ANACOSTIA WATERSHED IMPLEMENTATION PLAN

PREPARED FOR:

MONTGOMERY COUNTY

DEPARTMENT OF ENVIRONMENTAL PROTECTION

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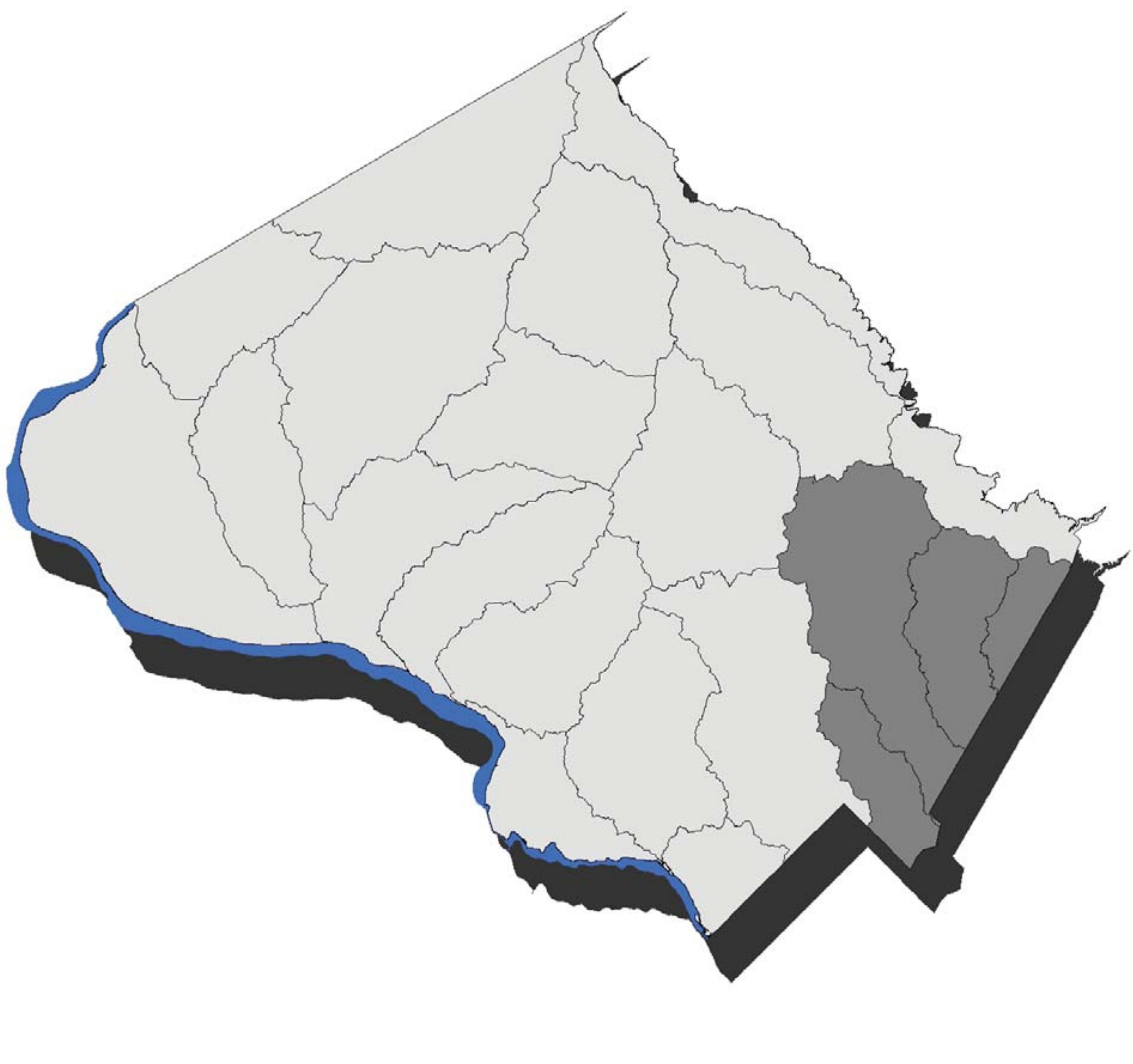

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Anacostia Watershed Implementation Plan

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Anacostia Watershed Implementation Plan

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Notes to Reader:

1. Throughout this Plan there are text boxes such as this that focus on public outreach and stewardship elements to consider for the Plan. In addition, there are references to Practice Sheets which have been developed that are general strategies that apply countywide but will require some customization on a watershed basis to reflect certain stakeholder demographics and priorities. These practice sheets are included as an appendix to the Countywide Coordinated Implementation Strategy.
2. Environmental Site Design (ESD) is defined within the 2010 Maryland Stormwater Design Manual as the use of small-scale stormwater management practices, nonstructural techniques, and better site planning to mimic natural hydrologic cycling of rainwater and minimize the impact of land development on water resources. The application of the term is focused on new and redevelopment projects, and does not explicitly address or consider retrofit applications where site constraints such as drainage area, utilities, and urban soil quality are significant factors. This watershed implementation plan uses the term ESD in a more flexible manner to include structural practices such as bioretention, vegetated filters, and infiltration that provide distributed runoff management using filtering, infiltration, and vegetative uptake processes to treat the water quality volume to the maximum extent practicable. These practices are also thought of as Low Impact Development (LID) practices.

Acronyms List

USACE – Army Corps of Engineers

BMPs – best management practices

DA – drainage area

DEP – Department of Environmental Protection

DF – discount factor

DU – dwelling unit

EPA – Environmental Protection Agency

ESD – environmental site design

GIS – geographic information systems

HOA – homeowners association

IA – impervious area

IC – impervious cover

LDR – low density residential

LID – low impact development

MDE – Maryland Department of the Environment

MEP – maximum extent practicable

MDP – Maryland Department of Planning

MNCPPC – Maryland National Capital Parks and Planning Commission

MPN – most probable number

MPR – maximum practicable reductions

MS4 – municipal separate storm sewer system

NPDES – National Pollutant Discharge Elimination System

RR – runoff reduction

SPA – Special Protection Area

TFPI – Trash Free Potomac Watershed Initiative

TMDLs – total maximum daily loads

TN – total nitrogen

TP – total phosphorus

TSS – total suspended solids

WLAs – waste load allocations

WQPC – water quality protection charge

WRAP- Watershed Restoration Action Plan

WTM – watershed treatment model

1 Goals and Existing Conditions

1.1 Introduction to the Implementation Plan and Watershed Goals

This Implementation Plan (the Plan) for the Anacostia watershed was developed in order to quantitatively demonstrate compliance with the County's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit. The Plan must meet the MS4 Permit's three major requirements:

- Assigned waste load allocations (WLAs) for EPA-approved **Total Maximum Daily Loads (TMDLs)**
- Watershed restoration via **runoff management and impervious cover treatment**
- **Trash and litter management** to meet the commitments of the Potomac River Watershed Trash Treaty

The Plan outlines a comprehensive roadmap for watershed restoration that targets runoff management; bacteria, sediment, and nutrient reduction; and trash and litter management – including information pertinent to effectively include stakeholders in watershed restoration. The County's MS4 Permit area covers 70% of the total watershed area within the County and the Plan focuses on restoration effort within the MS4 Permit area. This MS4 Permit area has approximately 21% impervious cover within the Anacostia watershed.

The US Army Corps of Engineers (USACE), Baltimore District, working with partners at the state and local levels, began work on a restoration plan for the Anacostia watershed in 2007. The goal of that planning effort was to produce a systematic 10-year plan for environmental and ecological restoration within the Anacostia watershed. Elements of the Draft Anacostia River Watershed Restoration Plan (2010) are included within this Plan.

Outreach and Stewardship Strategy
Primary messages for delivery in this watershed will focus on activities the County is undertaking to manage runoff, reduce bacteria, sediment, and nutrients and to manage trash and litter.

Outreach and Stewardship Strategy Watershed-specific Messages: The iterative process of implementing the MDE required reductions is an important component of the County's priorities in this watershed. The important need to first address those sources with the largest impact to water quality and risks to human health should be communicated to watershed stakeholders. Allowances for consideration of ease and cost of implementation should also be communicated to watershed stakeholders to garner consensus support for County actions.

Total Maximum Daily Loads (TMDLs)

The Maryland Department of the Environment (MDE) established a TMDL for bacteria in 2006, sediment in 2007, nutrients in 2008, and trash in 2010 for the Anacostia watershed. This Plan addresses and documents TMDL pollutant loading to the Anacostia watershed from the County's MS4 Permit area. It also tracks potential reduction of pollutant loads through the application of various watershed restoration best management practices (BMPs). This Plan focuses on achieving the maximum practicable reductions as indicated in TMDL documents. MDE recommended that required reductions should be implemented in an iterative process that first addresses those sources with the largest impacts to water quality and risks to human health, with consideration given to ease and cost of implementation.

Runoff Management and Impervious Cover Treatment

During the 5 year permit cycle, the County must add stormwater management for an additional 20% of untreated impervious cover within the County's MS4 permit area, that is not currently managed to the maximum extent practicable (MEP). The baseline year for determining the 20% goal is 2009 since the Permit was issued on February 16, 2010. Full implementation of projects identified through this implementation plan can provide control of an additional 4,544 acres of untreated impervious area (79 % of impervious cover subject to the county permit within the Anacostia Watershed, see Table 1).

Trash and Litter Reduction

The third major element is that of trash and litter management to meet the commitments in the Potomac River Watershed Trash Treaty. The County must identify trash and litter reduction measures that are being implemented towards the goal of a Trash Free Potomac by the year 2013. In the case of the Anacostia Watershed, a trash TMDL has been set that requires that the County prevent 621.6 pounds of trash per day or 226,884 pounds per year from being discharged through its storm drain system. This Plan documents trash loading from the watershed and a proposed approach to meet the County's wasteload allocation under the Trash TMDL. An estimated 68% reduction of trash loads compared to baseline conditions is projected based on full implementation of structural and environmental site design (ESD) BMPs identified in this plan. Implementing additional non-structural BMPs including outreach and enforcement are proposed to achieve the required 100% reduction from baseline conditions.

Outreach and Stewardship Strategy Watershed-specific Messages: The large amount of land to be treated in this watershed is unique and impressive. To properly demonstrate to stakeholders county-wide that the County is committed to watershed protection, it is recommended that outreach information highlight the number of acres being treated.

Outreach and Stewardship Strategy Watershed-specific Messages: Elimination of trash loading to the Anacostia could be a highly motivating message for the whole Chesapeake Bay watershed. It is a quantifiable, tangible goal that can be embraced by stakeholders of all ages, education levels, income, and ethnicity. It is desirable to multiple stakeholder groups (i.e., anglers, paddlers, walkers, elected officials). It can be achieved in a highly visible watershed in the Nation's Capital on a river and its tributaries that have national symbolic significance where there has been over 20 years of awareness building that can be used as a foundation for additional outreach and education.

1.2 Existing Conditions in the Anacostia Watershed

Introduction to the Anacostia Watershed

The Anacostia watershed spans areas of Montgomery County, Prince George's County, and Washington, DC., and has been the focus of inter-jurisdictional watershed management and restoration since the early 1980's. It is a major tributary to the Potomac River. Many areas of the Anacostia watershed contain development built prior to modern stomwater management and erosion and sediment control regulations. The drainage within Montgomery County is approximately 61 square miles, and accounts for roughly one third of the total Anacostia watershed. The four subwatersheds within the Montgomery County are the Northwest Branch, Sligo Creek, Paint Branch, and Little Paint Branch. A basic profile of the watershed is provided in Table 1, a map depicting existing conditions is presented in Figure 1, and a map depicting resources conditions is presented in Figure 2.

Outreach and Stewardship Strategy Potential Partners:
This watershed benefits from established partnerships and advocacy organizations. It is recommended that the County work with these well-organized stakeholder groups to effectively disseminate education and outreach materials. Example organizations include the Alice Ferguson Foundation, Anacostia Watershed Society, Eyes of Paint Branch, Friends of Little Paint Branch and Friends of Sligo Creek, Neighbors of Northwest Branch, and the Anacostia Watershed Citizens Advisory Committee.

Outreach and Stewardship Strategy Potential Partners:
Although excluded from the County's permit areas, stakeholders in the watershed most likely do not distinguish between county and municipal jurisdictions in management of stormwater. It is recommended that outreach and education activities in this watershed be coordinated with the listed municipalities – both in messaging and in delivery. Such coordination will ensure consistency of messages and likely save costs.

Outreach and Stewardship Strategy Watershed-specific Messages: This watershed is somewhat unique in the county in that there was paving over and piping of tributaries. To avoid lethargy caused by stakeholders being unable to see the streams, it is recommended that signage should be used to increase awareness of the streams below the pavement as described in the practice sheet entitled Innovative Stormwater Management Awareness Campaign.

Northwest Branch

The Northwest Branch subwatershed of the Anacostia originates south and east of Olney, MD near the intersection of Route 108 and Georgia Avenue, and flows south approximately 15 miles before passing into Prince Georges County, where it is joined by several other major tributaries to form the Anacostia River. (The Northwest Branch mainstem and some tributaries are located within an extensive forested stream valley park system. Without this protection the stream conditions would likely be worse.) Above Ednor Road, there is low density development, and streams are undergoing a transition from widespread historic agricultural use to higher impervious land uses. Newer development in this area must provide stream buffers and modern stormwater management techniques, but some changes in watershed hydrology are inevitable. Below Ednor Road, the middle section of the subwatershed contains a mix of moderate to higher density housing interspersed with large areas of parkland. Some stormwater BMPs are in place, but they are less effective than current technology. Altered hydrology is common in this section, and many of the tributaries have insufficient stream buffers. Below Bonifant Road, the downstream portion of Northwest Branch is an older urban subwatershed. It is highly developed and densely populated in many areas, with very little stream valley protection or stormwater management. As a result, stream conditions have been significantly altered.

