CHAPTER 1
INTRODUCTION

Purpose

The District of Columbia is a signatory to the Trash Free Potomac Watershed Treaty. This agreement calls for the Potomac River and tributaries to be trash free by the year 2013. The District has decided to focus its efforts on the Anacostia River. Consequently, the District of Columbia Department of the Environment (DDOE) decided to develop the Anacostia Watershed Trash Reduction Plan. The purpose of the plan is to conduct the necessary research, and develop a comprehensive framework, that will guide the trash reduction efforts in the watershed. Upon completion of the Trash Total Maximum Daily Load (TMDL) for the Anacostia, the Trash Reduction Plan will serve as the implementation plan for the TMDL in the District of Columbia portion of the watershed. It will also guide efforts in Rock Creek and the Potomac by serving as example of how a basin can be made trash free.

History

The District of Columbia is located at the confluence of the Anacostia River and the Potomac River. In the early development, the larger navigable rivers were a main artery of transportation of people and goods. Ports at Georgetown and Alexandria on the Potomac River, and Bladensburg on the Eastern Branch were important to the economy of the region. The Eastern Branch of the Potomac was later renamed the Anacostia River. The many small streams of the region provided shad and herring during the spring spawning runs. As the region developed, pollution problems developed. Sewage and sediment ran unchecked into the rivers. Early improvements to the sewage system routed the effluent to the nearest stream, and once the stream was too putrid to tolerate, it was enclosed and routed to the next larger stream. In the end, few of the small streams survived the process.

The District was developed with three types of sewers. In the early days, combined sewers were constructed. These carry the sanitary sewage at all times of the day, and during precipitation events, they also carry storm water. Before treatment facilities were constructed, they simply discharged to a stream or river. Once treatment facilities were available, the combined sewers were extended to the facility, but because they were not large enough to carry all of the runoff from all of the rainfall events, the sewers were constructed with overflow points along the way to relieve the pipes of the surplus flow. An overflow can be triggered by as little as a quarter inch of rainfall for some of these combined sewers. Because the combined sewers intercept storm water runoff from the streets, any trash and litter that is washed in from the streets is transported through the network of pipes, and any overflows from this system will contain trash and litter. Later in the development of the District, separate sanitary and storm sewers were constructed.

The separate sanitary sewers collect sewage and transport it to Blue Plains WWTP. The separate storm sewers collect runoff from inlets along the streets and transport it to a stream where it is discharged. In general, the older developed areas of the District have combined sewers and the newer parts of the District have separate sewers.

As development continued and pollution increased, the situation with the Anacostia reached a point where it was silted in, overloaded with sewage and believed to be the source of mosquito borne diseases. The debate over whether to dredge the river ended beginning in the 1920's, with the river being dredged and straightened. The wetlands that were the source of the mosquitoes were filled along and rock seawalls constructed. On the east side of the river only one stream survived the construction of the railroad and that was Watts Branch. Every other stream, such as Pope Branch, enters a pipe and is transported underground to outfalls at the Anacostia River seawall. On the West side, only Hickey Run survived and enters the Anacostia River as a free flowing stream.

Figure 1.1
View of the United States Capital across the Anacostia River

Modern Events

In 1989, Robert Boone created the Anacostia Watershed Society (AWS) with the well recognized logo of **START**: **S**top **T**rashing the **A**nacostia **R**iver **T**oday.

Figure 1.2
Anacostia Watershed Society Logo

This was the first effort to draw attention to the amount of trash in the Anacostia River. Since its inception in 1989, AWS has mobilized over 55,500 volunteers who have planted over 13,200 trees and stenciled 1,200 storm-drains within the watershed with anti-dumping messages as well as removed 790 tons of trash and over 12,800 tires from the watershed. Furthermore, AWS has educated 17,911 people with its slide presentation which explains the river's history and the current threats it faces, as well as the different lifestyle choices and changes citizens can undertake to improve the condition of the watershed. In addition to these education and restoration events, AWS has introduced 8,200 people, of which 4,500 were children, to the river through paddling clinics, canoe adventures and pontoon boat tours along the "Kingfisher Canoe Trail," a scenic five-mile stretch of the Anacostia River. All AWS programs teach citizens that they are integral participants in the restoration and preservation of this urban river.

The Alice Ferguson Foundation has been organizing trash Cleanups of the Potomac Watershed for twenty years. They realized that simply picking up the trash was a never ending task and set about to eliminate the trash. A Trash Free Potomac Watershed Treaty was developed and has now been signed by the governor of every state in the Potomac Watershed including the Mayor of the District of Columbia. The key provision was for entities to develop strategies for reducing trash.

Regulating Trash

Since at least 1896, it has been illegal to throw trash into the rivers of the District.

AN ACT To establish certain harbor regulations for the District of Columbia.

[29 Stat., 126.]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be unlawful for any owner or occupant of any wharf or dock, any master or captain of any vessel, or any person or persons to cast, throw, drop, or deposit any ballast, dirt, oyster shells, or ashes in the water in any part of the Potomac River or its tributaries in the District of Columbia, or on the shores of said river below high-water mark, unless for the purpose of making a wharf, after permission has been obtained from the Commissioners of the District of Columbia for that purpose, which wharf shall be sufficiently inclosed and secured so as to prevent injury to navigation.

SEC. 2. That it shall be unlawful for any owner or occupant of any wharf or dock, any captain or master of any vessel, or any other person or persons to cast, throw, deposit, or drop in any dock or in the waters of the Potomac River or its tributaries in the District of Columbia any dead fish, fish offal, dead animals of any kind, condemned oysters in the shell, watermelons, canteloupes, vegetables,

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fruits, shavings, hay, straw, ice, snow, filth, or trash of any kind whatsoever.

SEC. 3. That any person or persons violating any of the provisions of this act shall be deemed guilty of a misdemeanor, and on conviction thereof in the police court of the District of Columbia shall be punished by a fine not exceeding one hundred dollars or by imprisonment not exceeding six months, or by both such punishments, in the discretion of the court.

SEC. 4. That nothing in this act contained shall be construed to interfere with the work of improvement in or along the said river and harbor, under the supervision of the United States Government.

SEC. 5. That all acts or parts of acts inconsistent herewith are hereby repealed.

Approved, May 19, 1896.

APPLICABLE WATER QUALITY STANDARDS

Title 21 of the District of Columbia Municipal Regulations (DCMR) Chapter 11 contains the Water Quality Standards (WQS). The Anacostia River has the designated beneficial uses of:

1. *Class A- primary contact recreation,*
2. *Class B- secondary contact recreation,*
3. *Class C- protection and propagation of fish, shellfish, and wildlife,*
4. *Class D - protection of human health related to consumption of fish & shellfish,*
5. Class E- navigation.

Primary contact recreation *- those water contact sports or activities which result in frequent whole body immersion and/or involve significant risks of ingestion of the water.*

Secondary contact recreation *- those water contact sports or activities which seldom result in whole body immersion and/or do not involve significant risks of ingestion of the water.*

The provisions that deal with trash are as follows:

1104.1 *The surface waters of the District shall be free from substances attributable to point or nonpoint sources discharged in amounts that do any one of the following:*

(a) Settle to form objectionable deposits;

(b) Float as debris, scum, oil or other matter to form nuisances;

1104.3 *Class A waters shall be free of discharges of untreated sewage, litter and unmarked, submerged or partially submerged, man-made structures which would constitute a hazard to the users. Dry weather discharges of untreated sewage are prohibited.*

1104.4 *The aesthetic qualities of Class B waters shall be maintained.*

The Federal Water Pollution Control Act has provisions that relate to streams that have pollutants in quantities that affect the uses of the streams. Section 303(d)(1)(A) of the Federal Clean Water Act (CWA) states:

Each state shall identify those waters within its boundaries for which the effluent limitations required by section 301(b)(1)(A) and section 301(b)(1)(B) are not stringent enough to implement any water quality standards applicable to such waters. The State shall establish a priority ranking for such waters taking into account the severity of the pollution and the uses to be made of such waters.

Further section 303(d)(1)(C) states:

Each state shall establish for the waters identified in paragraph (1)(A) of this subsection, and in accordance with the priority ranking, the total maximum daily load, for those pollutants which the Administrator identifies under section 304(a)(2) as suitable for such calculations. Such load shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality.

In 1996, the District of Columbia developed a list of waters that do not, or are not, expected to meet water quality standards as required by section 303(d)(1)(A). The list was updated in 1998, 2002, 2004 and 2006. This list, submitted to the Environmental Protection Agency every two years, is known as the Section 303(d) list. For each of the listed waters, states are required to develop a Total Maximum Daily Load (TMDL) which calculates the maximum amount of a pollutant that can enter the water without violating water quality standards, and which allocates that load to all significant sources. Pollutants above the allocated loads must be eliminated. The District of Columbia 2006 303(d) list, as approved by EPA, specifies that the Anacostia River is impaired by trash. The State of Maryland has also listed their portion of the Anacostia as impaired by trash. The District and Maryland are currently working in cooperation to develop a TMDL for trash. The TMDL will determine the level of trash that can be in the river and will assign load reductions (allocations) to the point and nonpoint sources. The load reductions will become a part of the discharge permits for the systems which discharge trash to the Anacostia River. In the District of Columbia, the two main systems will be the WASA combined sewer system regulated under the Blue Plains Waste Water Treatment Plant permit and the storm sewers regulated under the stormwater permit. Once the allocations are incorporated into the discharge permit, trash reduction will no longer be a voluntary exercise, but will become a mandated enforceable provision of the permits that must be followed.

