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

Decision Rationale
Total Maximum Daily Loads
Anacostia River Watershed
For Fecal Coliform Bacteria

Approved

John A. Armstead for
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Date: *August 28, 2003*

Amended

Jon M. Capacasa
Jon M. Capacasa, Director
Water Protection Division

Date: *October 16, 2003*

Decision Rationale
Total Maximum Daily Loads
Anacostia River Watershed
For Fecal Coliform Bacteria
Executive Summary
October 16, 2003

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. The TMDL is commonly expressed as:

$$TMDL = WLAs + LAs + MOS$$

where

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

II. Summary

This document sets forth the United States Environmental Protection Agency's (EPA) rationale for approving the TMDLs for fecal coliform bacteria in the tidal Anacostia River and its tributaries. The following TMDL Summary table is discussed in Section V.2. of the Decision Rationale. The approved TMDLs are shaded. Maryland's allocations are based on meeting water quality standards.

TMDL Summary

Total Annual Loads - MPN[1]					
Segment	TMDL	WLA[2]	LA[3]	Upstream	MOS[4]
Upper Anacostia	1.99×10^{15}	1.63×10^{15}	1.11×10^{13}	3.48×10^{14}*	Implicit
Lower Anacostia	8.27×10^{14}	8.21×10^{14}	5.98×10^{12}		Implicit
Total	2.83×10^{15}	2.46×10^{15}**	1.71×10^{13}*	3.48×10^{14}*	

Tributary name	Existing Loads	TMDL - to meet WQS	TMDL - 90% load reduction	WLA	LA	MOS
Fort Stanton	2.54×10^{7}*	3.81×10^{6}*	2.54×10^{6}	4.09×10^{5}	2.13×10^{6}	1.27×10^{6}
Fort Davis	1.78×10^{7}*	$2.84 \times 10^{6*}$	1.78×10^{6}	1.15×10^{6}	6.26×10^{5}	1.06×10^{6}
Fort Dupont	5.81×10^{7}*	$8.72 \times 10^{6*}$	5.81×10^{6}	1.13×10^{6}	4.68×10^{6}	2.91×10^{6}
Fort Chaplin	3.39×10^{7}*	$4.74 \times 10^{6*}$	3.39×10^{6}	2.70×10^{6}	0.69×10^{6}	1.35×10^{6}
Hickey Run	1.79×10^{8}*	$2.51 \times 10^{7*}$	1.79×10^{7}	1.08×10^{7}	7.14 x 106	7.20×10^{6}
Nash Run	5.52×10^{7}*	$8.28 \times 10^{6*}$	5.52×10^{6}			
DC loads	3.68×10^{7}*	5.52×10^{6}	3.68×10^{6}	3.63×10^{6}	4.68×10^{4}	1.84×10^{6}
MD loads	1.84×10^{7}*	2.76×10^{6}				
Popes Branch	3.80×10^{7}*	$6.08 \times 10^{6*}$	3.80×10^{6}	5.81×10^{6}	2.72×10^{5}	2.28×10^{6}
Texas Ave. Tributary	3.25×10^{7}*	$4.88 \times 10^{6*}$	3.25×10^{6}	4.38×10^{6}	0.50×10^{6}	1.63×10^{6}
Watts Branch	3.56×10^{8}*	$4.98 \times 10^{7*}$	3.56×10^{7}			
DC loads[5]	1.67×10^{8}	4.98×10^{7}	1.67×10^{7}			
Upper Watts	1.22×10^{8}	1.71×10^{7}	1.22×10^{7}	1.19×10^{7}	2.61×10^{5}	0.47×10^{7}
Lower Watts	0.45×10^{8}	0.63×10^{7}	0.45×10^{7}	0.44×10^{7}	1.02×10^{5}	0.18×10^{7}
MD loads	1.89×10^{8}	2.64×10^{7}				

*Values from the TMDL Report
**Sum of CSO allocation and tributary storm water allocation from TMDL Report
[1]Most Probable Number is a statistical estimation of bacteria count based on a specific analytical method
[2]Wasteload Allocation
[3]Load Allocation
[4]Margin of Safety
[5]DC loads taken as 47 percent of total load consistent with previous TMDLs

III. 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

[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.

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 drainage is controlled by storm sewers or combined (storm and sanitary) sewers. Combined sewer overflows (CSOs) are a contributor to fecal coliform bacteria in 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 bacteria, the agreement's *Priority Urban Waters* section does call for reducing pollution loads to the Anacostia River in order to eliminate public health concerns.

IV. 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 fecal coliform bacteria. 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 oxygen demand (SOD). The water quality sub-model is used to simulate eutrophication and other chemical and biological transformations which affect dissolved oxygen levels in the water column.

ICPRB[2] constructed a simple mass balance model to estimate tributary fecal coliform loads. As described below, 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.

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[2]Interstate Commission on the Potomac River Basin

[3]Hydrologic Simulation Program - Fortran

V. 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:

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
District of Columbia
Total Maximum Daily Loads
Anacostia River Watershed
For Fecal Coliform Bacteria
October 16, 2003

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 fecal coliform bacteria 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 Fecal Coliform Bacteria Upper Anacostia River, Lower Anacostia River, Watts Branch, Fort Dupont Creek, Fort Chaplin Tributary, Fort Stanton Tributary, Hickey Run, Nash Run, Popes Branch, Texas Avenue Tributary, District of Columbia,* dated May 2003 (TMDL Report), to EPA for final review which was received by EPA on May 27, 2003. The TMDL Report uses as its technical basis *The TAM/WASP Model: A Modeling Framework for the Total Maximum Daily Load Allocation in the Tidal Anacostia River, Final Report*[4] and subsequent model additions and modifications described in *Long Term Control Plan Study Memorandum LTCP-6-4, Anacostia River Model Documentation*,[5] and *District of Columbia Small Tributaries Total Maximum Daily Load Model*[6] Draft Report.

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[4]Mandel, Ross and Cherie L. Schultz, *TAM/WASP Model: A Modeling Framework for the Total Maximum Daily Load Allocation in the Tidal Anacostia River, Final Report*, Interstate Commission on the Potomac River Basin, October 6, 2000.