Sligo Creek
The Sligo Creek headwaters are located in the Wheaton area, north of the intersection of Georgia Avenue and University Avenue. Sligo Creek flows southeast approximately eight miles before passing into Prince Georges County, where it joins the Northwest Branch of the Anacostia River. It is one of the County's most urbanized areas, containing high density residential and commercial areas such as Wheaton Triangle, Wheaton Central Business District, parts of Silver Spring, and Takoma Park. This older development was established before today's modern stormwater structures and environmental buffers were required. There are many areas where tributaries were paved over and piped into storm drains and where the larger stream channels have been heavily armored to resist erosion. Although this does provide increased bank stability, it reduces available instream habitat. Areas that have not been armored suffer from varying degrees of erosion due to unmitigated stormflows.

This subwatershed was the first targeted for Anacostia watershed restoration efforts within the County. Since the early 1990's, these have included new runoff BMPs, improvements to the sanitary sewers, and stream channel restoration. This has lead to notable increases in stormwater management and improving instream habitat stability. There have also been multiple efforts to reintroduce native fish in the upper mainstem of Sligo Creek to accompany the improved stream habitat. Blockages downstream prevent natural re-colonization of Sligo from the Northwest Branch. These reintroduction efforts have resulted in an increase in the number of native fish species from only two species in 1988 to 12 in 2009.

Paint Branch
The Paint Branch subwatershed begins near Spencerville, MD, just to the south and east of the intersection of Spencerville Road and New Hampshire Avenue. Paint Branch flows south for approximately nine miles before entering Prince Georges County, and then joins Little Paint and several other major tributaries to form the Northeast Branch of the Anacostia River. Paint Branch is unique in that it provides a coldwater fishery and wild brown trout population close to the Nation's capital. The Upper Paint Branch (above Fairland Road) is a county Special Protection Area (SPA) where new development is required to follow regulations for the protection of the coldwater resources here. There is an 8% imperviousness cap on new development in the Upper Paint Branch SPA.

The Gum Springs and Good Hope tributaries of Paint Branch provide spawning/nursery areas and cold clean baseflow for young trout, while the Right Fork and the Left Fork provide cold clean baseflow. The mainstem supports adult trout populations as far downstream as I-495. Land use in the upper portion of Paint Branch is primarily made up of areas of low and medium density residential housing with open section road which has benefited the receiving streams as opposed to curb and gutter roadways, with some commercial and agricultural activities. Development in the lower portions of the watershed occurred primarily before requirements for stormwater BMPs were put in place and are reflected in degraded stream habitat. Among the historic development in the lower watershed is a quarry. There has been a continuing effort to improve the stream through restoration projects and the purchase of large areas of forested parkland to provide protection to the riparian areas.

Little Paint Branch

Little Paint Branch is located in the easternmost portion of Montgomery County. It is unique in that it is a transition area between the Piedmont and the Coastal Plain physiographic regions. The headwaters originate south of Burtonsville, near the intersection of Routes 29 and 198, and the stream flows south for approximately three miles before entering Prince Georges County, where it eventually joins Paint Branch. Little Paint Branch is transected by the Rt. 29 corridor, which contains many of the County's important industrial and commercial complexes. Many regional stormwater BMPs have been installed in the upper portions of Little Paint to mitigate the effects from high density residential and commercial land uses. The lower portions of the subwatershed were developed prior to requirements for stormwater BMPs, leading to degraded conditions. High densities in this part of the subwatershed and lack of available public land make retrofitting these areas difficult.

Outreach and Stewardship Strategy Potential Partners:
The high quality trout streams and spawning areas in this portion of the watershed can be used to engage stakeholder groups representing anglers to assist in dissemination of outreach and education materials. Example organizations include Trout Unlimited.

Outreach and Stewardship Strategy Potential Partners:
The location of many of the County's important industrial and commercial complexes in this watershed makes it essential that the County specifically reach out to establish partnerships with these property managers to ensure that outreach and education programs are extended to tenants and their employees. Examples include building upon existing initiatives like the Green Business Certification Program and the Smart Organizations Reduce and Recycle Tons (SORRT) Program.

Outreach and Stewardship Strategy Potential Partners:
Lack of public land in this portion of the watershed makes it important for the County to reach out to private landowners and multi-family residential/management companies in order to achieve reduction goals.

Table 1: Anacostia Watershed Profile

Metric	*Acres*	*Percent of Watershed*
Watershed Drainage Area	38,867	100%
Impervious Cover	6,917	18%
Watershed Area Subject to County Permit[1]	27,202	70%
Impervious Cover Subject to County Permit[1]	5,741	21%
Pervious Cover (e.g., forest, turf, meadow, farm fields)[1]	21,461	79%

[1] Excluded areas include Takoma Park, rural zoning, all MNCPP parks, Federal and State property, and Federal and State roads.

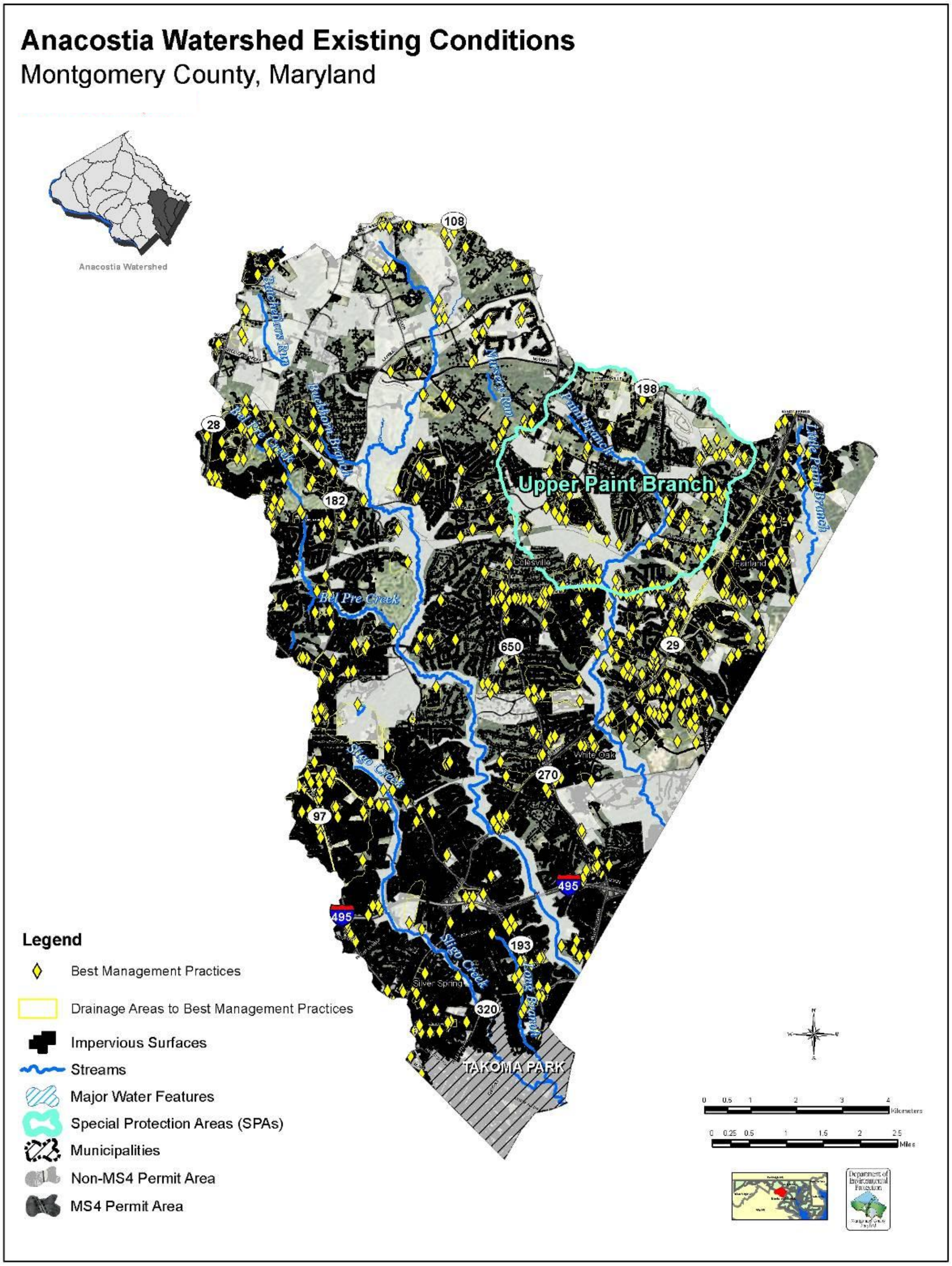

Figure 1: Existing Conditions and BMP Locations for the Anacostia Watershed

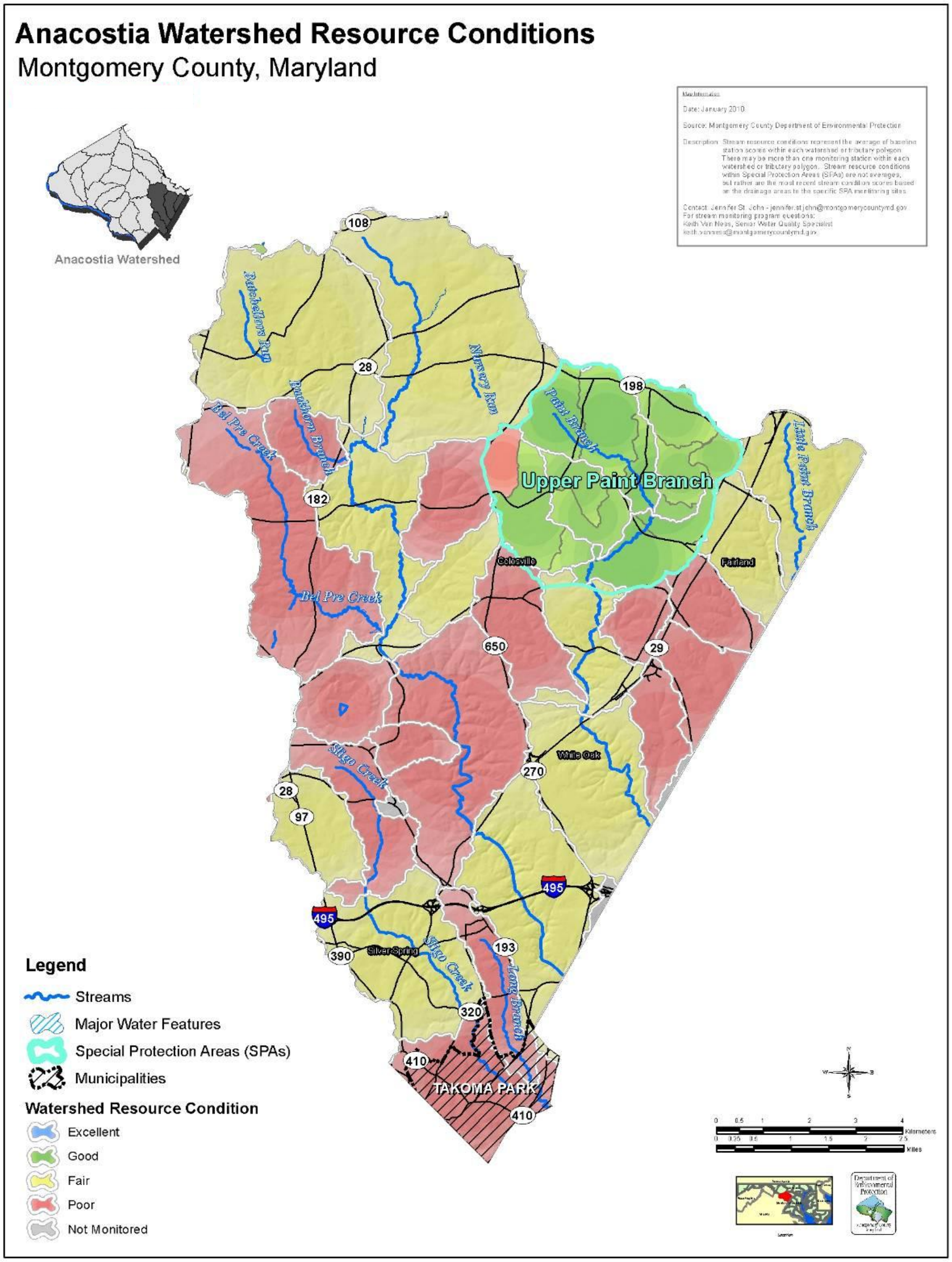

Figure 2: Stream Resource Conditions for the Anacostia Watershed

Watershed Land Use

MS4 Permit area land use in the watershed is displayed in Table 2. Residential land use is the dominant land use in the watershed, covering about 68% of the watershed. This is followed by municipal/institutional at almost 8% and roadway at just under 7%. The watershed is largely built-out, with just over 9% identified as forest, open water, or bare ground.

Outreach and Stewardship Strategy Demographic Snapshot:
As with most of Montgomery County, this watershed contains residents with above average education levels and above average income. It includes a mix of ethnicities including Caucasian, African American, Latino and Asian populations. It will be important to reach these stakeholder groups in multiple languages (Spanish and Korean) and in a variety of venues (i.e., at cultural festivals, sporting events and at places of worship).

Table 2: County MS4 Permit Area Land Uses

Maryland Department of Planning 2002 Land Cover/Land Use	*Watershed Acres*	*Percent of Total (%)*
Low Density Residential (<1 du/acre)	7613	28%
Medium Density Residential (1-4 du/acre)	9122	34%
High Density Residential (>4 du/acre)	1683	6%
Commercial	875	3%
Industrial	728	3%
Municipal/Institutional- Intensive[3]	1423	5%
Municipal/Institutional- Extensive[4]	853	3%
Roadway[5]	1838	7%
Rural[6]	642	2%
Forest[7]	2338	9%
Open Water	26	0.1%
Bare Ground	61	0.2%
Total Watershed	**27,200**	**100%**

[1] Identified by intersection of commercial zoning in PROPERTIES.shp and WQCases2004_2009_Locations.shp
[2] Identified by intersection of industrial zoning in PROPERTIES.shp and WQCases2004_2009_Locations.shp
[3] Institutional land use
[4] Open Urban Land and Bare Rock land use
[5] Combined County and private roads (excludes Federal and State roads)
[6] Orchards, Vineyards, Horticulture, Feeding Operations, Cropland, Pasture, and Agricultural Buildings land use
[7] 2002 Land Use Data

Existing Stormwater Best Management Practices (BMPs)

There are currently 662 structural stormwater BMPs within the MS4 Permit area, each with a contributing drainage area that varies from over 600 acres for regional pond BMPs to less than 0.01 acres for small, on-site BMPs. The current inventory of County BMPs was categorized according to design era and historic performance criteria. The second criteria used historic performance metrics to group the BMPs into the five categories as shown in Table 3. Based upon these criteria, currently just under 34% of the impervious cover in the watershed is treated by a range of BMPs. The BMPs are classified according to their performance code as presented in the Guidance Document, Appendix B.