CHAPTER 2
ANACOSTIA BASIN DESCRIPTION

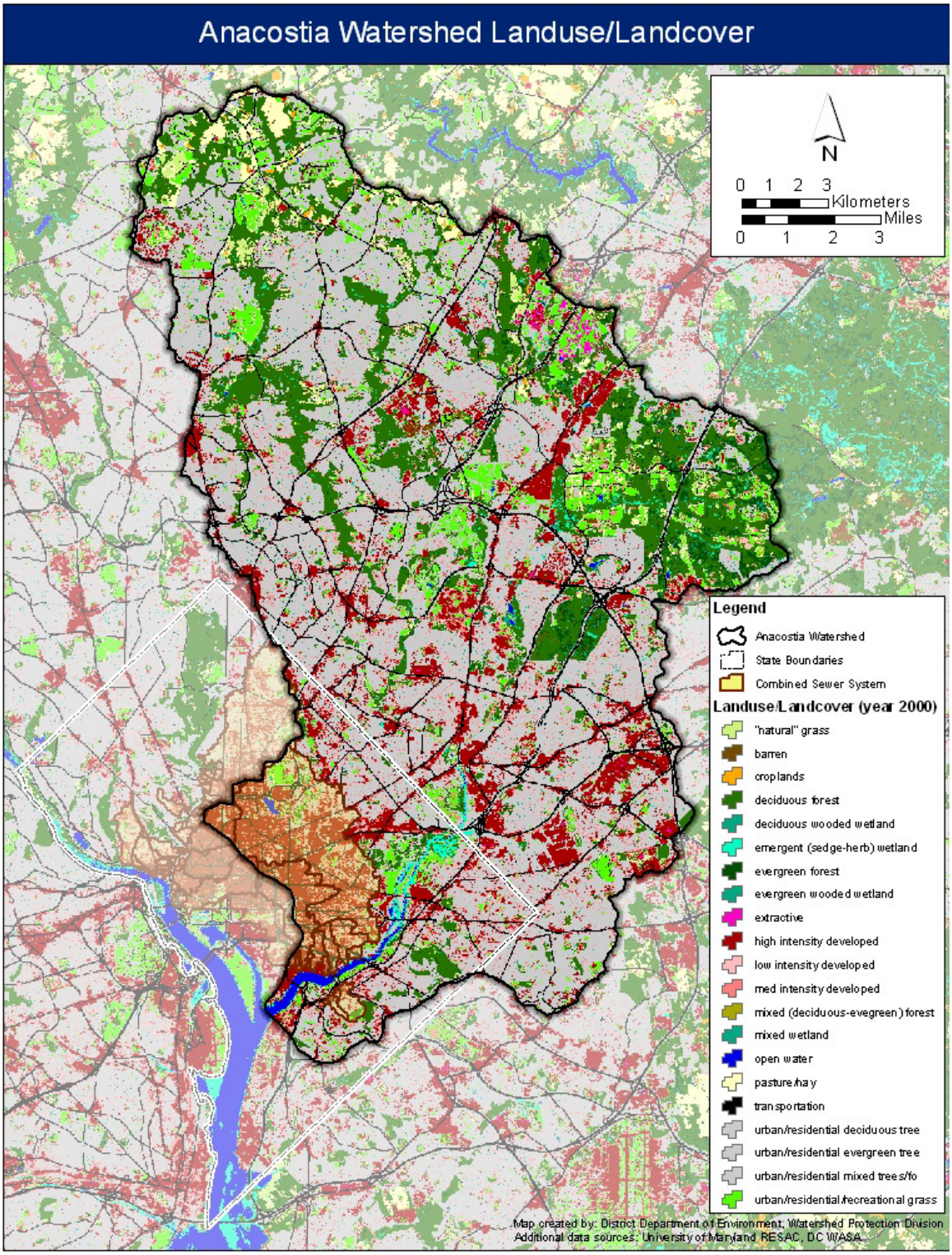
Anacostia Basin Description

Around the 1800s, the Anacostia River was a major thoroughfare for trade in the area now known as the District of Columbia and Bladensburg was a deep water port in Maryland. By 1850, the Anacostia River had developed sedimentation problems due to deforestation and improper farming techniques related to tobacco farms and European settlements. Channel volumes were greatly decreased and stream flow patterns were altered. Due to the continuation of the urbanization process, the river was never able to flush out the excessive amount of sediment and nutrients. The District of Columbia, as many cities in the 19th and early 20th centuries, developed a combined sewer system, which transported both rainfall and sanitary sewage away from the developed areas and discharged it into the rivers. The two major combined sewage outfalls were at the present location of the O" Street Pump Station and at the North East Boundary Sewer just below what is now Kingman Lake. In the 1930s, Blue Plains Waste Water Treatment Plant (WWTP) was constructed and flows of dry weather sewage flows were transported across the Anacostia River to Blue Plains. However, the wet weather flows were, and are, often greater than the transmission capacity of the pump stations and piping system, and there are overflows to the rivers and streams. Later, modern sewer system construction utilized two pipes so that the storm water could be kept separate from the sanitary sewage. Storm water is transported to the nearest stream channel and discharged while the sanitary sewage is transported to Blue Plains WWTP for treatment.

The Anacostia watershed is approximately 117,353 acres, with the drainage area being 49% in Prince George's County, 34% in Montgomery, and 17% in the District of Columbia. Two thirds of the basin lies within the Atlantic Coastal Plain and the remaining is in the Piedmont. The Anacostia River watershed is mostly residential and forest. There are 30% park and forest lands evenly dispersed throughout the watershed such as the National Park Service's Anacostia Park and Greenbelt Park, the National Arboretum and Beltsville Agricultural Research Center. The industrial and manufacturing land use is largely confined to the tidal area of the basin such as Hickey Run, Lower Beaverdam Creek, and Indian Creek. These creek sub- watersheds contain impervious land uses as high as 80%.

The head of tide for the Anacostia River is at Bladensburg, MD. Above Bladensburg, the river is composed of the Northeast Branch and the Northwest Branch. The mean annual stream flow for Northwest Branch is 48.6 cubic feet per second and the mean annual flow for the Northeast Branch is 86.4 cubic feet per second. This provides a combined mean annual flow of 135 cubic feet per second (cfs).

Figure 2.1
Anacostia Watershed and Sewershed

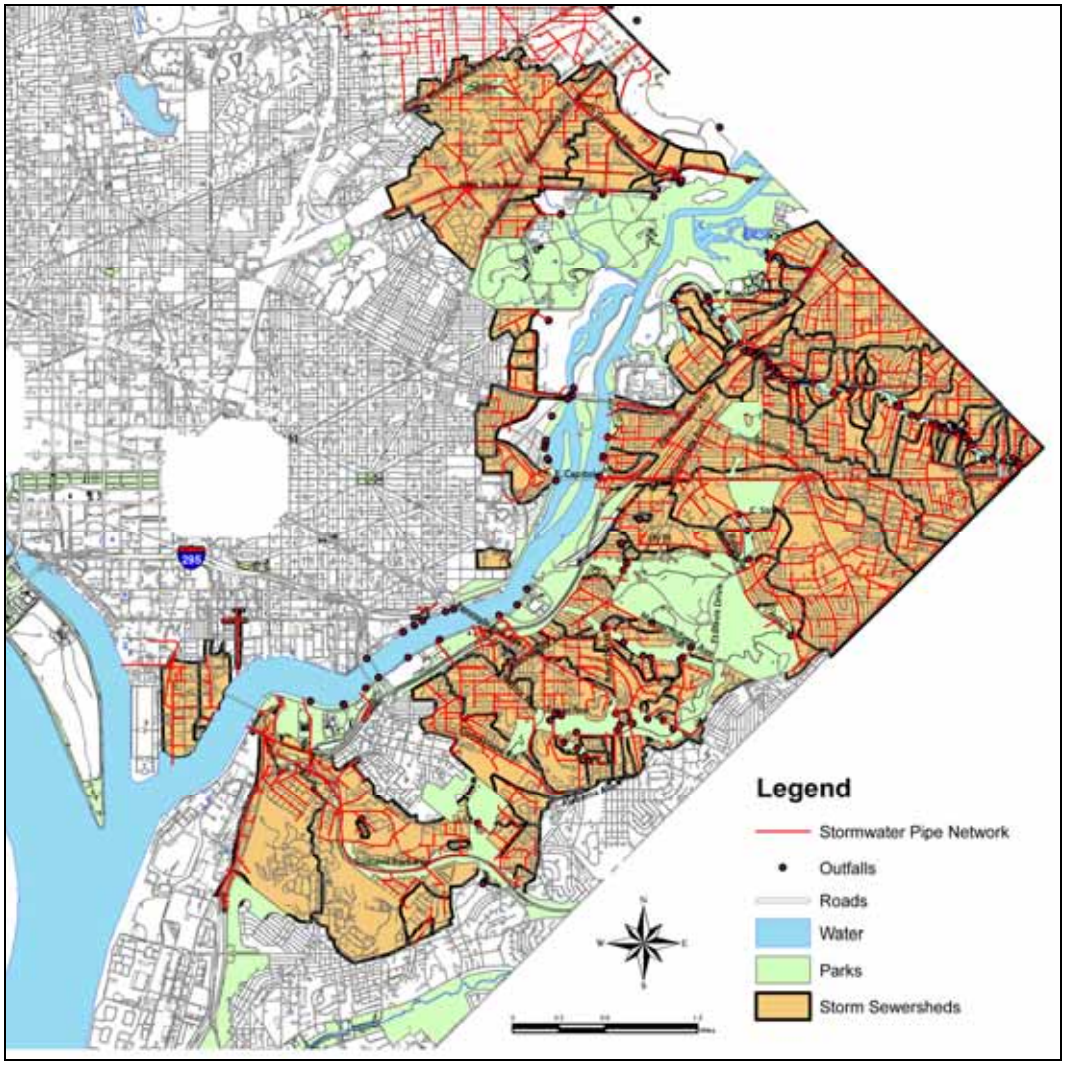


District of Columbia Anacostia Watershed

In the District, the Anacostia watershed is heavily urbanized and there are 9,460 acres of areas that are served by storm sewers with 167 outfalls. The drains carry the rainwater to the streams and rivers where they discharge. The majority of the drainage basin in the central part of the District is served by combined sewers. A Long Term Control Plan (LTCP) has been developed that will reduce the frequency and volume of overflows which contain trash.

The map below shows the MS4 (Municipal Separate Storm Sewer System = MSSSS= MS4) areas in orange with the storms sewers in red. The majority of the data collection for this report occurred in those areas.

Figure 2.2
Anacostia MS4 Systems



Land use in the MS4 portion of the study area is predominantly residential with a lot of open space. Imperviousness of each land use is given in Table 2.2. Overall imperviousness is estimated to be 56.35% according to the MS4 *Anacostia TMDL Implementation Plan*. The acres of MS4 in the drainage basin of each free flowing tributary are shown. These numbers are different from the total numbers of acres in the natural basins in several instances because it is based upon storm sewers. Most of the streams become piped at some point and the acres of MS4 below that point are included in the direct drainage to the Anacostia. The number of storm sewer outfalls for each basin is shown in Table 2.3.

