UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Amended
Decision Rationale
Total Maximum Daily Loads
Anacostia River Watershed
For Organics and Metals

Approved

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Date: *September 29, 2003*

Amended

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Date: *October 16, 2003*

Decision Rationale
Amended October 16, 2003
Total Maximum Daily Loads
Anacostia River Watershed
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Executive Summary

I. Introduction

The Clean Water Act requires that Total Maximum Daily Loads (TMDLs) be developed for those water bodies that will not attain water quality standards after application of technology-based and other required controls. A TMDL sets the quantity of a pollutant that may be introduced into a waterbody without exceeding the applicable water quality standard. EPA's regulations define a TMDL as the sum of the wasteload allocations (WLAs) assigned to point sources, the load allocations (LAs) assigned to nonpoint sources and natural background, and a margin of safety (MOS). The TMDL is commonly expressed as:

$$TMDL = WLAs + LAs + MOS$$

This document sets forth the United States Environmental Protection Agency's (EPA) rationale for approving the TMDLs for organics and metals in the tidal Anacostia River and its tributaries. The following TMDL Summary table is discussed in Section V.2. of the Decision Rationale.

II. Background

The Anacostia River Watershed covers 176 square miles in the District of Columbia and Maryland. The Basin is highly urbanized, with a population of 804,500 and a population density of 4,570 per square mile in 1990[1]. Only 25 percent of the watershed is forested and another three percent is wetlands. The Anacostia River is formed by the confluence of the Northeast Branch and the Northwest Branch at Bladensburg, MD.

The length of the tidal portion of the Anacostia River is 8.4 miles. The average tidal variation in water surface elevation is 2.9 feet all along the tidal river. The average depth at Bladensburg is six feet, while the average depth at the Anacostia's confluence with the Potomac River is 20 feet. The average width of the river increases from 375 feet at Bladensburg to 1,300 feet at the mouth. Only 17 percent of the watershed lies within the District; much of this

[1]Warner, A., D. Shepp, K. Corish, and J. Galli, 1997, *An Existing Source Assessment of Pollutants to the Anacostia Watershed.* Metropolitan Washington Council of Governments, Washington, DC.

drainage is controlled by storm sewers or combined (storm and sanitary) sewers. Combined sewer overflows (CSOs) are a contributor of metals and potential contributor of organics to the tidal portion of the river. CSOs drain approximately 11 square miles of the Basin in the District of Columbia, and 17 CSO outfalls drain directly into the tidal Anacostia River.

As the Anacostia River watershed is heavily urbanized, it can be expected to have the water quality problems associated with urban streams. The District is also a signatory to the Chesapeake Bay Agreement, pledging to reduce nutrient loads to the Bay by 40 percent or more by the year 2010. While not specifically addressing these specific organics and metals, the agreement's *Priority Urban Waters* section does call for reducing pollution loads to the Anacostia River in order to eliminate public health concerns.

III. History and use of the Tidal Anacostia Model/Water Quality Simulation Program (TAM/WASP)

The TAM/WASP model simulates the physical, chemical, and biological processes in the river which are believed to have the most significant impact on these organics and metals. TAM/WASP is composed of three sub-models: (1) a hydrodynamic sub-model, which consists of the hydrodynamic portion of TAM, (2) a sediment exchange sub-model, and (3) a water quality sub-model, which consists of a modified version of the WASP5 EUTRO eutrophication model. The hydrodynamic sub-model is used to simulate water flow velocity and depth, which govern the transport of constituents in the water column. The sediment exchange sub-model is used to simulate sediment/water column exchange processes related to sediment flux.

ICPRB[2] constructed a simple mass balance model to estimate tributary organic and metal loads. The model treats each tributary as a "bathtub" where the daily base flow and storm water loads are reduced until instream water quality standards are met.

Additionally, a variety of methods are used to simulate daily input flows and loads, including use of a HSPF[3] model for the Watts Branch sub-watershed.

Tables containing the TMDLs, WLAs, and LAs are in Appendix A of this decision rationale.

IV. Discussions of Regulatory Requirements

EPA has determined that these TMDLs are consistent with statutory and regulatory requirements and EPA policy and guidance. Based on this review, EPA determined that the following eight regulatory requirements have been met:

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[2]Interstate Commission on the Potomac River Basin

[3]Hydrologic Simulation Program - Fortran

1. The TMDLs are designed to implement the applicable water quality standards,
2. The TMDLs include a total allowable load as well as individual waste load allocations and load allocations,
3. The TMDLs consider the impacts of background pollutant contributions,
4. The TMDLs consider critical environmental conditions,
5. The TMDLs consider seasonal environmental variations,
6. The TMDLs include a margin of safety,
7. There is reasonable assurance that the proposed TMDLs can be met, and
8. The TMDLs have been subject to public participation.

Decision Rationale
Amended October 16, 2003
District of Columbia
Total Maximum Daily Loads
Anacostia River Watershed
For Organics and Metals

I. Introduction

The Clean Water Act (CWA) requires that Total Maximum Daily Loads (TMDLs) be developed for those water bodies that will not attain water quality standards after application of technology-based and other required controls. A TMDL sets the quantity of a pollutant that may be introduced into a waterbody without exceeding the applicable water quality standard. EPA's regulations define a TMDL as the sum of the wasteload allocations (WLAs) assigned to point sources, the load allocations (LAs) assigned to nonpoint sources and natural background, and a margin of safety.

This document sets forth the United States Environmental Protection Agency's (EPA) rationale for approving the TMDLs for organics and metals in the tidal mainstem Anacostia River and its tributaries. These TMDLs were established to address impairment of water quality as identified in the District of Columbia's (DC) 1998 Section 303(d) list of impaired waters. The DC Department of Health, Environmental Health Administration, Bureau of Environmental Quality, Water Quality Divistion, submitted the *Total Maximum Daily Loads, for Organics and Metals in the Anacostia River, Fort Chaplin Tributary, Fort Davis Tributary, Fort Dupont Creek, Fort Stanton Tributary, Hickey Run, Nash Run, Popes Branch, Texas Avenue Tributary, and Watts Branch District of Columbia,* dated August 2003 (TMDL Report), to EPA for final review which was received by EPA on August 18, 2003. The TMDL Report uses as its technical basis *TAM/WASP Toxics Screening Level Model of the Anacostia River, Final Draft,* dated April 2003[4] and *District of Columbia Small Tributaries Total Maximum Daily Load Model*[5] Draft Report, dated July 2003, as appendices to the TMDL Report.

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[4]The *Final Draft* report became final without changes.

[5]*District of Columbia Small Tributaries Total Maximum Daily Load Model* Draft Report, Interstate Commission on the Potomac River Basin (ICPRB), June 2003.

Based on this review, EPA determined that the following eight regulatory requirements have been met:

1. The TMDLs are designed to implement the applicable water quality standards,

2. The TMDLs include a total allowable load as well as individual waste load allocations and load allocations,
3. The TMDLs consider the impacts of background pollutant contributions,
4. The TMDLs consider critical environmental conditions,
5. The TMDLs consider seasonal environmental variations,
6. The TMDLs include a margin of safety,
7. There is reasonable assurance that the proposed TMDLs can be met, and
8. The TMDLs have been subject to public participation.

II. Summary

Table 1 presents the 1998 Section 303(d) listing information for the water quality-limited waters of the Anacostia River and tributaries in effect at the time the consent decree was filed.