Outreach and Stewardship Strategy Education Project:
To help watershed stakeholders understand modern methods of managing runoff, stakeholder outreach such as installing educational signage at stream restoration sites is recommended. This can be accomplished through partnerships with organizations such as "Friends Of" groups. Messaging should focus on the importance of healthy streams as described in the Practice Sheet entitled Innovative Stormwater Management Outreach and Stewardship Campaign.

Table 3: Existing Stormwater Management for the Anacostia Watershed

***BMP Performance Code*[1]**	***Count***	***Acres of Impervious Cover (IC) Treatment***	
		Drainage Area Treated	***Total IC in Drainage Area***
(4) ESD BMPs	135	366	105
(3) Effective BMPs	153	3,838	1,074
(2) Under-performing BMPs	73	227	86
(1) Non-performing BMPs	124	1,690	474
(0) Pretreatment and Unknown[2]	177	357	210
Total	***662***	***6,479***	***1,949***

[1]For drainage areas with more than one BMP, the maximum performance code was taken after deleting pretreatment BMPs (Code 0).
[2]Drainage area not associated with a specific BMP type

In addition to the structural stormwater BMPs listed above, there are 23 completed stream restoration sites within the MS4 permit area. The completed projects cover almost 15.6 linear miles of streams within the watershed.

1.3 Problems Facing the Anacostia Watershed

Biological and Habitat Conditions

During a countywide, five-year monitoring cycle completed in 2009, 33 tributaries in the Anacostia watershed were sampled for benthic invertebrates, fish species, and habitat metrics in order to assess the stream resource conditions. Results of the survey are in Table 4, summarized by both stream length (miles) and drainage area (acres). The survey data can be used to classify both instream conditions and overall water quality from the watershed. Therefore, the stream length resource conditions can be interpreted as an indicator of the current instream resource conditions while the drainage area summary can be used to indicate the condition of water quality draining from the watershed.

Outreach and Stewardship Strategy Public Outreach Stewardship Education Project: To help watershed stakeholders understand that the watershed's streams are in poor health, nurturing of a subset of watershed champions is recommended as described in the Practice Sheet entitled Stream Stewards Outreach and Stewardship Campaign.

Currently, the majority of the stream resource conditions in Anacostia Watershed were assessed as 'Fair', with large percentages of 'Poor' streams, and less than 10% 'Good' or 'Excellent' streams. The only high quality streams were found in the Upper Mainstem and Left Fork of Paint Branch, which received the only 'Good' ratings (as noted above the Gum Springs and Good Hope tributaries provide spawning and nursery areas). The 'Poor' ratings were spread throughout the Lower Paint Branch, Little Paint Branch, Northwest Branch, and Sligo Creek, which can mostly be attributed to the increased development in these watersheds.

Table 4: Anacostia Watershed Stream Resource Condition Survey Results by Stream Miles and Drainage Area

Resource Condition	*Stream Length (miles)*	*%*	*Drainage Area (Acres)*	*%*
Excellent	0	0	0	0
Good	14.2	6	2,143	6
Fair	117.3	50	22,034	57
Poor	96.0	41	14,568	37
Not Accessed	6.3	3	171	0
Total	*233.8*	*100*	*38,916*	*100*

Water Quality and Trash Issues

As part of its environmental enforcement program, the County tracks citizen complaints regarding water quality and solid waste dumping. Table 5 summarizes the number and type of citizen complaints recorded for Anacostia Watershed during the five year cycle from 2004 to 2009. The overwhelming majority of the complaints received were related to stormwater pollutant discharge. Table 6 includes the same complaints summarized by location, and general zoning type. For some properties there were multiple complaints. The majority of complaints recorded were in residential and commercial zoning. These locations were given 'hotspot' identification in the pollutant loading model, discussed further in Section 3.

Table 5: Recorded Water Quality Complaints[1] in the Anacostia Watershed

Number by Water Quality Complaint Type				
Total # of cases	*Stormwater-Pollutant Discharge*	*Surface Water-Chemical Discoloration/ Unknown*	*Surface Water-Sewage*	*Surface Water-Petroleum Product in Water*
199	163	28	4	4

[1] From WQCases2004_2009_Locations.shp

Table 6: Water Quality Complaint by Zoning[1] in the Anacostia Watershed

General Zoning Type[2]	*Acres*	*Total # of Properties*
Apartments	4.0	3
Residential	92.3	109
Commercial	65.7	34
Industrial	36.8	4
Unzoned	90.4	5

[1] From SWCases2004_2009_locations.shp
[2] From County PROPERTIES.shp

Solid waste trash dumping sites were also logged by the County to identify trash hotspots. Table 7 includes a summary of the complaint database by complaint type. The majority of complaints were recorded as residential dumping or dumpster management. For some properties there were multiple complaints. Table 8 identifies the general zoning type at the site of the complaint. The majority of complaints were in residential areas.

Outreach and Stewardship Strategy Education Project: To reduce trash hot spots, stakeholder outreach is recommended in partnership with HOAs, county recycling offices and athletic organizations educating watershed residents on the importance of proper trash can maintenance, keeping playing fields clean, and dumpster maintenance is recommended for success. Implementation details are in the Practice Sheet entitled Anti-littering Outreach and Stewardship Campaign.

Table 7: Solid Waste Trash Dumping Sites[1] in the Anacostia Watershed

Number per Solid Waste Type				
Total # of cases	*Farm Land*	*Residential*	*Public Land*	*Dumpster*
297	1	179	58	59

[1] From SWCases2004_2009_locations.shp

Table 8: Solid Waste Trash Dumping Sites by Zoning[1] in the Anacostia Watershed

General Zoning Type[2]	*Acres*	*Total # of Properties*
Apartments	116.5	22
Residential	213.8	180
Commercial	38.6	21
Unzoned	92.4	9

[1] From SWCases2004_2009_locations.shp
[2] From County PROPERTIES.shp

1.4 Existing Pollutant Loads and Impervious Surfaces

TMDLs and Existing Pollutant Loads

The EPA has approved the following TMDLS for the Anacostia watershed.

- "Total Maximum Daily Loads of Fecal Bacteria for the Anacostia River Basin in Montgomery and Prince George's Counties, Maryland" Final Report in November 2006,
- "Total Maximum Daily Loads of Sediment/Total Suspended Solids for the Anacostia River Basin, Montgomery and Prince George's Counties, Maryland and the District of Columbia" Final Report in June, 2007.
- "Total Maximum Daily Loads of Nutrients/Biochemical Oxygen Demand for the Anacostia River Basin, Montgomery and Prince George's Counties, Maryland and The District of Columbia" Final Report in April, 2008,
- "Total Maximum Daily Loads of Trash for the Anacostia River Watershed, Montgomery and Prince George's Counties, Maryland and the District of Columbia" Final report in September 2010

These documents established TMDLs for the separate MS4 Permit areas in the Anacostia watershed for Montgomery and Prince George's Counties, and The District of Columbia. As part of the approved TMDLs, MDE established specific baseline loads and wasteload allocations (WLAs) for the watershed area under the MS4 Permit area. These are displayed in Table 9.

Table 9: Baseline and Target Pollutant Loads from approved TMDLs for the Anacostia Watershed

Parameter	***Year***	***Baseline Montgomery County MS4 load***	***Montgomery County WLA Reduction***	***Target Montgomery County MS4 load***
Bacteria (Enterococci)	2006	247,809 billion MPN/year	87.9%	29,978 billion MPN/year
Nitrogen	2008	206,312 lbs/year	81.8%	38,959 lbs/year
Phosphorus	2008	20,953 lbs/year	81.2%	3947 lbs/year
Sediment	2007	7,682 tons/year	87.5%	1,101 tons/year

Existing Trash Loads

In addition to bacteria, nutrients, and sediment, the County must also identify a specific strategy to target existing trash loads from the Anacostia watershed. In September 2010, EPA approved the TMDL for trash in the Anacostia River watershed. This Plan establishes initial estimates to achieve the required trash reductions of 621.6 lbs per day (or 226,884 lbs per year) to meet the MS4 Permit wasteload allocation in that TMDL.

Impervious Surfaces

Impervious cover in the watershed, as derived from County geographical information system (GIS), is summarized in Table 10. The roofs of single family homes account for the largest impervious cover type in the watershed at just over 27%. This is followed closely by County and private roads at about 24%.

Table 10: Impervious Cover in the MS4 Permit Area in the Anacostia Watershed

Impervious Cover Type	*Impervious Acres*	*Watershed (%)*
1. Roads		
a. Low Density Residential[1]	458.3	8.0%
b. Other[2]	1379.6	24.0%
2. Parking Lot		
a. County Small Lots (<1 acre)[3]	42.3	0.7%
b. County Large Lots (>=1 acre)[3]	133.7	2.3%
c. Private	1093.4	19.0%
3. Roofs		
a. County[4]	135.1	2.4%
b. Single Family Homes[5]	1558.7	27.1%
c. Other	740.6	12.9%
4. Sidewalks[6]	161.2	2.8%
5. Other		
a. Schools[7]	178.9	3.1%
b. Recreational[8]	38.5	0.7%
Total Impervious Acres from GIS[9]	**5,741.4**	**100.0%**

[1]All roads in RE2 or R200 property zoning.
[2]Includes County and private roads.
[3]Parking lots located in County-owned parcels, derived using County_pnts from the County's PROPERTY geodatabase.
[4]Buildings located in County-owned parcels, derived using County_pnts from the County's PROPERTY geodatabase.
[5]Buildings located on single family home parcels, derived using MDP_pnts from the County's PROPERTY geodatabase and selecting only single-family dwelling types.
[6]Sidewalks in jurisdiction. Does not include all residential sidewalks or driveways.
[7]Impervious cover located in public school parcels, derived using pubsch points from the County's LOCATIONS geodatabase. Some overlap with other impervious.
[8] Impervious cover identified as Recreational in geodatabase. Some overlap with other impervious.
[9] Sum of all GIS impervious. Excludes overlaps in schools and recreational.
[10] As of 2009

2 Inventory of Provisional Restoration Candidates

2.1 Types of Restoration Practices

Table 11 summarizes the 11 groups of watershed restoration practices evaluated for the Anacostia watershed. The first four groups involve various forms of ESD. All restoration practices differ in the mode and manner by which they will be delivered in the watershed (capital budgets, operating budgets, regulation, etc.). Multiple delivery mechanisms are needed to implement enough restoration practices to meet the stringent watershed treatment and pollutant reduction targets set forth in the County's MS4 permit and the approved TMDLs.

Table 11: Restoration Practices to be Evaluated in the Anacostia Watershed Implementation Plan

Description of Practice	***Application in the Anacostia River Watershed***
ESD Practices	
New ESD Retrofit Practices - These include small scale ESD practices applied to County- owned or privately owned buildings, streets and parking lots and rights of way. Examples include rainwater harvesting, bioretention, green roofs, upland reforestation, soil compost amendments, rooftop disconnection, "green street" retrofits, and converting roadway swales to bio-swales.	Public ESD Retrofits
ESD Upgrades - This category includes retrofit ESD practices within existing publicly-owned or privately-owned stormwater infrastructure, so that their hydrologic and pollutant removal performance is upgraded.	Code 1 and 2 BMP Upgrades (see WTM 3.0)
Impervious Cover Reduction - This category involves cases where un-needed impervious cover is removed, soils amended and vegetation restored primarily on County schools, streets and parking lots	Not Applicable
Voluntary ESD Implementation - ESD practices that are installed as a result of County education and incentive programs.	Private ESD Retrofits
Programmatic and Operational Practices	
MS4 Programmatic Practices – This category deals with reduced pollutants that can be attributed and quantified through MS4 stormwater education (e.g., lawn care), pollution prevention improvements at municipal hotspots, and better housekeeping on County land and facilities. Also includes any pollutant reductions due to product substitution, such as imposing restrictions on N or P content in fertilizer, increased pet waste enforcement, trash prevention and control.	Pet Waste Education
Hotspot Pollution Prevention – This category credits enhanced structural and non-structural practices employed at non-publicly owned stormwater hotspots that are identified through land use analysis.	Not applicable

Description of Practice	*Application in the Anacostia River Watershed*
Enhanced County Street Sweeping - This category includes any pollutant reduction that can be attributed to more intensive and targeted street sweeping in the watershed conducted by the County.	Arterial, DOT, and Priority Residential Routes
Trash Prevention and Control - This category includes a wide range of programs and practices specially aimed at reducing trash inputs to stream, including reduce, reuse and recycle campaigns, littering and illegal dumping enforcement, dumpster management, storm drain marking, storm drain inlet devices, stream cleanups, instream controls to trap and remove trash, etc. These measures are in addition to any trash trapped and removed by other restoration practices which are computed separately.	Illegal Dumping Prevention and Enforcement; Plastic Bag Ban; Anti-litter campaign; Recycling Education and Investigations
Structural Practices	
Traditional Retrofits - This is the traditional retrofit scale where large-scale, non-ESD retrofits are constructed on larger parcels of public or private land as discovered through analysis of MCDEP BMP inventory.	New Ponds
BMP Maintenance Upgrades - Credit for improvement in current permit cycle for major maintenance upgrades of failed stormwater practices that result in significant improvement in hydraulic function and increased treatment capacity using existing County maintenance budget. Credit can only be taken for increased load reduction due to upgrades that significantly rehabilitate BMP function from its installation baseline. (e.g., increase capacity, lengthen flow path, reduce short-circuiting, eliminate design failures).	Code 1 and 2 BMP Upgrades (see WTM 3.0)
Habitat Restoration - This category includes any pollutant reduction or volume reduction that can be attributed to specific stream restoration or riparian reforestation projects planned for construction in the watershed for the permit cycle.	Stream Restoration Riparian Reforestation

2.2 Inventory of Previously Identified Projects

Potential restoration strategies were drawn from the Anacostia River Watershed Feasibility Study, the Watershed Restoration Action Plan, the County Restoration Sites database, and feedback received from watershed stakeholders. Previously identified restoration projects identified are presented in Figure 3.

