CHAPTER 7
IMPLEMENTATION SCHEDULE

The goal is to achieve significant and measurable reductions of trash discharged to the Anacostia River by 2013. A five year schedule of activities was developed that will reasonably lead to a Trash Free Anacostia River. It will also make significant reductions in the amount of trash in Rock Creek and the Potomac.

General Activities

There are recommendations that are for the whole Anacostia Basin. They should be done as soon as possible. The legislative solutions if enacted quickly will alter the alternatives and costs of the program and save the ratepayers significant amounts of money. Activities such as developing a coordinated litter inspection and enforcement program should begin immediately.

Basin Schedules

The five year schedule outlined below is developed following the concept of beginning work on the tributaries which are easiest to clean up using the easiest actions to accomplish. The more complicated and expensive actions are placed later in the schedule. Existing programs such as the Hickey Run BMP are compatible as currently planned. DPW will need to acquire more street sweepers, as the area and frequency of sweeping increases.
Additionally, because the application of inlet screens has not been proven in the climatic conditions of Washington, DC, they should be used for the smaller basins where the costs will be less.

Year 1 - 2009

Ft DuPont

A. Screen catch basins
B. Sweep Streets
C. Curb Cuts
D. Clean up debris
E. Fence
F. Repair outfall

Ft Davis 1

A. Screen catch basins
B. Sweep Streets
C. Curb Cuts
D. Clean trash rack

Ft Davis 2

A. Screen catch basins

B. Sweep streets
C. Curb Cuts
D. Remove tires

Nash Run

A. Install temporary netting system to protect the Kenilworth Aquatic Gardens

CSO Outfall #006

A. LID the MS4

Unscreened CSO Outfalls

A. Conduct study of trash discharges and boom and skim

WASA to study catch basin cleaning and performance

Year 2 - 2010

Ft Chaplin

A. Screen catch basins
B. Sweep streets
C. Curb Cuts
D. Clean trash rack

Pope Branch and Pope MS4

A. Implement Restoration plan
B. Screen catch basins
C. Sweep streets
D. Curb Cuts
E. Clean trash rack

Hickey Run BMP

A. Proceed as planned
B. Evaluate untreated outfalls

Kingman Lake

A. Investigate potential for wetland at M and Maryland

Year 3 - 2011

Texas Avenue and Pennsylvania Avenue

A. Screen catch basins
B. Sweep streets
C. Curb Cuts

D. Relocate storm sewer and treat.
E. Clean Trash Rack

Nash
A. Screen catch basins
B. Sweep streets

Ft Stanton and MS4
A. Screen catch basins
B. Sweep streets

Kingman Lake
A. Screen catch basins
B Sweep streets
C. Install LID and daylight for the M Street & Maryland Avenue area

Ely MS4, Stickfoot MS4 and Naylor.
A. Initiate planning and design for wetlands.

<u>Year 4 - 2012</u>

Watts Branch
A. Screen catch basins
B. Sweep streets
C. LID

East Capitol MS4
A. Screen catch basins
B. Sweep streets
C. LID

Fort Davis MS4
A. Screen catch basins
B. Sweep streets

<u>Year 5 - 2013</u>

Ely, Stickfoot and Naylor MS4's
A. Construction of wetlands.

Cost Comparison

Using the cost information from the *Anacostia TMDL Implementation Plan* and estimates of impervious acres per sub-basin, a rough cost can be obtained for the different basins. The costs for screening and <u>weekly</u> sweeping (S&S) include the regular catch basin cleaning costs which may be reduced with a lower amount of trash entering the catch basin. Conversely, the recommended study on catch basin cleaning might conclude that more frequent cleaning is needed. A cost of $500 was used for screening a catch basin with a 20% operation and maintenance (O&M) cost and four per block, each 8 feet long. This cost may be about 25 % high in some areas; but, it is not a major component of the cost of screening and sweeping. The cost of wetlands is very capital intensive and is approximately three times more costly than screening and sweeping; however, the areas where they are recommended are based upon there being habitat benefits to offset the costs.

The option of screening and sweeping has a capital cost of about $4.5M, while going solely with CDS type hydrodynamic units have a capital cost of about $20M, and using only wetlands would require $60M. Weekly sweeping of streets has a very high O&M value while hydrodynamic units and wetlands have a very low O&M value.

It is not recommended that wetlands or other inline solutions be used for controlling trash in the areas draining to and from the tributaries. Once a tributary has been treated and enters a storm sewer, it is very expensive to re-treat it after it becomes comingled with other untreated flows.

This study recommends that a detailed evaluation be made of the Naylor, Ely & Stickfoot storm sewers, and of the small area of Maryland and M Street. Designing a wetland detention system is a critical issue and needs to be done on a site specific basis.

