	5	22	25	53
Maryland	-	-	-	-
Total	306	300	38	643

6.5.1 Dieldrin TMDLs

Table 6.36 presents the average annual baseline dieldrin loads and TMDL allocations. Table 6.37 presents maximum average daily baseline dieldrin loads and TMDL allocations. Since the

concentration of dieldrin in storm flow is less than the concentration in base flow, concentrations decrease in storm events.

Table 6.36 Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Luzon Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	3.16E-03	1.42E-04	95.5%
	Total	3.16E-03	1.42E-04	95.5%
Load Allocation	Direct Drainage	1.06E-03	2.57E-05	97.6%
	Upstream Maryland	-	-	
	Total	1.06E-03	2.57E-05	97.6%
Margin of Safety		-	Implicit	-
Total		4.22E-03	1.68E-04	96.0%

Table 6.37 Dieldrin Maximum Average Daily Loads (lbs/d), Luzon Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	5.51E-04	2.48E-05	95.5%
	Total	5.51E-04	2.48E-05	95.5%
Load Allocation	Direct Drainage	3.49E-05	1.53E-06	95.6%
	Upstream Maryland	-	-	-
	Total	3.49E-05	1.53E-06	95.6%
Margin of Safety		-	Implicit	-
Total		5.86E-04	2.63E-05	95.5%

6.5.2 Heptachlor Epoxide

Table 6.38 presents the average annual baseline heptachlor epoxide loads and TMDL allocations. Table 6.39 presents maximum average daily baseline heptachlor epoxide loads and TMDL allocations. Like dieldrin, the concentration of heptachlor epoxide in storm flow is less than the concentration in base flow, so concentrations decrease in storm events.

Table 6.38 Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Luzon Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.61E-03	1.03E-04	93.6%
	Total	1.61E-03	1.03E-04	93.6%
Load Allocation	Direct Drainage	8.10E-04	1.86E-05	97.7%
	Upstream Maryland	-	-	-
	Total	8.10E-04	1.86E-05	97.7%
Margin of Safety		-	Implicit	-
Total		2.42E-03	1.21E-04	95.0%

Table 6.39 Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), Luzon Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	2.80E-04	1.79E-05	93.6%
	Total	2.80E-04	1.79E-05	93.6%
Load Allocation	Direct Drainage	1.82E-05	1.11E-06	93.9%
	Upstream Maryland	-	-	-
	Total	1.82E-05	1.11E-06	93.9%
Margin of Safety		-	Implicit	-
Total		2.98E-04	1.90E-05	93.6%

6.5.3 Chlordane TMDLs

Table 6.40 presents the average annual baseline chlordane loads and TMDL allocations. Table 6.41 presents maximum average daily baseline chlordane loads and TMDL allocations. Unlike dieldrin, the concentration of chlordane in storm flow is greater than the concentration in base flow, so concentrations increase in storm events.

Table 6.40 Average Annual Chlordane Baseline Loads and TMDL Allocations (lbs/yr), Luzon Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	5.00E-01	2.13E-03	99.6%
	Total	5.00E-01	2.13E-03	99.6%
Load Allocation	Direct Drainage	1.40E-02	3.86E-04	97.2%
	Upstream Maryland	-	-	-
	Total	1.40E-02	3.86E-04	97.2%
Margin of Safety		-	Implicit	-
Total		5.14E-01	2.52E-03	99.5%

Table 6.41 Chlordane Maximum Average Daily Loads (lbs/d), Luzon Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	8.72E-02	3.72E-04	99.6%
	Total	8.72E-02	3.72E-04	99.6%
Load Allocation	Direct Drainage	3.19E-03	2.30E-05	99.3%
	Upstream Maryland	-	-	-
	Total	3.19E-03	2.30E-05	99.3%
Margin of Safety		-	Implicit	-
Total		9.04E-02	3.95E-04	99.6%

6.5.4 PCB TMDLs

Table 6.42 presents the average annual baseline total PCB loads and TMDL allocations. Table 6.43 presents maximum average daily baseline dieldrin loads and TMDL allocations. Since the concentration of PCBs in storm flow is greater than the concentration in base flow, concentrations increase during storm events.

Table 6.42 Average Annual PCB Baseline Loads and TMDL Allocations (lbs/yr), Luzon Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.29E-01	1.69E-04	99.87%
	Total	1.29E-01	1.69E-04	99.87%
Load Allocation	Direct Drainage	7.51E-03	3.05E-05	99.59%
	Upstream Maryland	-	-	
	Total	7.51E-03	3.05E-05	99.59%
Margin of Safety		-	Implicit	-
Total		1.37E-01	1.99E-04	99.85%

Table 6.43 PCB Maximum Average Daily Loads (lbs/d), Luzon Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	2.25E-02	2.94E-05	99.87%
	Total	2.25E-02	2.94E-05	99.87%
Load Allocation	Direct Drainage	9.35E-04	1.82E-06	99.81%
	Upstream Maryland	-	-	-
	Total	9.35E-04	1.82E-06	99.81%
Margin of Safety		-	Implicit	-
Total		2.34E-02	3.12E-05	99.87%

6.6 MELVIN HAZEN VALLEY BRANCH

Melvin Hazen Valley Branch is a second-order tributary of Rock Creek. It originates near 34th street and Tilden Street, NW. Figure 6.6 shows the location of Melvin Hazen Valley Branch and its watershed. Melvin Hazen Valley Branch stretches approximately 4,500 feet to its mouth at Rock Creek, and is buffered on both sides by several hundred feet of forested parkland. The stream is carried in a pipe under Connecticut Avenue[7]. The stream is about 11 feet wide (DDOH, 2004a).

The Melvin Hazen Valley Branch watershed covers 174 acres, and more than two-thirds of the watershed is residential and commercial. The lower segment of the watershed is parkland. Table 6.44 gives the land use acreage in the Melvin Hazen Valley Branch watershed. The watershed is 30% impervious and 63% lies within the District MS4. There is one MSGP in the

[7] Drainage along Connecticut Avenue discharges directly to Rock Creek through separate storm sewers.

watershed, the U.S. Post Office facility in Friendship Heights (DCR05A471), as shown in Figure 6.6. This permit is aggregated under the MS4 WLA.

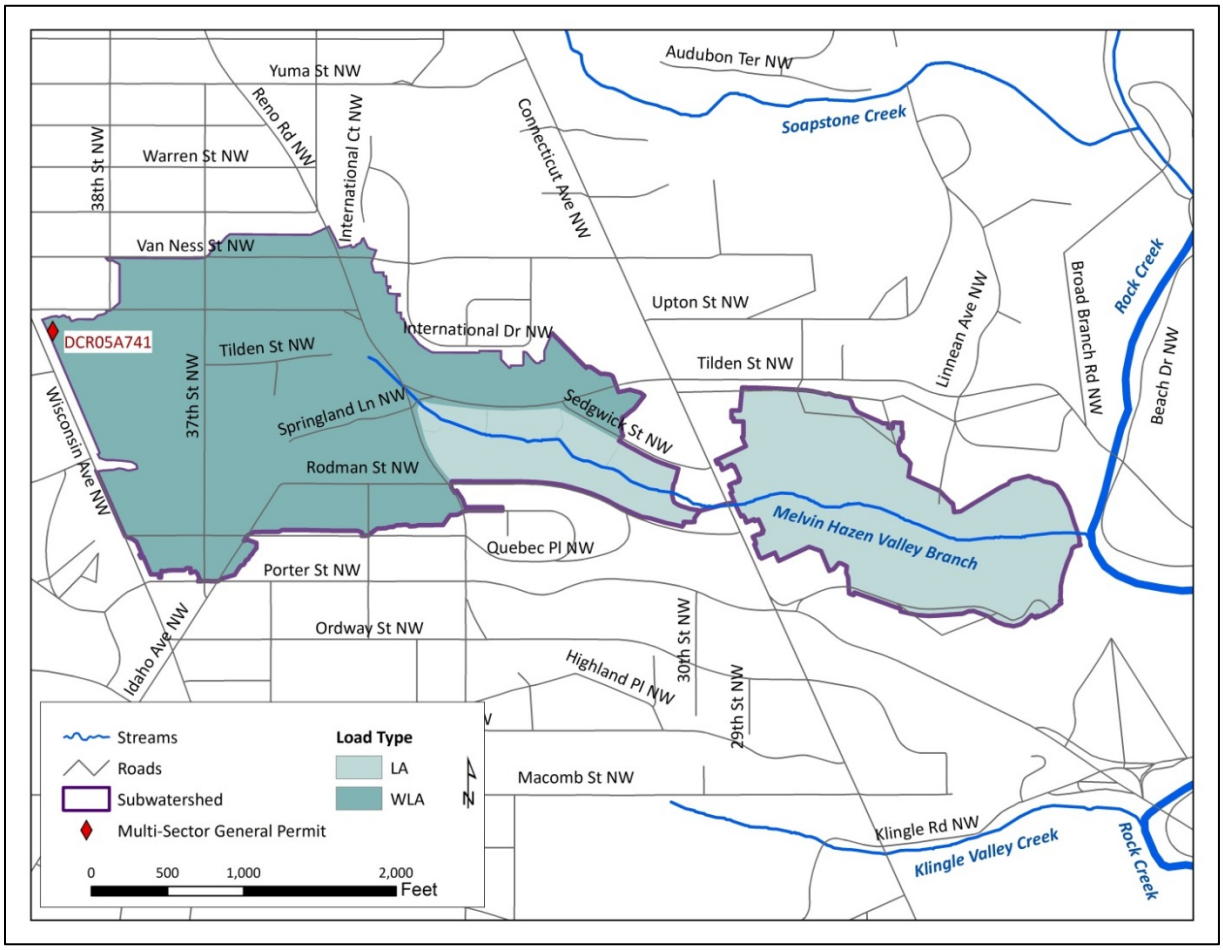

Figure 6.6 Melvin Hazen Valley Branch and its Watershed

Table 6.44 Melvin Hazen Valley Branch Land Use (acres)

Type	Impervious	Pervious	Forest	Total
District MS4	43	60	6	109
District Non-MS4	9	9	47	65
Maryland	-	-	-	-
Total	52	69	53	174

6.6.1 Dieldrin TMDLs

Table 6.45 presents the average annual baseline dieldrin loads and TMDL allocations. Table 6.46 presents maximum average daily baseline dieldrin loads and TMDL allocations. Baseline loads and allocations for MSGP DCR05A741 are included in the District stormwater baseline

loads and allocations. Since the concentration of dieldrin in storm flow is less than the concentration in base flow, concentrations decrease in storm events.

Table 6.45 Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Melvin Hazen Valley Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	4.87E-04	2.19E-05	95.5%
	Total	4.87E-04	2.19E-05	95.5%
Load Allocation	Direct Drainage	5.33E-04	1.51E-05	97.2%
	Upstream Maryland	-	-	-
	Total	5.33E-04	1.51E-05	97.2%
Margin of Safety		-	Implicit	-
Total		1.02E-03	3.70E-05	96.4%

Table 6.46 Dieldrin Maximum Average Daily Loads (lbs/d), Melvin Hazen Valley Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	9.10E-05	4.09E-06	95.5%
	Total	9.10E-05	4.09E-06	95.5%
Load Allocation	Direct Drainage	3.65E-05	1.63E-06	95.5%
	Upstream Maryland	-	-	-
	Total	3.65E-05	1.63E-06	95.5%
Margin of Safety		-	Implicit	-
Total		1.27E-04	5.72E-06	95.5%

6.6.2 PCB TMDLs

Table 6.47 presents the average annual baseline total PCB loads and TMDL allocations. Table 6.48 presents maximum average daily baseline dieldrin loads and TMDL allocations. Baseline loads and allocations for MSGP DCR05A741 are included in the District stormwater baseline loads and allocations. Since the concentration of PCBs in storm flow is greater than the concentration in base flow, concentrations increase during storm events.

Table 6.47 Average Annual PCB Baseline Loads and TMDL Allocations (lbs/yr), Melvin Hazen Valley Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.99E-02	2.60E-05	99.87%
	Total	1.99E-02	2.60E-05	99.87%
Load Allocation	Direct Drainage	5.99E-03	1.79E-05	99.70%
	Upstream Maryland	-	-	-
	Total	5.99E-03	1.79E-05	99.70%
Margin of Safety		-	Implicit	-
Total		2.59E-02	4.39E-05	99.83%

Table 6.48 PCB Maximum Average Daily Loads (lbs/d), Melvin Hazen Valley Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	3.72E-03	4.85E-06	99.87%
	Total	3.72E-03	4.85E-06	99.87%
Load Allocation	Direct Drainage	8.59E-04	1.93E-06	99.78%
	Upstream Maryland	-	-	-
	Total	8.59E-04	1.93E-06	99.78%
Margin of Safety		-	Implicit	-
Total		4.57E-03	6.78E-06	99.85%

6.7 NORMANSTONE CREEK

Normanstone Creek is a first order western tributary of Rock Creek and originates from a storm drain near Garfield Avenue and 33rd Street, NW. The stream travels parallel to Normanstone Parkway three quarters of a mile southeast to its confluence with Rock Creek, about 1,000 feet northeast of the Massachusetts Avenue bridge. Figure 6.7 shows the location of Normanstone Creek and its watershed[8]. Normanstone Creek is approximately 12 feet wide. Both sides of the stream are buffered by 100-1000 feet of forested parkland. The watershed includes most of the grounds of the National Cathedral, part of U.S. Naval Observatory, and parts of Cleveland and Woodley Park (DDOH, 2004a).

Table 6.49 gives the land use acreage in the Normanstone Creek watershed. The watershed encompasses 217 acres. The watershed is 35% impervious and 76% lies within the District MS4.

[8] Areas in white surrounded by the Normanstone Creek watershed discharge directly to Rock Creek through separate storm sewers.

Most of the acreage is residential and light commercial (retail) with forested parkland along the stream reach.