[5]*Long Term Control Plan Study Memorandum LTCP-6-4, Anacostia River Model Documentation*, August 2001.

[6]*District of Columbia Small Tributaries Total Maximum Daily Load Model* Final Report, Interstate Commission on the Potomac River Basin (ICPRB), July 2003. Earlier versions of the report were used in developing and evaluating the fecal coliform bacteria TMDL.

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 the1998 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

1998 Section 303(d) list					
Segment No.	Waterbody	Pollutants of Concern	Priority	Ranking	Action Needed
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

CSO - combined sewer outfall

Maryland's 1998 Section 303(d) list of impaired waters included their portion of 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, 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.

The following TMDL Summary table is discussed in Section V.2. The approved TMDLs are shaded. Maryland's allocations are based on meeting the District's applicable water quality standards at the Maryland/DC border:

Table 2 - TMDL Summary

Total Annual Loads - MPN[1]					
Segment	TMDL	WLA[2]	LA[3]	Upstream	MOS[4]
Upper Anacostia	1.99×10^{15}	1.63×10^{15}	1.11×10^{13}	3.48×10^{14}*	Implicit
Lower Anacostia	8.27×10^{14}	8.21×10^{14}	5.98×10^{12}		Implicit
Total	2.83×10^{15}	2.46×10^{15}**	1.71×10^{13}*	3.48×10^{14}*	

The approved TMDLs are shaded. Maryland's allocations are based on meeting the District's applicable water quality standards at the Maryland/DC border.

Tributary name	Existing Loads	TMDL - to meet WQS	TMDL - 90% load reduction	WLA	LA	MOS
Fort Stanton	2.54×10^{7}*	3.81×10^{6}*	2.54×10^{6}	4.09×10^{5}	2.13×10^{6}	1.27×10^{6}
Fort Davis	1.78×10^{7}*	2.84×10^{6}*	1.78×10^{6}	1.15×10^{6}	6.26×10^{5}	1.06×10^{6}
Fort Dupont	5.81×10^{7}*	8.72×10^{6}*	5.81×10^{6}	1.13×10^{6}	4.68×10^{6}	2.91×10^{6}
Fort Chaplin	3.39×10^{7}*	4.74×10^{6}*	3.39×10^{6}	2.70×10^{6}	0.69×10^{6}	1.35×10^{6}
Hickey Run	1.79×10^{8}*	2.51×10^{7}*	1.79×10^{7}	1.08×10^{7}	7.14 x 106	7.20×10^{6}
Nash Run	5.52×10^{7}*	8.28×10^{6}*	5.52×10^{6}			
DC loads	3.68×10^{7}*	5.52×10^{6}	3.68×10^{6}	3.63×10^{6}	4.68×10^{4}	1.84×10^{6}
MD loads	1.84×10^{7}*	2.76×10^{6}				
Popes Branch	3.80×10^{7}*	6.08×10^{6}*	3.80×10^{6}	5.81×10^{6}	2.72×10^{5}	2.28×10^{6}
Texas Ave. Tributary	3.25×10^{7}*	4.88×10^{6}*	3.25×10^{6}	4.38×10^{6}	0.50×10^{6}	1.63×10^{6}
Watts Branch	3.56×10^{8}*	4.98×10^{7}*	3.56×10^{7}			
DC loads[5]	1.67×10^{8}	4.98×10^{7}	1.67×10^{7}			
Upper Watts	1.22×10^{8}	1.71×10^{7}	1.22×10^{7}	1.19×10^{7}	2.61×10^{5}	0.47×10^{7}
Lower Watts	0.45×10^{8}	0.63×10^{7}	0.45×10^{7}	0.44×10^{7}	1.02×10^{5}	0.18×10^{7}
MD loads	1.89×10^{8}	2.64×10^{7}				

*Values from the TMDL Report
**Sum of CSO allocation and tributary storm water allocation from TMDL Report
[1]Most Probable Number is a statistical estimation of bacteria count based on a specific analytical method
[2]Wasteload Allocation
[3]Load Allocation
[4]Margin of Safety
[5]DC loads taken as 47 percent of total load consistent with previous TMDLs

III. Background

Anacostia River Watershed

The Anacostia River watershed covers 176 square miles in the District of Columbia and Maryland.[7] 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[8]. 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 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 6 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 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

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[7]Much of the background information is taken from ICPRB, 2000.

[8]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.

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 bacteria, the agreement's *Priority Urban Waters* section does call for reducing pollution loads to the Anacostia River in order to eliminate public health concerns.

Table 3 - Land Use 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 to high fecal bacteria counts in the river. CSOs drain approximately 11 square miles of the District of Columbia with 17 CSO outfalls 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. WASA has chosen a "demonstration approach" for the design of the LTCP, meaning that it is designed to achieve applicable water quality standards.[9] As part of the LTCP, computer simulation models of the District's combined sewer and storm water system were constructed. Those models were used to simulate current conditions and alternative management plans. As part of WASA's assessment of alternative control plans, the TAM/WASP model was also used to assess the impact of CSOs on water quality in the Anacostia River and to demonstrate that the recommended LTCP adequately protects water quality standards. WASA's recommended LTCP

[9] EPA's 1994 CSO Policy, 59 FR 18688

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.[10] 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.

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 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.

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

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 head water of Hickey Run daylights near Queen Chapel Road and Lawrence and enters a square culvert for approximately 3000 feet to daylight 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 fecal coliform bacteria TMDLs for the Upper and Lower Anacostia River and its tributaries. Third-year requirements also include TMDLs for various combinations of the Anacostia River and tributaries for metals, organics, 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/importance/significance of the pollutant loading. For example, the District used the relatively complex TAM/WASP model to develop bacteria TMDLs for the Upper and Lower Anacostia River mainstem because of the significant impact of the loading from those segments on water quality and because of the relatively rich amount of data for those segments. The District chose to use a less complex model to develop the bacteria 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 on mainstem water quality is relatively less significant than the impact of the mainstem loadings on water quality. Complex models such as the TAM/WASP model require large amounts of water quality data. Overall EPA finds that the District's selection of models for the two types of waterbodies is reasonable and appropriate as described in the following sections.