Table 1 - Section 303(d) Listing Information

1998 Section 303(d) list					
Segment No.	Waterbody	Pollutants of Concern	Priority	Ranking	Action Needed
1.	Lower Anacostia (below Pennsylvania Ave Bridge)	BOD, bacteria, organics, metals, total suspended solids, and oil & grease	High	1	Control CSO, Point and Nonpoint Source (NPS) pollution
2.	Upper Anacostia (above Pennsylvania Ave Bridge)	BOD, bacteria, organics, metals, total suspended solids, and oil & grease	High	2	Control CSO, Point and Nonpoint Source (NPS) pollution
3.	Hickey Run	Organics, bacteria, oil & grease	High	3	Control NPS pollution
4.	Upper Watts Branch (above tidal boundary)	Organics, bacteria, and total suspended soilids	High	4	Control Upstream, Point, and NPS pollution
5.	Lower Watts Branch (below tidal boundary)	Organics, bacteria, and solids	High	5	Control NPS pollution
7.	Fort Dupont Creek	Bacteria and metals	High	7	Control NPS pollution
8.	Fort Chaplin	Metals and bacteria	High	8	Control NPS pollution
9.	Fort Davis Tributary	BOD, metals and bacteria	Medium	9	Control NPS
10.	Fort Stanton Tributary	Organics, metals and bacteria	Medium	10	Control NPS pollution
11.	Nash Run	Organics, metals and bacteria	Medium	11	Control NPS pollution
13.	Popes Branch (Hawes Run)	Organics, metals and bacteria	Medium	13	Control NPS pollution
14.	Texas Ave. Tributary	Organics, metals and bacteria	Medium	14	Control NPS pollution

Maryland's 1998 Section 303(d) list of impaired waters included the Anacostia River for nutrients, as included in the Chesapeake Bay Tributary Strategies, and suspended sediment attributed to nonpoint sources and natural conditions. Maryland's 2002 Section 303(d) list of impaired waters adds bacteria, biological, polychlorinated biphenyls (PCBs), and heptachlor epoxide as impairing substances to the Anacostia River.

The TMDL is a written plan and analysis established to ensure that a waterbody will attain and maintain water quality standards. The TMDL is a scientifically-based strategy which considers current and foreseeable conditions, the best available data, and accounts for uncertainty with the inclusion of a margin of safety value. TMDLs may be revised in order to address new water quality data, better understanding of natural processes, refined modeling assumptions or analysis and/or reallocation.

III. Background

Anacostia River Watershed

The Anacostia River Watershed covers 176 square miles in the District of Columbia and Maryland.[6] The watershed lies in two physiographic provinces, the Atlantic Coastal Plain and the Piedmont. The division between the provinces lies roughly along the boundary between Prince George County and Montgomery County, both located in Maryland. The Basin is highly urbanized, with a population of 804,500 and a population density of 4,570 per square mile in 1990[7]. Only 25 percent of the watershed is forested and another three percent is wetlands. The Anacostia River is formed by the confluence of two branches, the Northeast Branch and the Northwest Branch at Bladensburg, MD. For all practical purposes the tidal portion of the Anacostia River can be considered to begin at their confluence, although the Northeast and Northwest Branches are tidally-influenced up to the location of the United States Geological Survey (USGS) gages on each branch: Station 01649500 at Riverdale Road on the Northeast Branch and Station 01651000 at Queens Chapel Road on the Northwest Branch.

The length of the tidal portion of the Anacostia River is 8.4 miles. The average tidal variation in water surface elevation is 2.9 feet all along the tidal river. The average depth at Bladensburg is six feet, while the average depth at the Anacostia's confluence with the Potomac River is 20 feet. The average width of the river increases from 375 feet at Bladensburg to 1,300 feet at the mouth. Average discharge to the tidal river from the Northeast and Northwest Branches is 133 cubic feet per second (cfs). Under average flow conditions, the mean volume of

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[6]Much of the background information is taken from *The TAM/WASP Model: A Modeling Framework for the Total Maximum Daily Load Allocation in the Tidal Anacostia River Final Report*, ICPRB, October 6, 2000.

[7]Warner, A., D. Shepp, K. Corish, and J. Galli, *An Existing Source Assessment of Pollutants to the Anacostia Watershed.* Metropolitan Washington Council of Governments (MWCOG), Washington, DC., 1997.

the tidal river is approximately 415 million cubic feet. Detention time in the tidal Anacostia under average conditions is thus over 36 days and longer detention times can be expected under low-flow conditions in summer months.

Just over 25 percent of the Anacostia Basin drains into the tidal river below the confluence of the Northwest and Northeast Branches. Much of this drainage is controlled by storm sewers or combined (storm and sanitary) sewers. The two largest tributaries are Lower Beaverdam Creek (15.7 sq. mi.), and the Watts Branch (3.8 sq. mi.). Table 3 shows the breakdown of land uses in the drainage areas of the Northwest Branch, the Northeast Branch, Lower Beaverdam Creek, and the Watts Branch.

As Table 3 shows, the Anacostia River Watershed is heavily urbanized and can be expected to have the water quality problems associated with urban streams. The District has several programs in place to control the effects of storm water runoff and promote nonpoint source pollution prevention and control. Because nonpoint source pollution problems are best addressed on a watershed-wide basis, the District also has joined with the State of Maryland, Prince George's and Montgomery Counties, the Army Corps of Engineers, and other federal agencies to form the Anacostia Watershed Restoration Committee, whose goal is to coordinate efforts to improve water quality in the Anacostia Watershed. The District is also a signatory to the Chesapeake Bay Agreement, pledging to reduce nutrient loads to the Bay by 40 percent by the year 2010. While not specifically addressing organics and metals, the agreement's *Priority Urban Waters* section does call for reducing pollutant loads to the Anacostia River in order to eliminate public health concerns.

Table 2 - Landuse in the Anacostia River Basin (acres)

Watershed	Residential	Commercial	Industrial	Parks	Forest	Agriculture	Other
NW Branch	14,044	1,437	117	2,155	6,592	2,428	1,908
NE Branch	16,086	2,333	1,391	1,393	14,445	4,978	5,897
Lower Beaverdam Creek	4,374	314	314	314	2,296	429	364
Watts Branch	1,691	116	23	190	289	0	96

(ICPRB, 2000)

In the tidal portion of the river, combined sewer overflows (CSOs) are a contributor of various metals to the river and are assumed to contribute various organics to the river.[8] CSOs drain approximately 11 square miles of in the District of Columbia with 17 CSO outfalls

[8]Although sampling for the LTCP was performed, analytical methods' detection levels were not low enough to quantify the organics concentration. (ICPRB, 2003)

draining directly into the tidal Anacostia River. The two largest CSO outfalls are the Northeast Boundary CSO, which drains into the Anacostia near RFK Stadium (East Capital Street), and the "O" Street Pump Station, just below the Navy Yard.

The management of CSOs is the responsibility of the Washington Water and Sewer Authority (WASA), an independent agency of the District of Columbia which is responsible for the District's combined sanitary and storm sewers, sanitary sewers, and the waste water treatment plant at Blue Plains. WASA developed a Long-Term Control Plan (LTCP) for the District's CSOs, dated July 2002, and submitted it to EPA for review. The LTCP does not address organics or metals. WASA's recommended LTCP consolidates CSOs and limits discharges to an annual average of two discharges per year during the representative three years of modeling described in the LTCP (page 11-36).

Anacostia River Tributaries

The watersheds of the Anacostia River tributaries are, with the exception of Watts Branch and Nash Run, within the city limits. While some tributaries are flanked by parks, the watersheds are highly urban. Characterization of the tributaries' watersheds takes into consideration both the topographic drainage and the storm water drainage which, in some cases, cover areas outside the topographic drainage. The drainage areas used in these TMDLs are the areas upstream of the last conduit before entering the Anacostia River as estimated by ICPRB.

Fort Chaplin

Fort Chaplin Tributary originates from a 6.5 ft. storm discharge near Burns Street and Texas Avenue SE and parallels Burns Street for approximately 0.57 miles until draining into a pipe at C Street which connects with the East Capitol Street storm drain. The mouth of Fort Chaplin is a 21 ft. by 7.5 ft. storm drain which discharges into the Anacostia just south of the eastern foot of the East Capitol Street Bridge. Fort Chaplin's watershed is about 204 acres.[9] About 90 percent of the watershed is residential and 10 percent is parkland, most of the stream is buffered by 200 feet of forest on each side. Most of the drainage area has storm sewers.