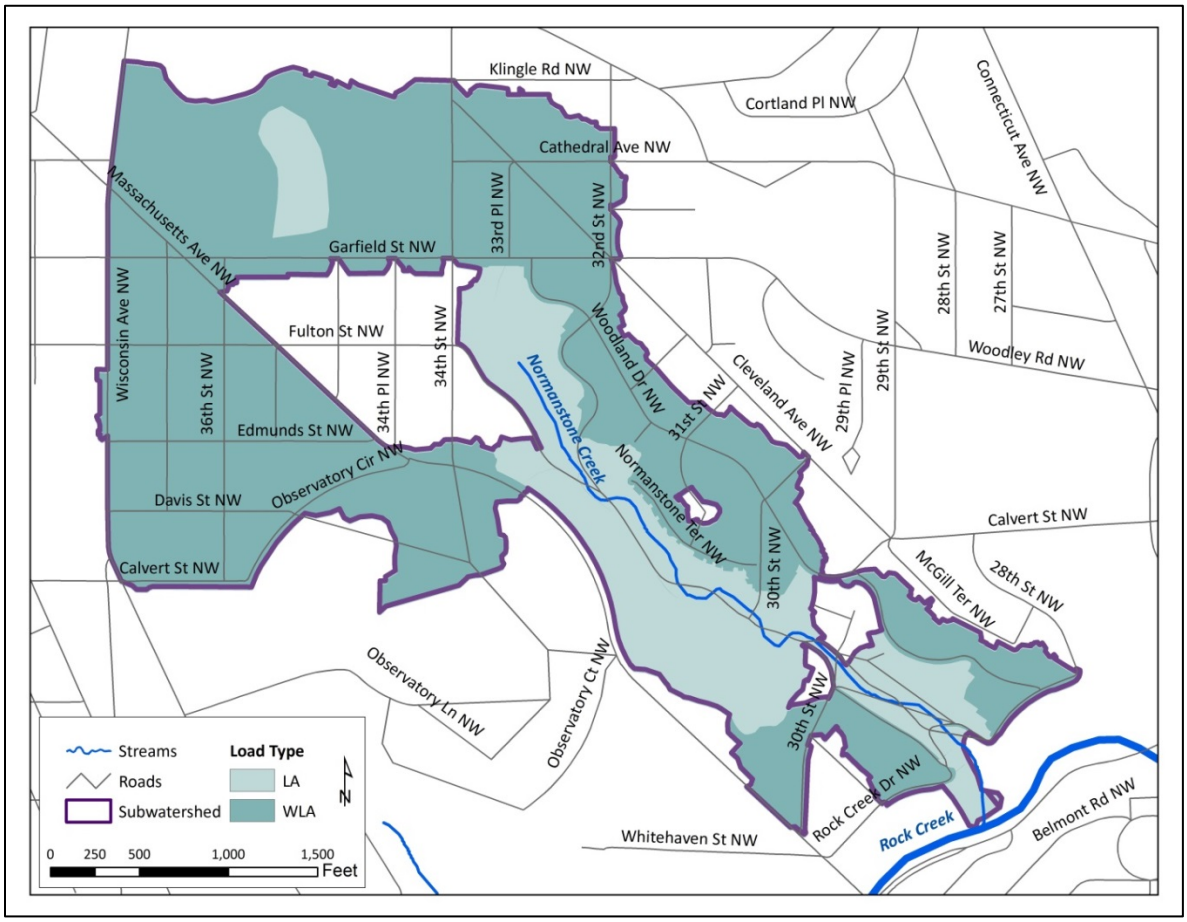

Figure 6.7 Normanstone Creek and its Watershed

Table 6.49 Normanstone Creek Land Use (acres)

Type	Impervious	Pervious	Forest	Total
District MS4	70	88	8	166
District Non-MS4	6	12	34	51
Maryland	-	-	-	-
Total	76	100	41	217

6.7.1 Dieldrin TMDLs

Table 6.50 presents the average annual baseline dieldrin loads and TMDL allocations. Table 6.51 presents maximum average daily baseline dieldrin loads and TMDL allocations. Since the concentration of dieldrin in storm flow is less than the concentration in base flow, concentrations decrease in storm events.

Table 6.50 Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Normanstone Creek

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	7.76E-04	3.49E-05	95.5%
	Total	7.76E-04	3.49E-05	95.5%
Load Allocation	Direct Drainage	5.33E-04	1.42E-05	97.3%
	Upstream Maryland	-	-	-
	Total	5.33E-04	1.42E-05	97.3%
Margin of Safety		-	Implicit	-
Total		1.31E-03	4.91E-05	96.2%

Table 6.51 Dieldrin Maximum Average Daily Loads (lbs/d), Normanstone Creek

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.42E-04	6.41E-06	95.5%
	Total	1.42E-04	6.41E-06	95.5%
Load Allocation	Direct Drainage	2.98E-05	1.33E-06	95.6%
	Upstream Maryland	-	-	-
	Total	2.98E-05	1.33E-06	95.6%
Margin of Safety		-	Implicit	-
Total		1.72E-04	7.73E-06	95.5%

6.7.2 Heptachlor Epoxide TMDLs

Table 6.52 presents the average annual baseline heptachlor epoxide loads and TMDL allocations. Table 6.53 presents maximum average daily baseline heptachlor epoxide loads and TMDL allocations. Like dieldrin, the concentration of heptachlor epoxide in storm flow is less than the concentration in base flow, so concentrations decrease in storm events.

Table 6.52 Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Normanstone Creek

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	3.94E-04	2.52E-05	93.6%
	Total	3.94E-04	2.52E-05	93.6%
Load Allocation	Direct Drainage	3.93E-04	1.03E-05	97.4%
	Upstream Maryland	-	-	-
	Total	3.93E-04	1.03E-05	97.4%
Margin of Safety		-	Implicit	-
Total		7.87E-04	3.55E-05	95.5%

Table 6.53 Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), Normanstone Creek

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	7.24E-05	4.63E-06	93.6%
	Total	7.24E-05	4.63E-06	93.6%
Load Allocation	Direct Drainage	1.53E-05	9.57E-07	93.8%
	Upstream Maryland	-	-	-
	Total	1.53E-05	9.57E-07	93.8%
Margin of Safety		-	Implicit	-
Total		8.77E-05	5.58E-06	93.6%

6.7.3 PCB TMDLs

Table 6.54 presents the average annual baseline total PCB loads and TMDL allocations. Table 6.55 presents maximum average daily baseline dieldrin loads and TMDL allocations. Since the concentration of PCBs in storm flow is greater than the concentration in base flow, concentrations increase during storm events.

Table 6.54 Average Annual PCB Baseline Loads and TMDL Allocations (lbs/yr), Normanstone Creek

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	3.17E-02	4.14E-05	99.87%
	Total	3.17E-02	4.14E-05	99.87%
Load Allocation	Direct Drainage	5.03E-03	1.69E-05	99.66%
	Upstream Maryland	-	-	-
	Total	5.03E-03	1.69E-05	99.66%
Margin of Safety		-	Implicit	-
Total		3.67E-02	5.83E-05	99.84%

Table 6.55 PCB Maximum Average Daily Loads (lbs/d), Normanstone Creek

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	5.81E-03	7.59E-06	99.87%
	Total	5.81E-03	7.59E-06	99.87%
Load Allocation	Direct Drainage	7.23E-04	1.57E-06	99.78%
	Upstream Maryland	-	-	-
	Total	7.23E-04	1.57E-06	99.78%
Margin of Safety		-	Implicit	-
Total		6.54E-03	9.16E-06	99.86%

6.8 PINEHURST BRANCH

Pinehurst Branch originates at the District/MD state line in Chevy Chase Manor, Maryland. Figure 6.8 shows the location of Pinehurst Branch and its watershed. Pinehurst travels about 1.3 miles east-southeast to its confluence with Rock Creek. The average gradient of the stream is approximately 2 percent over its entire length (DDOH, 2004a).

Table 6.56 gives the land use acreage in the Pinehurst Branch watershed. Total watershed size is 664 acres. About a third of the watershed is in MD. The District portion of the watershed is 23% impervious and 55% lies within the District MS4. Most of the land use is low-medium density residential and commercial, and the remaining area is parklands (DDOH, 2004a).

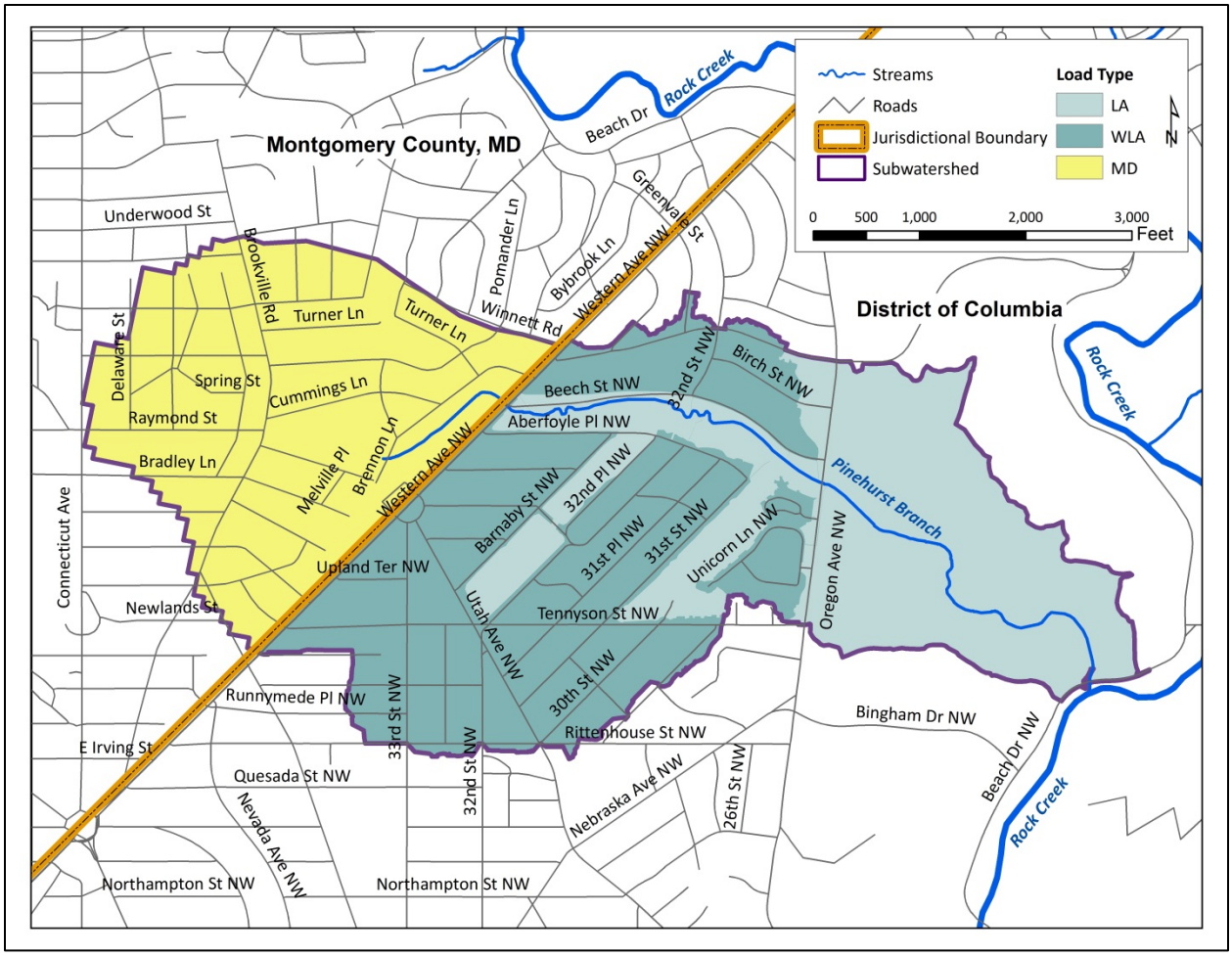

Figure 6.8 Pinehurst Branch and its Watershed

Table 6.56 Pinehurst Branch Land Use (acres)

Type	Impervious	Pervious	Forest	Total
District MS4	89	151	6	246
District Non-MS4	12	28	160	201
Maryland	59	160	0	218
Total	160	339	166	664

6.8.1 Dieldrin TMDLs

Table 6.57 presents the average annual baseline dieldrin loads and TMDL allocations. Table 6.58 presents maximum average daily baseline dieldrin loads and TMDL allocations. Since the concentration of dieldrin in storm flow is less than the concentration in base flow, concentrations decrease in storm events.

Table 6.57 Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Pinehurst Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.05E-03	4.75E-05	95.5%
	Total	1.05E-03	4.75E-05	95.5%
Load Allocation	Direct Drainage	1.42E-03	3.84E-05	97.3%
	Upstream Maryland	1.38E-03	4.71E-05	96.6%
	Total	2.80E-03	8.55E-05	96.9%
Margin of Safety		-	Implicit	-
Total		3.85E-03	1.33E-04	96.5%

Table 6.58 Dieldrin Maximum Average Daily Loads (lbs/d), Pinehurst Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	2.05E-04	9.20E-06	95.5%
	Total	2.05E-04	9.20E-06	95.5%
Load Allocation	Direct Drainage	9.27E-05	4.13E-06	95.5%
	Upstream Maryland	8.76E-05	3.92E-06	95.5%
	Total	1.80E-04	8.05E-06	95.5%
Margin of Safety		-	Implicit	-
Total		3.85E-04	1.73E-05	95.5%

6.8.2 Heptachlor Epoxide TMDLs

Table 6.59 presents the average annual baseline heptachlor epoxide loads and TMDL allocations. Table 6.60 presents maximum average daily baseline heptachlor epoxide loads and TMDL allocations. Like dieldrin, the concentration of heptachlor epoxide in storm flow is less than the concentration in base flow, so concentrations decrease in storm events.

Table 6.59 Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Pinehurst Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	5.36E-04	3.43E-05	93.6%
	Total	5.36E-04	3.43E-05	93.6%
Load Allocation	Direct Drainage	1.04E-03	2.77E-05	97.3%
	Upstream Maryland	8.86E-04	3.40E-05	96.2%
	Total	1.93E-03	6.18E-05	96.8%
Margin of Safety		-	Implicit	-
Total		2.46E-03	9.60E-05	96.1%

Table 6.60 Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), Pinehurst Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.04E-04	6.65E-06	93.6%
	Total	1.04E-04	6.65E-06	93.6%
Load Allocation	Direct Drainage	4.76E-05	2.98E-06	93.7%
	Upstream Maryland	4.48E-05	2.83E-06	93.7%
	Total	9.25E-05	5.81E-06	93.7%
Margin of Safety		-	Implicit	-
Total		1.96E-04	1.25E-05	93.7%

6.8.3 PCB TMDLs

Table 6.61 presents the average annual baseline total PCB loads and TMDL allocations. Table 6.62 presents maximum average daily baseline dieldrin loads and TMDL allocations. Since the concentration of PCBs in storm flow is greater than the concentration in base flow, concentrations increase during storm events.