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

The TAM/WASP model simulates the physical, chemical, and biological processes in the Anacostia River mainstem. The District's Biochemical Oxygen Demand (BOD) TMDL approved by EPA by letter December 14, 2001, used a TAM/WASP model composed of three sub-models: (1) a hydrodynamic sub-model, which consists of the hydrodynamic portion of

TAM, (2) a sediment exchange sub-model, which uses a new implementation by Dr. Lung[11] of the sediment oxygen demand (SOD) model of DiToro[12], and (3) a water quality sub-model, which consists of a modified version of the WASP5 EUTRO eutrophication model. The hydrodynamic sub-model was 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 SOD. The water quality sub-model is used to simulate eutrophication and other chemical and biological transformations which affect dissolved oxygen levels in the water column. Additionally, a variety of methods are used to simulate daily input flows and loads, including use of a HSPF[13] model for the Watts Branch sub-watershed. The methods are explained in detail in *The TAM/WASP Model: A Modeling Framework for the Total Maximum Daily Load Allocation in the Tidal Anacostia River, Final Report,* October 6, 2000.

The Anacostia River is not a static system. It continues to change, both from the forces of nature and man-made effects. Likewise, the model used to compute the BOD TMDL continues to change. Model development often proceeds from the simple to the complex and may go through several iterations. As additional data is collected and the understanding of the modeled system increases, the modeled representation of the natural system can be improved.

In the October 6, 2000, modeling report, ICPRB details the models' history, structure, modification, available data, calibration, verification, and sensitivity analysis. EPA's evaluation of the model is contained in the *Decision Rationale for the Anacostia River Watershed For Biochemical Oxygen Demand*, approved by EPA on December 14, 2001. The model was turned over to the District, and WASA began testing the model for use in developing the LTCP for the CSOs.[14] The model was modified to reflect new information available, specifically, revised cross section geometry obtained from the Corps of Engineers reflecting recent dredging and revised model segmentation based on a dye study performed during the summer of 2000.

Improvements to the TAM/WASP model are described in WASA's LTCP *Study Memorandum LTCP-6-4, Anacostia River Model Documentation*. The following improvements have been made to the model:

- The sediment oxygen demand and ammonia flux representation were improved so that now as pollution loads are reduced, the sediment oxygen demand and ammonia fluxes change dynamically within the model.

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[11]Lung, W., *Incorporating a Sediment Model into the WASP/EUTRO Model*, Appendix A of the ICPRB, October 6, 2000, report.

[12]Di Toro, D. M., P. R. Paquin, K. Subburamu, and D. A. Gruber, 1990, *Sediment Oxygen Demand Model: Methane and Ammonia Oxidation,* Journal of Environmental Engineering 116: 945-986.

[13]Hydrologic Simulation Program - Fortran

[14]The July 2002 Long-Term Control Plan, Final Report, was submitted to EPA.

- The original TAM/WASP model did not model bacteria. As part of the LTCP, the eutrophication simulation code was modified to provide the model with the capability to predict first-order bacteria degradation kinetics. The change allows ammonia to act as a surrogate state variable for simulating both fecal coliform and *e. coli* bacteria, without affecting the dissolved oxygen and eutrophication kinetics, in the TAM/WASP model framework.

- The model was re-segmented, from 15 to 35 segments, based on 1999 Corps of Engineers survey information and the June 2000 dye study (Figure 1). The objective of the changes was to improve the representation of chemical fate and transport within TAM/WASP model framework by reducing possible grid-induced numerical dispersion effects and to better represent current river channel geometry conditions.

The hydrodynamic portion of the TAM/WASP model requires two types of times series, hourly tidal heights at the downstream boundary with the Potomac River and the daily rate of inflow for each modeling segment. Hourly tidal heights were obtained from the NOAA[15] web site for a station that is approximately at the confluence of the Potomac and Anacostia Rivers.

The rate at which water enters a model segment from outside the model boundary is also needed as input to the hydrodynamic model. For the LTCP and this TMDL, the sources of inflow include:

Upstream flows/loads from Maryland based on the USGS gage records on the Northeast and Northwest Branches and increased for the additional drainage area and Lower Beaverdam Creek located between the gages and the Maryland/ District line,
Storm water from WASA's storm sewers,
Lateral flow from overland runoff the Anacostia River, and
Combined Sewer Outfall discharges.

WASA did not attempt to include groundwater, or tributary base flow, as an input flow. EPA believes[16] any resulting error is within the accuracy of the model, based on work performed by T.J. Murphy, MWCOG. In addition, ICPRB's technical document, *TAM/WASP Toxics*

[15] National Oceanic and Atmospheric Administration

[16] Personal communication Mary F. Beck, EPA, with T.J. Murphy, MWCOG.

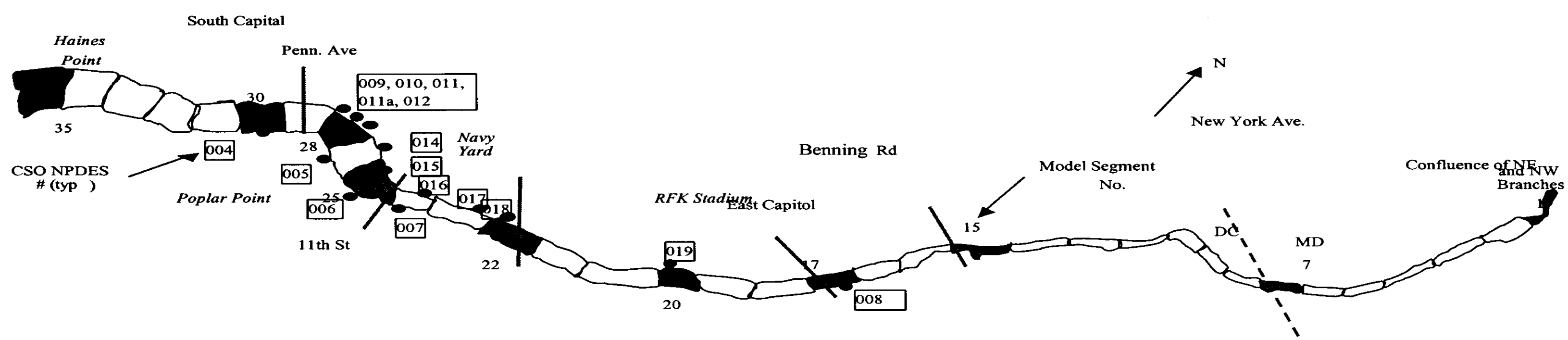


Figure 1. Anacostia River modeled as 35 segments, 1 at the upstream end and 35 at the confluence with the Potomac River.