Table 2.1
Anacostia MS4 Land Use

LAND DESCRIPTION	Sum of acres		SUMMARY	Sum of acres
Federal	183.5		Commercial	238.6
Industrial	567.3		Industrial	567.3
Institutional	376.1		Mixed Industrial and Commercial	216.8
Local Public Facilities	408.7		Mixed Residential and Commercial	263.3
Low Commercial + Low Residential	40.4		Parks	1792.2
Low Density Commercial	172.8		Public - Federal and Institutional	968.3
Low Density Residential	2461.5		Residential	5391.3
Medium Commercial + Medium Residential	61.2		Water	4.3
Medium Commercial + Moderate Residential	64.6			
Medium Density Commercial	13.7		Parks + Residential	7183.5
Medium Density Residential	93.1			
Medium-high Commercial + Industrial + High Residential	116.9			
Medium-High Commercial + Institutional + High Residential	33.5			
Medium-High Density Commercial	1.5			
Moderate Commercial + Industrial	61.2			
Moderate Commercial + Industrial + Medium Residential	5.2			
Moderate Commercial + Medium Residential	80.0			
Moderate Commercial + Moderate Residential	17.2			
Moderate Density Commercial	50.7			
Moderate Density Residential	2836.671835			
Parks	1792.2			
Water	4.2			

Table 2.2
Land Use Type Codes

Land Use Type	Land Use Code	Runoff Coefficient (Rvi)
Low Density Residential	R1	0.48
Moderate Density Residential	R2	0.65
Medium Density Residential	R3	0.65
Low Density Commercial	C1	0.64
Moderate Density Commercial	C2	0.68
Medium Density Commercial	C3	0.73
Medium-High Density Commercial	C4	0.77
Moderate Commercial + Moderate Residential	M1	0.59
Low Commercial + Low Residential	M2	0.48
Medium Commercial + Medium Residential	M21	0.68
Medium Commercial + Moderate Residential	M5	0.68
Moderate Commercial + Medium Residential	M6	0.64
Industrial	I1	0.73
Moderate Commercial + Industrial	M10	0.7
Medium-High Commercial + Industrial + High Residential	M14	0.73
Moderate Commercial + Industrial + Medium Residential	M15	0.67
Medium-High Commercial + Institutional + High Residential	M23	0.73
Federal	P1	0.77
Local Public Facilities	P2	0.77
Institutional	P3	0.68
Parks	P4	0.35
Water	W1	1.00
Total Acres is 9442		
Total Impervious Acres @ 56.35 % Impervious	5,321	imp. Acres

Table 2.3
Drainage Basin Acreage and Outfalls

	Acres	Number of Outfalls
Anacostia direct drainage	6,466	60
Hickey Run	848	4
Watts Branch	1,025	54
Nash Run	320	4
Ft Chaplin	151	5
Fort DuPont	99	9
Pope Branch	149	6
Fort Davis	51	5
Texas Ave.	36	4
Park Drive Ft Davis -2	24	3
Hillcrest- Texas	103	5
Fort Stanton	62	3
Stickfoot	56	3
Other (St. E)	54	2
Total	**9,442**	**167**

Water Quality

The Anacostia water quality has been assessed and it was determined that the water quality standards were not being achieved. Consequently, the pollutants causing the non-attainment of Anacostia River were listed pursuant to Section 303 (d) of the Federal Clean Water Act. Using computer simulations, the Total Maximum Daily Load of each pollutant was determined and allocations were established for all the sources including the MS4 system. EPA then inserted that allocation into the relevant NPDES permits including the MS4.

Pollutants identified for reductions in discharges from the MS4 include:

- Specific TMDL fecal coliform bacteria
- Biochemical oxygen demand (BOD)
- Total nitrogen (TN)
- Total phosphorous (TP)
- Total suspended solids (TSS)
- Oil and grease
- Zinc

- Lead
- Copper
- Arsenic
- Chlordane
- Heptachlor expoxide
- Dieldrin
- Polynuclear aromatic hydrocarbons (PAHs), including:
    - PAH-1 - naphthalene, 2-methyl naphthalene, acenaphthylene, acenaphthene, fluorene, and phenanthrene;
    - PAH-2 - fluoranthene, pyrene, benzo[a]anthracene, and chrysene;
    - PAH-3 - benzo[k]fluoranthene, benzo[a]pyrene, perylene,
        - indeno[1,2,3-c,d]pyrene, benzo[g,h,i]perylene, and
        - dibenzo[a,h+ac]anthracene.
- DDT (dichloro-diphenyl-trichloroethane)
- DDE (dichloro-diphenyl-dichloroethylene)
- DDD (dichloro-diphenyl-dichloroethane)
- Total polychlorinated biphenyls (PCBs).

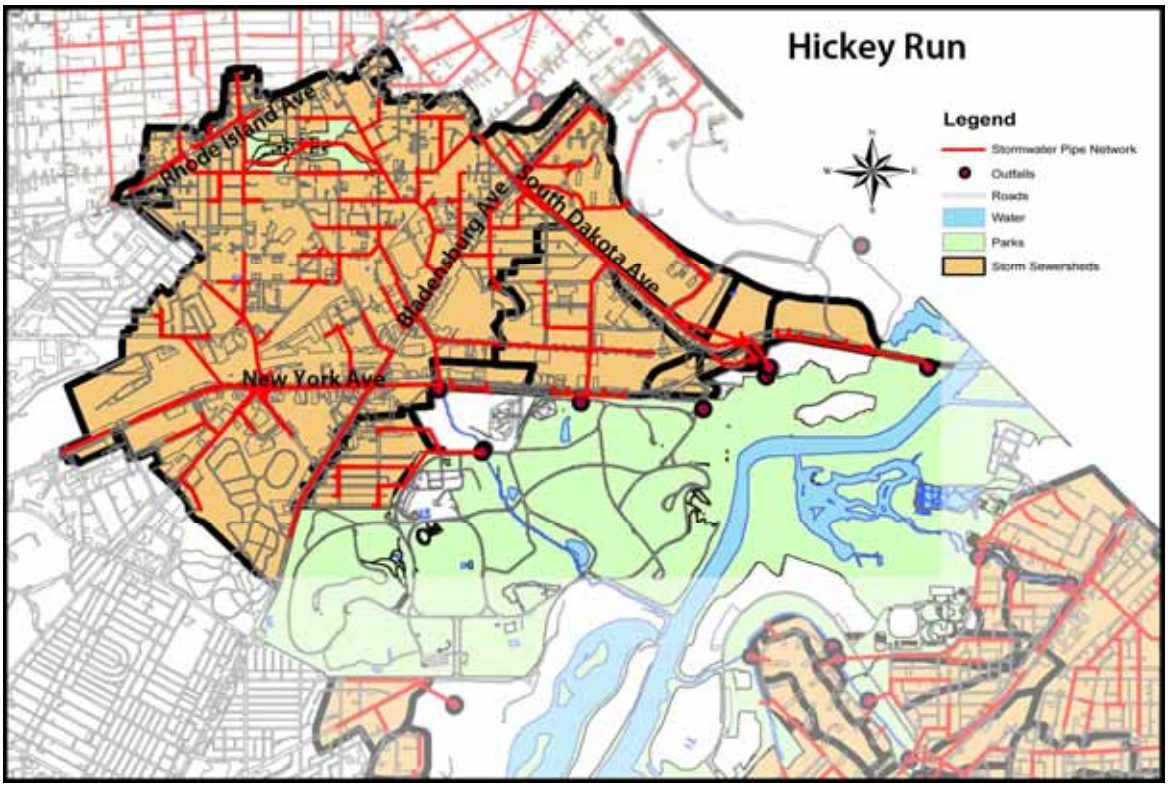
Individual Drainage Basins

The Anacostia watershed was divided up into sub-basins with each free flowing tributary having a separate database. The MS4 systems were also sub-divided but sometimes a few small ones would be grouped together with a large one for ease of data collection and analysis.

Hickey Run

Hickey Run is a western tributary of the Anacostia River which flows approximately 0.9 miles southeast to the Anacostia. The total watershed area is roughly 1,079 acres or 1.7 square miles. It has an average flow of about 8 cfs. The northern half of Hickey Run's watershed lies in a heavily industrialized and mostly impervious area above New York Avenue and is essentially a sewershed, as it is completely piped. The southern half of the stream is open channel fed by this complex storm sewer system and traverses the USDA National Arboretum to the Anacostia River. Due to the heavily developed and mostly impervious northern half of the watershed, high peak flows with short times of concentration for even relatively minor rain events are the norm. As a result Hickey Run is heavily degraded, as are most of the streams in the highly urban Anacostia River watershed.

Figure 2.3
Hickey Run



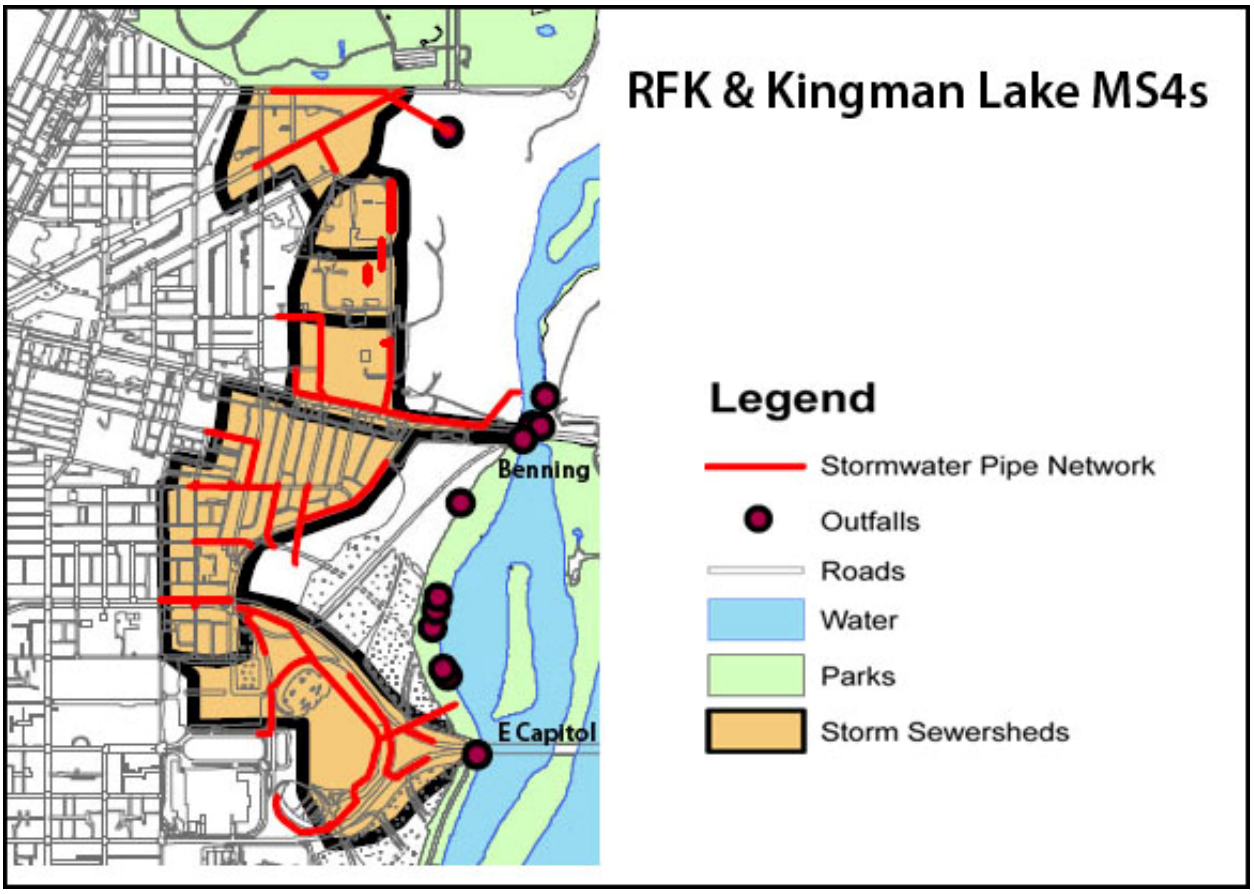
Kingman Lake

Kingman Lake direct drainage is about 367 acres, composed of about 50 percent parkland, 25 percent residential and 25 RFK stadium and parking lot. The portions of the lake above the Benning Road Bridge is chiefly drainage from a golf course, a high school and a few blocks of residential area (100,000sqft). The portion below Benning Road on the northwestern shore is predominately developed as residential and a stadium and parking while the southeastern shore is parkland. The stadium parking has a green space buffer along the lake shore.