Table 6.61 Average Annual PCB Baseline Loads and TMDL Allocations (lbs/yr), Pinehurst Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	4.31E-02	5.62E-05	99.87%
	Total	4.31E-02	5.62E-05	99.87%
Load Allocation	Direct Drainage	1.23E-02	4.55E-05	99.63%
	Upstream Maryland	3.28E-02	5.58E-05	99.83%
	Total	4.51E-02	1.01E-04	99.78%
Margin of Safety		-	Implicit	-
Total		8.82E-02	1.58E-04	99.82%

Table 6.62 PCB Maximum Average Daily Loads (lbs/d), Pinehurst Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	8.35E-03	1.09E-05	99.87%
	Total	8.35E-03	1.09E-05	99.87%
Load Allocation	Direct Drainage	1.83E-03	4.89E-06	99.73%
	Upstream Maryland	3.54E-03	4.64E-06	99.87%
	Total	5.37E-03	9.54E-06	99.82%
Margin of Safety		-	Implicit	-
Total		1.37E-02	2.04E-05	99.85%

6.9 PINEY BRANCH

Piney Branch runs approximately three-quarters of a mile through a strip of forested parkland about 1,000 yards wide before it enters Rock Creek from the east above the National Zoo. Piney Branch is approximately 12 feet wide. The watershed comprises about 2,500 acres, but most of the drainage area lies within the District CSS (DDOH, 2004a). Figure 6.9 shows the Piney Branch watershed, including the CSS area discharging to the CSO outfalls on Piney Branch. Piney Branch is the only small tributary with CSO outfalls.

The CSS portion of the watershed contributes flow and pollutant loads only when CSO events occur; otherwise, flows from the CSS portion of the watershed are transported to the Blue Plains Advanced Wastewater Treatment Plant. As discussed in Section 5.3.2, CSO events are estimated to happen 28 times a year under current conditions, with a total annual volume of 280 MG. Under the District's LTCP, however, CSO events are expected to occur only twice a year, on average, with an average annual volume of 6.3 MG. When CSO events are not occurring, the

flows and load from Piney Branch stem from the small portion of the watershed outside the CSS, which is only 100 acres.

Table 6.63 gives the land use acreage in the Piney Branch watershed. Figure 6.10 shows the location of Piney Branch and the watershed excluding the CSS area discharging the stream. Outside of the CSS, the watershed is 20% impervious and 45% lies within the District MS4. The surface stream portion of the watershed is surrounded by predominantly forested parkland. The rest of the watershed is primarily urban residential and some light commercial (DDOH, 2004a).

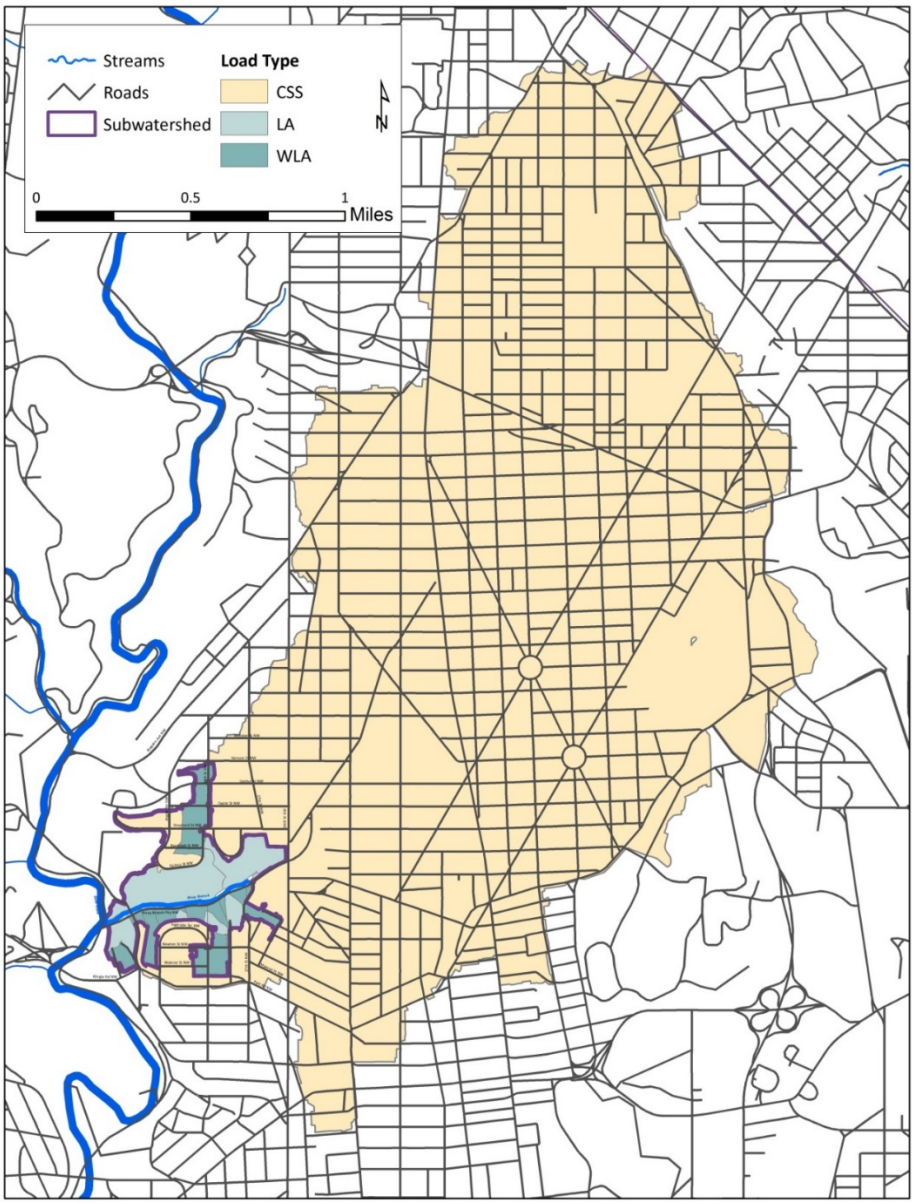

Figure 6.9 Piney Branch and its Watershed

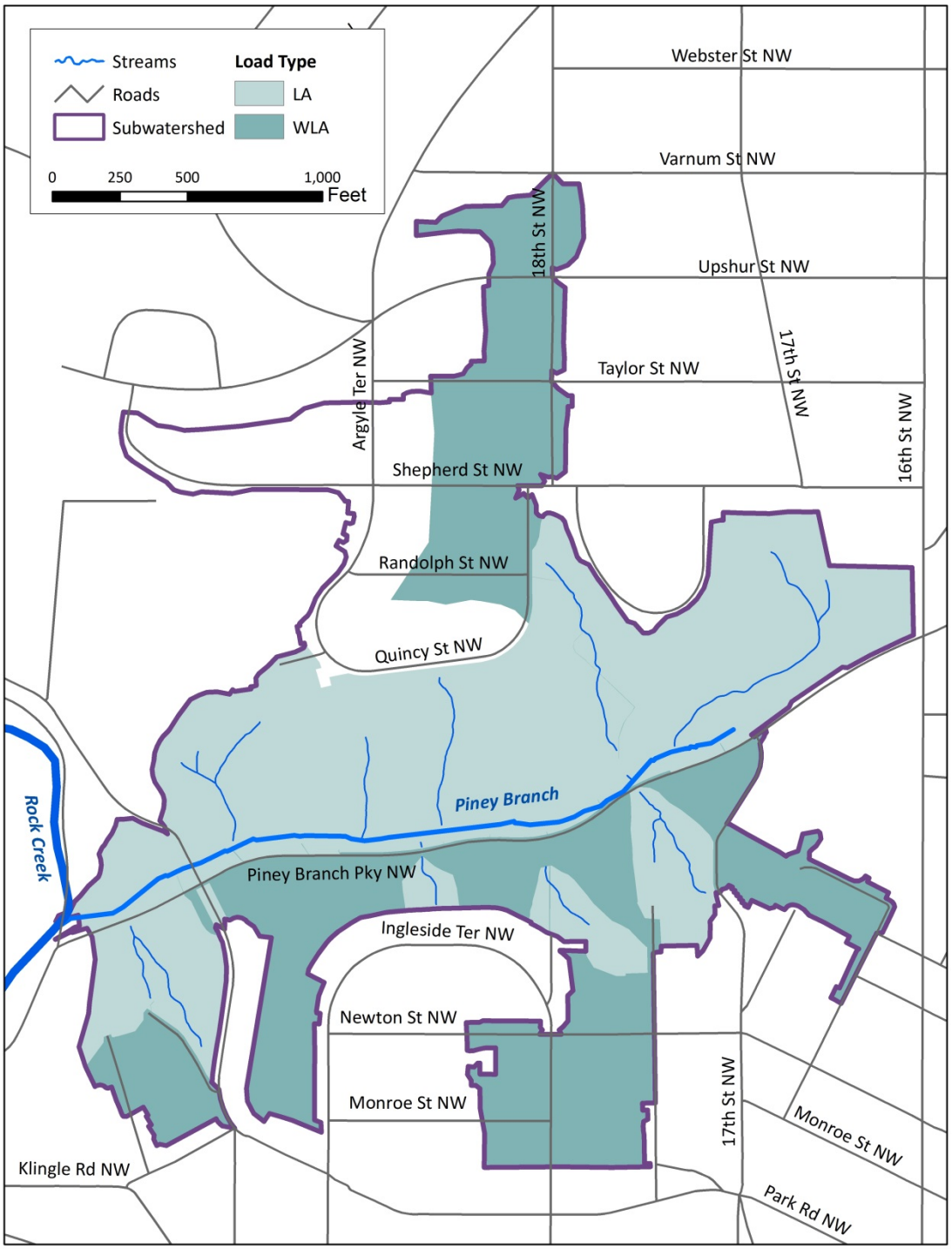

Figure 6.10 Piney Branch and its Watershed, Excluding CSS Area

Table 6.63 Piney Branch Land Use (acres)

Type	Impervious	Pervious	Forest	Total
District MS4	18	18	9	45
District Non-MS4	2	7	46	55
Maryland	-	-	-	-
Total Outside District CSS	20	25	55	100
District CSS				2,406
Total				2,506

6.9.1 Dieldrin TMDLs

Table 6.64 presents the average annual baseline dieldrin loads and TMDL allocations. Table 6.65 presents maximum average daily baseline dieldrin loads and TMDL allocations. Since the concentration of dieldrin in storm flow is less than the concentration in base flow, concentrations decrease in storm events.

Table 6.64 Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Piney Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.89E-04	8.51E-06	95.5%
	District Combined Sewer System	4.01E-04	7.07E-07	99.8%
	Total	5.90E-04	9.22E-06	98.4%
Load Allocation	Direct Drainage	3.57E-04	9.78E-06	97.3%
	Upstream Maryland	-	-	-
	Total	3.57E-04	9.78E-06	97.3%
Margin of Safety		-	Implicit	-
Total		9.48E-04	1.90E-05	98.0%

Table 6.65 Dieldrin Maximum Average Daily Loads (lbs/d), Piney Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	3.36E-05	1.51E-06	95.5%
	District Combined Sewer System	1.57E-04	1.77E-06	98.9%
	Total	1.91E-04	3.28E-06	98.3%
Load Allocation	Direct Drainage	2.65E-05	1.18E-06	95.5%
	Upstream Maryland	-	-	-
	Total	2.65E-05	1.18E-06	95.5%
Margin of Safety		-	Implicit	-
Total		2.17E-04	4.46E-06	97.9%

6.9.2 Heptachlor Epoxide TMDLs

Table 6.66 presents the average annual baseline heptachlor epoxide loads and TMDL allocations. Table 6.67 presents maximum average daily baseline heptachlor epoxide loads and TMDL allocations. Like dieldrin, the concentration of heptachlor epoxide in storm flow is less than the concentration in base flow, so concentrations decrease in storm events.

Table 6.66 Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Piney Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	9.61E-05	6.15E-06	93.6%
	District Combined Sewer System	2.04E-04	5.10E-07	99.7%
	Total	3.00E-04	6.66E-06	97.8%
Load Allocation	Direct Drainage	2.60E-04	7.06E-06	97.3%
	Upstream Maryland	-	-	-
	Total	2.60E-04	7.06E-06	97.3%
Margin of Safety		-	Implicit	-
Total		5.60E-04	1.37E-05	97.6%

Table 6.67 Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), Piney Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.71E-05	1.09E-06	93.6%
	District Combined Sewer System	7.98E-05	1.28E-06	98.4%
	Total	9.69E-05	2.37E-06	97.6%
Load Allocation	Direct Drainage	1.36E-05	8.53E-07	93.7%
	Upstream Maryland	-	-	-
	Total	1.36E-05	8.53E-07	93.7%
Margin of Safety		-	Implicit	-
Total		1.11E-04	3.22E-06	97.1%

6.9.3 Chlordane TMDLs

Table 6.68 presents the average annual baseline chlordane loads and TMDL allocations. Table 6.69 presents maximum average daily baseline chlordane loads and TMDL allocations. Unlike dieldrin, the concentration of chlordane in storm flow is greater than the concentration in base flow, so concentrations increase in storm events.

Table 6.68 Average Annual Chlordane Baseline Loads and TMDL Allocations (lbs/yr), Piney Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	2.99E-02	1.28E-04	99.6%
	District Combined Sewer System	6.35E-02	1.06E-05	100.0%
	Total	9.35E-02	1.38E-04	99.9%
Load Allocation	Direct Drainage	5.25E-03	1.47E-04	97.2%
	Upstream Maryland	-	-	-
	Total	5.25E-03	1.47E-04	97.2%
Margin of Safety		-	Implicit	-
Total		9.87E-02	2.85E-04	99.7%

Table 6.69 Chlordane Maximum Average Daily Loads (lbs/d), Piney Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	5.32E-03	2.27E-05	99.6%
	District Combined Sewer System	2.49E-02	2.65E-05	99.9%
	Total	3.02E-02	4.92E-05	99.8%
Load Allocation	Direct Drainage	1.11E-03	1.77E-05	98.4%
	Upstream Maryland	-	-	-
	Total	1.11E-03	1.77E-05	98.4%
Margin of Safety		-	Implicit	-
Total		3.13E-02	6.69E-05	99.8%

6.9.4 PCB TMDLs

Table 6.70 presents the average annual baseline total PCB loads and TMDL allocations. Table 6.71 presents maximum average daily baseline dieldrin loads and TMDL allocations. Since the concentration of PCBs in storm flow is greater than the concentration in base flow, concentrations increase during storm events.