Screening Level Model for the Tidal Portion of the Anacostia River, Final Draft, April 2003, estimated the base flow to be approximately two percent of the total flow and has only a minor impact on the model results.

The USGS maintains two surface-water gaging stations; one on the Northeast Branch and one on the Northwest Branch approximately at the head-of-tide on each branch. Daily flows and periodic water quality monitoring data was used to create load inputs.

The locations of the combined sewer overflows are shown in Figure 1. The CSO flows used for this TMDL are based on the extensive studies, flow and water quality monitoring, and modeling performed for the District's LTCP and documented in Study Memorandums and summarized in the final LTCP Report dated July 2002. The District of Columbia WASA has the responsibility for developing the LTCP.

Because of the complex nature of the hydrology and hydraulics governing the combined sewer system (CSS), a comprehensive model was required to relate the occurrence of CSO outfall events to a system-wide precipitation event. The model needed to be sufficiently detailed to allow prediction of overflow events observed during the monitoring period and flexible enough to allow modification that accurately characterize the implementation of future long-term control options. (Study Memorandum LTCP-5-4) The selected model is the propriety program MOUSE by the Danish Hydraulic Institute.

The MOUSE hydrology characterization consists of 969 separate catchment areas, each with its own associated hydrologic parameters. The MOUSE network is comprised of six element types: (1) manholes, (2) basins, (3) outlets, (4) weirs, (5) pumps, and (6) pipes or (7) custom cross-sections. MOUSE input data includes several separate time series databases. Types of data include rainfall, water level (tide), and discharge. The systems diversion structures, inflatable dams and dynamic gates, and pumping stations were also modeled.

The combined sewer system has evolved over the years. In 1960 the District adopted a policy to separate the system over time. Separation projects undertaken in several smaller drainage areas on the west side of Rock Creek but construction difficulty brought the project to a halt. In 1970 and 1973 feasibility studies were performed regarding off-line storage. However, both studies were rejected by the District because of the costs involved.

In the early 1980s, another attempt at CSO discharge abatement was made. A two-phase program was developed that focused primarily on overflows to the Anacostia River. Phase I was completed in 1991. Phase I consisted of a 400 million gallons per day (mgd) CSO treatment facility, the Northeast boundary Swirl Facility, and installation of inflatable dams at eight of the largest CSOs. Phase II, consisting of two additional swirl concentrator facilities, a sewer separation project, and a screening facility for the Piney Branch drainage area, was never implemented because of lack of funding (LTCP). A 1998 evaluation of WASA's pumping stations and conveyance system recommended rehabilitation of restore capacity.

In order to evaluate either LTCP alternatives or TMDL scenarios, a baseline must be established. The LTCP, Table 6-1, identifies three potential baseline scenarios:

	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 Bacteria TMDL Report selected B1 as the baseline scenario. The baseline scenario provides a basis from which to evaluate alternate control scenarios and establish required reductions, *i.e.,* a 95 percent reduction is required from the B1 scenario.

MOUSE was also used to develop storm sewer volumes during the representative three-year period of analysis, 1988 to 1990. The year 1988 was a dry year with a total rainfall of 31.74 inches, 1989 was a wet year with 50.32 inches of rain, and 1990 was an average year with 40.94 inches of rain. This TMDL and the previous Anacostia River TMDLs for biochemical demand and total suspended solids also used the same period of analysis. EPA finds that the use of these representative years is appropriate.

WASA also conducted monitoring programs to establish pollutant concentrations in both the CSO discharge and storm water described in various study memorandums. *Study Memorandum LTCP-5-8*[17] describes the "event mean concentration" (EMC). As the pollutant concentration varies over the course of storm runoff, the EMC is the runoff volume averaged concentration.

From August 1999 to July 2000, approximately 19 CSS and separate storm water system (SSWS) locations were monitored for some or all of the following:

- Flow
- Conventional parameters including fecal coliform and *e.-coli* [18]
- Total metals
- Dissolved metals

[17] *Long Term Control Plan Study Memorandum LTCP-5-8, CSS and SSWS Event Mean Concentrations*, Draft, September 2000.