Fort Davis

Fort Davis is a first order eastern tributary of the Anacostia River. The stream is now conducted by storm drains from Pennsylvania and Carpenter Street SE to a confluent discharge of several storm drains about 2,000 ft. upstream of the Sousa Bridge. The entire watershed is 72 acres but about 15 percent of its watershed is drained away independently of the stream by storm drains. Approximately half of the watershed is forested National Parkland with the other half is residential and includes an elementary school.

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[9]The tributaries' areas were measured by ICPRB and often include sewersheds extending beyond the topographic drainage area.

Fort Dupont

The stream's watershed is 474 acres of which approximately 90 percent falls within Fort Dupont Park. Much of the stream is buffered on both sides throughout its length by forested parkland before entering a box culvert before discharging to the Anacostia River. Several portions of the lower stream mainstem have narrow riparian buffer zones, encroached upon by the remnant greens. The primary headwater stream receives impervious runoff from the adjacent neighborhood outside of the park.

Fort Stanton

Fort Stanton's Watershed is 125 acres. Roughly half of the watershed is National Park Service parkland with the remaining land residential and commercial property. Most of the drainage area has storm sewers and the stream enters a 5-foot diameter pipe at Good Hope Road.

Hickey Run

Hickey Run is a western tributary of the Anacostia, which discharges into the river just north of Kingman Lake, near the southern border of the National Arboretum. The mouth of the stream is a broad, tidally influenced area. The headwaters of Hickey Run daylights near Queen Chapel Road and Lawrence and enters a square culvert for approximately 3000 feet to daylight again from an 11-foot by 11-foot culvert below the historic brick kilns at New York Avenue NE. The watershed is 1081 acres and about 20 percent of the watershed is forest or managed parkland administered by the National Arboretum, U.S. Department of the Interior. The remainder upper reaches of the watershed is residential, commercial and industrial, including easements for the railroad, as well as a large bus parking and maintenance yard.

Nash Run

Nash Run is one of the few tributaries which discharges via an open channel. Nash Run discharges to Kenilworth Aquatic Gardens. The drainage area is 465 acres, with approximately 62 percent of the watershed in the District of Columbia. The remainder of the watershed is in Deanwood Park, Prince George's County, Maryland. All but five percent of the watershed is urban residential and commercial property drained by storm drains some of which originate in Maryland.

Popes Branch

The Popes Branch Watershed is 232 acres and includes Popes Branch Park, a forested section 1.4 miles long and about 400 feet wide, and all of Fort Davis. The watershed is approximately 15 percent forested parkland; the remaining 85 percent is residential and light commercial property. The whole drainage area has storm sewers with very little overland flow to the stream. The stream enters a 7-foot by 6-foot culvert before discharging to the Anacostia River.

Texas Avenue Tributary

The Texas Avenue Tributary is a small first order stream segment remotely connected to the Anacostia River by a network of storm water pipes. The watershed of Texas Avenue Tributary measures 176 acres and is about 40 percent forested parkland and 60 percent residential and light commercial property. Most of the drainage area is storm sewered.

Watts Branch

Watts Branch is the largest tributary to the Anacostia River in the District of Columbia. Originating in Prince George's County, Maryland, Watts Branch travels for four miles to its mouth on the eastern side of the Anacostia. The watershed is 2,470 acres with 47 percent in the District and 53 percent in Maryland. Approximately 80 percent of the watershed exists as urban residential and commercial property. Less than 15 percent is forested, mainly along the parkside riparian stream corridor. Approximately five percent is light industrial property.

Consent Decree

These fecal coliform bacteria TMDLs were completed by the District to partially meet the third-year TMDL milestone commitments under the requirements of the 2000 TMDL lawsuit settlement of *Kingman Park Civic Association et al. v. EPA*, Civil Action No. 98-758 (D.D.C.), effective June 13, 2000, as modified March 25, 2003. Third-year milestones include the development of TMDLs for various combinations of the Anacostia River and tributaries for organics and metals. Third-year requirements also include TMDLs for various combinations of the Anacostia River and tributaries for fecal coliform bacteria, total suspended solids, biochemical oxygen demand, and oil and grease.

IV. Technical Approach

When models are used to develop TMDLs, the model selection depends on many factors, including but not limited to, the complexity of the system being modeled, available data, and impact of the pollutant loading. For example, the District used the TAM/WASP Toxics Screening Level Model to develop the organics/metals TMDLs for the Upper and Lower Anacostia River mainstem because loading from these segments significantly impacted water quality and the minimum data requirements were generally satisfied. The District chose to use less complex models to develop the TMDLs for the Anacostia River tributaries partly because of the relative lack of data and because the overall impact of pollutant loadings from the individual tributaries of bacteria on water uses is less significant that the impact of the mainstem loadings. Models such as the TAM/WASP Screening Level Model require large amounts of water quality data. Overall, EPA finds that the District's selection of models for the two types of waterbodies are reasonable and appropriate as described in the following sections.

History and Use of the Tidal Anacostia Model (TAM/WASP)

The TAM/WASP Toxics Screening Level Model (Toxics Model) simulates the loading, fate, and transport of toxic chemical contaminants, organics and metals, in the tidal Anacostia River and can predict the changes over time of concentrations in both the river water and the surfical bed sediments.

The Anacostia River, as one of the most polluted rivers in the nation, has received a lot of attention. Anacostia River modeling has evolved since TAM's development by the Metropolitan Washington Council of Governments (MWCOG) for the District to assess water quality impacts in the Anacostia River in 1988. Additional improvements were made by MWCOG and Limno-Tech.[10]

In 2000 ICPRB, under the direction of the Department of Health (DOH), converted the model to TAM/WASP by adding the EPA-supported Water Quality Analysis Simulation Program (WASP) framework as detailed in *The TAM/WASP Model: A Modeling Framework for the Total Maximum Daily Load Alloction in the Tidal Anacostia River - Final Report,* ICPRB, 2000. DOH used the TAM/WASP model for their Biochemical Oxygen Demand (BOD) TMDL approved by EPA on December 14, 2001.

The model was turned over to WASA and Limno-Tech improved the hydraulic component by increasing from 15 to 35 the number of segments used to represent the Anacostia River from the Potomac River to the Northeast and Northwest Branches, and modified the model to simulate both fecal coliform and *E. coli*. Changes to and uses of the model are detailed in the *LTCP Study Memorandum LTCP-6-4: Anacostia River Model Documentation*, Draft, August 2001.

ICPRB adopted the new river geometry and added segment 36 to represent the effect of Kingman Lake on the river. The sediment transport capabilities of the model were further developed for use in developing the Total Suspended Solids (TSS) TMDL for the Anacostia River (TAM/WASP Version 2.1). The District intended to use the output of Version 2.1 as input to a light extinction model, also developed by ICPRB, for the TSS TMDL. However, a procedural problem with modifying the District's water quality standards prevented EPA from approving the District's TSS TMDL within the time frame required by the Consent Decree. Therefore, EPA established the Total Suspended Solids TMDL for the Upper and Lower Anacostia River using Version 2.1 on March 1, 2002. Draft reports of Version 2.1 in *Calibration of the TAM/WASP Sediment Transport Model - Final Report*, 2003, were used to develop the TSS TMDL.

Under the direction of DOH, ICPRB developed the TAM/WASP Toxics Screening Level Model - Version 2.3 for use in these TMDLs. Version 2.3 used, with only minor changes, the hydrodynamic model and the sediment transport model components of Version 2.1.

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[10]Limno-Tech is currently WASA's consultant for the LTCP.

TAM/WASP is a one-dimensional (1-D) model simulating processes in the river by idealizing the river as a long channel where conditions may vary along the length of the channel but are assumed to be uniform throughout any channel transect *(*i.e.*,* from left bank to right bank). This assumption is reasonable given the results of the summer 2000 SPAWAR study,[11] which concluded that throughout a channel transect, the water in the river was generally well-mixed, and current velocities were relatively homogenous and primarily directed along the axis of the channel. The conclusions also supported by model simulations carried out subsequent to a dye study conducted in 2000 by Limno Tech, Inc. for EPA.[12] These results showed that a 35 segment 1-D model was capable of simulating fairly well the time evolution of dye concentrations in the tidal river.