Table 6.70 Average Annual PCB Baseline Loads and TMDL Allocations (lbs/yr), Piney Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	7.72E-03	1.01E-05	99.87%
	District Combined Sewer System	4.01E-02	8.37E-07	99.998%
	Total	4.78E-02	1.09E-05	99.98%
Load Allocation	Direct Drainage	2.84E-03	1.16E-05	99.59%
	Upstream Maryland	-	-	-
	Total	2.84E-03	1.16E-05	99.59%
Margin of Safety		-	Implicit	-
Total		5.07E-02	2.25E-05	99.96%

Table 6.71 PCB Maximum Average Daily Loads (lbs/d), Piney Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.37E-03	1.79E-06	99.87%
	District Combined Sewer System	1.57E-02	2.09E-06	99.99%
	Total	1.71E-02	3.89E-06	99.98%
Load Allocation	Direct Drainage	4.42E-04	1.40E-06	99.68%
	Upstream Maryland	-	-	-
	Total	4.42E-04	1.40E-06	99.68%
Margin of Safety		-	Implicit	-
Total		1.75E-02	5.29E-06	99.97%

6.10 PORTAL BRANCH

Portal Branch is an eastern tributary of Rock Creek near the northern corner of the District, and joins Fenwick Branch about 120 feet north of the Fenwick Branch's confluence with Rock Creek. The surface portion of the stream is less than half a mile long and is completely contained in the District. Portal Branch stretches about 2,220 feet and has an average width of 10 feet (DDOH, 2004a).

Figure 6.11 shows the location of Portal Branch and its watershed. Table 6.72 gives the land use acreage in the watershed. The watershed measures 201 acres, of which 71 acres lie within the District. The watershed in the District is mainly low medium density residential and parklands. Impervious surfaces cover about a third of the District portion of the watershed and 88% of the watershed is served by the District's separate storm sewer system. The stream is buffered by 100 feet or less of parkland (DDOH, 2004a). The portion in MD is located in the heart of downtown Silver Spring, a commercial and transportation hub in Montgomery County.

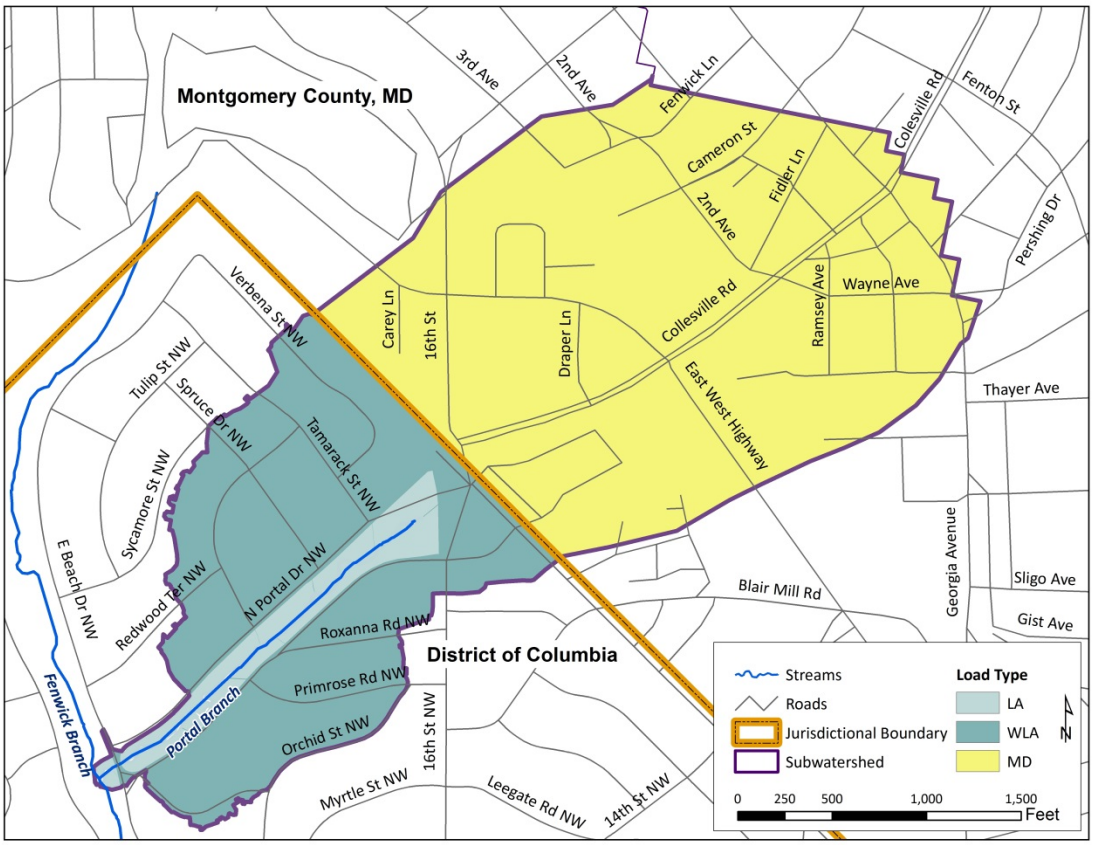

Figure 6.11 Portal Branch and its Watershed

Table 6.72 Portal Branch Land Use (acres)

Type	Impervious	Pervious	Forest	Total
District MS4	22	37	2	62
District Non-MS4	0	1	7	9
Maryland	80	50	0	130
Total	102	89	10	201

6.10.1 Dieldrin TMDLs

Table 6.73 presents the average annual baseline dieldrin loads and TMDL allocations. Table 6.74 presents maximum average daily baseline dieldrin loads and TMDL allocations. Since the concentration of dieldrin in storm flow is less than the concentration in base flow, concentrations decrease in storm events.

Table 6.73 Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Portal Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	2.65E-04	1.19E-05	95.5%
	Total	2.65E-04	1.19E-05	95.5%
Load Allocation	Direct Drainage	1.51E-04	3.55E-06	97.6%
	Upstream Maryland	9.76E-04	3.92E-05	96.0%
	Total	1.13E-03	4.28E-05	96.2%
Margin of Safety		-	Implicit	-
Total		1.39E-03	5.47E-05	96.1%

Table 6.74 Dieldrin Maximum Average Daily Loads (lbs/d), Portal Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	5.11E-05	2.30E-06	95.5%
	Total	5.11E-05	2.30E-06	95.5%
Load Allocation	Direct Drainage	4.46E-06	1.95E-07	95.6%
	Upstream Maryland	9.79E-05	4.40E-06	95.5%
	Total	1.02E-04	4.59E-06	95.5%
Margin of Safety		-	Implicit	-
Total		1.53E-04	6.89E-06	95.5%

6.10.2 Heptachlor Epoxide TMDLs

Table 6.75 presents the average annual baseline heptachlor epoxide loads and TMDL allocations. Table 6.76 presents maximum average daily baseline heptachlor epoxide loads and TMDL allocations. Like dieldrin, the concentration of heptachlor epoxide in storm flow is less than the concentration in base flow, so concentrations decrease in storm events.

Table 6.75 Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Portal Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.35E-04	8.60E-06	93.6%
	Total	1.35E-04	8.60E-06	93.6%
Load Allocation	Direct Drainage	1.17E-04	2.56E-06	97.8%
	Upstream Maryland	5.54E-04	2.83E-05	94.9%
	Total	6.71E-04	3.09E-05	95.4%
Margin of Safety		-	Implicit	-
Total		8.06E-04	3.95E-05	95.1%

Table 6.76 Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), Portal Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	2.60E-05	1.66E-06	93.6%
	Total	2.60E-05	1.66E-06	93.6%
Load Allocation	Direct Drainage	2.33E-06	1.41E-07	93.9%
	Upstream Maryland	4.99E-05	3.18E-06	93.6%
	Total	5.22E-05	3.32E-06	93.6%
Margin of Safety		-	Implicit	-
Total		7.82E-05	4.98E-06	93.6%

6.10.3 PCB TMDLs

Table 6.77 presents the average annual baseline total PCB loads and TMDL allocations. Table 6.78 presents maximum average daily baseline dieldrin loads and TMDL allocations. Since the concentration of PCBs in storm flow is greater than the concentration in base flow, concentrations increase during storm events.

Table 6.77 Average Annual PCB Baseline Loads and TMDL Allocations (lbs/yr), Portal Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.08E-02	1.41E-05	99.87%
	Total	1.08E-02	1.41E-05	99.87%
Load Allocation	Direct Drainage	7.39E-04	4.20E-06	99.43%
	Upstream Maryland	3.25E-02	4.65E-05	99.86%
	Total	3.32E-02	5.07E-05	99.85%
Margin of Safety		-	Implicit	-
Total		4.41E-02	6.48E-05	99.85%

Table 6.78 PCB Maximum Average Daily Loads (lbs/d), Portal Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	2.09E-03	2.73E-06	99.87%
	Total	2.09E-03	2.73E-06	99.87%
Load Allocation	Direct Drainage	6.40E-05	2.31E-07	99.64%
	Upstream Maryland	3.99E-03	5.21E-06	99.87%
	Total	4.05E-03	5.44E-06	99.87%
Margin of Safety		-	Implicit	-
Total		6.14E-03	8.17E-06	99.87%

6.11 SOAPSTONE CREEK

Soapstone Creek is a tributary of Broad Branch. Soapstone joins Broad Branch just before Broad Branch's confluence with Rock Creek. Soapstone Creek runs about 0.9 mile through a steep-sided heavily wooded valley about 500 yards wide. The average channel width is approximately 15 feet. Figure 6.12 shows the location of Soapstone Creek and its watershed (DDOH, 2004a).

Table 6.79 gives the land use acreage in the Soapstone Creek watershed. The watershed covers 514 acres and is mostly urban, with parkland and forest in the lower reaches of the creek. The northern quarter of the urban watershed is densely populated residential property. The southwestern quarter of the watershed is much less densely populated residential and commercial property (DDOH, 2004a). The watershed is 43% impervious and 80% lies within the District MS4.

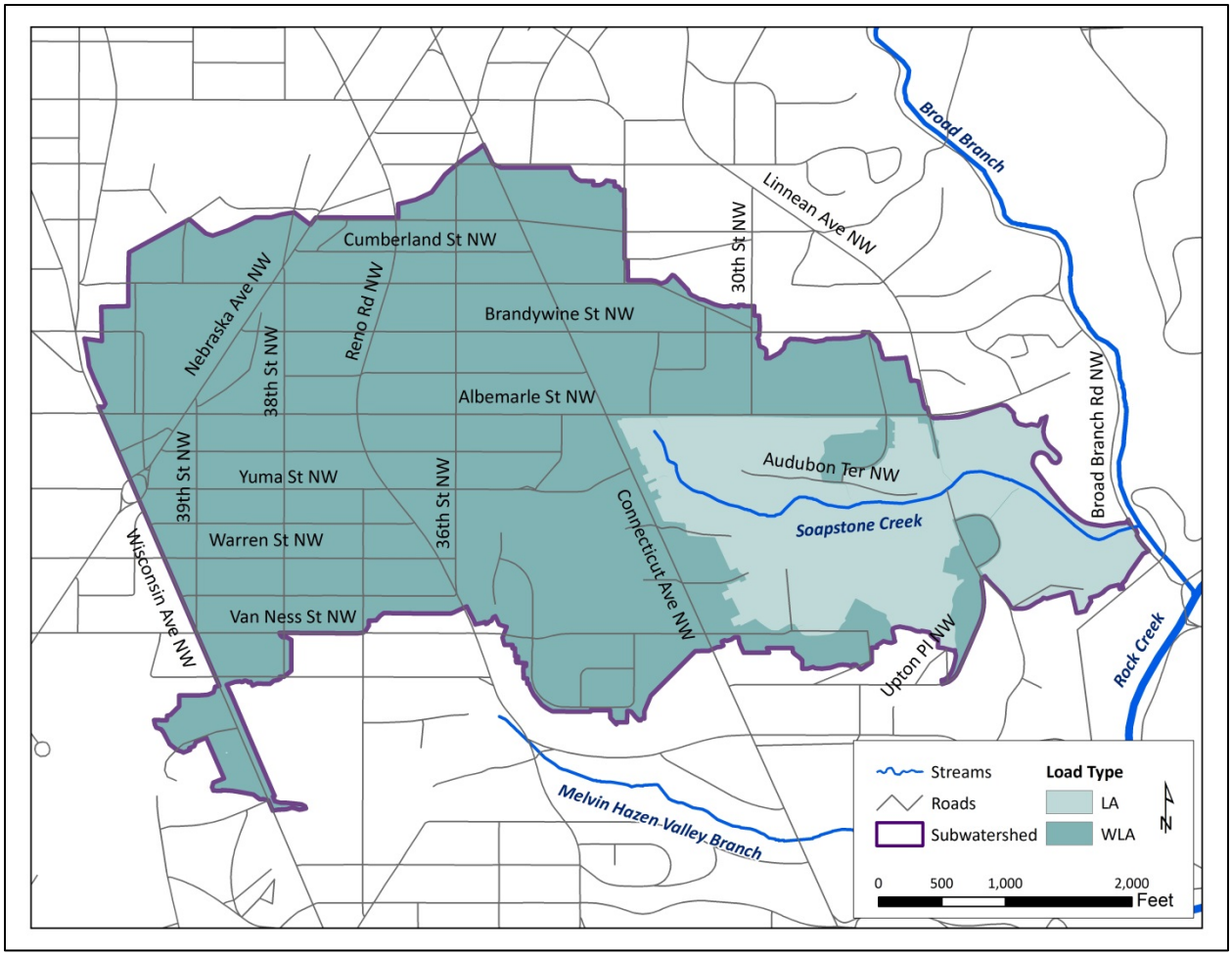

Figure 6.12 Soapstone Creek and its Watershed

Table 6.79 Soapstone Creek Land Use (acres)

Type	Impervious	Pervious	Forest	Total
District MS4	202	202	7	411
District Non-MS4	22	30	52	104
Maryland	-	-	-	-
Total	223	232	59	514

6.11.1 Dieldrin TMDLs

Table 6.80 presents the average annual baseline dieldrin loads and TMDL allocations. Table 6.81 presents maximum average daily baseline dieldrin loads and TMDL allocations. Since the

concentration of dieldrin in storm flow is less than the concentration in base flow, concentrations decrease in storm events.