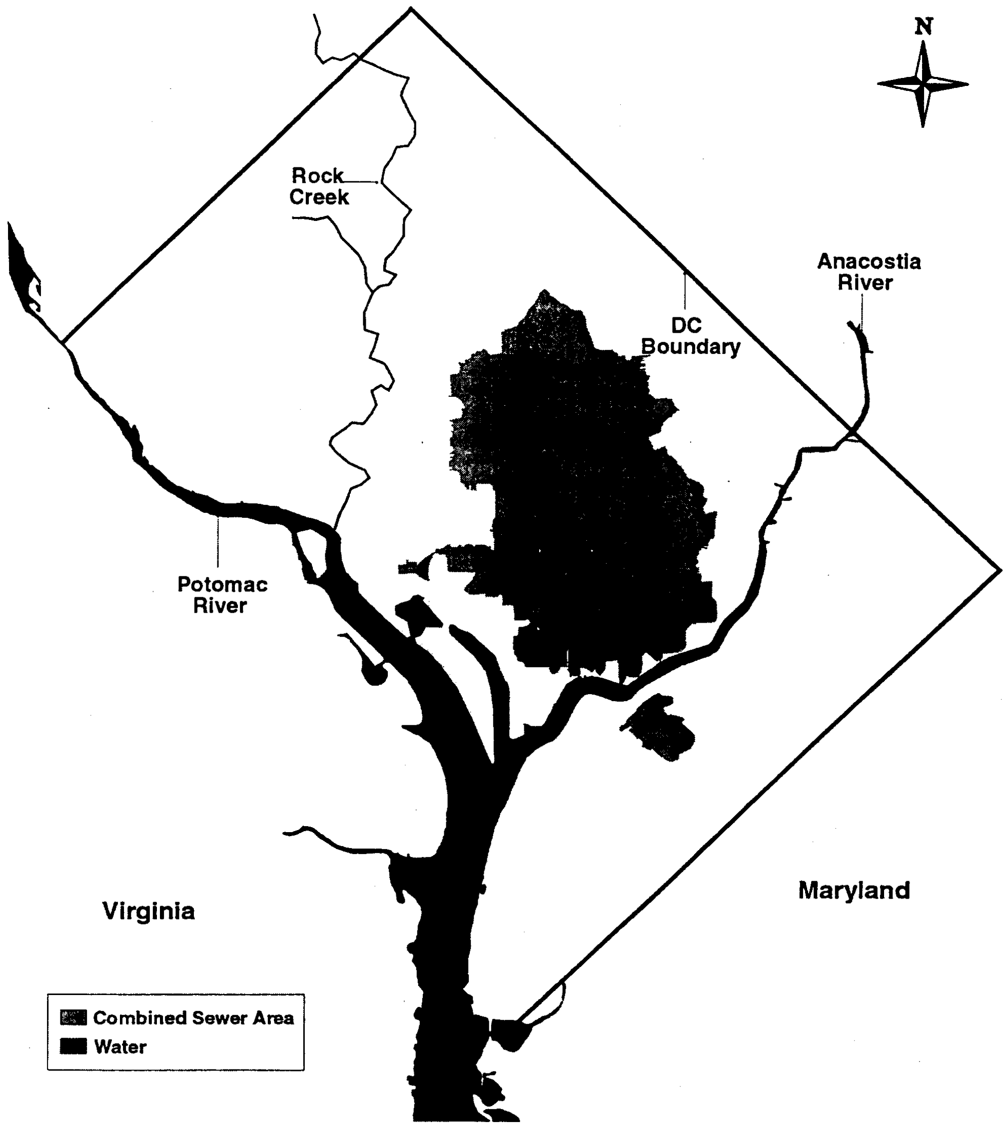
[18] Samples taken from March 2000 to September 2000.

The LTCP and the Anacostia River Bacteria TMDLs used the following Event Meam Concentrations:

Table 4. CSO Event Mean Concentrations

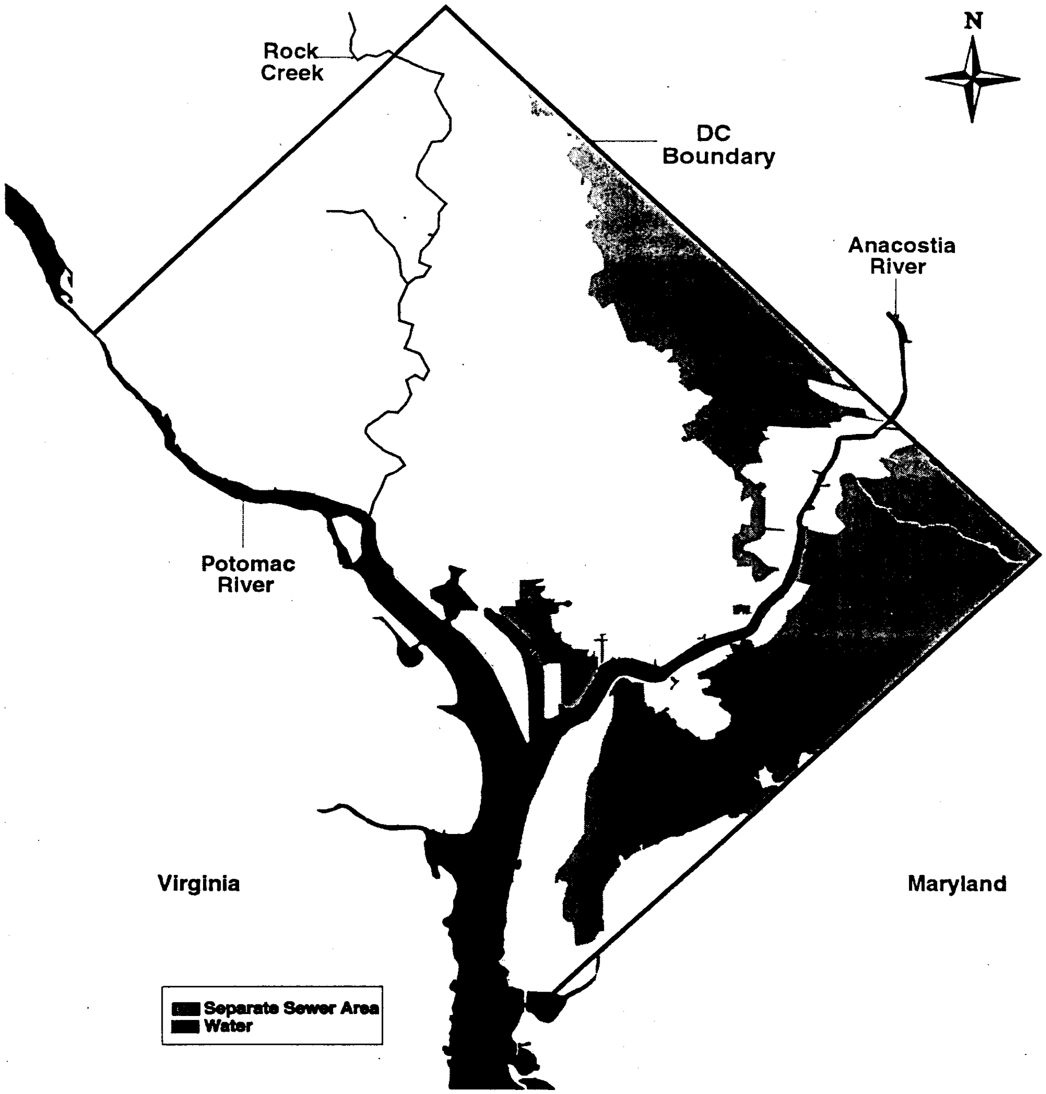
Parameter	CSOs 009, 010, 011, 011a	CSO 012	CSO 019, Swirl Effluent	CSO 019, Swirl Bypass	All Other Anacostia CSOs	SSWS
Fecal Coliform MPN/100 ml	939,270	939,270	191,309	939,270	939,270	28,265
E. Coli MPN/100 ml	686,429	686,429	122,011	686,429	686,429	16,238
Dissolved Oxygen mg/l	6	6	6	6	6	6

The LTCP describes the combined sewer system, separate storm water sewer system, "lateral flow," and upstream flow.