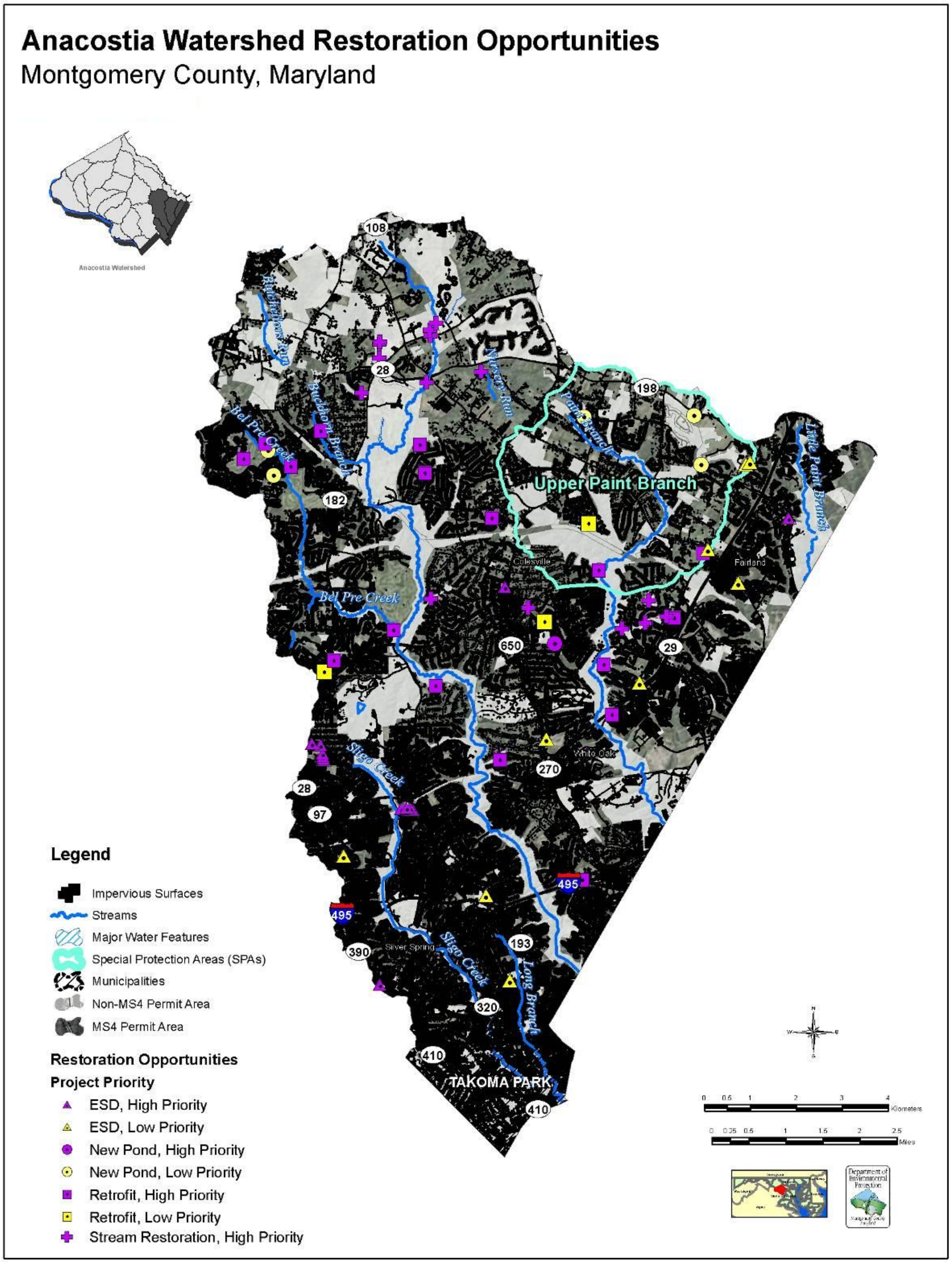

Figure 3 : Identified Restoration Opportunity Locations for the Anacostia Watershed

3 Evaluation of the Restoration Strategies to Meet MS4 Permit and TMDL Requirement

3.1 Pollutant Load Tracking

MDE established the TMDL for bacteria in Anacostia River using actual water quality samples taken from three monitoring stations during both wet and dry periods from October 2002 through October 2003. The point source WLA for the MS4 Permit area was determined using both bacterial source tracking and distributed land use. MDE used the Maryland Department of Planning (MDP) 2000 land use/land cover information. For nutrient and sediment TMDLs, MDE used analytical results from water quality monitoring from 1995-1997 and established downstream conditions using the Tidal Anacostia Model/Water Analysis Simulation Program. The trash TMDL was established using data collected in 2008 and 2009 with MDP 2002 land use for Prince Georges and Montgomery Counties.

This Plan uses a similar land use based model to develop a primary source load of bacteria, sediment, nutrients, and trash to the Montgomery County tributaries within the Anacostia watershed. The Plan uses MDP land use data from 2002 for consistency with the Countywide Implementation Strategy. Land use specific loading rates can be found in the Guidance Document, Section 2.

The baseline year for calculating pollutant reductions is different than that used to determine progress toward the MS4 permit requirement for watershed restoration.

- Sediment and Nutrients: 1997
- Bacteria: 2003
- Trash: 2009

3.2 Desktop Review of BMP Coverage

A desktop review of BMP coverage was used to analyze the existing BMP coverage, proposed County restoration sites inventory of potential restoration projects, and other project inventory from the Anacostia River Watershed Feasibility Study and Watershed Action Plan. The BMPs were classified according to their performance code as shown in Table 12. The relative performance of each practice type was based on comparative reviews of pollutant reduction and runoff reduction performances of practices from across the country (CWP, 2007; and CWP and CSN, 2008) or performance studies on individual practices (Schueler, 1998). The composite efficiencies were also compared to recent research values and assumptions used in local models (USACE, 2008; Chesapeake Bay Program, 2008; and MDE, 2009) to further justify the performance coding. A summary of the BMP modeling assumptions are in Table 12. In addition to these categories, stand-alone pre-treatment BMPs were given Code 2 efficiency.

Table 12: Composite Runoff reduction, Effectiveness Factor, and Pollutant Reduction by BMP Performance Code

Performance Code	*Description*	*TN[1] (%)*	*TP[2] (%)*	*TSS[3] (%)*	*FC[4] (%)*	*DF[5]*
1	**Non-performing BMPs**	0	0	5	0	0.05
2	**Underperforming BMPs**	5	5	20	10	0.15
3	**Effective BMPs**	40	50	80	65	0.75
4	**ESD Practices**	65	65	90	75	1.0

[1] TN: Total Nitrogen Removal Rate (Mass)
[2] TP: Total Phosphorus Removal Rate (Mass)
[3] TSS: Sediment Removal rate
[4] FC: Fecal coliform reduction, see rationale in Guidance Document, Section 5.5 for why entercocci could not be used.
[5] DF: Discount Factor: Fraction of contributing impervious acres effectively treated to the Water Quality Volume, used to rate BMP treatability

3.3 Summary of Watershed Treatment Model Scenarios

The Watershed Treatment Model (WTM) was used to estimate pollutant sources and treatment options for Anacostia River. The spreadsheet used was an updated version of the publicly available v3.1, which included an expanded runoff volume reduction component (personal correspondence, Deb Caraco, 2009). The WTM was used to track a progression of restoration strategies across the watershed to illustrate the effectiveness of each strategy in reducing pollutant loads and ultimately meeting the TMDL load reduction targets. Targeted strategies range from specific capital improvement projects identified by the County to less well defined nonstructural strategies tied to stakeholder participation and involvement.

A summary of the model scenarios evaluated using the Watershed Treatment Model are provided in Table 13 below and described in more detail in the following sections.

Table 13: Summary of Watershed Treatment Model (WTM) Scenarios

Implementation Phase	*Description*
WTM Baseline Conditions	The WTM was run under existing conditions approach with the MDP year 2002 land use/land cover data and existing BMPs. A rough normalization to the MDE TMDL baseline load was conducted using a baseline year of 1997 (nutrients and sediment) and 2003 (bacteria).
WTM 2.0 Completed as of 2009; High Priority; Low Priority and Other Potential Projects	The WTM was run with a series of future management practices, which were proposed projects from the County inventory of restoration sites. These practices cover new ponds, retrofits of existing BMPs, and ESD practices from the proposed projects list determined in the Watershed Action Plan and Feasibility Study.
WTM 3.0 ESD Strategies and Other Structural BMPs and	The remaining inventory of BMPs with reduced treatment efficiency were reviewed for retrofit opportunities and potential increased pollutant reduction efficiencies. In addition, the County's inventory for other project types that include public properties (e.g., libraries and parking lots), public schools, and open section roads available for ESD retrofits was reviewed, as were areas for private property ESD retrofits.
WTM 4.0 Habitat Restoration	Other projects on public lands and other practices that are identified in Appendix B of the Guidance Document were explored. For Anacostia River this focused on habitat restoration related to riparian buffer reforestation and stream restoration.
WTM 5.0 MS4 Programmatic Practices	Other MS4 programmatic practices that are identified in Appendix B of the Guidance Document were examined. For Anacostia River, this was limited to pet waste education and street sweeping, to address the TMDL pollutants of bacteria and sediment.

WTM 1.0 – Baseline Conditions
The WTM was run under existing conditions approach with the MDP year 2002 land use/land cover data (Table 2) and existing BMPs coded under "Existing Management Practices" (Table 14).

Nutrients and Sediment
The baseline pollutant load was calculated and compared to the MDE-determined baseline MS4 load for nutrients and sediment. The data used to establish the nutrients and sediment TMDLs was collected by MDE from 1995, 1996, and 1997 (MDE, 2007 and MDE, 2008), so any BMPs with "approved" dates after 1997 were not included in this baseline calculation. The summary of BMPs with approval dates prior to 1997 is included in Table 14. Table 15 summarizes the BMPs approved after 1997, which were counted towards meeting the TMDL reduction target.

Table 14: 1997 BMP Inventory for Anacostia watershed (pre-nutrient and sediment TMDL)

BMP Performance Category	***Count***	***Total DA (Acres)***	***Total IA (Acres)***
ESD Practices (Code 4)	112	335	93
Effective BMPS (Code 3)	107	3,639	1,024
Underperforming BMPs (Code 2)	44	143	58
Non-performing BMPs (Code 1)	113	1,614	454
Pretreatment BMPs (Code 0)	163	336	199

DA: Drainage Area
IA: Impervious Area

Table 15: Existing BMPs approved between 1998 and 2003, used to track sediment and nutrient reduction for the Anacostia watershed after the TMDL baseline sediment and nutrient loads were established

BMP Performance Category	***Count***	***Total DA (Acres)***	***Total IA (Acres)***
ESD Practices (Code 4)	19	27	10
Effective BMPS (Code 3)	42	180	48
Underperforming BMPs (Code 2)	24	66	19
Non-performing BMPs (Code 1)	9	22	11
Pretreatment BMPs (Code 0)	13	20	10

DA: Drainage Area
IA: Impervious Area

Bacteria

A similar approach was used for Enterococci (bacteria). The baseline pollutant load was calculated in the WTM and compared to the MDE-determined baseline MS4 load. The data used to establish the TMDL was collected by MDE in 2002 and 2003 (MDE, 2006), so any BMPs with “approved” dates after 2003 (Table 16) were not included in this baseline calculation. BMPs approved after 2003 were counted towards meeting the TMDL reduction target.

Table 16: Existing BMPs approved after 2003, used to track bacteria reduction to the Anacostia Watershed after the TMDL baseline bacteria load was established

BMP Performance Category	***Count***	***Total DA (Acres)***	***Total IA (Acres)***
ESD Practices (Code 4)	4	4	1
Effective BMPS (Code 3)	5	19	1
Underperforming BMPs (Code 2)	5	18	9
Non-performing BMPs (Code 1)	2	54	10
Pretreatment BMPs (Code 0)	2	1	1

DA: Drainage Area
IA: Impervious Area

WTM 2.0 – Completed as of 2009, High Priority, Low Priority and Other Potential Projects

The WTM was run with a series of future BMPs, which were proposed projects from the County inventory of restoration sites. These practices cover new ponds, retrofits of existing BMPs, and ESD projects from the proposed projects list determined in the Watershed Action Plan and Feasibility Study, as summarized in Table 18. Drainage area (DA), impervious area (IA), total length, and total cost were all determined from engineering designs or estimated based on the running average per practice values from the County database (DEP, 2010). In general, the County used the information in Table 17 below to estimate proposed impervious area and costs, where engineering costs were unavailable:

Outreach and Stewardship Strategy Education Project: To help watershed stakeholders understand why stormwater retrofits and other watershed restoration improvements are under construction, stakeholder outreach such as installing educational signage near all retrofit projects is recommended. This can be accomplished through partnerships with organizations such as the many "Friends Of" groups in this watershed. Messaging should focus on the ways that the treatment of stormwater on roads and public lands is changing. This is a demonstration of the new ways in which we manage stormwater. Implementation details on this stakeholder outreach are described in the Practice Sheet entitled Innovative Stormwater Management Outreach and Stewardship Campaign.