Table 6.80 Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Soapstone Creek

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	2.15E-03	9.67E-05	95.5%
	Total	2.15E-03	9.67E-05	95.5%
Load Allocation	Direct Drainage	1.14E-03	3.17E-05	97.2%
	Upstream Maryland	-	-	-
	Total	1.14E-03	3.17E-05	97.2%
Margin of Safety		-	Implicit	-
Total		3.29E-03	1.28E-04	96.1%

Table 6.81 Dieldrin Maximum Average Daily Loads (lbs/d), Soapstone Creek

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	3.80E-04	1.71E-05	95.5%
	Total	3.80E-04	1.71E-05	95.5%
Load Allocation	Direct Drainage	6.76E-05	3.01E-06	95.5%
	Upstream Maryland	-	-	-
	Total	6.76E-05	3.01E-06	95.5%
Margin of Safety		-	Implicit	-
Total		4.47E-04	2.01E-05	95.5%

6.11.2 Heptachlor Epoxide TMDLs

Table 6.82 presents the average annual baseline heptachlor epoxide loads and TMDL allocations. Table 6.83 presents maximum average daily baseline heptachlor epoxide loads and TMDL allocations. Like dieldrin, the concentration of heptachlor epoxide in storm flow is less than the concentration in base flow, so concentrations decrease in storm events.

Table 6.82 Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Soapstone Creek

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.09E-03	6.98E-05	93.6%
	Total	1.09E-03	6.98E-05	93.6%
Load Allocation	Direct Drainage	8.22E-04	2.29E-05	97.2%
	Upstream Maryland	-	-	-
	Total	8.22E-04	2.29E-05	97.2%
Margin of Safety		-	Implicit	-
Total		1.91E-03	9.28E-05	95.2%

Table 6.83 Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), Soapstone Creek

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.93E-04	1.23E-05	93.6%
	Total	1.93E-04	1.23E-05	93.6%
Load Allocation	Direct Drainage	3.48E-05	2.18E-06	93.7%
	Upstream Maryland	-	-	-
	Total	3.48E-05	2.18E-06	93.7%
Margin of Safety		-	Implicit	-
Total		2.28E-04	1.45E-05	93.6%

6.11.3 Chlordane TMDLs

Table 6.84 presents the average annual baseline chlordane loads and TMDL allocations. Table 6.85 presents maximum average daily baseline chlordane loads and TMDL allocations. Unlike dieldrin, the concentration of chlordane in storm flow is greater than the concentration in base flow, so concentrations increase in storm events.

Table 6.84 Average Annual Chlordane Baseline Loads and TMDL Allocations (lbs/yr), Soapstone Creek

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	3.40E-01	1.45E-03	99.6%
	Total	3.40E-01	1.45E-03	99.6%
Load Allocation	Direct Drainage	3.92E-02	4.76E-04	98.8%
	Upstream Maryland	-	-	-
	Total	3.92E-02	4.76E-04	98.8%
Margin of Safety		-	Implicit	-
Total		3.79E-01	1.93E-03	99.5%

Table 6.85 Chlordane Maximum Average Daily Loads (lbs/d), Soapstone Creek

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	6.01E-02	2.56E-04	99.6%
	Total	6.01E-02	2.56E-04	99.6%
Load Allocation	Direct Drainage	7.23E-03	4.52E-05	99.4%
	Upstream Maryland	-	-	-
	Total	7.23E-03	4.52E-05	99.4%
Margin of Safety		-	Implicit	-
Total		6.73E-02	3.01E-04	99.6%

6.11.4 PCB TMDLs

Table 6.86 presents the average annual baseline total PCB loads and TMDL allocations. Table 6.87 presents maximum average daily baseline dieldrin loads and TMDL allocations. Since the concentration of PCBs in storm flow is greater than the concentration in base flow, concentrations increase during storm events.

Table 6.86 Average Annual PCB Baseline Loads and TMDL Allocations (lbs/yr), Soapstone Creek

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	8.78E-02	1.15E-04	99.87%
	Total	8.78E-02	1.15E-04	99.87%
Load Allocation	Direct Drainage	1.38E-02	3.76E-05	99.73%
	Upstream Maryland	-	-	-
	Total	1.38E-02	3.76E-05	99.73%
Margin of Safety		-	Implicit	-
Total		1.02E-01	1.52E-04	99.85%

Table 6.87 PCB Maximum Average Daily Loads (lbs/d), Soapstone Creek

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.55E-02	2.02E-05	99.87%
	Total	1.55E-02	2.02E-05	99.87%
Load Allocation	Direct Drainage	2.04E-03	3.57E-06	99.82%
	Upstream Maryland	-	-	-
	Total	2.04E-03	3.57E-06	99.82%
Margin of Safety		-	Implicit	-
Total		1.75E-02	2.38E-05	99.86%

6.12 DALECARLIA TRIBUTARY

Dalecarlia Tributary is a tributary of Little Falls Branch in Maryland that flows to the Potomac. Figure 6.13 shows the location of Dalecarlia Tributary and its watershed. Table 6.88 gives the land use acreage in the watershed. The watershed encompasses 1,091 acres. The watershed is 37% impervious and 90% lies within the District MS4. West of Dalecarlia Parkway, the tributary flows through sloping parkland. Most of the remainder of the watershed is suburban-style residential housing (DDOH, 2004b).

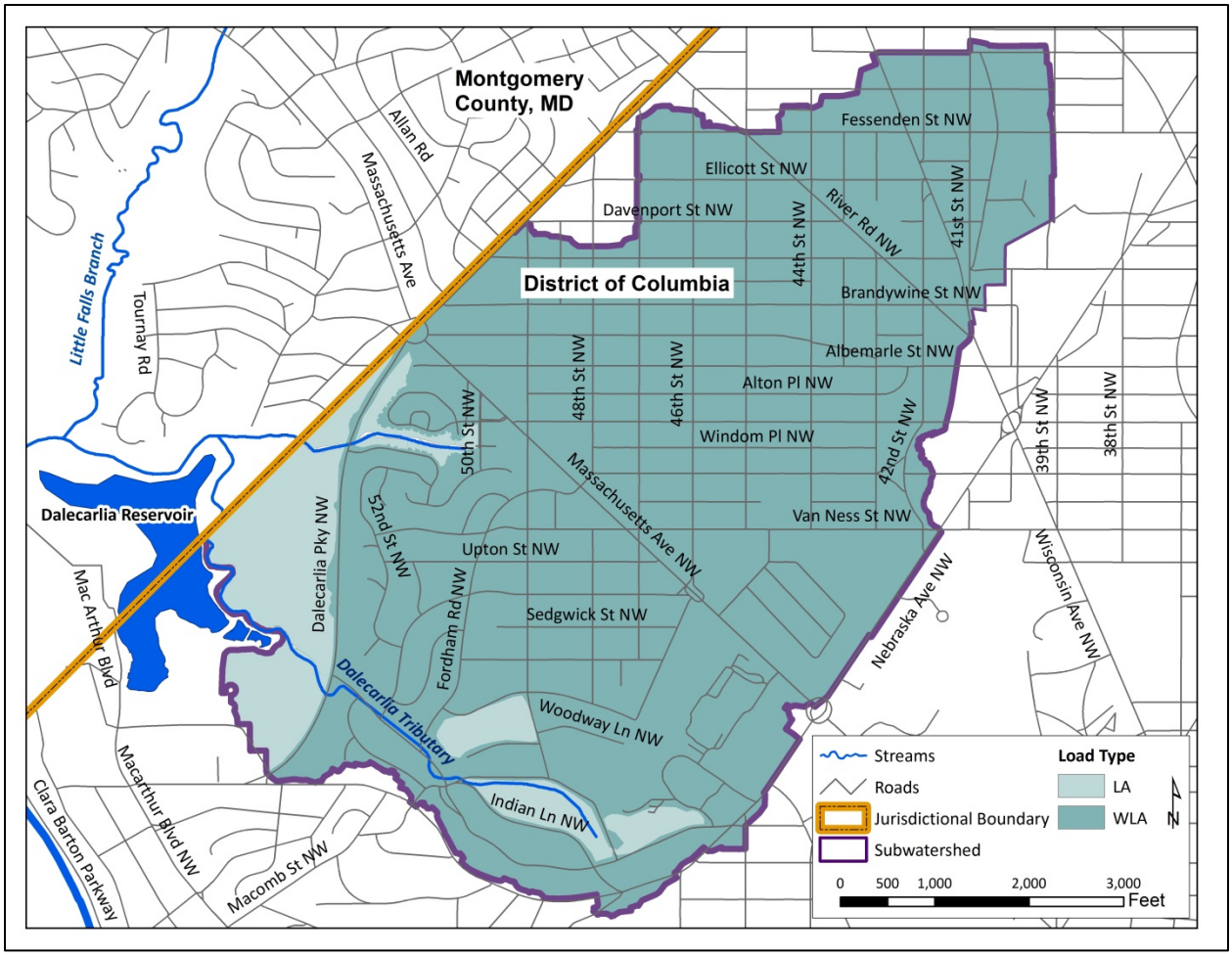

Figure 6.13 Dalecarlia Tributary and its Watershed

Table 6.88 Dalecarlia Tributary Land Use (acres)

Type	Impervious	Pervious	Forest	Total
District MS4	393	534	50	977
District Non-MS4	12	30	72	114
Maryland	-	-	-	-
Total	405	564	122	1,091

6.12.1 Dieldrin TMDLs

Table 6.89 presents the average annual baseline dieldrin loads and TMDL allocations. Table 6.90 presents maximum average daily baseline dieldrin loads and TMDL allocations.

Table 6.89 Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Dalecarlia Tributary

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	4.43E-03	2.00E-04	95.5%
	Total	4.43E-03	2.00E-04	95.5%
Load Allocation	Direct Drainage	2.23E-03	5.47E-05	97.5%
	Upstream Maryland	-	-	-
	Total	2.23E-03	5.47E-05	97.5%
Margin of Safety		-	Implicit	-
Total		6.66E-03	2.54E-04	96.2%

Table 6.90 Dieldrin Maximum Average Daily Loads (lbs/d), Dalecarlia Tributary

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	8.24E-04	3.71E-05	95.5%
	Total	8.24E-04	3.71E-05	95.5%
Load Allocation	Direct Drainage	7.90E-05	3.48E-06	95.6%
	Upstream Maryland	-	-	-
	Total	7.90E-05	3.48E-06	95.6%
Margin of Safety		-	Implicit	-
Total		9.03E-04	4.06E-05	95.5%

6.12.2 Heptachlor Epoxide TMDLs

Table 6.91 presents the average annual baseline heptachlor epoxide loads and TMDL allocations. Table 6.92 presents maximum average daily baseline heptachlor epoxide loads and TMDL allocations.

Table 6.91 Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Dalecarlia Tributary

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	2.25E-03	1.44E-04	93.6%
	Total	2.25E-03	1.44E-04	93.6%
Load Allocation	Direct Drainage	1.70E-03	3.95E-05	97.7%
	Upstream Maryland	-	-	-
	Total	1.70E-03	3.95E-05	97.7%
Margin of Safety		-	Implicit	-
Total		3.95E-03	1.84E-04	95.4%

Table 6.92 Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), Dalecarlia Tributary

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	4.19E-04	2.68E-05	93.6%
	Total	4.19E-04	2.68E-05	93.6%
Load Allocation	Direct Drainage	4.11E-05	2.51E-06	93.9%
	Upstream Maryland	-	-	-
	Total	4.11E-05	2.51E-06	93.9%
Margin of Safety		-	Implicit	-
Total		4.60E-04	2.93E-05	93.6%

6.13 OXON RUN

Oxon Run is a tributary to the Potomac River. Figure 6.14 shows the location of Oxon Run and its watershed. The headwaters of Oxon Run originate in Prince George's County, MD. Oxon Run then flows into the southeastern section of the District before crossing back over the MD state line, then discharging into the Potomac River. The length of the mainstem of Oxon Run is approximately 6.8 miles from its headwaters in Prince George's County downstream to where it re-enters MD from the District. The length of Oxon Run in the District is approximately 2.9 miles. Most of the Oxon Run segment in the District is a concrete-lined trapezoidal channel approximately 50 feet wide and 112 feet deep with the exception of two reaches in which the natural streambed has remained intact (DDOH, 2004c).

Table 6.93 gives the land use acreage in the Oxon Run watershed. The watershed is 7,895 acres or 12.3 square miles. Seventy-three percent of the watershed is in MD. The District portion of the watershed is 40% impervious and 84% of the District portion lies within the District MS4.

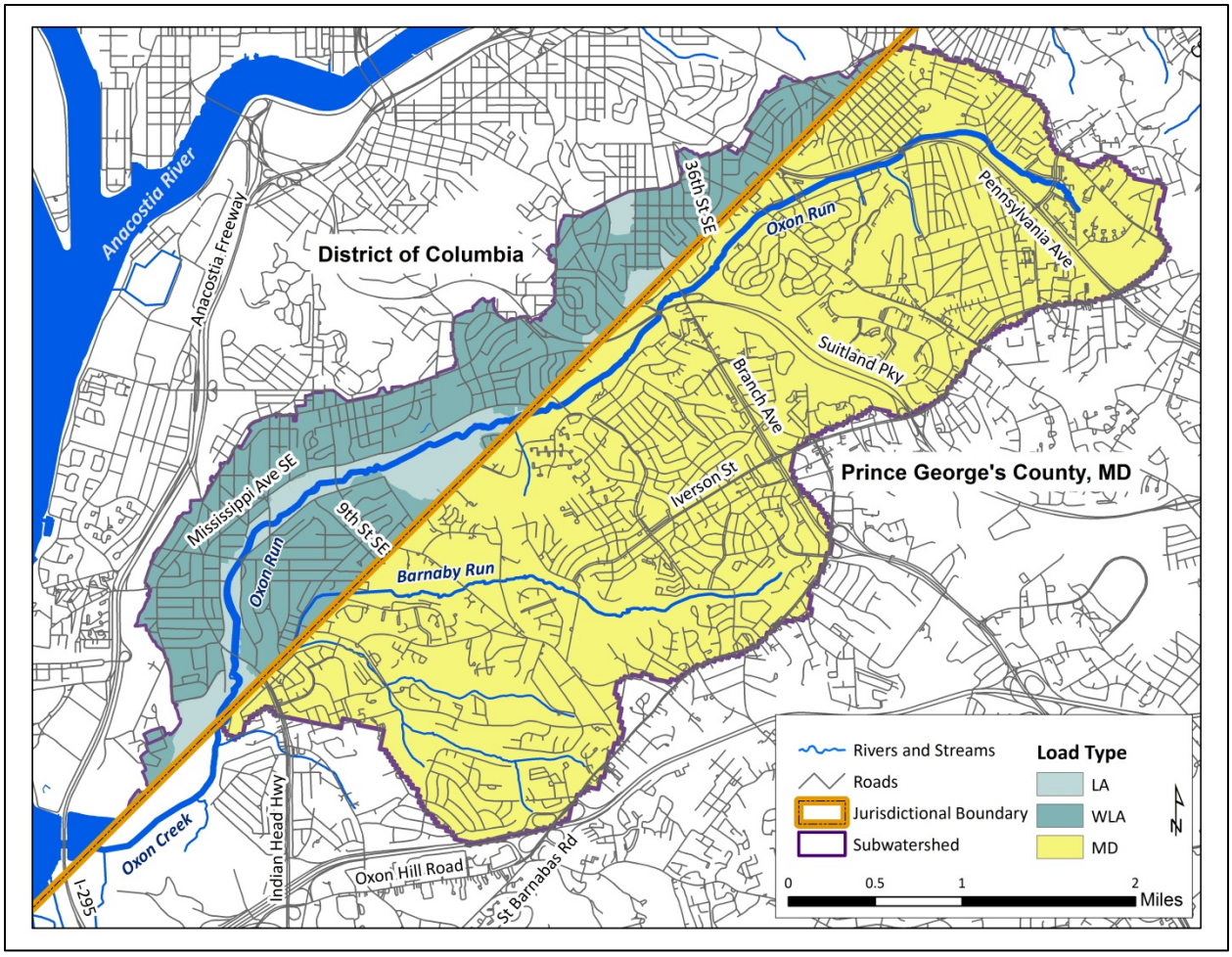

Figure 6.14 Oxon Run and its Watershed

Table 6.93 Oxon Run Land Use (acres)

Type	Impervious	Pervious	Forest	Total
District MS4	829	890	81	1,800
District Non-MS4	28	133	183	344
Maryland	1,940	2,866	946	5,751
Total	2,797	3,888	1,210	7,895

6.13.1 Dieldrin TMDLs

Table 6.94 presents the average annual baseline dieldrin loads and TMDL allocations. Table 6.95 presents maximum average daily baseline dieldrin loads and TMDL allocations. Since the concentration of dieldrin in storm flow is less than the concentration in base flow, concentrations decrease in storm events.