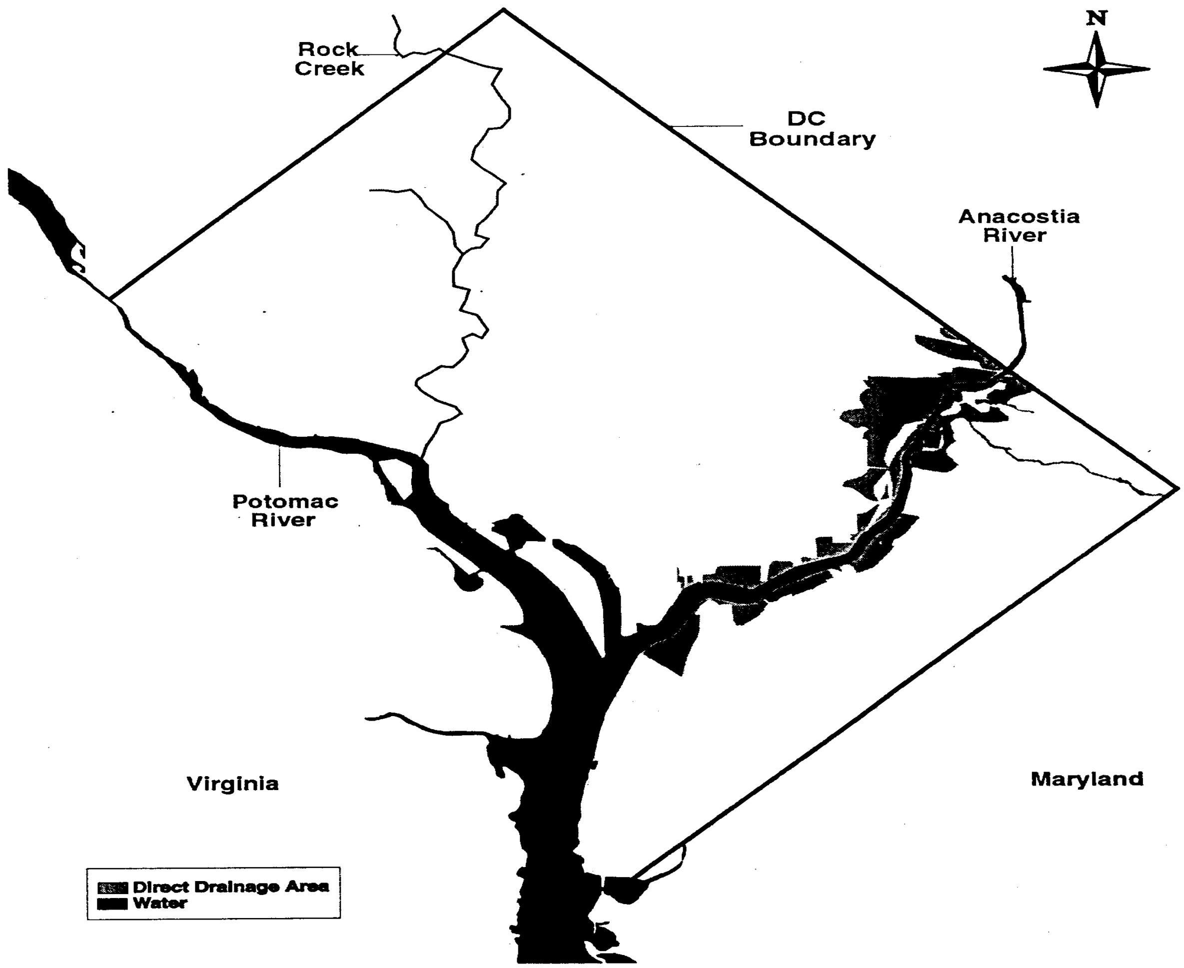
Combined Sewer Area that Drains to the Anacostia River

Figure 2



Separate Storm Sewers Within the District Portion of the Anacostia Watershed.

Figure 3



Land that Drains Directly to the Anacostia River

Figure 4

The other source of storm water is rainfall runoff that flows overland directly to the Anacostia River, or through storm sewers not under the control of the District. A variation of the rational equation was used:

$$Q = 0.042(Rv * I * Pj * A)$$

where

Rv = runoff coefficient
I = rainfall intensity in inches / day
Pj = fraction of rainfall events that produce runoff - 0.9 (to account for initial abstraction)
A = direct drainage area in acres
Q = flow in cubic feet / second

The above describes how the EMC and flow to each WASP segment was determined.

The upstream Anacostia River and storm water concentrations are shown in Table 5.

Table 5 - Storm Water Constituent Concentrations.

Water Body	Flow Type	Constituent	Concentration
NW Branch	Base	Fecal Coliform	500 MPN/100 ml
NW Branch	Storm	*E. coli*	8,000 MPN/100 ml
NW Branch	Base/Storm	Dissolved Oxygen	90% of Saturation
NE Branch	Base	Fecal Coliform	200 MPN/100 ml
NE Branch	Storm	*E. coli*	3,500 MPN/100 ml
NE Branch	Base/Storm	Dissolved Oxygen	90% of Saturation
MS4	Storm	Fecal Coliform	28,265 MPN/100 ml
MS4	Storm	*E. coli*	16,238 MPN/100 ml
MS4	Storm	Dissolved Oxygen	6 mg/l

(LTCP-6-4, August 2001 and LTCP-5-8, September 2000)

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 fecal coliform. The fecal coliform sub-model simulates concentrations of fecal coliform which is used as an indicator of human and non-human fecal matter and is associated with pathogens in natural waterbodies.[19]

[19]ICPRB 2003.