Kingman Lake is tidal with an opening at each end. Tidal amplitude is about 3 feet. The lake was originally about 94 acres but after creation of 44 acres of wetlands there was 50 acres of open lake left. There is a small stream which may be perennial that emerges in Langston golf course from the storm drain serving M and Maryland Streets.

There is a combination of several storm sewers sheds that discharge to Kingman Lake. They lie to both the east and west of Benning Road. RFK Stadium and Langston Golf Course occupy much of the land. There are three schools in the neighborhoods and commercial activities along Benning Road. Both low density and medium density landuses are present.

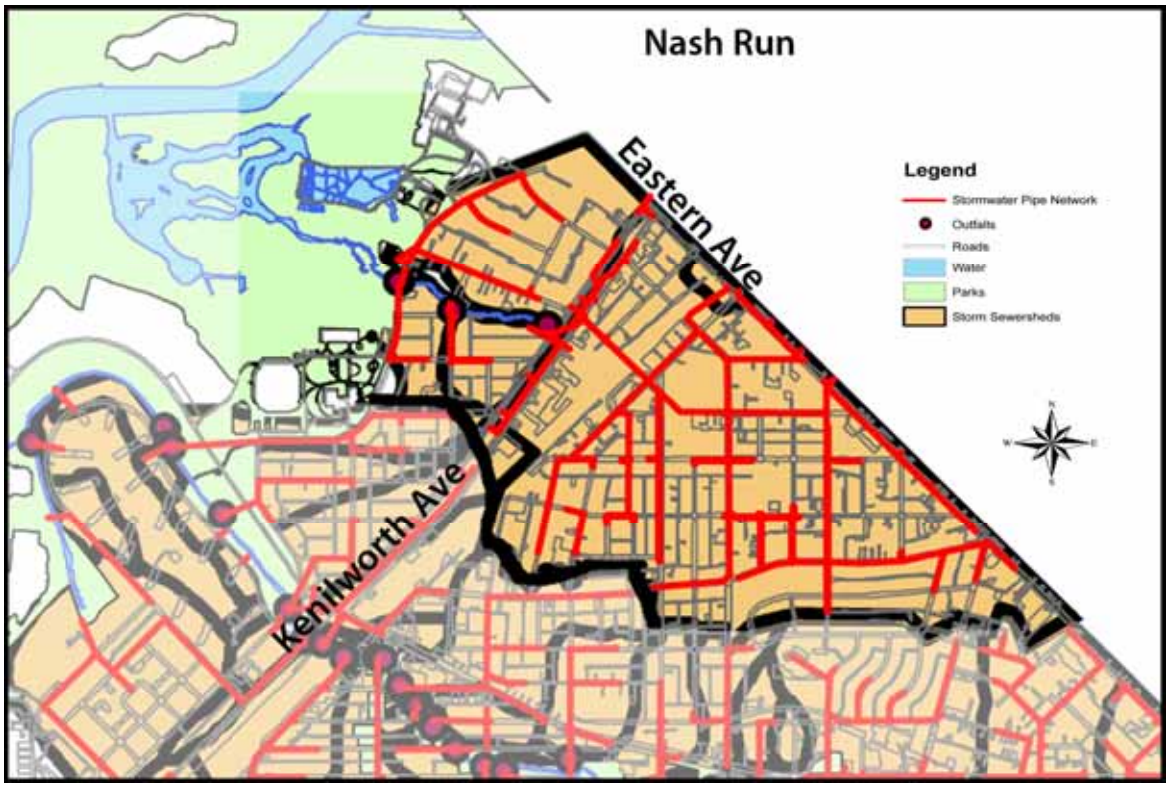
Figure 2.4
RFK & Kingman Lake MS4s



Nash Run

Nash Run has been heavily altered as it lies within the developed areas of the District and Maryland. The Nash Run watershed measures approximately 0.7 mi^2 (460 acres), with approximately two-thirds of the watershed in the District of Columbia. The remainder of the watershed is in Deanwood Park, Prince George's County, Maryland. All but 5% of the watershed is urban residential and commercial property drained by storm drains. It has an estimated flow of 2 cfs.

Figure 2.5
Nash Run

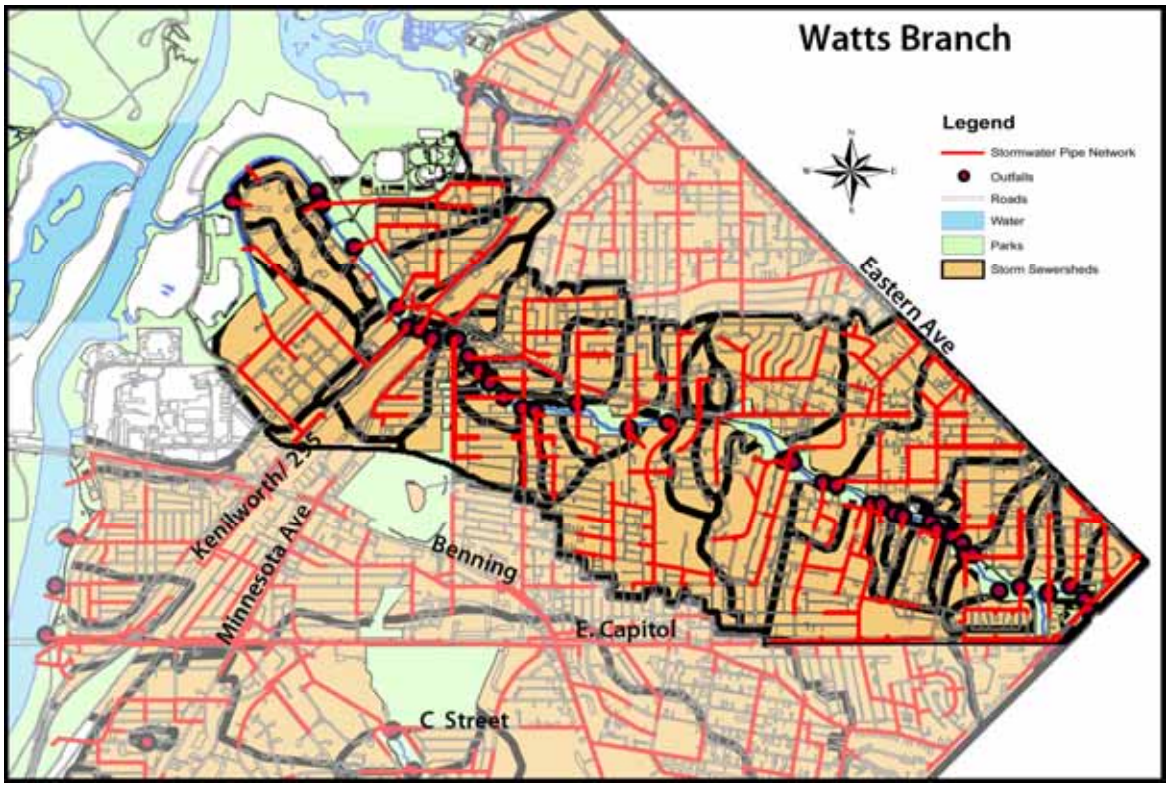


Watts Branch

Watts Branch is the largest tributary of the Anacostia River in DC. Roughly half of the Watts Branch watershed is contained within the District of Columbia. The headwaters of Watts Branch drain Prince George's County, Maryland. From Southern Avenue, the stream flows three miles, in a northwesterly direction, eventually meeting the Anacostia River in Kenilworth Park, a National Park Service property. The tidal influence of the Anacostia River reaches upstream for about 1200 feet. There is a tributary that arises in Maryland and joins the main stem below Southern Avenue. At the head of tide there is a ditch that the beaver has flooded with its dam. This flooded wetland area has a few storm sewer discharges from the adjacent residential area.

The entire Watts Branch watershed measures 3.53 square miles. Half a square mile of this area, or less than 15% of the watershed, is forested. Most of this forest area lies along the Watts Branch stream corridor, serving dually as parkland and riparian buffer. The U.S. National Park Service once controlled all of this parkland surrounding Watts Branch. However, a 1973 agreement with The District transferred authority of the park, upstream of the Kenilworth Park property, to the DC Department of Parks and Recreation.