Table 6.94 Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Oxon Run

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	1.94E-03	4.02E-04	79.2%
	Total	1.94E-03	4.02E-04	79.2%
Load Allocation	Direct Drainage	1.14E-03	1.14E-04	90.0%
	Upstream Maryland	9.07E-03	1.41E-03	84.5%
	Total	1.02E-02	1.52E-03	85.1%
Margin of Safety		-	Implicit	-
Total		1.21E-02	1.93E-03	84.1%

Table 6.95 Dieldrin Maximum Average Daily Loads (lbs/d), Oxon Run

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[5]
Wasteload Allocation	District Regulated Stormwater	3.46E-04	7.18E-05	79.2%
	Total	3.46E-04	7.18E-05	79.2%
Load Allocation	Direct Drainage	4.67E-05	9.51E-06	79.7%
	Upstream Maryland	8.78E-04	1.80E-04	79.6%
	Total	9.25E-04	1.89E-04	79.6%
Margin of Safety		-	Implicit	-
Total		1.27E-03	2.61E-04	79.5%

7 PUBLIC PARTICIPATION

The availability of draft TMDLs was advertised in the District Register beginning on July 29, 2016. Interested parties were invited to submit comments during the public comment period, which began on July 29, 2016, and ended on August 29, 2016. The electronic documents were also posted on the DOEE's internet site at http://doee.dc.gov/service/public-notices-hearings.

8 REASONABLE ASSURANCE

Neither the Clean Water Act nor current EPA regulations direct states to develop a detailed implementation plan as part of the TMDL development and approval process.

When a TMDL is developed for waters impaired by point sources, the issuance of a NPDES permit(s) provides the reasonable assurance that the wasteload allocations contained in the TMDL will be achieved. This is because 40 CFR §122.44(d)(1)(vii)(B) requires that effluent

limits in permits be consistent with "the assumptions and requirements of any available wasteload allocation" in an approved TMDL. There are currently no Clean Water Act regulations requiring reductions from nonpoint sources in a TMDL, however a demonstration of reasonable assurance must show that management measures or other control actions are available to implement the load allocation.

The District has several programs in place to control the effects of stormwater runoff and promote nonpoint source pollution prevention and control. The District is a signatory to the Chesapeake Bay Agreement, which includes commitments to address toxic contaminants such as those addressed in this TMDL report. Additionally, other source control measures described in the following sections will help reduce pesticide and PCB pollution of the District's waters.

Given that chlordane, dieldrin, DDT, heptachlor epoxide, and PCBs are no longer actively used in the District, the concentrations of each pollutant in the aquatic environment will decline with time. Processes, such as burial of contaminated sediments with newer, less contaminated material, flushing of sediments during periods of high stream flow, and biodegradation will contribute to this natural attenuation. These processes occur naturally within the environment and do not require additional remediation efforts; however, the half-lives of organochlorine pesticides and PCBs in the environment are long, and natural attenuation often requires decades before observing significant improvement. Loading from the watershed can also be expected to decline over time due to gradual reductions in atmospheric deposition rates.

Given the nature of the sources of these contaminants in the District as well these natural attenuation processes they will be subject to, an implementation approach that focuses on best management practice (BMP) implementation and source control efforts in lieu of water quality-based effluent limitations may be appropriate.

8.1 CHESAPEAKE BAY AGREEMENT

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

- Specifically, the CBP is currently in the process of developing *Guidance for Using Source Trackdown Studies to Reduce PCB Loads*. When finalized, the guidance will be incorporated by reference in NPDES permits to help Bay jurisdictions, including the District, to track PCB reduction measures and progress. Additionally, other source

control measures described in the following sections will help reduce pesticide pollution of the District's waters.

• The CBP also promotes water quality improvements in the basin in many ways, including monitoring, publication of water quality studies, including studies on toxics; and holding of numerous workshops regarding water issues. CBP's continued actions will further help ensure the success of this TMDL.

• In addition, DOEE's commitments to sediment-reduction implementation activities required by the Chesapeake Bay TMDLs WIPs will also help meet the requirements of this TMDL. Since PCBs and organochlorine pesticides adsorb to soil/sediment, reducing sediment load will in turn reduce PCBs, organochlorine pesticides and other toxics that are transported via sediment into small tributaries of the Rock Creek and the Potomac River.

8.2 SOURCE CONTROL

8.2.1 Stormwater Load Reductions

As part of the NPDES permit requirements, the District MS4 program is required to develop a TMDL implementation plan. In May 2015, the District submitted to EPA the draft Consolidated TMDL Implementation Plan. The draft Implementation Plan was revised in response to stakeholder and EPA comments and will be submitted as final in July 2016.

There are a number of ongoing initiatives throughout the District to reduce stormwater runoff, which in turn, will reduce PCB and pesticide loading to the Rock Creek and Potomac River tributaries. The centerpiece of these initiatives is the District's updated Stormwater Management Regulations, which require retention of the 1.2" rain event from new development and redevelopment projects. The impact of these regulations will be amplified by the District's direct investment in green infrastructure, through programs to promote voluntary retrofits, expand urban tree canopy, and incorporate green infrastructure features into the District capital projects.

In addition, under the MS4 Permit, the District implements a number of stormwater management and source control activities, including illicit discharge detection and elimination, enhanced street sweeping, construction site and industrial facility inspections and enforcement, and household hazardous waste collections. Implementation approaches, including BMPs that remove TSS, such as most structural BMPs, street sweeping, erosion and sediment control, and other practices will be effective in reducing PCB loads associated with sedimentation. Additionally, a database of Potential Sources can be developed to identify possible specific sources of PCBs in the District. Another programmatic activity could be implemented through "tracking back" high concentrations of PCBs through the MS4 system.

Overall, if is noted that the applicable BMPs are not being implemented and DOEE reasonably believes that individual sites or facilities are causing pollution, DOEE may use enforcement to achieve compliance with the District's water quality standards. The combination of both

regulatory initiatives and BMP installation should ensure continued decline of PCBs and organochlorine pesticides in the District's waters.

8.2.2 CSO Load Reductions

The only tributary impacted by CSOs is Piney Branch. In order to comply with their LTCP, DC Water is implementing the Clean Rivers Project. A storage tunnel for Piney Branch is being constructed, which will significantly reduce the number of CSO events and will significantly assist in meeting this TMDL's allocations.

8.2.3 Non-point Source Reductions

Load allocations are provided for direct drainage to the waterbodies as well as upstream from Maryland, where applicable. To meet these load allocations, DOEE's Watershed Protection Division (WPD) has developed several projects to restore damaged riparian areas and to educate the public on the role of riparian buffers in reducing pollution. All of these efforts will directly support this TMDL and help to ensure its success by reducing sediment loading.

Additionally, the District will coordinate with MDE to determine how to ensure consistency with the upstream load allocation for Maryland.

8.3 IMPLEMENTATION FUNDING

The funding sources to implement BMPs needed to achieve the reductions specified by this TMDL will be based on allocated public resources including:

- The Enterprise Fund, which are funds generated from the stormwater fee. These consist of rates derived from development and redevelopment under the District's revised Stormwater Management regulations.
- The Anacostia River Clean Up and Protection Fund, which are funds generated from the "Bag Law". This fund was established by the Anacostia River Clean Up and Protection Act (District of Columbia Code, 2009), more commonly referred to as the "Bag Law."
- EPA Clean Water Act Grants, including the Clean Water State Revolving Fund and Section 319 grants. The 319 Grants can be used for the implementation of watershed management plans, which focus on the installation of BMPs and /or stream restoration.
- EPA Chesapeake Bay Program Funds (Chesapeake Bay Implementation and Regulatory and Accountability Program grants) provide grants to support regulatory and accountability programs aimed at improving water quality in the Chesapeake Bay. Chesapeake Bay Regulatory and Accountability Program (CBRAP) funds are authorized by Congress and administered by EPA. The funds are intended to be used for a variety of purposes to include development and implementation of: regulatory monitoring, tracking, reporting and verification activities; trading and offset programs; and technical and compliance assistance and guidance for Watershed Implementation Programs.
- The LTCP implementation funds, which is funded through federal support and rates paid by users.

8.4 MONITORING

In order to refine the contribution of organochlorine pesticides or PCBs from each source for purposes of improving control actions and management, DOEE may undertake additional post-TMDL monitoring. This may include compiling and analyzing data to evaluate progress toward attaining the TMDL target. Post-TMDL monitoring may also help DOEE determine whether or not planned control actions are sufficient, or whether further measures need to be implemented. Monitoring implementation actions may accelerate the achievement of this TMDL's target as described below.

8.4.1 Ambient Monitoring

DOEE monitors the concentrations of PCB and pesticides in fish tissue regularly and uses the results to assess the status of existing fish consumption advisories or to issue new advisories. Currently, there are 11 species of fish in the District's waters having action-level (i.e., elevated) PCB; 1 species with elevated DDT; 4 species with elevated dieldrin; and 2 species with elevated heptachlor epoxide. DOEE's continued monitoring of PCB and these toxics and pesticides provides, and will continue to provide, important information to the public from a health perspective. At the same time, given that PCBs and organochlorine pesticides are no longer actively used in DC, their concentrations in the aquatic environment will decline with time. To ensure this, fish tissue PCB and pesticides concentration data collected will be analyzed to assess trends and/or progress toward this TMDL target.

8.4.2 Legacy Sites

The limited sampling underlying the development of this TMDL has not identified any hotspots of elevated loading under current conditions in these watersheds. It may, however, be necessary to further investigate potential sources of organochlorine pesticides and PCBs loading in the watershed, such as active and abandoned industrial sites, waste disposal areas, former chemical storage areas, and other potential hotspots.

The District has some legacy sites whose remediation would have significant positive impact on the targets of these TMDLs. For example, the Anacostia River Sediment Project is an on-going remedial investigation and feasibility study (RI/FS) of the Anacostia River sediments being conducted by DOEE to complement and supplement previous and existing restoration efforts. Its purpose is to assess the nature and extent of pollution (legacy pollutants) in Anacostia River by sampling river sediment and fish for a wide range of chemicals. The data collected will be used to develop a cleanup plan for contaminated sediments. More importantly, the project site's status as a remediation site guarantees regulatory action and funding. Thus, there is reasonable assurance that work will continue in the District. While the small tributaries are not within the Anacostia watershed, declining concentrations in the Anacostia will reduce volatilization and deposition to the neighboring, small tributary watersheds, thus decreasing levels in fish tissue.

8.4.3 Atmospheric Deposition Monitoring

This TMDL did not rule out air deposition as a possible source of PCBs and pesticides, particularly DDT and chlordane. Because of this, atmospheric monitoring of PCBs, DDT and chlordane is relevant to this TMDL. However, the technology required to precisely measure loadings at the water/air interface does not exist. This means that the District may need to

undertake additional monitoring to establish estimates of atmospheric loadings for each of these constituents. Doing this is very costly, time consuming and technically complex - involving use of direct surrogates in order to come up with estimates for loading to surface waters.

In interim, however, since the industrial use of PCBs has been banned, the primary sources of PCBs to the District waters are more likely to be from historical sediment contamination and on-going atmospheric deposition. Therefore, by addressing the legacy sites contribution through remediation efforts, as explained in 8.3.2 above, we ensure that there is no continued direct loading (i.e., loading capacity is established as, or set near zero in a TMDL), and the opportunities for volatilization are reduced to a minimum. Together, both zero or near zero loading capacity and a highly limited volatilization ensure continued declines in air deposition, which in turn enable the District to meet reduction targets.

Also, through public outreach and education initiatives, DOEE will promote the use of processes that don't inadvertently generate PCBs or release PCBs into waters of the District.

8.5 STRATEGIC STAKEHOLDER ENGAGEMENT

DOEE is exploring ways to put together a highly functional group of stakeholders comprising members with the ability to effect significant policy changes (including elected leaders, policy makers, business leaders, community members, environmental stakeholders, and District agency staff), and who would also be focused on developing the legislative, regulatory, programmatic, and political strategies necessary to enhance stormwater management and associated TMDL load reductions in the District. Members of this group will be people with demonstrable interest in environmental compliance and be dedicated to promoting successful TMDL implementation planning.

8.6 ADAPTIVE MANAGEMENT

Adaptive management process is an integral part of TMDL implementation. As new information becomes available, DOEE will evaluate the effectiveness of practices and the installed BMPs and modify them as necessary to ensure that water quality targets established in the TMDL are met.

9 REFERENCES

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APPENDIX A. TMDL ALLOCATIONS UNDER EPA RECOMMENDED HUMAN HEALTH CRITERIA

Appendix A presents informational TMDLs for all small tributaries and pesticides. The informational TMDLs allocations, as explained in Section 5.10, are calculated using the proposed Class D human health criteria that DOEE may adopt during its next triennial review. In the event that DOEE adopts the recommended criteria and the recommended criteria is approved by EPA as the applicable water quality standards for the District, DOEE intends to submit the informational TMDLs to EPA for approval. The TMDLs are expressed as average annual loads and maximum average daily loads, and were calculated as they were presented in Section 6.