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 fecal coliform load based on average concentrations measured in available storm water and base flow monitoring data. No additional instream processes, such as sediment resuspension or fecal coliform 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.

Based on the District's MS4 monitoring data, the storm water fecal coliform count used is 17,300 counts/100 ml and the baseflow count is 280 counts/100 ml.

Daily estimates of base flow and storm water volume for each tributary is based on ICPRB's Watts Branch HSPF model[20] 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. EPA finds the District's judgment reasonable and consistent with supporting information.

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 document allocates the District's portion of the TMDL between WLA, and LAs.

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:

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[20] Appendix B, ICPRB 2000.

$$\text{TMDL} = \sum \text{WLAs} + \sum \text{LAs} + \text{MOS}$$

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 because of "excessive counts of fecal coliform bacteria." In 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
E. Navigation

For purposes of the bacteria impairment identified on the District's 1998 Section 303(d) list, the TMDL Report notes that these bacteria TMDLs are designed to "achieve or exceed water quality standard[s] as measured by fecal coliform as indicator organism" for two of those uses: Class A (primary contact recreation) and B (secondary recreation and aesthetic enjoyment).[21] The District's definition of primary contact recreation is "those water contact sports or activities that result in frequent whole body immersion or involve significant risks of ingestion of the water."

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.

[21]The numeric standards for fecal coliform only apply to Class A and B uses since exposure to bacteria is normally express through illnesses related to human contact, *i.e.*, primary and secondary contact recreation.

Table 6 - Water Quality Standards

Fecal Coliform - No./100 ml		
District of Columbia*		
Class of Use	A	B
Bacteriological		
Fecal coliform - maximum 30-day geometric mean for 5 samples	200	1,000
Maryland**		
Bacteriological	Public health	
Fecal coliform - maximum log mean based on not less than 5 samples over any 30-day period, or	200	
Fecal coliform - maximum value which may exceeded during any 30-day period by less than 10% of total number of samples taken	400	

*49 D.C. REG. 3012; and 49 D.C. REG.4854
**COMAR 26.08.02.03-3

Table 7 - Comparison of Fecal Coliform Geometric Means Between Existing and TMDL Scenarios

Criteria	Model Segment					
	DC				MD	
	35	28	25	20	7	1
Existing Conditions						
Number of Months Geomean > 200 MPN/ 200 ml	1	7	9	11	12	12
Number of Months Geomean > 1000 MPN/1000 ml	0	1	1	4	6	7
TMDL Allocation Run						
Number of Months Geomean > 200 MPN/200 ml	0	0	0	0	0	0
Number of Months Geomean > 1000 MPN/1000 ml	0	0	0	0	0	0

EPA finds that this TMDL is consistent with and achieves the District's water quality standards for bacteria.

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 as "categorical load allocations" whether or not the storm water source is regulated by an 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.[22] Therefore, this Decision Rationale identifies WLAs for storm water discharges subject to NPDES permitting based on supporting information submitted by the District with this TMDL.

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 <u>not</u> be addressed by the load allocation (LA) component of a TMDL,
- Storm water discharges from sources that are not currently subject to NPDES regulation <u>may</u> 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, and
- 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 BOD and total suspended solids also assigned all storm water as a LA 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. The present Anacostia River mainstem model's input files, as refined by WASA, do distinguish storm water sewer discharge from overland flow. The TMDL Report identifies that portion of the existing load and allocated load resulting from "direct storm runoff."

In the previously approved/established TMDLs for the Anacostia River, the "tributary storm water" component included separate storm sewer discharge and tributary flow. However, the storm water input files for the LTCP and the Anacostia River mainstem fecal coliform bacteria TMDLs do not include tributary or base flow but do have separate fecal coliform files

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[22]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.

for the MS-4 permitted storm water and the overland or direct storm water (see the section on the history and use of the bacteria TAM/WASP model). Therefore, EPA was able to further identify the Anacostia River fecal coliform bacteria TMDL into WLAs and LAs.

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

Except for Watts Branch, Hickey Run and Nash 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 TMDL and the associated required percent reduction to meet water quality standards from existing loads in order to meet water quality standards. The required percent reduction ranges from 84 to 87 percent. In the MOS section the District states "(a)s a margin of safety the loads to all tributaries (hence the load to the Anacostia) will be reduced by 90%," therefore, EPA has made the arithmetic corrections to the allocations shown in this Decision Rationale. In addition, and the explicit MOS is included.

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 listed 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 further sub-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 fecal coliform loads:

- 95 percent reduction in CSO loads
- 97 percent reduction is upstream loads from Maryland
- 97 percent reduction in storm water loads discharging directly to the Anacostia River (overland flow)
- 90 percent reduction in loads from storm sewers
- 90 percent reduction in tributary storm water loads

The following tables contain the allocations and identify allocations as taken from the TMDL Report.