Version 2.3, uses 35 model water column segments, extending from the Northeast and Northwest Branches in MD to the Anacostia's confluence with the Potomac and a model segment 36, representing Kingman Lake, adjoins segment 19. (Kingman Lake is represented as a tidal embayment to segment 19 in ICPRB's upgraded version of the TAM hydrodynamic model). Each of these 36 water column segments is underlain by a surficial sediment segment (segments 37 to 72), and each surficial sediment segment is underlain by a segment of the lower sediment layer (segments 73 to 108). Surficial sediment segment 72 and lower sediment segment 108 underlie water column segment 36, representing Kingman Lake. In all but the PCB sub-model, the surficial bed sediment layer is 1 centimeter (cm) in thickness and the lower bed sediment layer is 5 cm in thickness. In the PCB sub-model has four bed sediment layers instead of two. ICPRB details Version 2.3 in *TAM/WASP Toxics Screening Level Model for the Tidal Portion of the Anacostia River* (Technical Report).

The TMDL Report includes the ICPRB technical report as Appendix D. Chapter 1 presents the history of the model and identifies data sources used in the model. Available data is sparse, especially for some of the organics. The contaminated sediments within the Anacostia River tend to contaminate the overlying water column and have been the subject of several investigations. Table 1-1, presented here as Table 3, from the Technical Report indicates where sediment data is lacking.

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[11]*Anacostia River Water Quality Assessment - Draft Report to the Anacostia Watershed Toxics Alliance*, December 2000. The Anacostia Watershed Toxics Alliance is a private-public partnership dedicated to characterization and remediation of the Anacostia River contaminated sediments.

[12]*Dye Study for the Tidal Anacostia River - Final Report*, September 30, 2000.

Table 3 - Number of Surficial Sediment Sampling Stations per Chemical from AWTA/NOAA Database

Study[1]	Zinc	Lead	Copper	Arsnic	PCB	PAH	Chlordane	Hepta Epox	Dieldrin	DDT
1995 PEPCO	5	5	x	x	5	x	6	4	5	5
1995 Washington Navy Yard	7	7	7	7	1	40	x	x	x	7
1966 FWS PAH/PCB Mason Neck	x	x	x	x	x	x	x	x	x	2
1996 Washington Gas - East Station Project	8	8	8	7	x	7	x	x	x	x
1996 Wetland Restoration - Kenilworth	2	2	2	2	x	x	2	2	x	x
1997 DC Sediment Core Analysis	6	6	6		6	x	6	1	6	6
1998 USACE Federal Navy Channel	4	4	4	4	x	x	x	x	x	4
1999 Washington Navy Yard RI	32	32	32	30	x	x	x	x	x	x
2000 Velinsky AR Sed[2]	128	128	128	x	126	125	132	122	119	120
Total No. of Stations	192	192	187	50	138	172	136	129	130	144

[1]Data from studies extracted from AWTA/NOAA database exept 2000 Velinsky AR Sed. *(ICPRB)*

[2]Source: Velinsky and Ashley (2001)

Section 1.5, Model Constituents, discusses each of the submodels (WASP handles only three chemical constituents at a time). Table 1-2, presented below as Table 4, summarizes the sub-models.

Table 4

Constituent	WASP Variable
Metals 1 Model	
Zinc	CHEM 1
Lead	CHEM 2
Copper	CHEM 3
Metals 2 Model	
Arsenic	CHEM 1
Polyclorinated biphenyls (PCB) Model	
Homolog 2 (dichlorobiphenyls)	CHEM 1 (PCB1)
Homolog 3 (trichorobiphenyls)	
Homolog 4 (tetrachlorobiphenyls)	CHEM2 (PCB2)
Homolog 5 (pentachorobiphenyls)	
Homolog 6 (hexachlorobiphenyls)	
Homolog 7 (heptachlorobiphenyls)	CHEM3 (PCB3)
Homolog 8 (octachlorobiphenyls)	
Homolog 9 (nonachlorobiphenyls)	
Polynuclear aromatic hydrocarbons (PAH) Model	
Napthalene	CHEM1 (PAH1) (2 and 3 ring PAHs)
2-methyl napthalene	
Acenapthylene	
Acenapthene	
Fluorene	
Phenanthrene	
Fluoranthene	CHEM2 (PAH2) (4 ring PAHs)
Pyrene	
Benz[a]anthracene	
Chrysene	

Constituent	WASP Variable
Benzo[k]fluoranthene	CHEM3 (PAH3) (5 and 6 ring PAHs)
Benzo[a]pyrene	
Perylene	
Indeno[1,2,3-c,d]pyrene	
Benzo[g,h,i]perylene	
Dibenz[a,h+ac]anthracene	
PEST1 Model	
Chordane (cis-chlordane + trans nonachlor + oxychlordane)	CHEM1
Heptachlor epoxide	CHEM2
PEST2 Model	
Dieldrin	CHEM1
DDT Model	
p,p'-DDD	CHEM1
p,p'-DDE	CHEM2
p,p'-DDT	CHEM3

Table 1-3, Rationale for PCB Grouping, TMDL Report, Appendix D, provides the rationale for the above grouping of pollutants.

The Technical Report, Chapter 2 identifies model inputs. The hydrodynamic model inputs to TAM/WASP Version 2.3 are identical to those of Version 2.1 with the exception that Version 2.3 includes baseflow or ground water flow from the CSO sub-sheds. This represents the continual improvement in the modeling.

The LTCP three alternative scenarios which could be considered a baseline scenario identified in the LTCP, Table 6-1:

	Scenario	CSO discharge to the Anacostia River
B1	Prior to CSO Phase I controls	2,142 million gallons per year
C2	Phase I CSO controls	1,485 million gallons per year
C3	Phase I CSO controls and pump station rehabilitation	1,282 million gallons per year

The Anacostia River Organics/Metals TMDL Report uses C2 as the baseline scenario. The baseline scenario provides a basis from which to evaluate alternate control scenarios and establish required reductions, (e.g.*,* a 95 percent reduction is required from the C2 scenario).

CSO discharges representing "current conditions" for the three-year period of analysis were obtained before October, 2001, from Andrea Ryon, prior both to her departure from MWCOG and to the development of the recommended LTCP CSO discharge estimates. In developing these TMDLs, DOH applies a constant reduction to all existing CSO discharges instead of using the recommended LTCP CSO discharges. The LTCP CSO discharge estimates consolidate CSOs such that only two model segments receive CSO flow during the three-year period of analysis. The TMDL Report allows the CSOs to discharge more frequently but with lower loads than does the recommended LTCP scenario. However, EPA believes that running the TMDL scenario with the recommended LTCP CSO discharge flows would result in slightly better instream concentrations than by using uniform CSO discharge reductions based on EPA's experience with the biochemical oxygen demand and total suspended solids TMDL models[13]. Therefore, the TMDL is consistent with the LTCP.

Water discharging into the tidal portion of the river from tributaries, sewer outfalls, and groundwater may carry with it measurable quantities of chemical contaminants. The daily quantities of these constituents entering the river, referred to as daily loads, have been estimated by ICPRB based on available toxic chemical monitoring data. Though it is possible in the model to specify distinct non-storm flow and storm flow chemical concentrations from each of the 34 individual tributary or outfall sub-sheds depicted in the TMDL Report, Appendix D, Figure 2-1, available monitoring data are limited. For this reason the model currently represents the entire Anacostia watershed as relatively homogenous in terms of storm water quality (and base flow/groundwater quality). For example, because the only available monitoring data for polynuclear aromatic hydrocarbons (PAHs), chlordane, heptachlor epoxide, and dieldrin are from samples taken from the upstream tributaries, the Northeast and Northwest Branches, the average concentrations computed from this data are used to estimate PAH, chlordane, heptachlor epoxide, and dieldrin loads for all Anacostia basin sub-sheds.

Because no CSO data exists for organic chemicals at detection limits low enough to quantify loads, concentrations of organic chemicals in CSO discharges were assumed to be the same as concentrations in the District's storm sewer system. Therefore, for organic chemical concentrations in CSOs, mean concentrations from the District's MS4 monitoring data were used when available. Otherwise, mean values from the Northeast and Northwest Branches data set were used. Arsenic was treated similarly.