Table 17: Impervious Cover and Cost Estimates used in the Future Management Scenarios
• **38% imperviousness per drainage acre**
• **New Ponds, $6,000 per drainage acre**
• **Retrofit Pond, $4,000 per drainage acre**
• **ESD project, $200,000 per impervious acre**
• **Wetland, $50,000 per drainage acre**

The cumulative pollutant load reduction was computed and compared to the TMDL annual target for bacteria, sediment, and nutrients. The applicable target reduction from the baseline load in order to meet the MDE stormwater WLA varies according to pollutant. Thus, this step determined how far and at what cost the existing list of restoration projects goes toward meeting the TMDL, impervious cover, trash and other pollutant reduction goals. New Ponds were given effective BMP pollutant reduction efficiency, and ESD practices were given full ESD pollutant reduction efficiency.

Retrofits of existing BMPs were reconciled with the existing urban BMP database and given an incremental increase in pollutant reduction efficiency based on an assumed Code 4 BMP efficiency. The actual drainage area and impervious area from the existing practice was used to calculate pollutant and runoff reduction.

Table 18: Three levels of treatment: Complete (includes post-TMDL date BMPs), High Priority, and Future for the Anacostia Watershed (See Appendix A for list of high and low priority projects.)

Restoration Type	*Count*	*Cost ($)*	*Total DA (acres)*	*Total IA (acres)*
Completed Projects				
ESD	6	$ 663,630	9	4
New Ponds	6	$ 1,212,046	329	56
Retrofits of Pretreatment BMPs	0	$ -	0	0
Retrofits of Non-performing BMPs	6	$ 1,200,757	303	70
Retrofits of Under-performing BMPs	1	$ 60,329	12	5
Retrofits of Effective BMPs	5	$ 5,812,717	1138	441
Retrofits of ESD BMPs	1	$ 532,243	131	50
High Priority Projects				
ESD	16	$ 4,132,284	47	24
New Ponds	0	$ -	0	0
Retrofits of Pretreatment BMPs	0	$ -	0	0
Retrofits of Non-performing BMPs	9	$ 1,293,183	309	65
Retrofits of Under-performing BMPs	0	$ -	0	0
Retrofits of Effective BMPs	7	$ 894,590	218	69
Retrofits of ESD BMPs	1	$ 30,902	8	4
Low Priority and Other Potential Projects				
ESD	292	$ 184,073,470	2208	1388
New Ponds	28	$ 4,724,660	993	333
Retrofits of Pretreatment BMPs	27	$ 22,675,089	47	24
Retrofits of Non-performing BMPs	74	$ 11,285,121	975	353
Retrofits of Under-performing BMPs	25	$ 9,698,891	103	34
Retrofits of Effective BMPs	46	$ 19,357,124	1653	462
Retrofits of ESD BMPs	21	$ 2,482,706	47	21

WTM 3.0 – ESD Strategies and Other Structural BMPs
The remaining inventory of Code 1 and 2 BMPs, which have reduced treatment efficiency, were reviewed for retrofit opportunities and potential increased pollutant reduction efficiencies. In addition, the County's inventory for other project types that include public properties (e.g., libraries), public schools, and open section roads available for ESD retrofits was reviewed. Then the Guidance Document was followed for determining total potential reduction from assumed treatment areas from these four target areas.

a. Code 1 and 2 BMP ESD Retrofits- The remaining Code 1 and Code 2 BMP treatment area was calculated by subtracting the previously targeted retrofits from (WTM 2.0) from the total BMP area (summarized in Table 19). It was then assumed these areas were suitable for retrofits and incrementally increased the performance efficiency of Code 1 and 2 BMPs to the MEP within Future Management Practices. The cost per impervious acre estimate was based on typical County retrofits for large pond BMPs.

Table 19: Underperforming (Code 2) and Non-performing (Code 1) BMPs targeted for retrofit for the Anacostia Watershed

Target	Count	Total DA (acres)	Total IA (acres)	Cost per IA	Total Cost
Total Code 2 BMPs	73	227	86		
-Previously Targeted for Retrofit	-26	-115.2	-33.53		
Remaining Code 2 for Retrofit	**47**	**111.8**	**52.47**	**$12,000**	**$629,640**
Total Code 1 BMPs	124	1690	474		
-Previously Targeted for Retrofit	-89	-1587.06	-426.5		
Remaining Code 1 for Retrofit	**35**	**102.94**	**47.5**	**$12,000**	**$570,000**
				Total	**$1,199,640**

Table 20 below shows the following:

b. Public properties – Forty percent of the impervious cover from the aggregate area and associated imperviousness from untreated County-owned Large Parking Lots and Rooftops was assigned to future management practices as code 4 (see Table B.4 of Guidance Document, and summary in Table 20 below). The forty percent target for restoration was based on a judgment of the maximum extent practicable considering physical constraints to ESD/LID. The unit cost estimate was based on an equal mix of new ESD retrofits for larger parking lots and rooftops.

c. Public schools – Forty percent of the impervious cover from the aggregate area and associated imperviousness and from untreated Public Schools Parcels was assigned to future management practices as code 4 (see Table B.4 of Guidance Document, and summary in Table 20 below). The restoration target was set similarly to part (b) above.

d. Low Density Residential (LDR) and Other County Roads - Seventy-five percent of the impervious cover from the aggregate area and associated imperviousness from RE2 and R200 roadways was assigned to future management practices as code 4 (see Table B.4 of Guidance Document, and summary in Table 20 below). The restoration target was set similarly to part (b) above. The unit cost estimation was based on an open-section road retrofit. Other County Roads were assigned a forty percent aggregate impervious cover restoration target, and the unit cost was based on a curbed road retrofit.

e. Private Property ESD implementation - The USACE Watershed Restoration Plan identified priority neighborhoods within the Anacostia watershed for private property ESD, similar to the County's Rainscapes program which provides financial incentives for adding ESD practices on private property. A thirty percent implementation target of site-scale ESD projects in the priority neighborhoods that meet criteria associated with home ownership, existing neighborhood treatment, and lot size was used. Figure 4 shows the priority neighborhoods in the Anacostia River. Table B.7 of the Guidance Document describes the basic approach used to make pollutant reduction and cost decisions.

   In order to identify additional Priority Residential Neighborhoods for private property ESD implementation, a desktop assessment was performed. The criteria used for evaluation included lot size, home ownership, presence or absence of homeowners association (HOA), and presence or absence of existing stormwater management BMPs. Neighborhood areas are then broken into tiers of high, medium, and low based on the points assigned to the various criteria:

- SWM Score:
  - Yes = 0; No = 2
- Lot Size Score:
  - > 1.0 acre = 0
  - <= 0.25 BUT <= 1.0 = 3 (High)
  - <= 0.1 BUT <0.25 = 2 (Medium)
  - < 0.1 acre = 1 (Low)
- Home Ownership Score:
  - > 70% = 3 (High)
  - <= 30 BUT <=70 = 2 (Medium)
  - < 30% = 1 (Low)
- HOA Score:
  - Yes = 2 ; No = 0
- Total Priority Score:
  - >=9 = High
  - >=6 BUT <=8 = Medium
  - <= 5 = Low

Outreach and Stewardship Strategy Education Project:
To reduce stormwater pollution from private property, stakeholder outreach is recommended explaining the need for watershed stakeholders to capture some of the precipitation that falls on their roof and allow for groundwater recharge hence slowing the flow of surface waters and potential erosion impacts. It is recommended that this can be accomplished by targeting expansion of existing County programs similar to RainScapes to the neighborhoods identified by the USACE and as described in the Practice Sheet entitled Roof Runoff Reduction Outreach and Stewardship Campaign.

f. Non-residential Property without Adequate Treatment ESD implementation: These are comprised of commercial properties that are not currently paying into Water Quality Protection Charge. It was assumed that forty percent of the impervious cover within these properties will apply ESD practices on site. This equates to 550 acres of impervious cover. This area was assumed to be treated to the maximum extent practicable within the WTM.

Table 20: Summary of restoration potential within County owned facilities, schools, and ESD roads options for the Anacostia Watershed

Land Cover	***Total IA***	***Restoration Potential****	***Restored IA***	***Unit Cost*****	***Restoration Cost****
Type	Acres	%	Acres	$/Acre IA	$
County Large Parking Lots[1]	134	40%	54	$317,500	$16,979,900
County Roofs[2]	135	40%	54	$508,500	$27,479,340
Schools[3]	179	40%	72	$484,000	$34,635,040
Low Density Residential Roads[4]	458	75%	344	$137,000	$47,090,325
Other County Roads	1380	40%	552	$200,000	$110,368,000
Residential Properties Priority Neighborhoods[5]	1485	30%	446	$298,000	$132,776,880
Non-residential Property without adequate treatment	673	40%	269	$298,000	$80,181,072
Totals	4444		1789		**$ 449,510,000**

* Restoration target was based on a judgment of the maximum extent practicable considering physical constraints to ESD/LID

**Unit Cost was derived from an equal mix of green roofs, cisterns, permeable paving, and bioretention BMPs according to the Guidance Document.

[1] Parking lots located in County-owned parcels, derived using County_pnts from the County's PROPERTY geodatabase.

[2] Buildings located in County-owned parcels, derived using County_pnts from the County's PROPERTY geodatabase.

[3] Impervious cover located in public school parcels, derived using pubsch points from the County's LOCATIONS geodatabase. Some overlap with other impervious.

[4] All roads in RE2 or R200 property zoning.

[5] Rooftop area in High and Medium Priority Neighborhoods

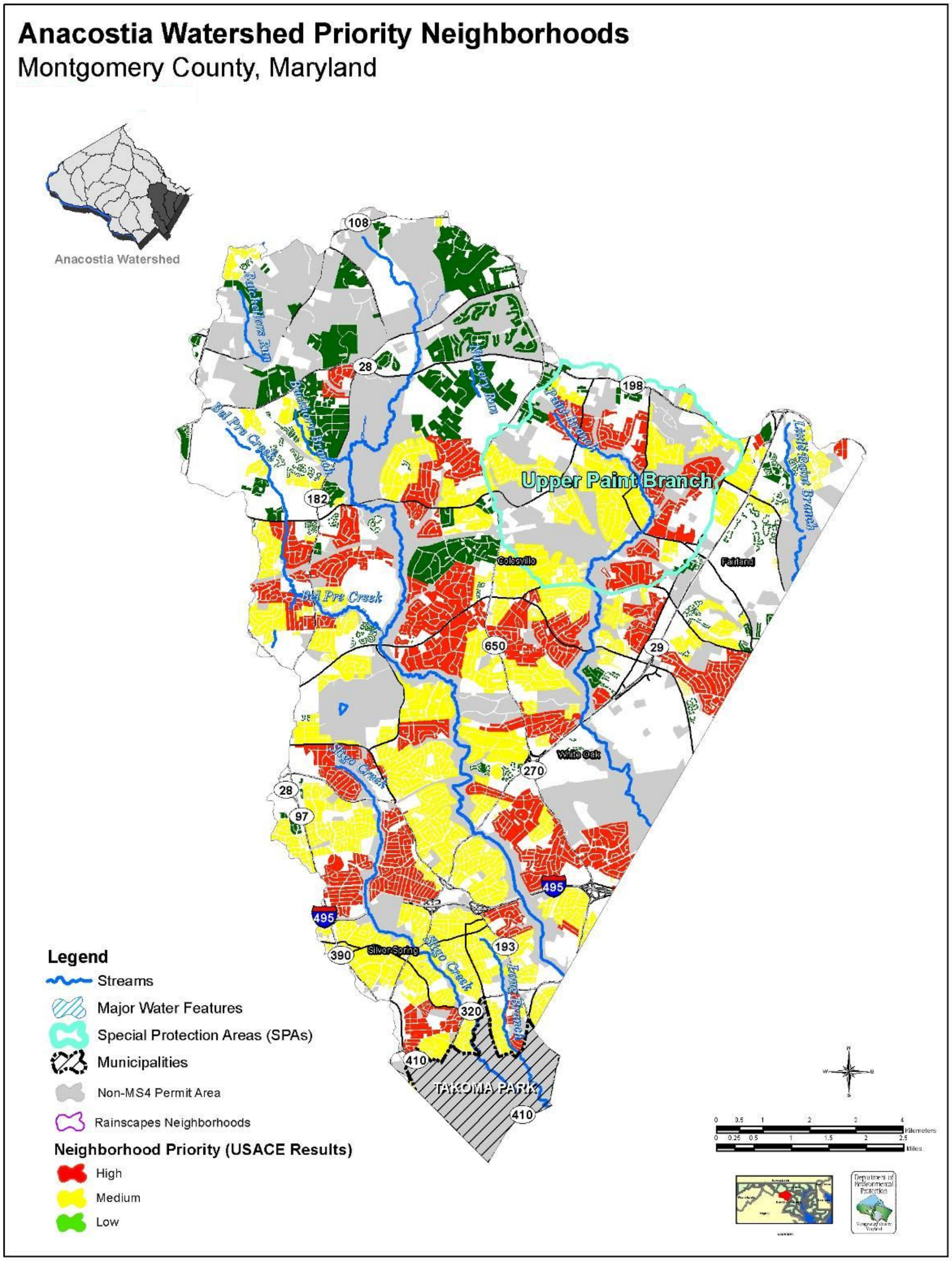

Figure 4: Priority Neighborhoods for ESD retrofits, adapted from the USACE Watershed Restoration Plan (2010)

WTM 4.0 – Habitat Restoration

Other projects on public lands and other practices that are identified in Appendix B of the Guidance Document were explored. The specific order of consideration was dependent on the parameter of focus, which for the Anacostia watershed are the bacteria, nutrient, and sediment loads.

a. Riparian reforestation and habitat enhancement – USACE (2009) identified location for riparian reforestation and habitat enhancement. The point locations for these projects were intersected with the MDP 2002 LULC data in order to convert the existing land use area to forest area in the WTM Future Management Practices (see Table B.13 of the Guidance Document, and summary of areas in Table 21 and 22 below). Since these sites were verified in the field by the USACE, one-hundred percent implementation of riparian reforestation across the total area was assumed.