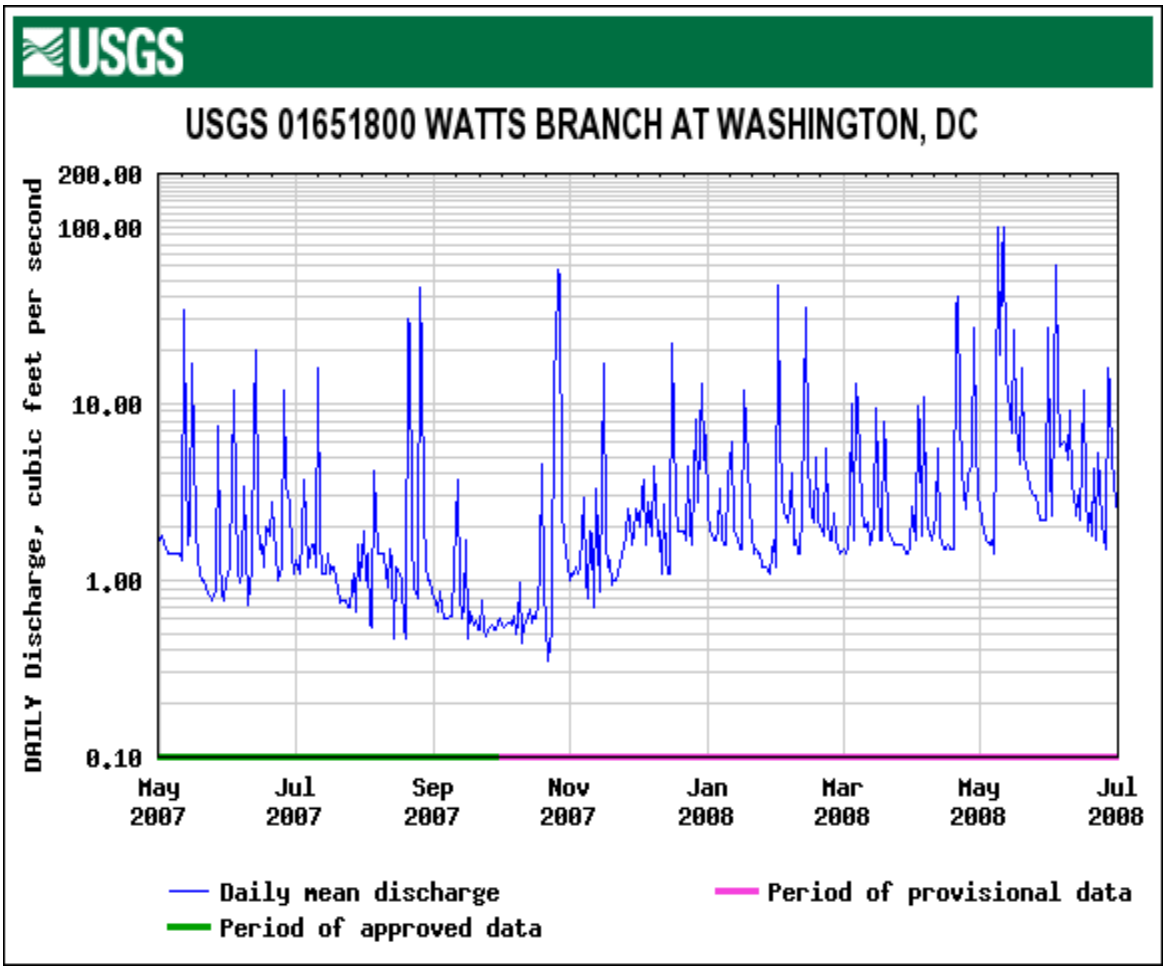
Figure 2.6
Watts Branch



Watts Branch is a perennial, low gradient, warm water stream. Channel width varies from approximately 20 feet (widest), to 5 feet (where the stream enters the District). The average stream gradient for Watts Branch is 1%. This gradient is relatively low and is common for slower moving, coastal plain streams. Average flow is about 5 cfs. These flows increase dramatically during storm events due to the imperviousness of the watershed.

A USGS stream flow gauging station (USGS site # 01651800), funded by the District, is located on Watts Branch and provides accurate stream flow data on a continuing basis.
Flow during the study period is displayed in the chart. The summer of 2007 was very dry and flow was low for the first quarterly survey. Peak flows were about 20-30 cfs: however, the May, 2008 rainfall caused flows that were about 200 cfs.

Figure 2.7
USGS Watts Brach at Washington, DC

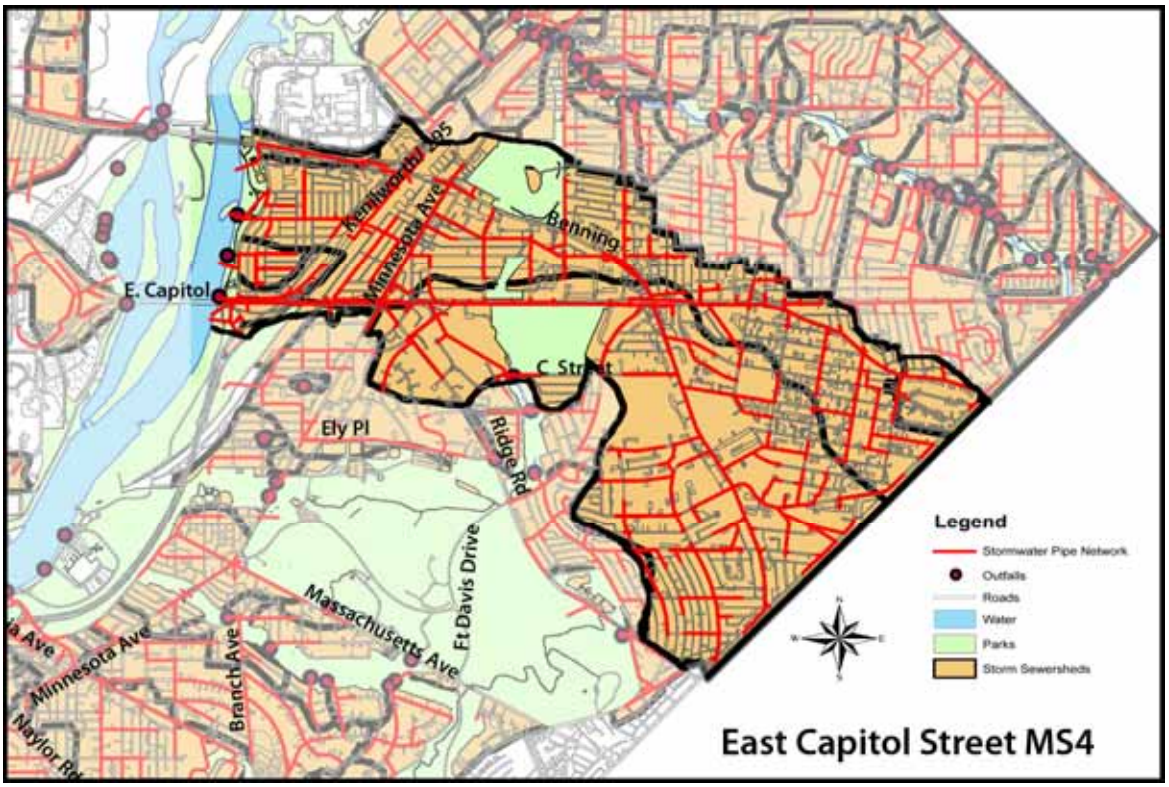


East Capitol Street MS4

This is a very large system of storm sewers that discharge to the Anacostia River. There are four major discharge points. One along Benning Road is primarily commercial landuse and it discharges at a point about 10 feet above the constructed wetland. A second storm sewer collects water from the River Terrace residential area as well as the Minnesota Avenue commercial area. It discharges to a gut cut through the wetland. A small storm sewer serving the residential area discharges to the wetland above the East Capitol Street Bridge and it is screened and cleaned by WASA and the contributing streets are swept by DPW weekly.

The major storm sewer serves the East Capitol, Benning Road area all the way to Southern Avenue. The sewer shed collect the water from Ft Chapin tributary. It discharges below the wetland. The East Capitol Street Bridge stormwater drops into a system of chutes under the bridge and enters the Anacostia.

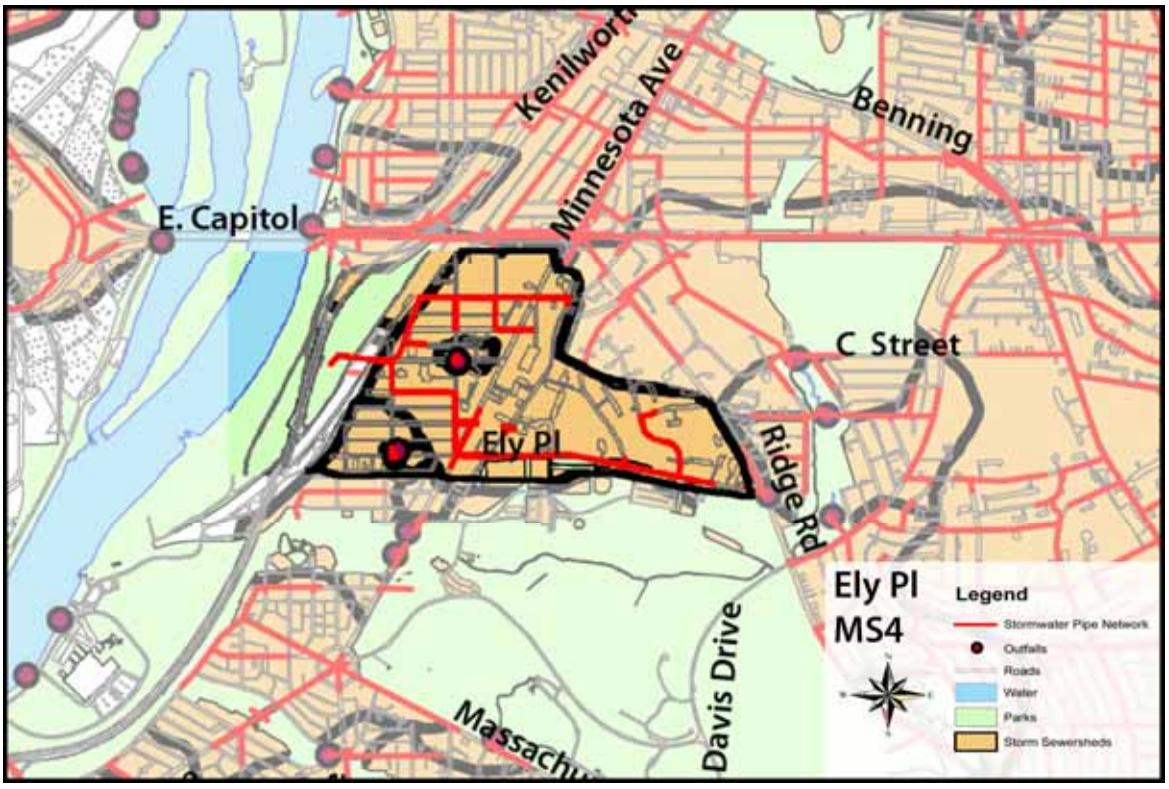
Figure 2.8
East Capitol Street MS4



Ely MS4

This is a small system bounded by Ely Place and Ridge Road. It contains a significant amount of public housing. The Potomac Division of the DC Housing Authority is located here. After the storm sewer travels under the railroad, it then goes under the elevated portion of the Anacostia Freeway and goes from there to the Anacostia River.