The situation is somewhat better for the metals included in the model, namely zinc, lead, and copper, where monitoring data is available from several sources, including the Northeast/ Northwest Branch study, the LTCP, recent MS4 program monitoring data, and several historical

[13]The LTCP and the Anacostia River Fecal Coliform TMDL used the same model input files so each is consistent with the other.

studies. For all of the sources considered, chemical loads are estimated by using estimated average non-storm flow and storm flow concentrations assumed to be time invariable.

The pollutant concentrations used in the model are discussed in the TMDL Report, Appendix D, Section 2.4, and are given in the following table:

Table 4 - Summary of Storm Flow (SF) and Base Flow (BF) Concentration Estimates Based on Available Monitoring Data

Parameter	Upstream BF/SF		WASA LTCP CSO Sub-Sheds SF				Storm Sewer and Tributary SF		
	Northeast Br. EMC	Northwest Br. EMC	B St. / NJ Ave EMC	Tiber Cr. EMC	NEB Swirl EMC	NEB Bypass EMC	WASA LTCP EMC	DC MS4 Composite Means	Lower Beaverdam Cr. BF/SF
Zinc (ug/L)	8/77	7/91	194	188	181	256	202	144	22/172
Lead (ug/L)	0.5/49	0.6/103	71	73	64	96	35	20	0.25/35
Copper (ug/L)	3/25	4/43	103	64	40	63	61	52	0.25/24
Arsenic (ug/L)	0.2/NA	0.2/NA	<5	<5	<5	<5	<5	1.4	DC MS4 values used
			DC MS4 value used						
PCB1 (ug/L)	0.58/0.66	0.60/0.41	DC MS4 value used					7.80	
PCB2 (ug/L)	2.63/8.81	1.90/6.13						14.97	
PCB3 (ug/L)	0.82/7.31	1.06/4.58						4.08	
PAH1 (ug/L)	0.054/0.271	0.56/0.607	Mean values from Northeast and Northwest Branches used						
PAH2 (ug/L)	0.099/1.634	0.193/3.911							
PAH3 (ug/L)	0.044/0.945	0.097/2.631							
Chlordane (ng/L)	0.81/4.49	1.19/18.93							
Heptachlor Epoxide (ng/L)	0.72/1.31	1.21/1.46							
Dieldrin (ng/L)	0.55/0.65	0.78/1.70	DC MS4 value used					0.29	DC MS4 value used
DDD (ng/L)	0.23/1.04	0.23/1.24						0.15	
DDE (ng/L)	0.52/0.07	ND/ND						0.89	
DDT (ng/L)	0.63/0.25	0.60/0.15						1.71	

TMDL Report, Appendix D, Section 2.5, discusses the uncertainty of the selected pollutant concentrations for the Northeast/Northwest Branches resulting from the small number of samples. Because the upstream flow represents approximately 70 percent of the flow in the Anacostia River, should future studies indicate that pollutant concentrations are different than current estimates, pollutant loads could change significantly to justify TMDL revisions.

Where no monitoring data existed for a potential source for the organics in the above table, ICPRB estimated pollutant concentrations. Appendix D presents the estimated concentrations for each pollutant. Where analytical results were reported as non-detect in various studies and the detection level was above the water quality criterion, ICPRB used one-half the detection level to estimate the pollutant's concentration. Future studies where pollutant concentrations are more accurately determined may also warrant revising these TMDLs.

TMDL Report, Appendix D, Chapter 3, discusses model calibration and verification. In the calibration/verification process, predictions of the TAM/WASP Toxics Screening Level Model were compared with available Anacostia River data, and, if necessary, adjustments were made to a limited number of model input parameters to improve model performance. Initial model runs were done using load estimates computed from mean storm flow and mean base flow chemical concentrations. These were computed from monitoring data, summarized above, and mean partition coefficient (K_d)[14] computed from Anacostia River base flow water column data, given in the TMDL Report, Appendix D, Table 2-3. These initial model runs simulated the deposition of contaminated sediment to the river bottom over a six-year time period in order to determine whether the model could simulate observed bed sediment contamination patterns. The three-year "period of analysis" represents data from 1988 through 1990 with typical "wet" year, "dry" year, and "average" year precipitation generating flows. The three-year simulation was run twice to simulate processes over a six-year time period. These model runs began with initial conditions that simulated a "clean" sediment bed, (*i.e.*, with chemical concentrations initially set equal to zero in all bed sediment segments).

It was determined that after a six-year simulation run, segment contaminant concentrations in the upper one cm of the sediment bed approached a relatively constant, "steady state," condition. Model predictions for last day of the six-year run for the 35 main channel sediment segments in the upper one cm of the bed sediment were compared to averaged bed sediment data for these segments to determine whether or not the initial load estimates were producing the observed magnitude of contamination in the river's sediment bed. In a number of cases, namely, for zinc, copper, chlordane, and dieldrin, predicted contaminant concentrations matched observed concentrations fairly well, and it was decided that loads estimated from the available monitoring data were reasonable. For PAHs, PCBs, and DDX's, the model predictions produced significantly lower concentrations in the sediment bed than is observed, and for lead and heptachlor epoxide, the model predicted significantly higher concentrations than are observed. ICPRB concluded, given the uncertainty in storm and base flow concentration

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[14]The partition coefficient, K_d, describes how a chemical prefers to distribute itself between the sediment and water in the river.

estimates, it is not unexpected that load estimates may be 50% too high, or may be a factor of two or three or more too low. Therefore, in cases where it appeared to be necessary, the model storm flow and base flow chemical concentrations were increased or decreased to obtain a more reasonable match of model predictions to bed sediment contamination data.

In the second phase of the calibration process, the model was run to simulate daily water column concentrations for time periods in which data was available. Water column data is available for 1998 for zinc, lead, copper, PCBs, p,p' DDE and p,p' DDT. For these chemicals, model predictions for the dissolved phase and for the total (dissolved + particulate) phase concentrations were compared with available data. In some cases, model K_d values were adjusted to produce a better fit to the dissolved concentration data. For chemicals for which no water column calibration data was available, model predictions were compared to predictions of ambient concentrations based on fish tissue data and bioaccumulation factors.

Table 6 - Summary of Multipliers Used on Storm Flow (SF) and Base Flow (BF) Concentration Estimates

Parameter	Upstream BF/SF		WASA LTCP CSO Sub-Sheds SF			Storm Sewer and Tributary		
	Northeast Br.	Northwest Br.	B St. / NJ Ave	NEB Swirl	Other CSOs	SW, Tribs BF	SW, Tribs SF	Lower Beaverdam Cr. BF/SF
Zinc (ug/L)	1/1	1/1	1	1	1	1	1	1/1
Lead (ug/L)	0.5/0.5	0.5/0.5	1	1	1	1	1	1/1
Copper (ug/L)	1/1	1/1	1	1	1	1	1	1/1
Arsenic (ug/L)	1/1	1/1	1	1	1	1	1	
PCB1 (ug/L)	3/3	3/3	3	3	3	3	3	3/3
PCB2 (ug/L)	3/3	3/3	3	3	3	3	3	3/3
PCB3 (ug/L)	3/3	3/3	3	3	3	3	3	3/3
PAH1 (ug/L)	1.5/1.5	1.5/1.5	1.5	1.5	1.5	1.5	1.5	1.5/1.5
PAH2 (ug/L)	1.5/1.5	1.5/1.5	1.5	1.5	1.5	1.5	1.5	1.5/1.5
PAH3 (ug/L)	1.5/1.5	1.5/1.5	1.5	1.5	1.5	1.5	1.5	1.5/1.5
Chlordane (ug/L)	1/1	1/1	1	1	1	1	1	1/1
Heptachlor Epoxide (ug/L)	0.7/0.7	0.7/0.7	0.7	0.7	0.7	0.7	0.7	0.7/0.7
Dieldrin (ug/L)	1/1	1/1	1	1	1	1	1	1/1
DDD (ug/L)	4/4	4/4	20	20	20	20	20	20/20
DDE (ug/L)	4/4	4/4	15	15	15	15	15	15/15
DDT (ug/L)	1/1	1/1	20	20	20	20	20	1/1

Comparing Tables 3, 4 and 5 discloses that where there was the most data, *i.e.*, metals, the concentrations used in the final model runs remained unchanged but some chemicals, *e.g.,* DDD, DDE, and DDT, a large multiplier was required to match sediment concentrations indicated uncertainty with respect to existing pollutant concentrations.