Outreach and Stewardship Strategy Education Project:
To encourage habitat restoration on private property, stakeholder outreach is recommended on the important roles of riparian buffers. Key partnerships include the local watershed stewards such as the many "Friends Of" organizations in this watershed. Implementation details are contained in the Practice Sheet entitled Riparian Reforestation Outreach and Stewardship Campaign.

Table 21: Summary of USACE riparian reforestation sites, intersected with land use for the Anacostia Watershed

Riparian Reforestation	**19 Sites**
MDP 2002 LULC	*Targeted Acres*
Deciduous Forest	8.1
Low Density Residential	8.6
Medium Density Residential	8.6
Open Urban Land	19.8
Pasture	2.4
Roadway	10.1
Cost	**$ 808,800**

Table 22: Summary of USACE habitat enhancement sites, intersected with land use for the Anacostia Watershed

Habitat Enhancement	**15 Sites**
MDP 2002 LULC	*Targeted Acres*
Deciduous Forest	6.8
Low Density Residential	3
Medium Density Residential	1.8
Open Urban Land	1.3
Pasture	2.5
Cost	**$ 611,000**

b. Stream restoration - The sediment load contribution from stream bank erosion can be highly variable according to research. Literature values for the watershed sediment load contribution from instream sources vary from 60% (Mukundan, et al., 2010), to 90% (Rosgen, 2006) and anywhere from 5-80% (Evans, et al., 2003). The Anacostia River Sediment TMDL estimates that stream channel erosion contributes 67% of the total annual sediment load, followed by urban land at 23%. Stream restoration can be an effective tool for both instream sediment source stabilization and habitat restoration. However, the efficiency of stream restoration at pollutant reduction is also highly variable. Table 23 summarizes the published reduction efficiencies from the Chesapeake Bay Program (2006), MDE (2010a), and guidance document. The guidance document data was largely based on data from highly urbanized Baltimore City streams (DPW, 2005). The sediment TMDL documentation links aquatic health directly to sediment pollution, thus the following potential pollutant reduction efficiencies were assigned to the County streams according to their biological monitoring results. Since all of the streams in the Anacostia River Watershed were rated as Poor, Fair, or Good, we used the reduction efficiencies listed in Table 23. Restoration of unrated streams was assigned a reduction efficiency equivalent to a Poor rating. The Stream Restoration Sites listed in Table 24 were compiled from proposed projects from the County and USACE inventory of restoration sites. A cost of $250 per linear foot was assumed for projects not yet assigned an engineering cost.

Table 23: Potential pollutant reduction efficiencies for stream restoration for the Anacostia Watershed

Source	TN Reduction	TP Reduction	TSS Reduction	IA Equivalency	IBI Score
	lbs/linear foot	lbs/linear foot	lbs/linear foot	IA/acre	Narrative
CBP, 2006	0.02	0.0035	2.55	0.175	Good
MDE, 2010a	0.2	0.011	3.58	0.535	Fair
Guidance Document	0.2	0.068	310	3.4	Poor

Table 24: Three levels of stream restoration sites: Complete (as of 2009), High Priority, and Future for the Anacostia Watershed

Restoration Type	*Count*	*Cost ($)*	*Total Length (mi)*
Completed Projects			
Stream Restoration- Poor Condition	10	$ 4,081,993	7.20
Stream Restoration- Fair Condition	12	$ 6,487,195	8.07
Stream Restoration- Good Condition	1	$ 377,000	0.32
High Priority Projects			
Stream Restoration- Poor Condition	5	$ 2,966,250	2.52
Stream Restoration- Fair Condition	12	$ 2,870,830	2.39
Stream Restoration- Good Condition	0	$ -	0.00
Low Priority and Other Potential Projects			
Stream Restoration- Poor Condition	61	$ 33,621,200	20.21
Stream Restoration- Fair Condition	91	$ 40,424,050	27.64
Stream Restoration- Good Condition	7	$ 2,550,250	1.80
Stream Restoration- Not Rated	1	$ 300,000	0.23

WTM 5.0 – Programmatic Practices

Other MS4 programmatic practices that are identified in Appendix B of the Guidance Document were examined. For Anacostia River, this was limited to pet waste education and street sweeping, to focus on the TMDL pollutants of bacteria and sediment.

a. MS4 programmatic practices - Table B.8 of the Guidance Document describes the basic approach.

   i. Pet Waste Education- The potential reduction in load was calculated using the WTM Pet Waste Education/Future Management Practice, which requires the total number of dwelling units in the watershed (78,909 RDUs). Default WTM discounts, which are based on residential surveys include an assumed 40% of households with dogs, 50% of owners who walk their dogs, 60% of owners who currently clean up after their pets, and 60% of owners willing to change their behavior. The percent willing to change is highly dependent on the establishment of ordinance and enforcement (see Caraco, 2001). An 80%

> **Outreach and Stewardship Strategy Education Project:**
> To reduce bacterial load from private property, stakeholder outreach on the importance of pet waste pick up anywhere a pet may go is recommended. Partnerships for implementation should be fostered between homeowner associations and pet product retailers and service industry. Implementation details are in the Practice Sheet entitled Pet Waste Pickup Outreach and Stewardship Campaign.

dog owner targeting strategy was assumed, which is dependent on the media outlet chosen for education, which for Anacostia watershed was every household within the watershed at a cost of $15 per household. The potential load from pet waste is shown in Table 25 (Schueler 2005 – USRM #2 Table 47).

Table 25: MS4 Programmatic Practices for the Anacostia Watershed – Pet Waste

Strategy	*# households*	*Potential Enterococci Bacteria Source (billion MPN/yr)*	*Unit Cost*	*Total Cost*
Pet Waste	58,820	19,643	$15 per house	$ 882,300

ii. Street Sweeping- The potential reduction in load was calculated using the County's data set on street sweeping from the DOT countywide street sweeping program from 2007-2009. The potential load reduction from street sweeping is shown in Table 26.

Table 26: MS4 Programmatic Practices use for the Anacostia Watershed – Street Sweeping

Strategy	*Road Miles*	*Potential Sediment Source (tons/yr)*	*Unit Cost*	*Total Cost*
Street Sweeping	1,885.1	800.3	$658 per mile	$ 1,240,396

3.4 Preliminary Results of the TMDL Pollutant Load Reduction Analysis

The WTM was run iteratively using a series of spreadsheets for each step outlined above. Initially, the WTM was coded with the existing land use and BMP database to calculate the baseline load. This was within 6% of the MDE baseline for bacteria, 17% for nitrogen, 11% for phosphorus, and 2% for sediment (The WTM calculated an urban land load which was 33% of the total MDE baseline load. The remaining 67% was attributed to stream erosion, which is a 6% difference in the TMDL source tracking estimate for stream erosion. The TMDL estimated that the sediment load from urban land was 33%). The targeted WLA reduction from the MDE baseline was applied to our WTM computed baseline to establish the targets for restoration efforts. From there, the iterative approach was used to track progress.

Preliminary Results of the Bacterial Load Reduction Analysis

Table 27 outlines the progress tracking toward meeting the bacteria TMDL reduction of 87.9%.

Table 27: Preliminary Results of WTM Modeling of the bacterial loading in the Anacostia Watershed

Implementation Phase	***Enterococci Loading***	***Comments***	***Cumulative Cost***
	% reduction from baseline		***Million $***
WTM Baseline Load*	**0%**	**Normalized to MDE Baseline Load**	$ -
WTM 2.0	34%	**Completed, High Priority, Low Priority and Other Potential Projects**	$ 270
WTM 3.0	56%	**ESD Strategies and Other Structural BMPs**	$ 722
WTM 4.0	56%	**Habitat Restoration**	$ 815
WTM 5.0	64%	**MS4 Programmatic Practices**	$ 817
TMDL WLA	87.9%		
* Excludes existing BMPs approved after the TMDL was established in 2003.			

The restoration strategy is further illustrated in **Figure** 5, where the implementation phases are shown in order with their resulting bacteria load in comparison to the WLA. The cost for each implementation phase is also shown. The greatest reduction is attributed to low priority and other potential projects (WTM 2.0) in Table 28, while pet waste education (WTM 5.0) was the most cost-efficient strategy, shown in Table 28.

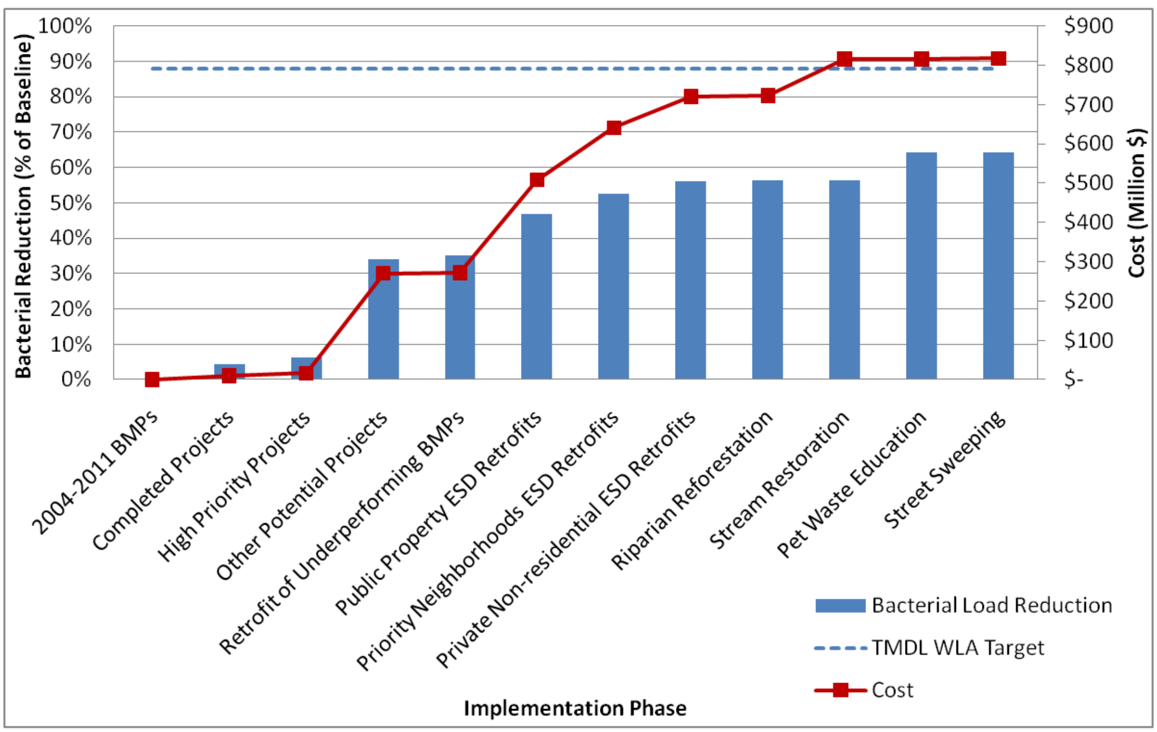

Figure 5: Bacteria loading over restoration implementation phase for the Anacostia Watershed

Table 28: Individual restoration strategy cost effectiveness for bacterial load reduction for the Anacostia Watershed

Rank	Restoration Strategy	Enterrococci reduction	Incremental Cost	Unit Cost
		Billion MPN/yr	Million $	Billion MPN /Million $
1	Pet Waste Education	19,643	0.88	22,263
2	Retrofit of Underperforming BMPs	2,781	1.20	2,318
3	Completed Projects	10,441	9.48	1,101
4	High Priority Projects	5,120	6.35	806
5	Low Priority and Other Potential Projects	69,895	254.30	275
6	Riparian Reforestation	310	1.41	219
7	Public Property ESD Retrofits	29,025	236.55	123
8	Priority Neighborhoods ESD Retrofits	14,777	132.78	111
9	Private Non-residential ESD Retrofits	8,917	80.18	111
10	Stream Restoration	-	93.04	-
11	Street Sweeping	-	1.24	-

Preliminary Results of the Nitrogen Load Reduction Analysis

Table 29 outlines the progress tracking toward meeting the nitrogen TMDL reduction of 81.8%.

Table 29: Preliminary results of WTM modeling of nitrogen loading for the Anacostia Watershed

Implementation Phase	Nitrogen Loading	Comments	Cumulative Cost
	% reduction from baseline		Million $
WTM Baseline Load*	0%	Normalized to MDE Baseline Load	$ -
WTM 2.0	32%	Completed, High Priority, Low Priority and Other Potential Projects	$ 270
WTM 3.0	52%	ESD Strategies and Other Structural BMPs	$ 722
WTM 4.0	95%	Habitat Restoration	$ 815
WTM 5.0	104%	MS4 Programmatic Practices	$ 817
TMDL WLA	81.8%		

* Excludes existing BMPs approved after the TMDL data collection period of 1995-1997.

The restoration strategy is further illustrated in Figure 6, where the implementation phases are shown in order with their resulting nitrogen load in comparison to the WLA. The cost for each implementation phase is also shown. The greatest reduction is attributed to stream restoration, while pet waste education was the most cost-efficient strategy, shown in Table 30.