Figure 2.9
Ely MS4

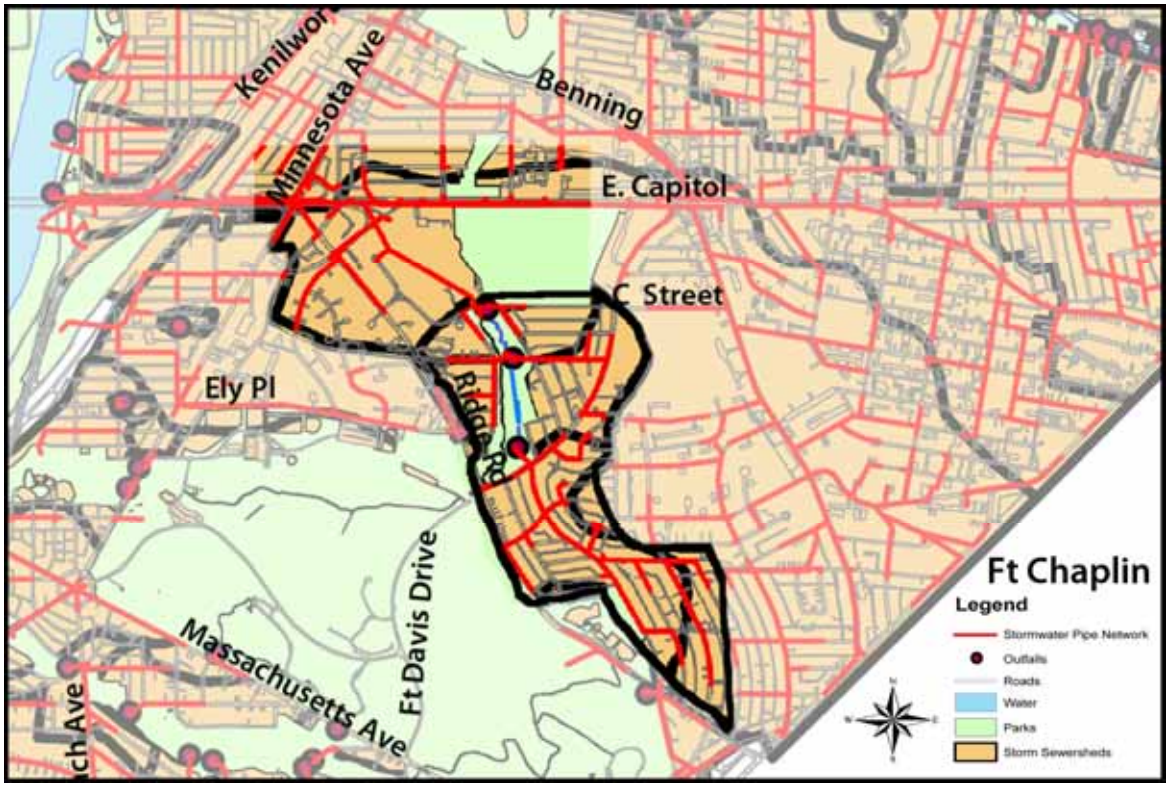


Fort Chaplin

Fort Chaplin is a small first-order tributary to the Anacostia River, draining a 344 acre watershed area within the southeast quadrant of the District of Columbia. It has an average flow of about 0.2 cfs. There are two open stream channels that combine for an approximate total length of 2,900 feet. The first open channel is an intermittent stream that originates downstream of Ridge Road. The channel heads in a northwesterly direction for approximately 1,000 feet whereupon it enters an approximately1,800 feet long 24" RCP pipe storm drain system which terminates immediately below Texas Avenue. At this point, the stream is considered to be perennial. The perennial stream portion also flows in a slight northwesterly direction for approximately 1,900 feet whereupon it enters a 48" RCP pipe immediately upstream of 'C' Street which is the East Capitol Street MS4 system. The mean open stream channel gradient for Fort Chaplin is, approximately 1.4 percent and is considered slightly high for a Coastal Plain stream. In comparison, the mean stream gradient for the adjacent Fort DuPont and Pope Branch tributaries were 1.9 and 2.6 percent, respectively. These higher than average stream gradients are a function of the river terrace-influenced morphology in this portion of the Anacostia watershed.

The predominant land uses for the Fort Chaplin sub-watershed include a mix of residential, institutional and commercial areas. The land uses for the drainage area above the Texas Avenue are predominantly single family and row house residential. This area drains approximately 113.0 acres, with 97.8 acres (86.5 percent) associated with the previously mentioned land use types and the remaining 15.2 acres (13.5 percent) is deciduous forest. Heading downstream, the catchment area between Texas Avenue and 'C' Street, drains 51.8 acres. Of the 51.8 acres, 35.2 acres (78.0 percent) is associated with single-family, row house residential and, garden apartment land uses. The remaining 16.6 acres (32.1 percent) is deciduous forest.

Figure 2.10
Fort Chaplin



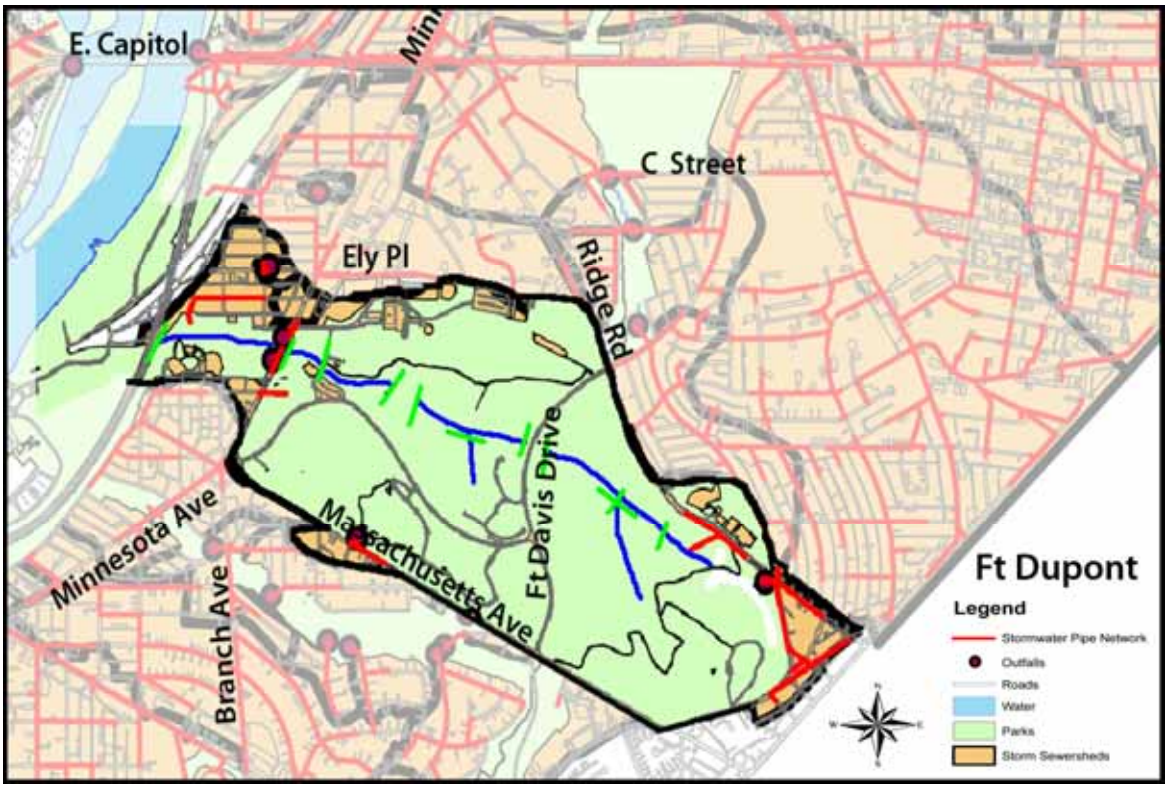
Fort DuPont

The Fort DuPont tributary is a small third-order stream draining a 443.0 acres (0.69 mi^2) watershed area. The stream originates in the vicinity of Alabama Avenue and Burns Road and flows in a northwesterly direction for approximately 1.9 miles before entering the Anacostia River. The lower two-thirds of the stream cuts through ancient river terrace deposits. Along the way, the stream flows under Fort Davis Drive, Minnesota Avenue and the CSX rail line area. Approximately 2,240 linear feet of the stream system (14.7 percent) is piped. Stream gradient for the Fort DuPont main stem is at 1.9 percent, relatively high for a Coastal Plain stream. This

high gradient is largely a function of the stream's river terrace-influenced morphology. It has an average flow of about 0.7 cfs.

The Fort DuPont tributary is atypical of District of Columbia streams in that most of its drainage area is undeveloped, wooded parkland. Approximately 376 acres (85 percent) are owned and managed by the National Park Service (NPS). Current park uses and facilities include tennis and basketball courts, athletic fields, a softball diamond, an ice skating rink, an activity center, Park Police stables, maintenance yard, amphitheater, picnic areas and a community garden. It should be noted that the park formerly included an 18-hole golf course, which was abandoned around 1970. Since then, much of the former golf course area has been allowed to naturally reforest itself. Impervious surfaces in the Fort DuPont sub-watershed such as rooftops, roads and parking lots comprise only 13.3 percent.