ICPRB's technical report concludes with Chapter 4: Conclusions. Where data was available, predictions of the calibrated model match observed water column concentrations reasonably well. To some extent, the model was able to reproduce the spatial pattern of contaminant concentrations. However, the model errors appeared to be dominated by load estimates and the K_d values. ICPRB identifies the key data gaps as:

1. Uncertainties in chemical load estimates, probably in the range of about -50% to +300%, could be reduced by additional storm water monitoring data for the upstream tributaries, Lower Beaverdam Creek, and the storm water and combined sewer systems, especially from outfalls in the vicinity of apparent sediment "contaminant hot spots." In order to support quantification of toxic chemical loads, it is necessary to use analytical techniques with sufficiently low detection limits.

2. Uncertainty concerning the importance of groundwater load inputs could be improved by the collection of groundwater monitoring data at several locations adjacent to the river, again, using sufficiently low analytical detection limits. Currently, the model uses upstream base flow monitoring results to estimate chemical concentrations in ground water inputs.

3. Lack of information concerning decay processes, such as biodegradation and photolysis, for chemicals such as PAHs, could be addressed by collection of a comprehensive water column calibration data set, including data to assess seasonal variations in concentrations. Decay rate coefficients are currently estimated by using values found in the published literature, which often vary by several orders of magnitude.

4. Lack of understanding of the importance of potential mixing processes, such as bioturbation, methane gas bubble generation, and tidal pumping effects, could be addressed by the collection of radioisotope and other types of data to characterize vertical mixing in the sediment bed. At this time it is not possible to assess the potential for recontamination of recently deposited sediments by underlying sediments due to these processes, and sediment bed mixing processes are not currently simulated by the model.

EPA believes the Screening Level Model produces reasonable results given the available information and that all reasonable efforts were made to secure available information.

Anacostia River Tributary Modeling

In order to assist the District in developing TMDLs for the Anacostia River Tributaries, ICPRB constructed a simple mass balance model composed of three sub-models, one of which is for organic pollutants and one for inorganic pollutants (metals).[15] These two sub-models predict daily water column concentrations of each pollutant in each of the Anacostia River tributaries under current conditions and under TMDL conditions. ICPRB's technical report, *District of Columbia Small Tributaries Total Maximum Daily Load Model, Final Draft,* July 2003, is included in the TMDL Report as Appendix E.

The mass balance model treats each tributary as a "bathtub" which, on each day of the simulation period, receives a volume of water representing storm water runoff and a volume of water representing base flow from groundwater infiltration. Base flow and storm water are assumed to contain a pollutant load based pollutant concentrations used in the mainstem modeling. Little toxics data exists for the tributaries, and what does exist relates is primarily to metals. In cases were samples were analyzed for organics, the detection level was frequently higher than the water quality standards. No additional instream processes, such as sediment resuspension or decay, are simulated. EPA concurs that this is appropriate based on the amount of data available and because each tributary's impact on the Anacostia River instream water quality is extremely small. Again, the Small Tributary Model does a fair job in simulating daily pollutant concentrations based on the available data.

Daily estimates of base flow and storm water volume for each tributary is based on ICPRB's Watts Branch HSPF model[16] and landuse information. The Watts Branch HSPF model was calibrated using stream discharge data from the USGS gage 01658000 on Watts Branch near Minnesota Avenue which has been in operation since June 1992. The HSPF model provided daily runoff for the period January 1, 1988, to December 31, 1990, by landuse. Each tributary's drainage area was divided into three representative landuses: (1) impervious, (2) urban pervious, and (3) forested pervious. Based on the assumption that tributaries have hydrologic properties similar to those of the Watts Branch drainage area, the flow for each day from each tributary was determined and the instream bacteria count was compared to the District's water quality criteria. EPA finds this modeling approach reasonable.

Because each tributary receives water discharged for the District's separate sewer system, tributaries' watershed boundaries were not delineated based on topography alone but based on a combination of topographic information and information on the sewer outfalls discharging into the tributary or its watershed. A certain amount of "engineering judgement" was also used.

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[15] The third sub-model models bacteria.

[16] Appendix B, ICPRB October 6, 2000.

Watts Branch and Nash Run are two tributaries with a significant portion of their topographic watersheds in Maryland. The TMDL Report allocates a portion of the Watts Branch and Nash Run TMDL load to Maryland and this Decision Rationale allocates the District's portion of the TMDL between WLA and LAs. See Section V.2.

V. Discussions of Regulatory Requirements

EPA has determined that these TMDLs are consistent with statutory and regulatory requirements and EPA policy and guidance. EPA's rationale for approval is set forth according to the regulatory requirements listed below.

The TMDL is the sum of the individual waste load allocations (WLAs) for point sources and the load allocations (LAs) for nonpoint sources and natural background and must include a margin of safety (MOS). The TMDL is commonly expressed as:

$$TMDL = \sum WLAs + \sum LAs + MOS$$

where

WLA = waste load allocation
LA = load allocation
MOS = margin of safety

1. The TMDLs are designed to implement the applicable water quality standards.

The TMDL Report states that the Anacostia River and tributaries are on the District's 1998 Section 303(d) list of impaired waters for toxics because of data derived for U.S. Fish and Wildlife Service (FWS) analysis of fish tissue and sediment analysis performed by the Patrick Center for Environmental Research, The Academy of Natural Sciences of Philadelphia.

The TMDL Report the District recites the Anacostia's beneficial water uses as well as the general and specific water quality criteria designed to protect those uses. The District identifies the designated uses for the Anacostia River which are:

A. Primary contact recreation,
B. Secondary contact recreation and aesthetic enjoyment,
C. Protection and propagation of fish, shellfish and wildlife,
D. Protection of human health related to consumption of fish and shellfish, and
E. Navigation.

The beneficial uses for the Anacostia River Tributaries, except Hickey Run and Watts Branch, are Class A through D, and Hickey Run and Watts Branch are Class B through Class D.

The majority of the Anacostia River Watershed lies in Maryland. Therefore, consistent with the Clean Water Act, the Anacostia River waters crossing the DC/Maryland border must meet the District's water quality standards at the border.

Table 7 - DC's Water Quality Standards for Metals

Metals	Criteria for Classes					
	Class C				Class D	
	Criteria Maximum		Criteria Continuous			
Arsenic - Dissolved	150.00		340.00		0.14	
	Anacostia	Tributaries	Anacostia	Tributaries	Anacostia	Tributaries
Copper - Dissolved	10.31	17.77	15.31	27.90	NA	NA
Lead - Dissolved	2.23	4.43	57.15	113.78	NA	NA
Zinc - Dissolved	95.04	163.02	104.08	178.52	NA	NA

The water quality criteria for copper, lead, and zinc is hardness dependant. The Anacostia River criteria shown are based on a hardness of 89.4 mg/L as $CaCO_3$ and the tributaries based on 169 mg/L as $CaCO_3$ from DC DOH monitoring data. It should be noted that the District's water quality regulations 49 D.C. REG. 3012; and 49 D.C. REG. 4854 require very careful reading and the Federal Register (60 FR 22,231) must be consulted to obtain the correct numerical values and units for hardness dependent criteria. The TMDL Report's Table 2-2: Dissolved Metals Numerical Criteria, and notes provided a complete explanation of the criteria.

The organic pollutant water quality criteria are found in the DC regulations at Section 1104.7, Table3.