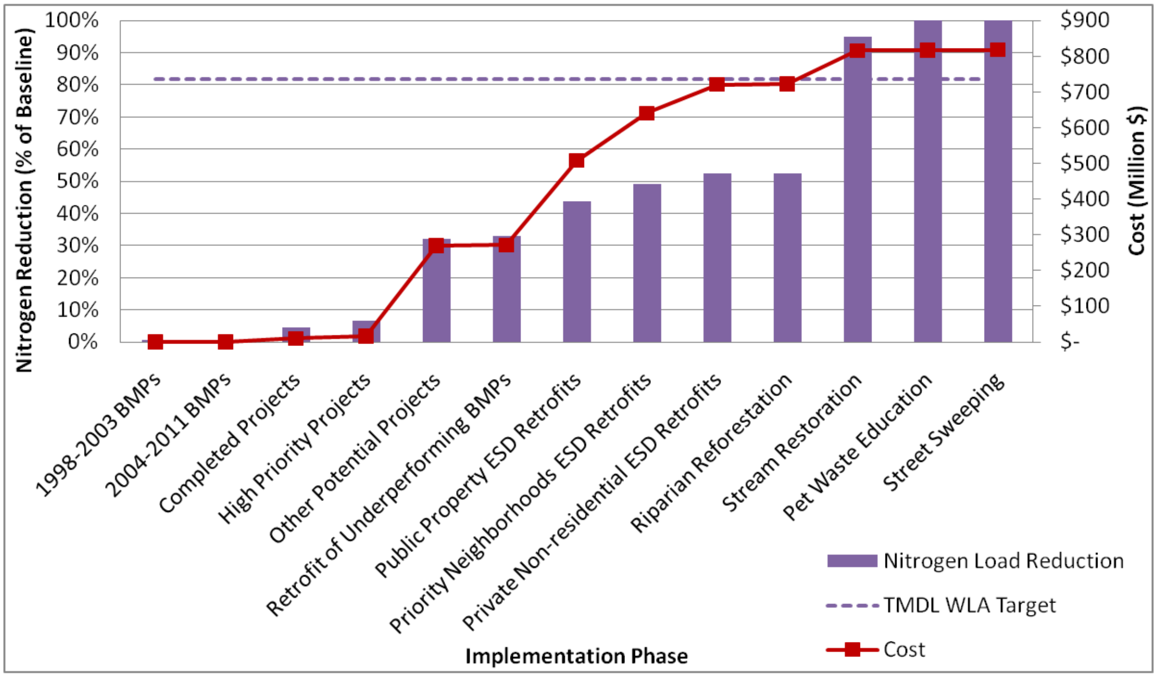

Figure 6: Nitrogen loading over restoration implementation phase for the Anacostia Watershed

Table 30: Individual restoration strategy cost effectiveness for nitrogen load reduction for the Anacostia Watershed

Rank	***Restoration Strategy***	***TN reduction***	***Incremental Cost***	***Unit Cost***
		lbs/yr	Million $	lbs/Million $
1	Pet Waste Education	15,169	0.88	17,193
2	Retrofit of Underperforming BMPs	1,769	1.20	1,475
3	Stream Restoration	72,423	93.04	778
4	Completed Projects	6,643	9.48	701
5	High Priority Projects	3,260	6.35	513
6	Low Priority and Other Potential Projects	43,276	254.30	170
7	Habitat Restoration	224	1.41	158
8	Public Property ESD Retrofits	18,270	236.55	77
9	Priority Neighborhoods ESD Retrofits	9,271	132.78	70
10	Private Non-residential ESD Retrofits	5,594	80.18	70
11	Street Sweeping	-	1.24	-

Preliminary Results of the Phosphorus Load Reduction Analysis

Table 31 outlines the progress tracking toward meeting the phosphorus TMDL reduction of 81.2%.

Table 31: Preliminary Results of WTM Modeling for the Anacostia Watershed

Implementation Phase	*Phosphorus Loading*	*Comments*	*Cumulative Cost*
	% reduction from baseline		*Million $*
WTM Baseline Load*	**0%**	**Normalized to MDE Baseline Load**	$ -
WTM 2.0	33%	**Completed, High Priority, Low Priority and Other Potential Projects**	$ 270
WTM 3.0	54%	**ESD Strategies and Other Structural BMPs**	$ 722
WTM 4.0	111%	**Habitat Restoration**	$ 815
WTM 5.0	119%	**MS4 Programmatic Practices**	$ 817
TMDL WLA	81.2%		
*Excludes existing BMPs approved after the TMDL data collection period of 1995-1997.			

The restoration strategy is further illustrated in Figure 7, where the implementation phases are shown in order with their resulting phosphorus load in comparison to the WLA. The cost for each implementation phase is also shown. The greatest reduction is attributed to stream restoration, while pet waste education was the most cost-efficient strategy, shown in Table 32.

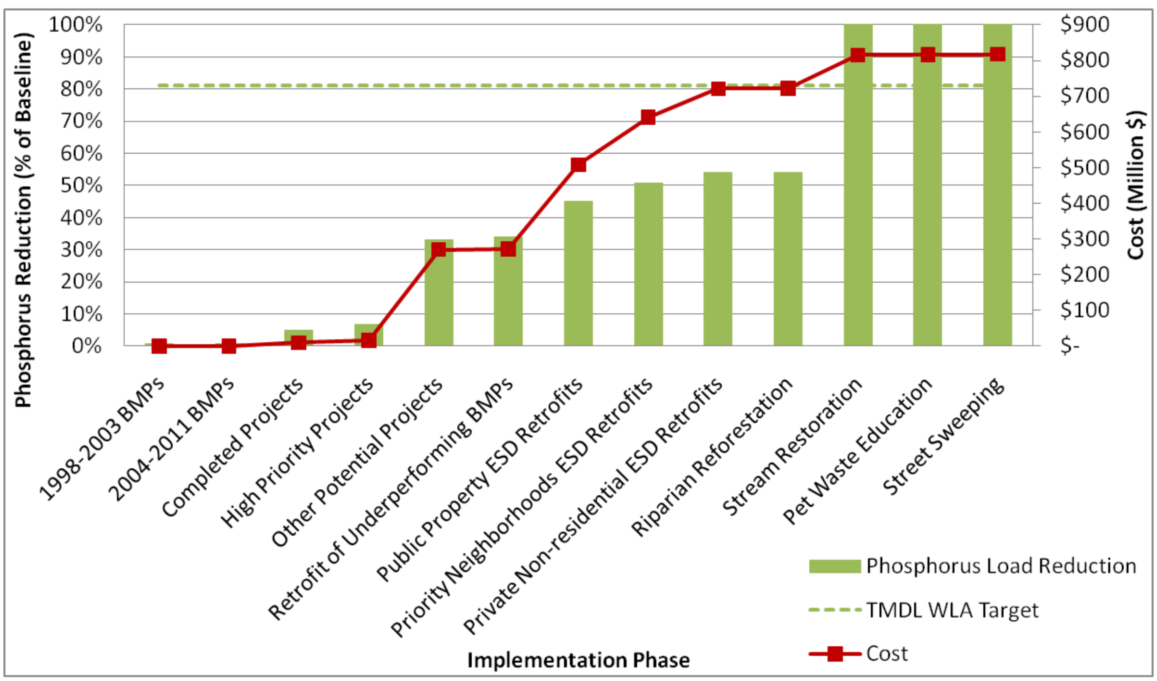

Figure 7: Phosphorus loading over restoration implementation phase for the Anacostia Watershed

Table 32: Individual restoration strategy cost effectiveness for phosphorus load reduction for the Anacostia Watershed

Rank	Restoration Strategy	TP reduction	Incremental Cost	Unit Cost
		lbs/yr	Million $	lbs/Million $
1	Pet Waste Education	1,979	0.88	2,243
2	Retrofit of Underperforming BMPs	247	1.20	206
3	Stream Restoration	13,097	93.04	141
4	Completed Projects	915	9.48	96
5	High Priority Projects	451	6.35	71
6	Habitat Restoration	37	1.41	26
7	Low Priority and Other Potential Projects	6,067	254.30	24
8	Public Property ESD Retrofits	2,546	236.55	11
9	Priority Neighborhoods ESD Retrofits	1,294	132.78	10
10	Private Non-residential ESD Retrofits	781	80.18	10
11	Street Sweeping	-	1.24	-

Preliminary Results of the Sediment Load Reduction Analysis
Table 33 outlines the progress tracking toward meeting the sediment TMDL reduction of 87.5%.

Table 33: Preliminary Results of WTM Modeling for the Anacostia Watershed

Implementation Phase	Sediment Loading	Comments	Cumulative Cost
	% reduction toward meeting TMDL		Million $
WTM Baseline Load*	0%	Normalized to MDE Baseline Load	$ -
WTM 2.0	11%	Completed, High Priority, Low Priority and Other Potential Projects	$ 270
WTM 3.0	18%	ESD Strategies and Other Structural BMPs	$ 722
WTM 4.0	344%	Habitat Restoration	$ 815
WTM 5.0	354%	MS4 Programmatic Practices	$ 817
TMDL WLA	87.5%		
* Excludes existing BMPs approved after the TMDL data collection period of 1995-1997.			

The restoration strategy is further illustrated in Figure 8, where the implementation phases are shown in order with their resulting sediment load in comparison to the WLA. The cost for each implementation phase is also shown. The greatest reduction is attributed to stream restoration, while street sweeping was the most cost-efficient strategy, shown in Table 34.

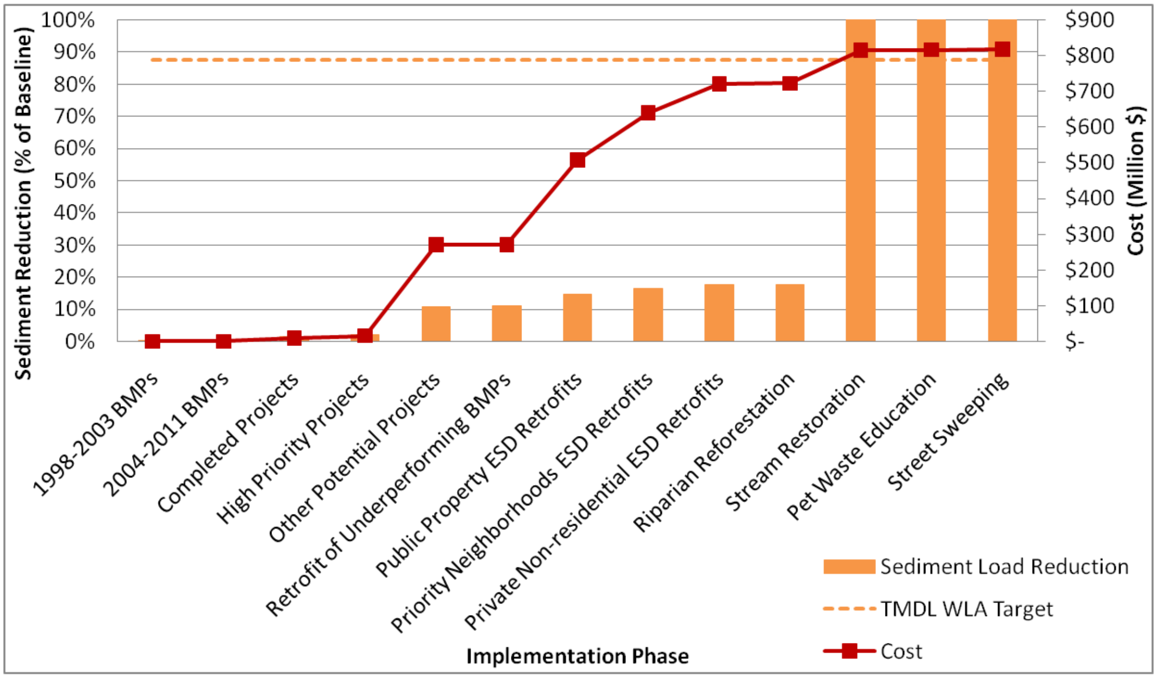

Figure 8: Sediment loading over restoration implementation phase for the Anacostia Watershed

Table 34: Individual restoration strategy cost effectiveness for sediment load reduction for the Anacostia Watershed

Rank	*Restoration Strategy*	*Sediment reduction*	*Incremental Cost*	*Unit Cost*
		tons/yr	Million $	tons/Million $
1	Street Sweeping	800	1.24	645
2	Stream Restoration	25,057	93.04	269
3	Retrofit of Underperforming BMPs	25	1.20	21
4	Completed Projects	97	9.48	10
5	High Priority Projects	47	6.35	7
6	Low Priority and Other Potential Projects	660	254.30	3
7	Public Property ESD Retrofits	272	236.55	1
8	Priority Neighborhoods ESD Retrofits	139	132.78	1
9	Private Non-residential ESD Retrofits	84	80.18	1
10	Habitat Restoration	2	1.41	1
11	Pet Waste Education	-	0.88	-

4 Evaluation of the Restoration Strategies to Meet MS4 Permit Trash Reduction Tracking

Table 35 presents recommended baseline loading rates for urban land uses in Montgomery County based on the MDE (2010) study. These rates will be used as default values in a land use based loading calculation model similar to the WTM. The model could be applied to individual Watershed Implementation Plans, or for a countywide calculation of trash loading.

Table 35: Montgomery County Point Source Baseline Loading Rates for Trash

Land Use	***Loading Rate[1] (lbs/ac/yr)***
Low-density residential	1.19
Medium-density residential	19.26
High-density residential	7.88
Commercial	2.22
Industrial	2.22
Institutional	2.22
Extractive	2.22
Parkland	0.32
Roadway[2]	2.22
Agricultural	0.32
Forest	0.32
Water	0.00
Bare Ground	2.22

[1] Montgomery County Trash Loading Rates from *Total Maximum Daily Loads of Trash for the Anacostia River Watershed, Montgomery and Prince George's Counties, Maryland and The District of Columbia, 2010*

[2] Prince George's County Trash Loading Rates from *Total Maximum Daily Loads of Trash for the Anacostia River Watershed, Montgomery and Prince George's Counties, Maryland and The District of Columbia, 2010*

In general, trash reduction strategies fall into four categories: (1) Structural; (2) Educational; (3) Municipal; and (4) Enforcement. For the purposes of the restoration strategies, structural stormwater BMPs were assigned 95% removal credit for trash from the contributing drainage area. BMPs, while not specifically designed to capture trash, are also not very good at passing trash, and debris is prone to build up in forebays, around plants and interior elements, and around the outlet structures. Periodic maintenance is needed for the best performance of these BMPs. Instream controls from trash nets or traps are also assumed to have 90% capture efficiency if maintained periodically.

In addition to trash removal by structural stormwater BMPs, land use conversion, such as riparian reforestation have an incremental reduction in trash by changing the loading rate according to Table 35.