Figure 2.11
Fort Dupont



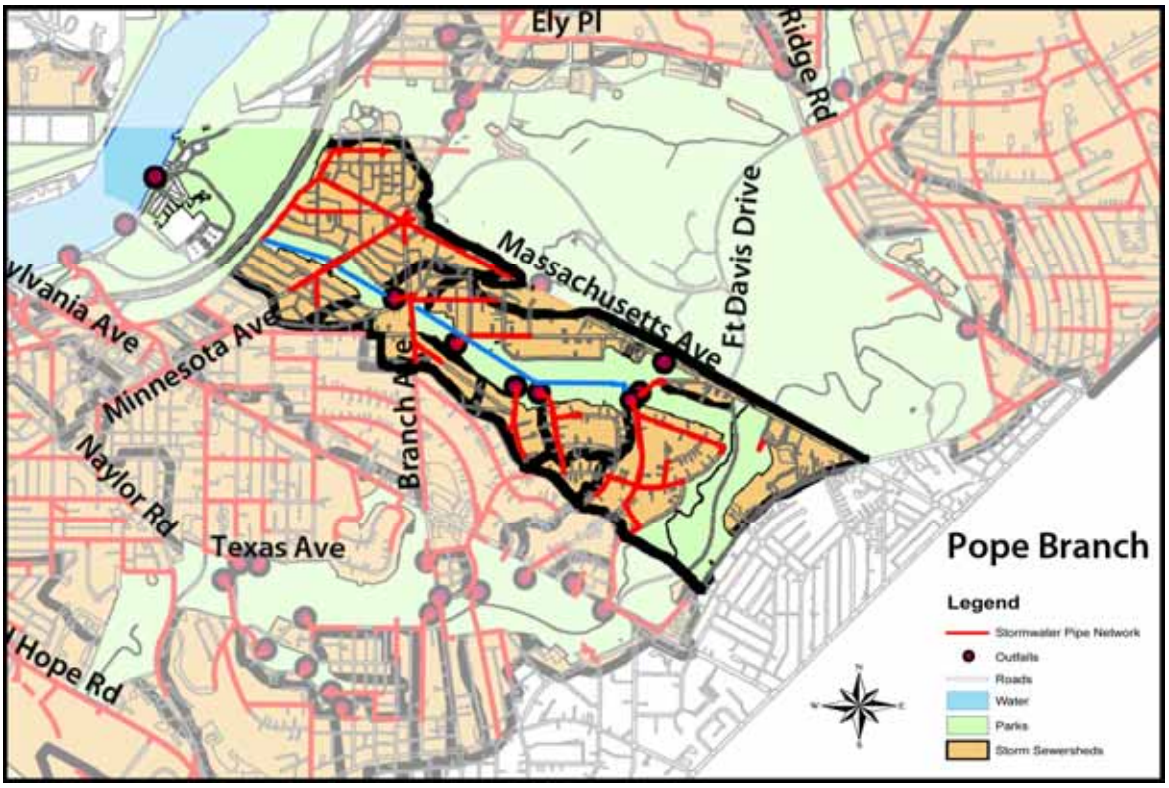
Pope Branch

Pope Branch is a 1.6-mile first-order tributary originating downstream of Fort Davis Drive and flowing in a northwesterly direction towards the Anacostia. A portion of this stream (1,700 linear feet or 20%) is piped beginning at the CSX railroad and ending at an outlet to the

Anacostia. The stream and surrounding riparian forest are known as Pope Branch Park. Originally, this park land was managed by the National Park Service; however, in the early 1970's Pope Branch Park lands were split off from Fort DuPont Park and management authorities were transferred to DC Department of Parks and Recreation. The piped portion of the stream is located under the Lower Anacostia Park, managed by the National Park Service.

The Pope Branch sub-watershed encompasses a 248.5-acre area and is roughly bounded by Alabama Avenue to the east, Pennsylvania Avenue to the south, and Massachusetts Avenue to the north. It has an average flow estimated to be 0.24 cfs

Figure 2.12
Pope Branch



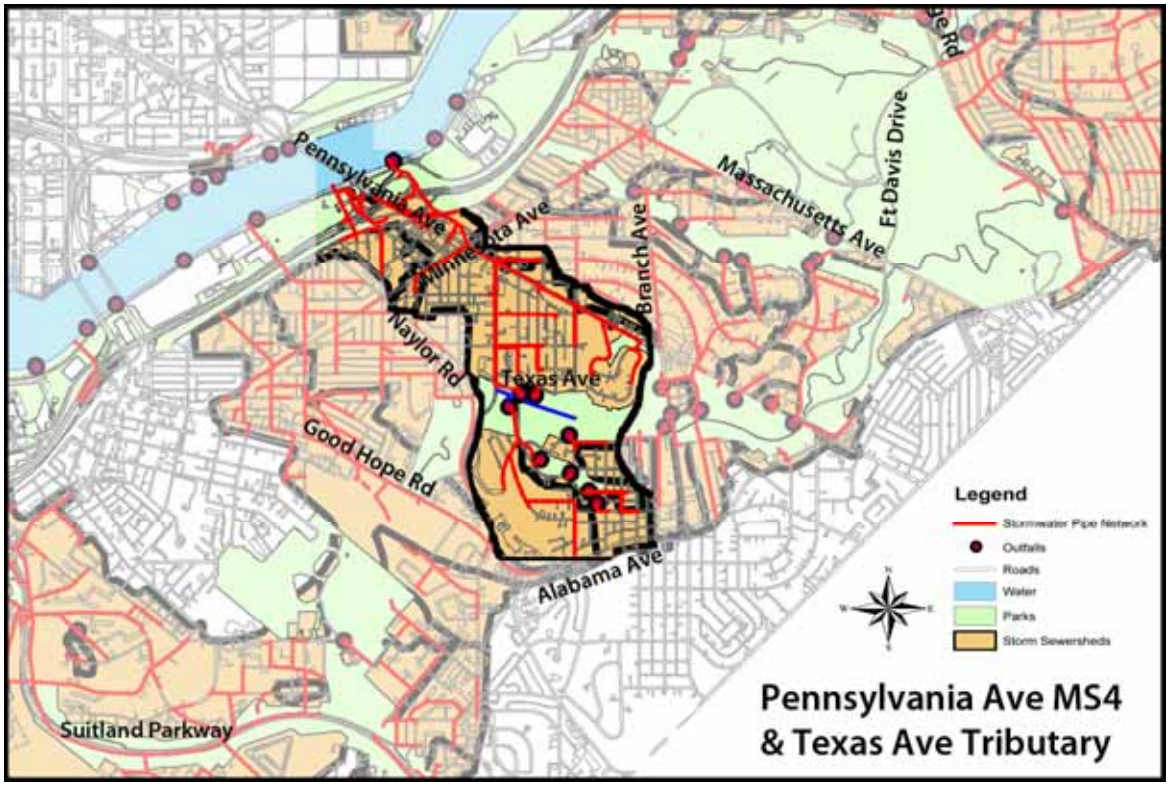
Texas Avenue Tributary

This is a small first order stream. One fork of this stream arises in the residential neighborhoods of Hillcrest and Ft Baker Drives and emerges from a pipe in Ft Davis Park and flows down toward Texas Avenue and 28th Street where it joins the other fork. The second fork arises in the woods of Ft Davis Park and flows under 28th Street. The combined stream enters a pipe at 27th Street and becomes a part of the flow in the Pennsylvania Avenue MS4 system which discharges to the Anacostia River. The watershed of Texas Avenue Tributary measures 0.17 mi^2 (110 acres)

and is about 40% forested parkland and 60% residential and light commercial property. It has a flow of about 0.75 cfs.

Below the tributary, the MS4 system serves a mixed use area with a significant amount of commercial area in the vicinity of Pennsylvania Avenue and Minnesota Avenue.

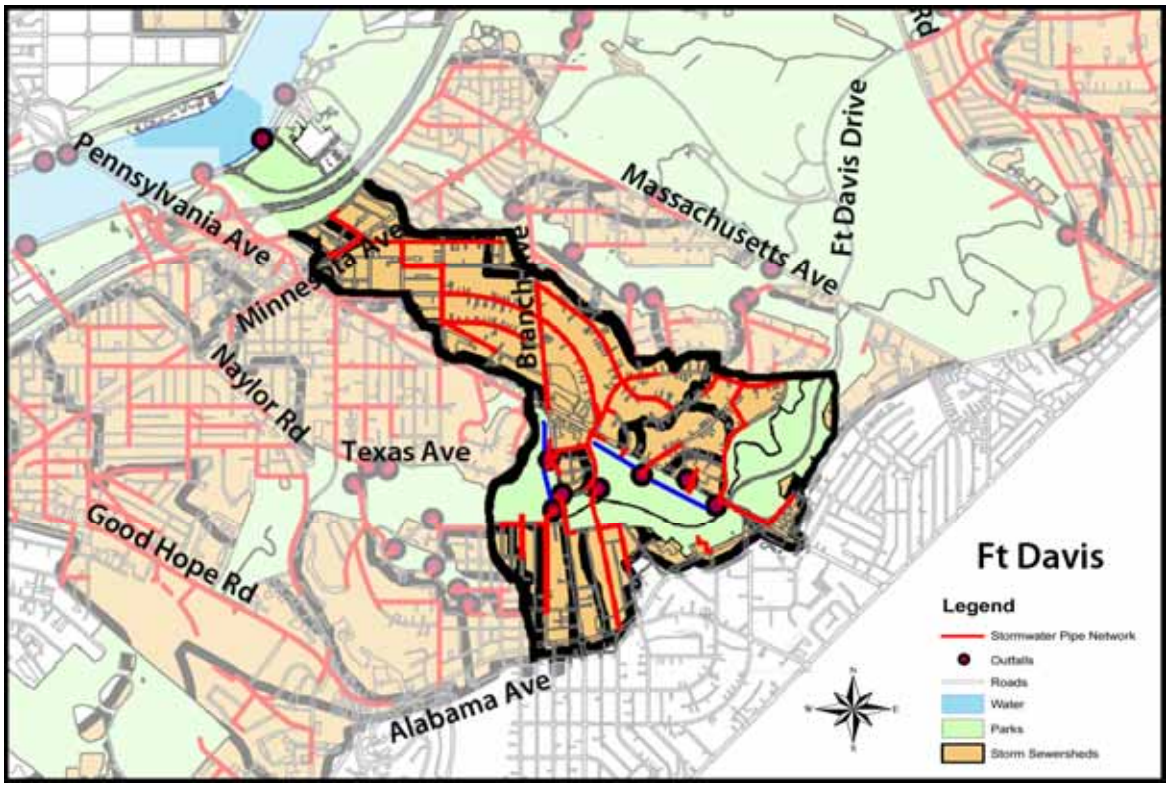
Figure 2.13
Pennsylvania MS4 & Texas Avenue Tributary



Fort Davis

Fort Davis is a first order eastern tributary of the Anacostia River. There are two arms of the stream. The eastern arm runs parallel with Pennsylvania Avenue from just below Alabama Avenue down to 33rd Street near Branch Avenue. The western arm runs along Branch Avenue from about Park Drive to just above Pennsylvania Avenue. The streams are now conducted by storm drains to the Anacostia River. The entire watershed measures about .11 mi^2 (70 acres) but about 15% of its watershed is drained away independently of the stream by storm drains. Approximately half of the watershed is forested parkland with the other half existing as urban residential and including an elementary school.