Table A.1: Dieldrin Average Annual Loads (lbs/yr), TMDL Scenario, Broad Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	4.13E-03	4.13E-06	99.9%
	Total	4.13E-03	4.13E-06	99.9%
Load Allocation	Direct Drainage	2.73E-03	1.57E-06	99.9%
	Upstream Maryland	-	-	-
	Total	2.73E-03	1.57E-06	99.9%
Margin of Safety		-	Implicit	-
Total		6.86E-03	5.70E-06	99.9%

Table A.2: Dieldrin Maximum Average Daily Loads (lbs/d), TMDL Scenario, Broad Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	7.67E-04	7.67E-07	99.9%
	Total	7.67E-04	7.67E-07	99.9%
Load Allocation	Direct Drainage	1.35E-04	1.33E-07	99.9%
	Upstream Maryland	-	-	-
	Total	1.35E-04	1.33E-07	99.9%
Margin of Safety		-	Implicit	-
Total		9.02E-04	9.00E-07	99.9%

Table A.3: Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Broad Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	2.10E-03	1.10E-04	94.8%
	Total	2.10E-03	1.10E-04	94.8%
Load Allocation	Direct Drainage	2.04E-03	4.18E-05	97.9%
	Upstream Maryland	-	-	-
	Total	2.04E-03	4.18E-05	97.9%
Margin of Safety		-	Implicit	-
Total		4.14E-03	1.52E-04	96.3%

[9] Percent reductions are meant to be illustrative due uncertainty in baseline load, as discussed in Section 4.5.4.

Table A.4: Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), TMDL Scenario, Broad Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	3.90E-04	2.04E-05	94.8%
	Total	3.90E-04	2.04E-05	94.8%
Load Allocation	Direct Drainage	6.97E-05	3.55E-06	94.9%
	Upstream Maryland	-	-	-
	Total	6.97E-05	3.55E-06	94.9%
Margin of Safety		-	Implicit	-
Total		4.60E-04	2.40E-05	94.8%

Table A.5: Average Annual Chlordane Baseline Loads and TMDL Allocations (lbs/yr), Broad Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	6.54E-01	1.10E-03	99.8%
	Total	6.54E-01	1.10E-03	99.8%
Load Allocation	Direct Drainage	4.58E-02	4.18E-04	99.1%
	Upstream Maryland	-	-	-
	Total	4.58E-02	4.18E-04	99.1%
Margin of Safety		-	Implicit	-
Total		7.00E-01	1.52E-03	99.8%

Table A.6: Chlordane Maximum Average Daily Loads (lbs/d), TMDL Scenario, Broad Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	1.21E-01	2.04E-04	99.8%
	Total	1.21E-01	2.04E-04	99.8%
Load Allocation	Direct Drainage	9.02E-03	3.55E-05	99.6%
	Upstream Maryland	-	-	-
	Total	9.02E-03	3.55E-05	99.6%
Margin of Safety		-	Implicit	-
Total		1.30E-01	2.40E-04	99.8%

Table A.7: Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Dalecarlia Tributary

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	4.43E-03	4.43E-06	99.9%
	Total	4.43E-03	4.43E-06	99.9%
Load Allocation	Direct Drainage	2.23E-03	1.22E-06	99.9%
	Upstream Maryland	-	-	-
	Total	2.23E-03	1.22E-06	99.9%
Margin of Safety		-	Implicit	-
Total		6.66E-03	5.65E-06	99.9%

Table A.8: Dieldrin Maximum Average Daily Loads (lbs/d), TMDL Scenario, Dalecarlia Tributary

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	8.24E-04	8.24E-07	99.9%
	Total	8.24E-04	8.24E-07	99.9%
Load Allocation	Direct Drainage	7.90E-05	7.73E-08	99.9%
	Upstream Maryland	-	-	-
	Total	7.90E-05	7.73E-08	99.9%
Margin of Safety		-	Implicit	-
Total		9.03E-04	9.02E-07	99.9%

Table A.9: Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Dalecarlia Tributary

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	2.25E-03	1.18E-04	94.8%
	Total	2.25E-03	1.18E-04	94.8%
Load Allocation	Direct Drainage	1.70E-03	3.24E-05	98.1%
	Upstream Maryland	-	-	-
	Total	1.70E-03	3.24E-05	98.1%
Margin of Safety		-	Implicit	-
Total		3.95E-03	1.51E-04	96.2%

Table A.10: Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), TMDL Scenario, Dalecarlia Tributary

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	4.19E-04	2.20E-05	94.8%
	Total	4.19E-04	2.20E-05	94.8%
Load Allocation	Direct Drainage	4.11E-05	2.06E-06	95.0%
	Upstream Maryland	-	-	-
	Total	4.11E-05	2.06E-06	95.0%
Margin of Safety		-	Implicit	-
Total		4.60E-04	2.40E-05	94.8%

Table A.11: Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Dumbarton Oaks

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	7.91E-05	7.91E-08	99.9%
	Total	7.91E-05	7.91E-08	99.9%
Load Allocation	Direct Drainage	6.87E-04	5.20E-07	99.9%
	Upstream Maryland	-	-	-
	Total	6.87E-04	5.20E-07	99.9%
Margin of Safety		-	Implicit	-
Total		7.66E-04	5.99E-07	99.9%

Table A.12: Dieldrin Maximum Average Daily Loads (lbs/d), TMDL Scenario, Dumbarton Oaks

Allocation Category	Source	Baseline (lbs/ d)	TMDL (lbs/ d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	1.24E-05	1.24E-08	99.9%
	Total	1.24E-05	1.24E-08	99.9%
Load Allocation	Direct Drainage	8.08E-05	8.05E-08	99.9%
	Upstream Maryland	-	-	-
	Total	8.08E-05	8.05E-08	99.9%
Margin of Safety		-	Implicit	-
Total		9.31E-05	9.29E-08	99.9%

Table A.13: Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Dumbarton Oaks

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	4.02E-05	2.11E-06	94.8%
	Total	4.02E-05	2.11E-06	94.8%
Load Allocation	Direct Drainage	4.43E-04	1.39E-05	96.9%
	Upstream Maryland	-	-	-
	Total	4.43E-04	1.39E-05	96.9%
Margin of Safety		-	Implicit	-
Total		4.84E-04	1.60E-05	96.7%

Table A.14: Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), TMDL Scenario, Dumbarton Oaks

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	6.29E-06	3.30E-07	94.8%
	Total	6.29E-06	3.30E-07	94.8%
Load Allocation	Direct Drainage	4.12E-05	2.15E-06	94.8%
	Upstream Maryland	-	-	-
	Total	4.12E-05	2.15E-06	94.8%
Margin of Safety		-	Implicit	-
Total		4.75E-05	2.48E-06	94.8%

Table A.15: Average Annual Chlordane Baseline Loads and TMDL Allocations (lbs/yr), Dumbarton Oaks

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	1.25E-02	2.11E-05	99.8%
	Total	1.25E-02	2.11E-05	99.8%
Load Allocation	Direct Drainage	5.03E-02	1.39E-04	99.7%
	Upstream Maryland	-	-	-
	Total	5.03E-02	1.39E-04	99.7%
Margin of Safety		-	Implicit	-
Total		6.28E-02	1.60E-04	99.7%

Table A.16: Chlordane Maximum Average Daily Loads (lbs/d), TMDL Scenario, Dumbarton Oaks

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	1.96E-03	3.30E-06	99.8%
	Total	1.96E-03	3.30E-06	99.8%
Load Allocation	Direct Drainage	1.01E-02	2.15E-05	99.8%
	Upstream Maryland	-	-	-
	Total	1.01E-02	2.15E-05	99.8%
Margin of Safety		-	Implicit	-
Total		1.20E-02	2.48E-05	99.8%

Table A.17: Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Fenwick Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	7.00E-04	7.00E-07	99.9%
	Total	7.00E-04	7.00E-07	99.9%
Load Allocation	Direct Drainage	5.93E-04	3.73E-07	99.9%
	Upstream Maryland	2.64E-03	2.13E-06	99.9%
	Total	3.23E-03	2.51E-06	99.9%
Margin of Safety		-	Implicit	-
Total		3.93E-03	3.21E-06	99.9%

Table A.18: Dieldrin Maximum Average Daily Loads (lbs/d), TMDL Scenario, Fenwick Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	1.33E-04	1.33E-07	99.9%
	Total	1.33E-04	1.33E-07	99.9%
Load Allocation	Direct Drainage	4.00E-05	3.96E-08	99.9%
	Upstream Maryland	2.03E-04	2.03E-07	99.9%
	Total	2.43E-04	2.42E-07	99.9%
Margin of Safety		-	Implicit	-
Total		3.76E-04	3.75E-07	99.9%

Table A.19: Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Fenwick Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	3.56E-04	1.87E-05	94.8%
	Total	3.56E-04	1.87E-05	94.8%
Load Allocation	Direct Drainage	4.25E-04	9.94E-06	97.7%
	Upstream Maryland	1.62E-03	5.69E-05	96.5%
	Total	2.05E-03	6.69E-05	96.7%
Margin of Safety		-	Implicit	-
Total		2.41E-03	8.55E-05	96.4%

Table A.20: Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), TMDL Scenario, Fenwick Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	6.76E-05	3.55E-06	94.8%
	Total	6.76E-05	3.55E-06	94.8%
Load Allocation	Direct Drainage	2.05E-05	1.06E-06	94.9%
	Upstream Maryland	1.04E-04	5.40E-06	94.8%
	Total	1.24E-04	6.46E-06	94.8%
Margin of Safety		-	Implicit	-
Total		1.92E-04	1.00E-05	94.8%

Table A.21: Average Annual DDT Baseline Loads and TMDL Allocations (lbs/yr), Fenwick Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	5.71E-03	1.75E-05	99.7%
	Total	5.71E-03	1.75E-05	99.7%
Load Allocation	Direct Drainage	1.20E-03	9.32E-06	99.2%
	Upstream Maryland	1.38E-02	5.34E-05	99.6%
	Total	1.50E-02	6.27E-05	99.6%
Margin of Safety		-	Implicit	-
Total		2.07E-02	8.02E-05	99.6%

Table A.22: DDT Maximum Average Daily Loads (lbs/d), TMDL Scenario, Fenwick Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	1.09E-03	3.32E-06	99.7%
	Total	1.09E-03	3.32E-06	99.7%
Load Allocation	Direct Drainage	2.37E-04	9.90E-07	99.6%
	Upstream Maryland	1.65E-03	5.06E-06	99.7%
	Total	1.89E-03	6.05E-06	99.7%
Margin of Safety		-	Implicit	-
Total		2.97E-03	9.38E-06	99.7%

Table A.23: Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Klingle Valley Creek

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	5.86E-04	5.86E-07	99.9%
	Total	5.86E-04	5.86E-07	99.9%
Load Allocation	Direct Drainage	4.62E-04	2.89E-07	99.9%
	Upstream Maryland	-	-	-
	Total	4.62E-04	2.89E-07	99.9%
Margin of Safety		-	Implicit	-
Total		1.05E-03	8.75E-07	99.9%

Table A.24: Dieldrin Maximum Average Daily Loads (lbs/d), TMDL Scenario, Klingle Valley Creek

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	1.04E-04	1.04E-07	99.9%
	Total	1.04E-04	1.04E-07	99.9%
Load Allocation	Direct Drainage	3.16E-05	3.13E-08	99.9%
	Upstream Maryland	-	-	-
	Total	3.16E-05	3.13E-08	99.9%
Margin of Safety		-	Implicit	-
Total		1.36E-04	1.36E-07	99.9%

Table A.25: Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Klingle Valley Creek

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	2.98E-04	1.56E-05	94.8%
	Total	2.98E-04	1.56E-05	94.8%
Load Allocation	Direct Drainage	3.32E-04	7.70E-06	97.7%
	Upstream Maryland	-	-	-
	Total	3.32E-04	7.70E-06	97.7%
Margin of Safety		-	Implicit	-
Total		6.30E-04	2.33E-05	96.3%

Table A.26: Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), TMDL Scenario, Klingle Valley Creek

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	5.30E-05	2.78E-06	94.8%
	Total	5.30E-05	2.78E-06	94.8%
Load Allocation	Direct Drainage	1.62E-05	8.35E-07	94.9%
	Upstream Maryland	-	-	-
	Total	1.62E-05	8.35E-07	94.9%
Margin of Safety		-	Implicit	-
Total		6.92E-05	3.61E-06	94.8%

Table A.27: Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Luzon Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	3.16E-03	3.16E-06	99.9%
	Total	3.16E-03	3.16E-06	99.9%
Load Allocation	Direct Drainage	1.06E-03	5.72E-07	99.9%
	Upstream Maryland	-	-	-
	Total	1.06E-03	5.72E-07	99.9%
Margin of Safety		-	Implicit	-
Total		4.22E-03	3.73E-06	99.9%

Table A.28: Dieldrin Maximum Average Daily Loads (lbs/d), TMDL Scenario, Luzon Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	5.51E-04	5.51E-07	99.9%
	Total	5.51E-04	5.51E-07	99.9%
Load Allocation	Direct Drainage	3.49E-05	3.41E-08	99.9%
	Upstream Maryland	-	-	-
	Total	3.49E-05	3.41E-08	99.9%
Margin of Safety		-	Implicit	-
Total		5.86E-04	5.85E-07	99.9%

Table A.29: Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Luzon Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	1.61E-03	8.43E-05	94.8%
	Total	1.61E-03	8.43E-05	94.8%
Load Allocation	Direct Drainage	8.10E-04	1.53E-05	98.1%
	Upstream Maryland	-	-	-
	Total	8.10E-04	1.53E-05	98.1%
Margin of Safety		-	Implicit	-
Total		2.42E-03	9.95E-05	95.9%

Table A.30: Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), TMDL Scenario, Luzon Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	2.80E-04	1.47E-05	94.8%
	Total	2.80E-04	1.47E-05	94.8%
Load Allocation	Direct Drainage	1.82E-05	9.09E-07	95.0%
	Upstream Maryland	-	-	-
	Total	1.82E-05	9.09E-07	95.0%
Margin of Safety		-	Implicit	-
Total		2.98E-04	1.56E-05	94.8%

Table A.31: Average Annual Chlordane Baseline Loads and TMDL Allocations (lbs/yr), Luzon Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	5.00E-01	8.43E-04	99.8%
	Total	5.00E-01	8.43E-04	99.8%
Load Allocation	Direct Drainage	1.40E-02	1.53E-04	98.9%
	Upstream Maryland	-	-	-
	Total	1.40E-02	1.53E-04	98.9%
Margin of Safety		-	Implicit	-
Total		5.14E-01	9.95E-04	99.8%