Overall, the trash load in Anacostia River was reduced by 68% using the same restoration strategies outlined for the bacteria, nutrient, and sediment load reduction and impervious cover reduction procedures. Table 36 and Figure 9 illustrate the reduction in trash load over time and implementation of the strategies.

Table 36: Preliminary Trash Results of WTM Modeling for the Anacostia Watershed

Implementation Phase	***Trash Loading***	***Comments***	***Cumulative Cost***
	% reduction from baseline		***Million $***
WTM Baseline Load	**0%**	**Calibrated to MDE Baseline Load**	$ -
WTM 2.0	40%	**Completed, High Priority, Low Priority and Other Potential Projects**	$ 270
WTM 3.0	67%	**ESD Strategies and Other Structural BMPs**	$ 722
WTM 4.0	68%	**Habitat Restoration**	$ 815
WTM 5.0	68%	**MS4 Programmatic Practices**	$ 817
TMDL WLA	100%		

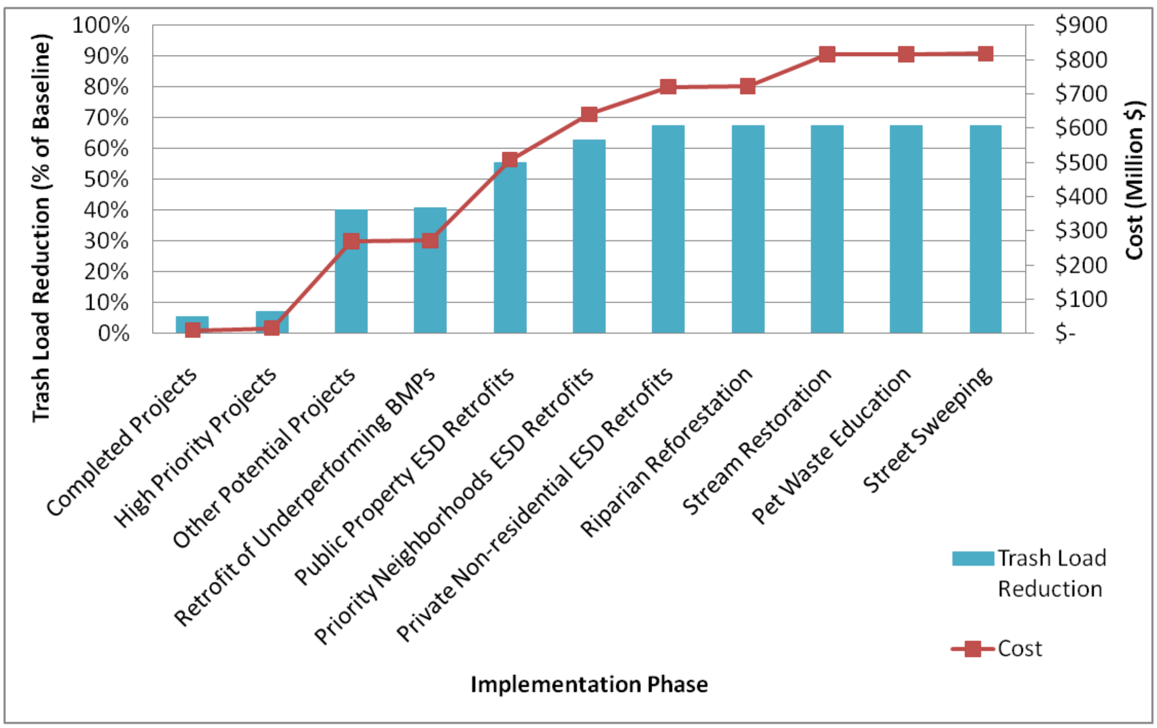

Figure 9: Trash load reduction and over associated costs over implementation phase as modeled using the WTM for the Anacostia Watershed

Additional trash reduction was calculated by using specific trash-related programmatic practices and estimated trash load reductions. These practices can have a range of removal effectiveness between 5-30%, depending on the intensity of implementation and frequency of follow-up. Examples include: anti-litter education campaigns, plastic bag bans, recycling programs, adopt-a-road and adopt-a-stream, street sweeping, and enforcement, as shown in Table 37.

Table 37: Programmatic Trash Reduction Efficiencies

Program Type	*Category*	*Unit Reduction Efficiency*
Anti-litter Campaign; School-Based Programs	Educational	12% of Residential Land Use[1]
Continued Waste Reduction, Reuse, and Recycling Education and Investigations	Educational; Municipal; Enforcement	25% of Total Load off of areas that have recycling services.[2]
Plastic Bag Ban	Educational; Municipal; Enforcement	30% of Total Load[3]
Littering and Illegal Dumping Enforcement; Dumpster Management	Enforcement	5% of Industrial and Commercial "Hot" Land Use[4]

Notes:
Based on assumptions in WTM (CWP, 2001) associated with other outreach and education programs. Assumes half of residential land use is influenced by school age kids, effectiveness of messaging is 40% and willingness to participate is 60% or .5 x .4 x .6 = .12.
[2] Based on California state-wide target of 50% diversion of waste from landfills. Assumed half of target (CA Coastal Commission, unknown date).
[3] Based on Anacostia Watershed Trash Reduction Plan, 2008.
[4] Based on assumptions in WTM (CWP, 2001) associated with other outreach and education programs. Assumes 100% of industrial and commercial hot areas are targeted and 8% awareness and 60% effectiveness, or 1.0 x .08 x .6 = .05.

These trash-specific programmatic practices offer a much more cost effective solution to the trash problem facing the Anacostia River. Table 38 illustrates the cost-benefit comparison of all the strategies employed in this Implementation Plan. The total trash removed by this combination of practices will meet the TMDL removal assignment for the MS4 Permit Area.

Outreach and Stewardship Strategy Potential Partners:
To implement effective litter management outreach and education, a partnership should be nurtured between County recycling offices and schools. Due to the dense residential areas of this watershed, there are many schools to garner as potential partners. Examples include Briggs Chaney MS, Benjamin Banneker MS, Paint Br HS, Sligo MS, Montgomery Blair HS. Northwood HS, and Springbrook HS to name a few. More partners and implementation details are listed in the Practice Sheet entitled Anti-Littering Outreach and Stewardship Campaign.

Table 38: Individual restoration strategy cost effectiveness for trash reduction

Rank	*Restoration Strategy*	*Potential Trash Reduction*	*Incremental Cost*	*Unit Cost*
		lbs/year	Million $	lbs /Million $
1	Recycling Education and Investigations	51,654	0.2	238,837
2	Plastic Bag Ban, and Misc. Enforcement	63,546	1.3	48,882
3	Anti-litter Campaign, Education	23,761	0.9	26,930
4	Retrofit of Underperforming BMPs	1,144	1.2	954
5	Completed Projects	6,598	9.5	696
6	High Priority Projects	2,786	6.4	439
7	Low Priority and Other Potential Projects	56,341	254.3	222
8	Habitat Restoration	266	1.4	188
9	Street Sweeping	204	1.2	164
10	Public Property ESD Retrofits	25,348	236.6	107
11	Priority Neighborhoods ESD Retrofits	12,529	132.8	94
12	Private Non-residential ESD Retrofits	7,547	80.2	94
13	Stream Restoration	-	93.0	-
14	Pet Waste Education	-	0.9	-

5 Action Inventory Implementation Schedule

5.1 Anacostia River Watershed Implementation Schedule

The implementation schedule summarized in Table 39 is an action inventory matrix that identifies priorities and timeframes for implementation of the above identified watershed restoration strategies as a function of project synergies and projected funding levels countywide. Table 40 includes a summary of implementation goals for the 2015, 2017, 2020, 2025, and out years in order to illustrate the expected timeframe for compliance with the MS4 permit area WLA. The assumptions for the 2020 and 2025 fiscal periods were that future MS4 permits would set a similar countywide impervious goal as in the current permit (20%). The 2017 fiscal period was important for the countywide implementation strategy for meeting the Chesapeake Bay TMDL goals. The out year 2030 was an arbitrary milestone set for complete implementation of the strategies outlined in this Plan.

For the first permit cycle (through 2015), a priority was placed on full implementation of complete, high and low priority projects. A list of the high and low priority projects is provided in Appendix A. Next, implementation of a third of the other potential projects was targeted, as a large number of these were identified in conjunction with the USACE's Anacostia Watershed Restoration Plan efforts. ESD was emphasized on both public (10%) and private property (10%). Finally, outreach (25%) and stream restoration (12%) are targeted for pollutant load reduction but are not credited towards impervious cover credit. In future permit cycles, the remainder of the other potential projects are targeted along with ESD and a limited amount of riparian reforestation for impervious cover and pollutant load reduction. Outreach and stream restoration are significant strategies pursued for load reduction benefits.

Nutrient and sediment WLAs are met for the MS4 permit area by 2030, but bacteria load reduction does not meet MS4 permit area WLA compliance. The remaining bacteria reduction is believed to be associated with urban wildlife sources. Unless intense urban wildlife management practices are implemented, this remaining load reduction will not be possible.

Table 39: Summary of Implementation Plan Schedule for the 2015 Fiscal Period, with expected level of ESD and pollutant load reductions

Strategies	% Completed in Permit Cycle	IC Treated (acres)	ESD (% IC)	Cost (Million $)	ESD (% Cost)	% Reduction from Baseline				
						TN	TP	TSS	Bacteria	Trash
Completed and High Priority Projects	100.0%	315	9%	$16	30%	5.8%	5.9%	1.9%	6.2%	5.5%
Low Priority Projects	100.0%	194	8%	$5	61%	2.0%	2.1%	0.7%	2.2%	2.7%
Other Potential Projects	33.0%	732	20%	$82	24%	7.7%	8.0%	2.6%	8.4%	10.0%
Public ESD Retrofits	10.0%	96	100%	$24	100%	1.1%	1.1%	0.4%	1.2%	1.4%
Private ESD Retrofits	10.0%	86	100%	$21	100%	1.0%	1.0%	0.3%	1.0%	1.3%
Riparian Reforestation	0.0%	-	0%	$0	0%	0.0%	0.0%	0.0%	0.0%	0.0%
Stream Restoration	11.7%	-	0%	$11	0%	5.0%	6.6%	38.1%	0.0%	0.0%
Programmatic Practices	25.0%	-	0%	$0.9	0%	2.2%	2.1%	2.6%	2.0%	20.4%
Subtotal	***31.3%***	***1,421***	***26.3%***	***$160***	***45.4%***	***24.8%***	***26.8%***	***46.6%***	***21.0%***	***41.3%***

IC: Impervious Cover
ESD: Environmental Site Design
TN: Total Nitrogen
TP: Total Phosphorus
TSS: Total suspended solids

Table 40: Summary of Implementation Plan schedule for the Anacostia Watershed with expected MS4 permit area WLA compliance endpoints

Fiscal Year		2015	2017	2020	2025	2030	TMDL WLAs
IC Treated (acres)		1,421	2,393	3,364	4,272	4,544	
ESD (% IC)		26%	44%	61%	69%	71%	
Cost (Million $)		160	307	486	732	820	
ESD (% Cost)		45%	62%	71%	78%	78%	
% Reduction from baseline	TN	25%	39%	68%	89%	100%	81.8%
	TP	27%	42%	77%	100%	100%	81.2%
	TSS	47%	72%	100%	100%	100%	87.5%
	Bacteria	21%	33%	46%	59%	64%	87.9%
	Trash	41%	65%	89%	100%	100%	

IC: Impervious Cover
ESD: Environmental Site Design
TN: Total Nitrogen
TP: Total Phosphorus
TSS: Total suspended solids
WLA: Waste Load Allocation

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Appendix A – List of High and Low Priority Projects

High and Low Priority Project List - Anacostia Watershed		
Subwatershed	**Project Type**	**Project Name**
Little Paint Branch	Environmental Site Design (ESD)	East County Services Center, Park & Ride, Community Center
		Greencastle Park & Ride
	Stormwater Pond Retrofit	Knightsbridge Regional
		Montgomery Auto Sales Park Regional
Northwest Branch	Environmental Site Design (ESD)	Colesville Park & Ride
	Stormwater Pond Retrofit	Country Boy Regional Retrofit (Glenmont Shopping Center)
		Dumont Oaks I SWM
		Gaywoods Pond
		George Meany Pond
		Kemp Mill Pond (Kemp Mill Forest - Ravenswood HOA)
		Longmeade Crossing Pond
		Naples Manor Dry Pond
		Naples Manor I Pond
		North Sherwood 2 Pond
		Rosmoor 2 Pond
		Rosmoor Aquarius 6 Pond (Currently Abondoned)
		Rossmor Leisure World
		Tivoti Pond
		Wixenburg Manor Pond
Paint Branch	Environmental Site Design (ESD)	Fairland Community Center
		Fairland Library
		Lockwood Drive and Stewart Lane
		Station 15 - Burtonsville
		Tech Road Park & Ride
		White Oak Library
	New Stormwater Pond	Killgore Road
	Stormwater Pond Retrofit	Briggs Chaney Shopping Center
		Broadmore SWM Retrofit
		Fairland Ridge Dry PD
		Oak Springs PD 2
		Rolling Acres
		Stonehedge Condo SWM Retrofit
		Tamarack Park (Valley Mill Pond)
		Verizon SWM retrofit
Sligo Creek	Environmental Site Design (ESD)	Amherst Right of Way LID
		Amherst Right of Way LID - Project ID# 3605
		Amherst Right of Way LID - Project ID# 3607
		Arcola Right of Way LID - Project ID# 3601
		Arcola Right of Way LID - Project ID# 3602
		Arcola Right of Way LID - Project ID# 3604
		Breewood Bioretention - Project ID# 3801
		Breewood Right of Way LID - Projec IDt# 3802
		Breewood Right of Way LID - Project ID# 3803
		Breewood Right of Way LID - Project ID# 3804
		Dennis Avenue Health Center
		Long Branch Library
		Silver Spring Regional Services Center
		Stephen Knolls Special School
		Tenbrook Right of Way LID - Project ID# 3903