Table 8 - DC's Water Quality Standards for Organics

Organics	Criteria for Classes		
	Class C		Class D
	CCC	CMC	30-Day Average - ug/L
Chlordane	0.004	2.4	0.00059
DDE	0.001	1.1	0.00059
DDD	0.001	1.1	0.00059
DDT	0.11	1.1	0.00059
Dieldrin	0.0019**	2.5	0.00014
Heptachlor Epoxide	0.0038	0.52	0.00011
PAH1	50.0	NA	1,4000.0*
PAH2	400.0	NA	0.031
PAH3	NA	NA	0.31
Total PCBs	0.014	NA	0.000045**

*This criterion is not based on 10^{-6} risk factor.
**The signed Decision Rationale incorrectly indicated these values as 0.00019 and 0.00045.

Within each PAH group, the most stringent water quality criterion was used as the criteria for each member of the group, each group's constituents are shown in Table 4. For example, the Class D water quality standard for fluoranthene, pyrene, benz[a]anthracene, and chrysene are 370, 11000, 0.031, and 0.031 ug/L, respectively. Therefore the most stringent of the individual standards, 0.031 ug/L is given in the TMDL Report Table 2-3 and Table 8 above as the Class D standard for PAH2.

Maryland's COMAR 26.08.02.03-2, Numerical Criteria for Toxic Substances in Surface Waters, Table 1, Toxic Substances Criteria for Ambient Surface Waters–Inorganic Substances, list Maryland's criteria. Copper, lead, and zinc numerical values are noted to be increased or decreased by hardness or pH. Although the regulations do not include the hardness equations to determine site specific criteria, Maryland Department of Environment indicated that they use the same equations as the District. Therefore, Maryland's metals criteria is the same as the District's with one exception. Maryland bases its fish consumption criteria on a 10^{-5} risk level instead of the District's more conservative 10^{-6} risk level, Maryland's 41 ug/L vs. the District's 0.14 ug/L for arsenic. Maryland will need to ensure the Anacostia River instream arsenic concentration is no greater than 0.14 ug/L.

Table 9 - Maryland's Water Quality Standards for Organics

Organics	Criteria for Classes		
	CCC Four-Day Average - ug/L	CMC One-Hour Average - ug/L	Fish Consumption 30-Day Average - ug/L (Risk Level 10^{-5})
Chlordane	0.0043	2.4	0.0022
DDE	NA	NA	0.0059
DDD	NA	NA	0.0084
DDT	NA	NA	0.0059
Dieldrin	0.0056	0.24	0.0014
Heptachlor Epoxide	0.0038	0.52	0.0011
PAH1	NA	NA	1,4000.0
PAH2	NA	NA	370.0
PAH3	NA	NA	0.49
Total PCBs	0.014	NA	0.0017

The District include more organics in their water quality standards than does Maryland and uses the more conservative 10^{-6} risk level for Class D uses. Maryland will need to ensure the Anacostia River instream organic pollutant concentrations do not exceed the District's water quality standards at the DC/Maryland border.

The TMDL Report demonstrates that water quality standards are or will be met for all pollutants except PCBs. The Anacostia River TAM/WASP model was run for 21 years without achieving water quality standards, although the Small Tributary Model did calculate a load reduction which would achieve water quality standards. As discussed in Section IV, the Small Tributary Model is a simple mass balance model which only considers the estimated loads entering the tributary each day.

The TAM/WASP Model not only considers the estimated loads entering the river each day but considers advection and dispersion of the flows/loads entering the river, adsorption to the medium-grained and fine-grained sediment fractions, including resuspension of sediment, and volatilization. Because the surface area of the waterbodies within the Anacostia River Watershed are small with respect to the watershed area, the TAM/WASP Model does not consider air deposition. The TMDL Report states that the primary source of PCBs causing continued water quality standards violations is the contaminated sediment by releasing PCBs to overlying water and sediment resuspension (page 46).

Because the models do not consider air deposition, the District estimated air deposition using *Chesapeake Bay Basin Toxics Loading and Release Inventory*, May 1999, as their reference and their calculations are in the TMDL Report, Appendices C and D. The TMDL Report allocates 70.34 percent of the instream PCB load to air, and the remaining 29.66 percent to existing sources without requiring any reduction.

Although the TMDL Report correctly states that releases from unidentified land sources are accounted for in the model by the CSO and storm water loads from the MS4 storm sewers, the allocations do not require any reduction is such sources.

When the TAM/WASP Model was run for 21 years without achieving water quality standards, all loads except sediment loads were turned off, leading DOH to believe that a sediment management plan will allow water quality standards to be met and "no further reductions to the remaining Maryland and District loads will be made at this time."

As discussed in Section IV of this decision rationale, few PCB sample results were available for the Anacostia River, and some of those were not to the low detection levels, no samples for the tributaries, and little air deposition data was available, together with the District's belief that a sediment management plan will allow water quality standards to be met, EPA is accepting the PCB TMDL at this time. EPA suggests that the District conduct an intensive search for sources and estimates of the amount of PCBs and revise the TMDL as necessary. In addition, air deposition rates and estimates of the amount of PCBs reaching the surface waters should be revisited.

2. The TMDLs include a total allowable load as well as individual waste load allocations and load allocations.

The TMDL Report identifies the CSOs as permitted point sources and lumps all storm water discharges together whether or not the storm water source has a NPDES permit. EPA guidance memorandum clarifies existing EPA regulatory requirements for establishing wasteload allocations (WLAs) for storm water discharges in TMDLs approved or established by

EPA.[17] Therefore, this document identifies WLAs for storm water discharges subject to NPDES permitting.

The key points established in the memorandum are:

- NPDES-regulated storm water discharges must be addressed by the wasteload allocation component of a TMDL.
- NPDES-regulated storm water discharges may not be addressed by the load allocation (LA) component of a TMDL.
- Storm water discharges from sources that are not currently subject to NPDES regulation may be addressed by the load allocation component of a TMDL.
- It may be reasonable to express allocations for NPDES-regulated storm water discharges from multiple point sources as a single categorical wasteload allocation when data and information are insufficient to assign each source or outfall individual WLAs.
- The wasteload allocations for NPDES-regulated municipal storm water discharge effluent limits should be expressed as best management practices.

The existing approved/established Anacostia River TMDLs for biochemical oxygen demand and total suspended solids also assigned all storm water as a load allocation because of the manner in which the input files were generated did not distinguish between storm water discharging from storm sewer outfalls, overland flow adjacent to the river, and tributary (*e.g.*, Watts Branch) flow. Although the Anacostia River Fecal Coliform Bacteria TMDL did divide storm water sewer discharge from overland flow, the TAM/WASP version used for these organics and metals TMDLs does not. The November 2002 memorandum does recognize that WLA/LA allocations may be fairly rudimentary because of data limitations. Therefore, the permitted storm water allocations were made based on the ratio of sewered areas to unsewered areas.

The Anacostia River tributaries' drainage area determined by ICPRB includes the sewershed areas as estimated from sewer maps. EPA divided the tributaries' TMDLs into wasteload allocations and load allocations based on an estimated ratio of sewered to unsewered areas.

Except for Watts Branch and Hickey Run, the tributaries discharge to the Anacostia River via storm sewers. The tributary TMDL was developed at the point the open channel flow enters the last storm sewer prior to discharging to the Anacostia River. The TMDL Report presents the TMDLs and the associated required percent reduction from existing loads in order to meet water quality standards.

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[17]Memorandum *Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs*, from Robert H. Wayland, III, Director, Office of Wetlands, Oceans and Watersheds, and James A. Hanlon, Director, Office of Wastewater Management, to Water Division Directors, Regions 1 - 10, dated November 22, 2002.

The TMDL Report states that although the Section 303(d) list of impaired waters divides the Anacostia River into upper and lower segments, the water quality standards do not divide the river into segments but specify water quality standard attainment over the entire length. EPA believes that because the District's Section 303(d) list and the Consent Decree divide the Anacostia River into upper and lower segments, TMDLs need to be developed for each segment. Water quality standards are attained for the entire length of the river. Similarly, Watts Branch TMDL is divided into segments consistent with the Section 303(d) list of impaired waters and Consent Decree. Therefore, EPA has used the TMDLs developed by the District, together with information contained in ICPRB's technical documents and WASA's LTCP to divide the TMDLs into WLAs and LAs and Upper and Lower Anacostia River and Upper and Lower Watts Branch.