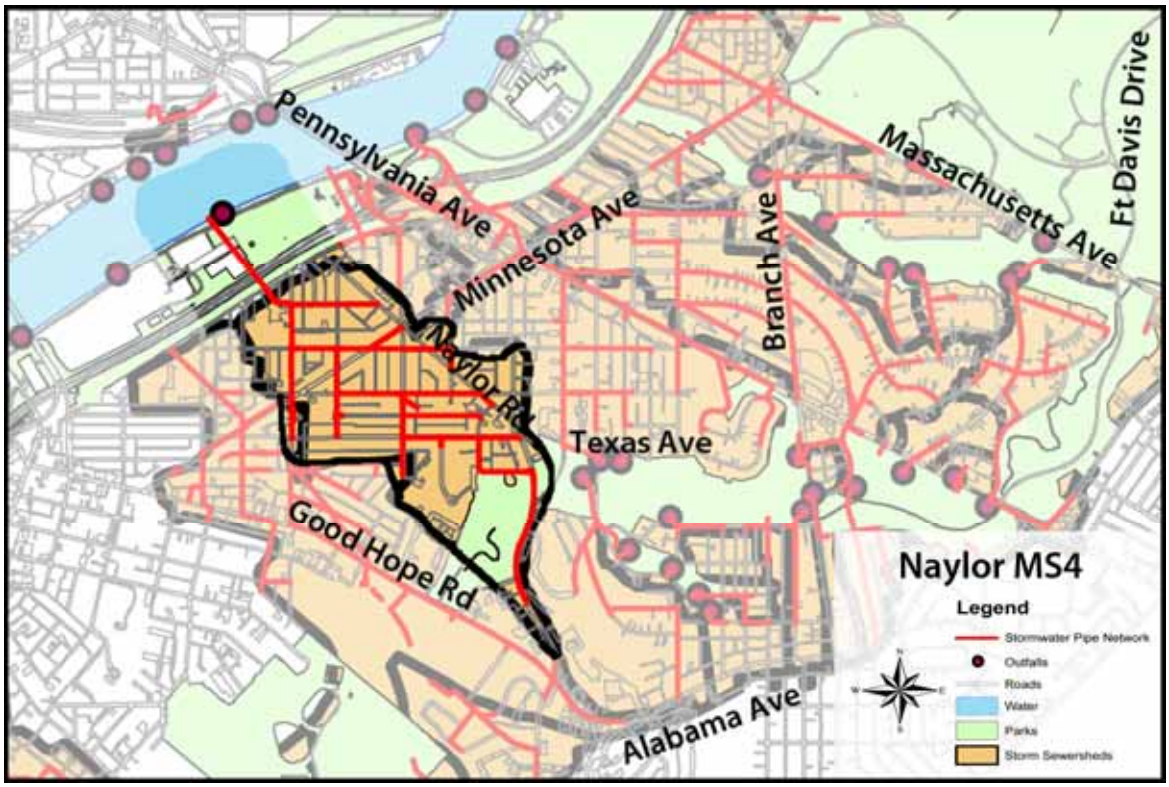
Figure 2.14
Fort Davis Tributaries & MS4



Naylor MS4

This MS4 system serves the predominantly residential area along Naylor Road. It discharges to the Anacostia River upstream of the DC Recreation Center. There is some uncertainty concerning the accuracy of the storm sewer maps in the commercial areas at the upper parts of the drainage system. It is possible some drainage may go over to the Texas Avenue system and some may go to Ft Stanton.

Figure 2.15
Naylor MS4

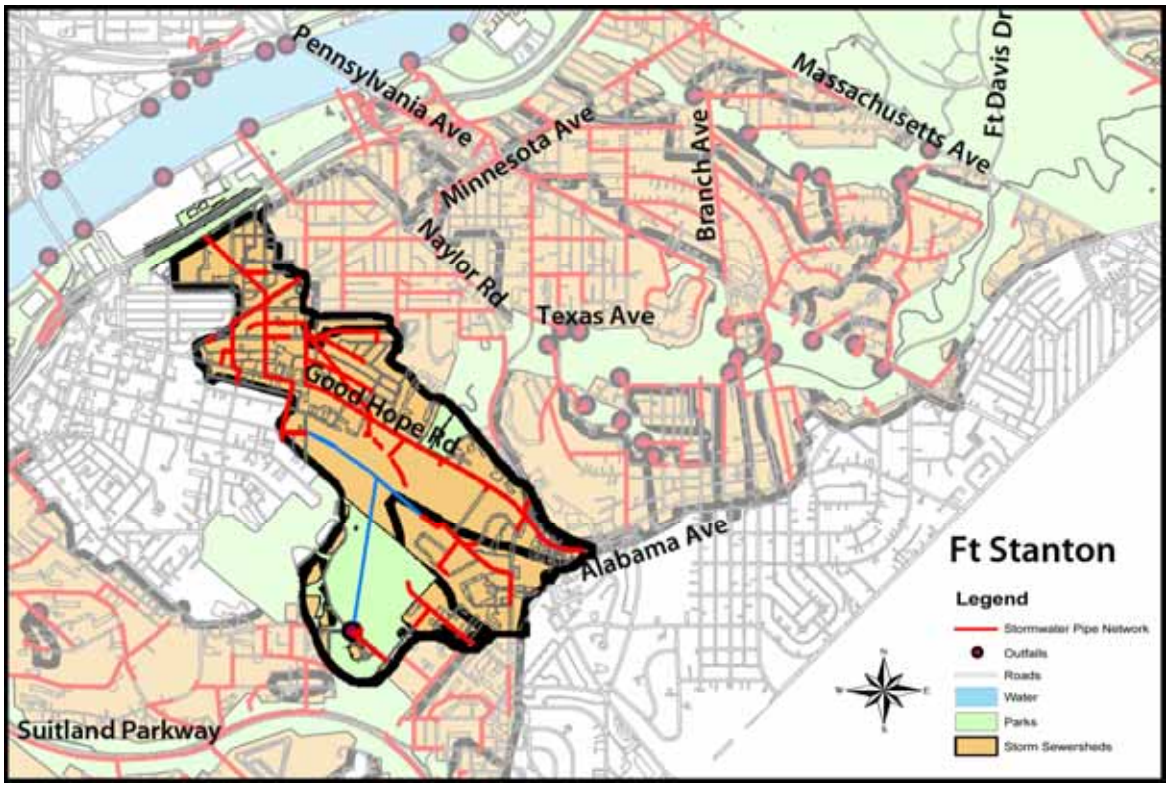


Fort Stanton

Fort Stanton's watershed measures approximately .28 square miles (180 acres). Roughly half of the watershed is National Park Service parkland with the remaining land existing as residential and commercial property. It has an average flow of about 0.05 cfs. One arm of the stream begins near the Smithsonian Anacostia Community Museum and flows about 1700 feet to the main stream. The primary stream flow emerges from a storm sewer below the Skyland Terrace community and flows about 1300 feet parallel to Good Hope Road where it enters another storm sewer. The lower portion of the stream was rip rapped a few years ago.

The Fort Stanton MS4 system collects the water from Fort Stanton Tributary as well as Historic Anacostia and some of the Alabama Avenue/Good Hope Road commercial district. Predominant land use is residential.

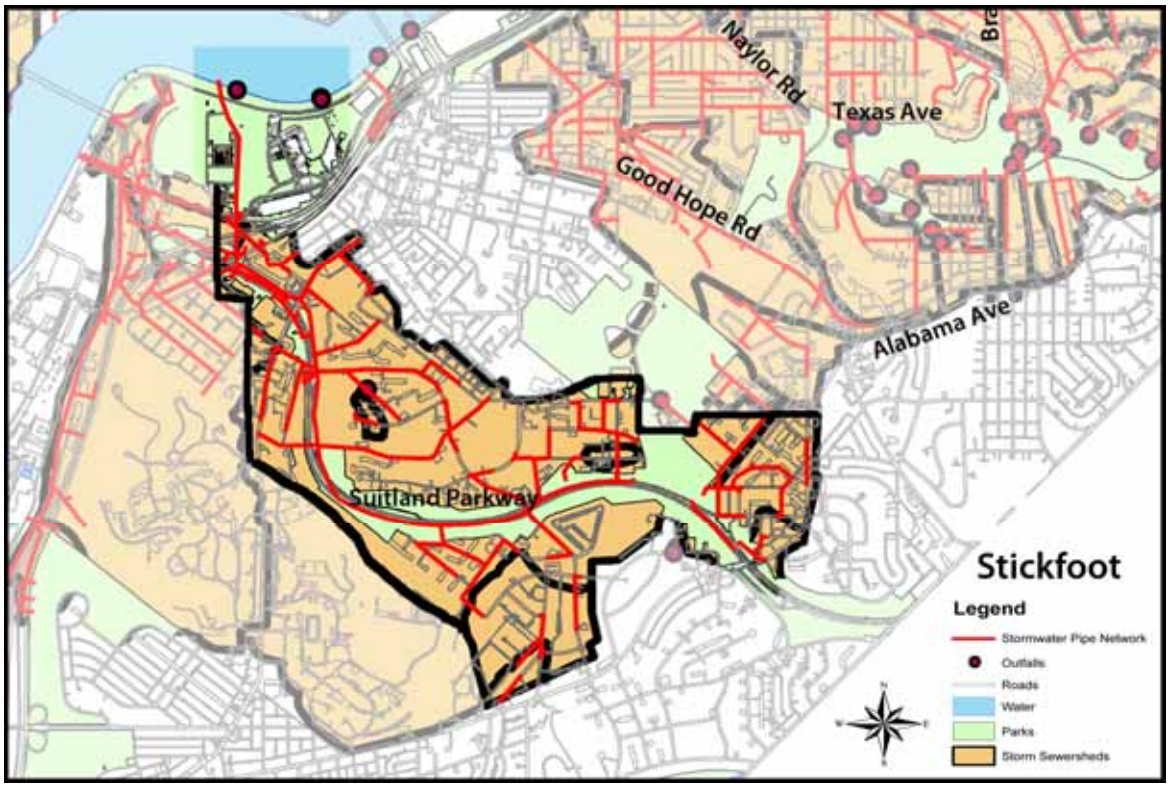
Figure 2.16
Fort Stanton



Stickfoot Sewer

This sewer is the old Stickfoot Creek and the trunk line runs along Suitland Parkway and crosses under the Poplar Point wetlands and discharges to the Anacostia River. The terrain in the upper part of the system is very steep and convoluted and affects the development and the sewer line locations. A very small portion of Historic Anacostia is drained to this storm sewer.

Figure 2.17
Stickfoot Sewer



Combined Sewer System

The combined sewer sheds compose most of the west side of the Anacostia except for the RFK and Hickey Run basins. On the East side, the old Anacostia neighborhood and business sections are on combined sewers. System 006, the smallest of the three in the east side of the river is scheduled to have the combined sewers separated; so, it will be served by storms sewers.

Figure 2.18
Anacostia CSO Outfalls and CSS Drainage Areas