Table 8 - TMDL Summary

Total Annual Loads - MPN[1]					
Segment	TMDL	WLA[2]	LA[3]	Upstream	MOS[4]
Upper Anacostia	1.99×10^{15}	1.63×10^{15}	1.11×10^{13}	3.48×10^{14}*	Implicit
Lower Anacostia	8.27×10^{14}	8.21×10^{14}	5.98×10^{12}		Implicit
Total	2.83×10^{15}	2.46×10^{15}**	1.71×10^{13}*	3.48×10^{14}*	

The approved TMDLs are shaded. Maryland's allocations are based on meeting water quality standards

Tributary name	Existing Loads	TMDL - to meet WQS	TMDL - 90% load reduction	WLA	LA	MOS
Fort Stanton	2.54×10^{7}*	3.81×10^{6}*	2.54×10^{6}	4.09×10^{5}	2.13×10^{6}	1.27×10^{6}
Fort Davis	1.78×10^{7}*	2.84×10^{6}*	1.78×10^{6}	1.15×10^{6}	6.26×10^{5}	1.06×10^{6}
Fort Dupont	5.81×10^{7}*	8.72×10^{6}*	5.81×10^{6}	1.13×10^{6}	4.68×10^{6}	2.91×10^{6}
Fort Chaplin	3.39×10^{7}*	4.74×10^{6}*	3.39×10^{6}	2.70×10^{6}	0.69×10^{6}	1.35×10^{6}
Hickey Run	1.79×10^{8}*	2.51×10^{7}*	1.79×10^{7}	1.08×10^{7}	7.14 x 106	7.20×10^{6}
Nash Run	5.52×10^{7}*	8.28×10^{6}*	5.52×10^{6}			
DC loads	3.68×10^{7}*	5.52×10^{6}	3.68×10^{6}	3.63×10^{6}	4.68×10^{4}	1.84×10^{6}
MD loads	1.84×10^{7}*	2.76×10^{6}				
Popes Branch	3.80×10^{7}*	6.08×10^{6}*	3.80×10^{6}	5.81×10^{6}	2.72×10^{5}	2.28×10^{6}
Texas Ave. Tributary	3.25×10^{7}*	4.88×10^{6}*	3.25×10^{6}	4.38×10^{6}	0.50×10^{6}	1.63×10^{6}
Watts Branch	3.56×10^{8}*	4.98×10^{7}*	3.56×10^{7}			
DC loads[5]	1.67×10^{8}	4.98×10^{7}	1.67×10^{7}			
Upper Watts	1.22×10^{8}	1.71×10^{7}	1.22×10^{7}	1.19×10^{7}	2.61×10^{5}	0.47×10^{7}
Lower Watts	0.45×10^{8}	0.63×10^{7}	0.45×10^{7}	0.44×10^{7}	1.02×10^{5}	0.18×10^{7}
MD loads	1.89×10^{8}	2.64×10^{7}				

*Values from the TMDL Report
**Sum of CSO allocation and tributary storm water allocation from TMDL Report
[1]Most Probable Number is a statistical estimation of bacteria count based on a specific analytical method
[2]Wasteload Allocation
[3]Load Allocation
[4]Margin of Safety
[5]DC loads taken as 47 percent of total load consistent with previous TMDLs

Because most of the loading to the Anacostia River and its tributaries is precipitation induced, the above 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[23] suggests that the "maximum daily loads only need to be extracted from the calculations already performed." EPA views a "maximum daily load" to mean that the permittee is allowed to discharge that load each and every day, which is suitable 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[24] period could be discharged every day and still meet the instream water quality standards. Instead, EPA believes the "average annual load" is an appropriate and reasonable expression of the TMDLs.

Attachment A presents one-day maximum loads extracted (or calculated) from various input files. The lateral (overland flow) loads, upstream loads, and permitted storm water flows are given for each date of CSO discharge under the recommended LTCP. The top 10 loads/ flows are also given. Because of the spacial and temporal variability, the top 10 may or may not correspond to a CSO discharge date.

Further, the commentor's 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 appropriate flexibility in crafting permit language.

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 bacteria and will develop specific TMDLs for their portion of the Anacostia River. MDE is currently having Maryland's portion of the watershed modeled using the Hydrologic System Program-Fortran (HSPF) in preparation for developing their TMDLs.

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[23]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.

[24]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.

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.[25] 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 9 - 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 CWA and Federal regulations require TMDLs to include a 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.

DC has chosen to use an implicit MOS for the mainstem Anacostia River. The District has invested a great deal of resources into defining CSO and MS4 loads to the river and an implicit margin of safety is reasonable.

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

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

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 MOS.

The tributaries' TMDLs were developed with less precise information. Therefore, a margin of safety equal to the difference between a 90 percent reduction in bacteria loading and the estimated TMDL load required to meet water quality standards is presented in this document.

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

Based on the WLA in the TMDL Report, the largest reduction in permitted loads to the Anacostia River will be to the CSOs at a 95 percent reduction based on the existing average annual volume scenario B1, prior to CSO Phase I controls, of 2,142 million gallons. The WASA-recommended final LTCP will meet this requirement.

The MS4 (municipal separate storm sewer system) permit and the NPDES storm water permits both provide regulatory authority to require effluent limits (numeric, narrative and/or BMPs) to achieve storm water pollutant load reductions, providing reasonable assurance that the TMDLs will be implemented. A 90 percent reduction in storm water bacteria loads is ambitious. EPA's comments on the draft TMDL requested some justification that a 90 percent reduction is possible. The District provided a report on the Mill Creek Investigation, dated March 21, 2003, and documentation[26] that WASA has selected a contractor to perform an evaluation of the D.C. sewer system. The estimated cost is approximately $12 million and take about five years. This effort includes an evaluation of capacity and condition of the collection system, identifying rehabilitation needs, and developing capital improvement program elements and schedules for rehabilitation. EPA finds this approach reasonable and recommends that the District reevaluate this TMDL at the end of that study period.

The re-affirmed Chesapeake Bay Agreement signed June 28, 2000, does not specifically address bacteria, but the *Priority Urban Waters* section does call for reducing pollution loads to the Anacostia River in order to eliminate public health concerns. In addition, the agreement does address bacteria reductions directly by establishing "no discharge zones" for human waste from boats. The Chesapeake Bay 2000 Agreement provides that there shall be no discharge of human waste from boats by 2003. The District intends to comply with that provision and has funded pump-out stations at every marina on the Anacostia River.

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

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[26]WASA's August 15, 2002, letter from Cuthbert Braveboy, Director of Sewer Services, to Jerusalem Bekele, Program Manager, Water Quality Division, Department of Health.

March 31, 2003. The TMDLs was placed in the Martin Luther King Jr. Library. The public notice was published in the D.C. Register. 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, and the District of Columbia Water and Sewer Authority. EPA considered those comments and the District's response to them in its evaluation of the TMDL submission.

APPENDIX A

Maximum Daily Loads