Table A.32: Chlordane Maximum Average Daily Loads (lbs/d), TMDL Scenario, Luzon Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	8.72E-02	1.47E-04	99.8%
	Total	8.72E-02	1.47E-04	99.8%
Load Allocation	Direct Drainage	3.19E-03	9.09E-06	99.7%
	Upstream Maryland	-	-	-
	Total	3.19E-03	9.09E-06	99.7%
Margin of Safety		-	Implicit	-
Total		9.04E-02	1.56E-04	99.8%

Table A.33: Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Melvin Hazen Valley Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	4.87E-04	4.87E-07	99.9%
	Total	4.87E-04	4.87E-07	99.9%
Load Allocation	Direct Drainage	5.33E-04	3.35E-07	99.9%
	Upstream Maryland	-	-	-
	Total	5.33E-04	3.35E-07	99.9%
Margin of Safety		-	Implicit	-
Total		1.02E-03	8.22E-07	99.9%

Table A.34: Dieldrin Maximum Average Daily Loads (lbs/d), TMDL Scenario, Melvin Hazen Valley Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	9.10E-05	9.10E-08	99.9%
	Total	9.10E-05	9.10E-08	99.9%
Load Allocation	Direct Drainage	3.65E-05	3.62E-08	99.9%
	Upstream Maryland	-	-	-
	Total	3.65E-05	3.62E-08	99.9%
Margin of Safety		-	Implicit	-
Total		1.27E-04	1.27E-07	99.9%

Table A.35: Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Normanstone Creek

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	7.76E-04	7.76E-07	99.9%
	Total	7.76E-04	7.76E-07	99.9%
Load Allocation	Direct Drainage	5.33E-04	3.16E-07	99.9%
	Upstream Maryland	-	-	-
	Total	5.33E-04	3.16E-07	99.9%
Margin of Safety		-	Implicit	-
Total		1.31E-03	1.09E-06	99.9%

Table A.36: Dieldrin Maximum Average Daily Loads (lbs/d), TMDL Scenario, Normanstone Creek

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	1.42E-04	1.42E-07	99.9%
	Total	1.42E-04	1.42E-07	99.9%
Load Allocation	Direct Drainage	2.98E-05	2.94E-08	99.9%
	Upstream Maryland	-	-	-
	Total	2.98E-05	2.94E-08	99.9%
Margin of Safety		-	Implicit	-
Total		1.72E-04	1.72E-07	99.9%

Table A.37: Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Normanstone Creek

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	3.94E-04	2.07E-05	94.8%
	Total	3.94E-04	2.07E-05	94.8%
Load Allocation	Direct Drainage	3.93E-04	8.43E-06	97.9%
	Upstream Maryland	-	-	-
	Total	3.93E-04	8.43E-06	97.9%
Margin of Safety		-	Implicit	-
Total		7.87E-04	2.91E-05	96.3%

Table A.38: Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), TMDL Scenario, Normanstone Creek

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	7.24E-05	3.80E-06	94.8%
	Total	7.24E-05	3.80E-06	94.8%
Load Allocation	Direct Drainage	1.53E-05	7.85E-07	94.9%
	Upstream Maryland	-	-	-
	Total	1.53E-05	7.85E-07	94.9%
Margin of Safety		-	Implicit	-
Total		8.77E-05	4.58E-06	94.8%

Table A.39: Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Oxon Run

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	1.94E-03	1.94E-06	99.9%
	Total	1.94E-03	1.94E-06	99.9%
Load Allocation	Direct Drainage	1.14E-03	6.30E-07	99.9%
	Upstream Maryland	9.07E-03	7.11E-06	-
	Total	1.02E-02	7.74E-06	99.9%
Margin of Safety		-	Implicit	-
Total		1.21E-02	9.68E-06	99.9%

Table A.40: Dieldrin Maximum Average Daily Loads (lbs/d), TMDL Scenario, Oxon Run

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	3.46E-04	3.46E-07	99.9%
	Total	3.46E-04	3.46E-07	99.9%
Load Allocation	Direct Drainage	4.67E-05	4.59E-08	99.9%
	Upstream Maryland	8.78E-04	8.66E-07	
	Total	9.25E-04	9.12E-07	99.9%
Margin of Safety		-	Implicit	-
Total		1.27E-03	1.26E-06	99.9%

Table A.41: Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Pinehurst Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	1.05E-03	1.05E-06	99.9%
	Total	1.05E-03	1.05E-06	99.9%
Load Allocation	Direct Drainage	1.42E-03	8.54E-07	99.9%
	Upstream Maryland	1.38E-03	1.05E-06	99.9%
	Total	2.80E-03	1.90E-06	99.9%
Margin of Safety		-	Implicit	-
Total		3.85E-03	2.95E-06	99.9%

Table A.42: Dieldrin Maximum Average Daily Loads (lbs/d), TMDL Scenario, Pinehurst Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	2.05E-04	2.05E-07	99.9%
	Total	2.05E-04	2.05E-07	99.9%
Load Allocation	Direct Drainage	9.27E-05	9.18E-08	99.9%
	Upstream Maryland	8.76E-05	8.70E-08	99.9%
	Total	1.80E-04	1.79E-07	99.9%
Margin of Safety		-	Implicit	-
Total		3.85E-04	3.83E-07	99.9%

Table A.43: Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Pinehurst Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	5.36E-04	2.81E-05	94.8%
	Total	5.36E-04	2.81E-05	94.8%
Load Allocation	Direct Drainage	1.04E-03	2.28E-05	97.8%
	Upstream Maryland	8.86E-04	2.79E-05	96.9%
	Total	1.93E-03	5.07E-05	97.4%
Margin of Safety		-	Implicit	-
Total		2.46E-03	7.88E-05	96.8%

Table A.44: Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), TMDL Scenario, Pinehurst Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	1.04E-04	5.45E-06	94.8%
	Total	1.04E-04	5.45E-06	94.8%
Load Allocation	Direct Drainage	4.76E-05	2.45E-06	94.9%
	Upstream Maryland	4.48E-05	2.32E-06	94.8%
	Total	9.25E-05	4.77E-06	94.8%
Margin of Safety		-	Implicit	-
Total		1.96E-04	1.02E-05	94.8%

Table 4.45: Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Piney Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	1.89E-04	1.89E-07	99.9%
	District Combined Sewer System	4.01E-04	1.57E-08	100.0%
	Total	5.90E-04	2.05E-07	99.9%
Load Allocation	Direct Drainage	3.57E-04	2.17E-07	99.9%
	Upstream Maryland	-	-	-
	Total	3.57E-04	2.17E-07	99.9%
Margin of Safety		-	Implicit	-
Total		9.48E-04	4.22E-07	100.0%

Table 4.46: Dieldrin Maximum Average Daily Loads (lbs/d), TMDL Scenario, Piney Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	3.36E-05	3.36E-08	99.9%
	District Combined Sewer System	1.57E-04	3.93E-08	100.0%
	Total	1.91E-04	7.29E-08	99.9%
Load Allocation	Direct Drainage	2.65E-05	2.63E-08	99.9%
	Upstream Maryland	-	-	-
	Total	2.65E-05	2.63E-08	99.9%
Margin of Safety		-	Implicit	-
Total		2.17E-04	9.91E-08	100.0%

Table A.47: Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Piney Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	9.61E-05	5.04E-06	94.8%
	District Combined Sewer System	2.04E-04	4.19E-07	99.8%
	Total	3.00E-04	5.46E-06	94.8%
Load Allocation	Direct Drainage	2.60E-04	5.79E-06	97.8%
	Upstream Maryland	-	-	-
	Total	2.60E-04	5.79E-06	97.8%
Margin of Safety		-	Implicit	-
Total		5.60E-04	1.13E-05	98.0%

Table A.48: Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), TMDL Scenario, Piney Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	1.71E-05	8.96E-07	94.8%
	District Combined Sewer System	7.98E-05	1.05E-06	98.7%
	Total	9.69E-05	1.94E-06	94.8%
Load Allocation	Direct Drainage	1.36E-05	7.00E-07	94.8%
	Upstream Maryland	-	-	-
	Total	1.36E-05	7.00E-07	94.8%
Margin of Safety		-	Implicit	-
Total		1.11E-04	2.64E-06	97.6%

Table A.49: Average Annual Chlordane Baseline Loads and TMDL Allocations (lbs/yr), Piney Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	2.99E-02	5.04E-05	99.8%
	District Combined Sewer System	6.35E-02	4.19E-06	100.0%
	Total	9.35E-02	5.46E-05	99.8%
Load Allocation	Direct Drainage	5.25E-03	5.79E-05	98.9%
	Upstream Maryland	-	-	-
	Total	5.25E-03	5.79E-05	98.9%
Margin of Safety		-	Implicit	-
Total		9.87E-02	1.13E-04	99.9%

Table A.50: Chlordane Maximum Daily Loads (lbs/d), TMDL Scenario, Piney Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	5.32E-03	8.96E-06	99.8%
	District Combined Sewer System	2.49E-02	1.05E-05	100.0%
	Total	3.02E-02	1.94E-05	99.8%
Load Allocation	Direct Drainage	1.11E-03	7.00E-06	99.4%
	Upstream Maryland	-	-	-
	Total	1.11E-03	7.00E-06	99.4%
Margin of Safety		-	Implicit	-
Total		3.13E-02	2.64E-05	99.9%

Table A.51: Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Portal Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	2.65E-04	2.65E-07	99.9%
	Total	2.65E-04	2.65E-07	99.9%
Load Allocation	Direct Drainage	1.51E-04	7.88E-08	99.9%
	Upstream Maryland	9.76E-04	8.72E-07	99.9%
	Total	1.13E-03	9.51E-07	99.9%
Margin of Safety		-	Implicit	-
Total		1.39E-03	1.22E-06	99.9%

Table A.52: Dieldrin Maximum Average Daily Loads (lbs/d), TMDL Scenario, Portal Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	5.11E-05	5.11E-08	99.9%
	Total	5.11E-05	5.11E-08	99.9%
Load Allocation	Direct Drainage	4.46E-06	4.34E-09	99.9%
	Upstream Maryland	9.79E-05	9.77E-08	99.9%
	Total	1.02E-04	1.02E-07	99.9%
Margin of Safety		-	Implicit	-
Total		1.53E-04	1.53E-07	99.9%

Table A.53: Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Portal Branch

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	1.35E-04	7.06E-06	94.8%
	Total	1.35E-04	7.06E-06	94.8%
Load Allocation	Direct Drainage	1.17E-04	2.10E-06	98.2%
	Upstream Maryland	5.54E-04	2.33E-05	95.8%
	Total	6.71E-04	2.54E-05	96.2%
Margin of Safety		-	Implicit	-
Total		8.06E-04	3.24E-05	96.0%

Table A.54: Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), TMDL Scenario, Portal Branch

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	2.60E-05	1.36E-06	94.8%
	Total	2.60E-05	1.36E-06	94.8%
Load Allocation	Direct Drainage	2.33E-06	1.16E-07	95.0%
	Upstream Maryland	4.99E-05	2.61E-06	94.8%
	Total	5.22E-05	2.72E-06	94.8%
Margin of Safety		-	Implicit	-
Total		7.82E-05	4.09E-06	94.8%

Table A.55: Average Annual Dieldrin Baseline Loads and TMDL Allocations (lbs/yr), Soapstone Creek

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	2.15E-03	2.15E-06	99.9%
	Total	2.15E-03	2.15E-06	99.9%
Load Allocation	Direct Drainage	1.14E-03	7.05E-07	99.9%
	Upstream Maryland	-	-	-
	Total	1.14E-03	7.05E-07	99.9%
Margin of Safety		-	Implicit	-
Total		3.29E-03	2.85E-06	99.9%

Table A.56: Dieldrin Maximum Average Daily Loads (lbs/d), TMDL Scenario, Soapstone Creek

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	3.80E-04	3.80E-07	99.9%
	Total	3.80E-04	3.80E-07	99.9%
Load Allocation	Direct Drainage	6.76E-05	6.69E-08	99.9%
	Upstream Maryland	-	-	-
	Total	6.76E-05	6.69E-08	99.9%
Margin of Safety		-	Implicit	-
Total		4.47E-04	4.46E-07	99.9%

Table A.57: Average Annual Heptachlor Epoxide Baseline Loads and TMDL Allocations (lbs/yr), Soapstone Creek

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	1.09E-03	5.73E-05	94.8%
	Total	1.09E-03	5.73E-05	94.8%
Load Allocation	Direct Drainage	8.22E-04	1.88E-05	97.7%
	Upstream Maryland	-	-	-
	Total	8.22E-04	1.88E-05	97.7%
Margin of Safety		-	Implicit	-
Total		1.91E-03	7.61E-05	96.0%

Table A.58: Heptachlor Epoxide Maximum Average Daily Loads (lbs/d), TMDL Scenario, Soapstone Creek

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	1.93E-04	1.01E-05	94.8%
	Total	1.93E-04	1.01E-05	94.8%
Load Allocation	Direct Drainage	3.48E-05	1.78E-06	94.9%
	Upstream Maryland	-	-	-
	Total	3.48E-05	1.78E-06	94.9%
Margin of Safety		-	Implicit	-
Total		2.28E-04	1.19E-05	94.8%

Table A.59: Average Annual Chlordane Baseline Loads and TMDL Allocations (lbs/yr), Soapstone Creek

Allocation Category	Source	Baseline (lbs/yr)	TMDL (lbs/yr)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	3.40E-01	5.73E-04	99.8%
	Total	3.40E-01	5.73E-04	99.8%
Load Allocation	Direct Drainage	3.92E-02	1.88E-04	99.5%
	Upstream Maryland	-	-	-
	Total	3.92E-02	1.88E-04	99.5%
Margin of Safety		-	Implicit	-
Total		3.79E-01	7.61E-04	99.8%

Table A.60: Chlordane Maximum Average Daily Loads (lbs/d), TMDL Scenario, Soapstone Creek

Allocation Category	Source	Baseline (lbs/d)	TMDL (lbs/d)	Percent Reduction[9]
Wasteload Allocation	District Regulated Stormwater	6.01E-02	1.01E-04	99.8%
	Total	6.01E-02	1.01E-04	99.8%
Load Allocation	Direct Drainage	7.23E-03	1.78E-05	99.8%
	Upstream Maryland	-	-	-
	Total	7.23E-03	1.78E-05	99.8%
Margin of Safety		-	Implicit	-
Total		6.73E-02	1.19E-04	99.8%