The TMDL Report requires the following reductions in loads. The required percent reductions for the Anacostia mainstem range from 30 percent for Dieldrin from CSOs and storm water to 100 percent for PAHs from the Northeast and Northwest Branches and for the tributaries, required reductions range from zero for zinc to 98 percent for PAH2 and PAH3.

The tables containing the TMDLs, WLAs, and LAs are contained in this decision rationale as Appendix A because of the large number of pollutants. The metal concentrations in Appendix A are total metals even though the water quality standards are for the metals addressed by these TMDLs are for the dissolved fraction. To determine attainment of the water quality standards, only the dissolved output concentrations were evaluated. Reducing the dissolved metal reduces the total metal by the same amount.

Because most of the loading to the Anacostia River and its tributaries is precipitation induced, TMDL, WLA, and LA loads are shown as average annual loads. EPA believes that this representation is appropriate in spite of comments received by the District asserting that average annual loads violate the law. The commentor's technical reviewer[18] suggests that the "maximum daily loads only need to be extracted from the calculations already performed." EPA views a "maximum daily loads" to mean that the permittee is allowed to discharge that load each and every day and is appropriate for steady state conditions, *e.g.*, constant flow in the river and constant pollutant loads. Neither the District nor EPA would contend that the maximum one-day load during the three-year forecast[19] period could be discharged every day and still meet the instream water quality standards.

Further, that memorandum suggests that there is nothing in the TMDL Report to prevent the entire "average annual load" from being discharged in one month, or even one day. Federal regulations at 40 CFR § 122.44(d)(vii)(B) require that any permitted effluent limits be consistent with the assumptions and requirements of any EPA-approved TMDL. Presenting allocations as "average annual loads" allows a permit writer flexibility in crafting permit language.

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[18]Jack Smith, Omicron Associates, March 30, 2003, memorandum attached to Earthjustice's March 31, 2003, comment letter to Jerusalem Bekele, Program Manager, Water Quality Division, Environmental Health Administration, D.C. Department of Health.

[19]Although the term, "three-year forecast period," is used, it should be noted that precise, future precipitation which drives Anacostia River loadings cannot be forecast.

3. The TMDLs consider the impacts of background pollutant contributions.

All of Maryland's pollutant loads are "background" to the District's portion of the Anacostia River. Maryland's contribution to the pollutant loads has been estimated based on available information. It should be noted that Maryland currently lists the Anacostia River as impaired by PCBs and heptachlor epoxide and will develop TMDLs. MDE is currently having Maryland's portion of the watershed modeled using the Hydrologic System Program - Fortran (HSPF) in preparation for developing their TMDLs.

4. The TMDLs consider critical environmental conditions.

The TMDL Report considers critical environmental conditions by modeling the watershed using daily simulations for three years. The three years represent average flow in the Anacostia River, a wetter than average year, and a drier than average year.

At the Ronald Reagan National Airport, the average annual rainfall for the period of record, 1949 to 1998, is 38.95 inches.[20] Yearly totals vary, from 26.94 inches in 1965 to 51.97 inches in 1972. Individual events, often hurricanes, can be significant. Hurricane Agnes in 1972 delivered approximately 10 inches of rain in the Washington, DC area. The District selected 1988 to 1990 as their representative rainfall years as shown:

Table 10 - Rainfall

Year	Annual Rainfall (inches)	Representing
1988	31.74	10 percentile, dry year
1989	50.32	90 percentile, wet year
1990	40.84	median, approx. 38 percentile

(LTCP-3-2, September 1999)

5. The TMDLs consider seasonal environmental variations.

The TMDL Report considers seasonal variations by modeling the watershed using daily simulations for three years with seasonal data as appropriate.

6. The TMDLs include a margin of safety.

The Clean Water Act and federal regulations require TMDLs to include a margin of safety (MOS) to take into account any lack of knowledge concerning the relationship between effluent limitations and water quality. EPA guidance suggest two approaches to satisfy the MOS requirement. First, it can be met implicitly by using conservative model assumptions to develop the allocations. Alternately, it can be met explicitly by allocating a portion of the allowable load to the MOS.

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[20] *Study Memorandum LTCP-3-2: Rainfall Conditions*, Draft, September 1999.

The District has chosen to use an explicit margin of safety equal to one percent of the TMDL load.

With respect to CSO loads, there is an implicit margin of safety, the recognized "first flush" effect. If the CSO concentrations were constant over time, capturing 95 percent of the volume captures 95 percent of the load; however, as concentrations are generally higher for the first one-half inch of storm water runoff, capturing 95 percent of the volume captures more than 95 percent of the storm water part of the load. The relative proportion of storm water to sanitary flow determines the size of the margin of safety.

7. There is reasonable assurance that the proposed TMDLs can be met.

The TMDL Report requires CSO load reductions ranging from a low of 30 percent for Dieldrin to 98 percent for PAHs. The recommended LTCP CSO loads to the Anacostia River will be reduced by 95 percent reduction based on the existing average annual volume scenario B1, prior to CSO Phase I controls, of 2,142 million gallons. ICPRB's technical report identifies scenario C2, CSO Phase I controls in place, of 1,485 million gallons.

The MS4 (municipal separate storm sewer system) permit and the NPDES storm water permits both provide regulatory authority to require storm water load reductions, providing reasonable assurance that the TMDLs will be implemented.

The Anacostia River has received a lot of attention for the past several years from many groups, *e.g.*, the Anacostia Watershed Society, which, among other things, teaches children the value of the river and wetlands. Another group is the Anacostia Watershed Toxics Alliance (AWTA), a public/private pardnership. AWTA seeks to draw all interested parties together and has funded intensive investigations of the contaminated sediment. In the fall 2003 AWTA is funding a pilot project to test covering the contaminated sediments. Four 100-foot by 100-foot sections will be covered and be monitored.

The TMDL Report, Section 8, Reasonable Assurance, lists remediation projects and programs undertaken by the District to improve water quality. While they may not specifically control pollutants addressed in this decision rationale, controlling one pollutant generally helps control others.

8. The TMDLs have been subject to public participation.

DC public noticed a February 2003 version of these TMDLs February 28, 2003, with comments due the beginning of March but extended the public comment period to March 31, 2003. The TMDLs was placed in the Martin Luther King Jr. Library. Although the public notice was published in the D.C. Register, a subscription is required to access the Register on line. Any notice in the Washington Post would be easy to miss and such notices are not included in the on-line version of the newspaper. In an effort to provide wider distribution of the TMDLs, EPA posted the public notice and TMDL Report on the Region III web site. In addition, EPA requested the District to use their e-mail list for the TMDL meetings to notify the interested parties of public comment period extensions and future postings on the Region III web site. EPA believes all interested parties have had adequate time to comment on these TMDLs.

The District and WASA held monthly technical (modeling) meetings where interested parties were briefed on the technical progress toward the District's TMDLs and WASA's LTCP.

As part of DC's TMDL submittal, a response to comments document was submitted to EPA via e-mail. In addition to EPA's comments, comments were received from Earthjustice Legal Defense Fund, Fish and Wildlife Service, Department of the Navy, the District of Columbia Water and Sewer Authority, and NRDC.

The Fish and Wildlife Service's March 18, 2003, letter to EPA identified the threatened bald eagle as nesting approximately three-quarters of a mile from the Lower Anacostia River and recommended that EPA prepare a Biological Evaluation analyzing potential impacts to bald eagles. EPA prepared and sent the Biological Evaluation on June 17, 2003.

The TMDL Report demonstrates that water quality standards are being met or will be met upon implementation the these TMDLs for all pollutants except for PCBS where the District believes a sediment management plan will allow water quality standards to be met.

Appendix A
Anacostia River Watershed Toxics TMDLs, WLAs, and LAs