Many areas are amenable to curb cuts which often times are recommended when it is known that they will work and there is space available, but they are not included in the price of any basin.

Benefits

One of the major benefits of regular street sweeping is that the neighborhoods are cleaner. The amount of TMDL pollutants will be reduced on a per sweeping basis but there will be a decrease in effectiveness on a per sweeping basis. The effectiveness of the catch basin in removing TMDL pollutants will be enhanced but it is not known before hand by how much. Some localized flooding may occur or it may occur more frequently from the screens being blocked. Experience will need to be gained with leaf fall and snow fall. Using controls such as screening and street sweeping will clean up the tributaries as well as the main stem Anacostia.

To the extent that Low Impact Development (LID) can be used in the upper basin of the tributaries, the benefits of ground water filtering and recharge to the stream and the wildlife that depends upon it will be worth the extra cost. Restoring the extensive wetlands that were lost decades ago when the Anacostia River was dredged and the wetlands filled, will assist in restoring wildlife to the river. It is possible that federal funding might be available to offset the extra cost if the wetland sites are included in the Corp of Engineers Anacostia River basin planning effort.

Total Costs

By using the estimates of the costs of the BMPS and the basin recommendations, a present value total cost figure can be derived for the main components of the recommended plan. This cost does not include such things as the Hickey Run BMP nor WASA's cost for booming and skimming CSO areas. The difference between a wetland for Ely MS4 and a hydrodynamic unit such as a Baysaver is about a million dollars more in costs. Table 7.1 below is a planning estimate to be used until more experience is gained with the solutions.

Table 7.1
Total Cost Planning Estimate

Basin	**S&S**	**Wetland**
Pope	$940,903	
FD-1	308,530	
FD-2	158,004	
Texas	622,043	
Pope MS4	310,674	
Chaplin	954,070	
Ft DuPont	281,690	
Stickfoot		$3,887,967
Watts	6,233,968	
Nash	1,959,372	
E Cap MS4	5,868,800	
Stanton	344,110	
StantonMS4	861,877	
Ely		2,704,673
Ft Dav MS4	947,298	
Penn	1,119,542	
Kingman	423,926	557,838
Naylor		3,887,967
Subtotal	$21,334,811	$11,038,448
	Total =	**$32,373,259**

The present worth cost of a trash free Anacostia River is about $32.4 million. The schedule recommended is not a constant average expenditure. Instead, it is based upon working in small drainages, and monitoring to ensure that the selected methods will work under the conditions found in the District of Columbia. If a more constant expenditure is desired, then some of the more expensive and larger basins can be moved up in the schedule. The costs can be greatly reduced with legislative solutions that discourage the throw away mentality of plastic bags, Styrofoam and beverage cans and bottles. The costs can be further reduced by using screening and sweeping in all basins and foregoing the wetlands. Wetlands cost about three times more per acre; but, they provide habitat restoration benefits to the Anacostia River.

Estimated total capital costs per basin are shown below in Table 7.2. Construction of wetlands is expensive on a per acre basis.

Table 7.2
Estimated Total Capital Costs per Basin

Basin	S&S	Wetland
Pope	$190,248	
FD-1	56,675	
FD-2	34,670	
Texas	113,795	
Pope MS4	74,007	
Chaplin	193,137	
Ft DuPont	57,708	
Stickfoot		$3,444,455
Watts	1,159,734	
Nash	370,277	
E Cap	979,730	
Stanton	49,566	
StantonMS4	124,915	
Ely		2,396,142
Ft Dav MS4	170,249	
Penn	216,475	
Kingman	86,069	494,204
Naylor		3,444,455
Subtotal	$3,877,262	$9,779,257
	Total Capital Cost =	**$13,656,520**

Capital Expenditures per year are presented in Table 7.3 below. O&M costs are high with this plan and will be about $2,600,000 per year once fully implemented.

Table 7.3
Capital Costs

	Capital Cost
Year 1	$149,054
Year 2	$457,393
Year 3	$1,455,305
Year 4	$2,309,714
Year 5	$9,285,053
Total	**$13,656,520**

The plan has a capital cost of $13.7 M which is beyond the fundable range of the storm water fee revenue that is produced. The costs can be reduced if the legislative packages are implemented and if the wetlands are cost shared by the Corps of Engineers. It is compatible and complements other pollutant removal plans. About one third of the total costs are already scheduled to be made pursuant to the *Anacostia TMDL Implementation Plan*. The major benefit is that the recommended plan restores the rivers and the communities.

Next Steps

This document presents a plan based upon what is currently known. There are several problem areas and several unknown issues. These need to be resolved.

DDOE should continue to work with EPA and Maryland to prepare a basin wide trash TMDL. This will include gathering data to determine exactly what types of trash actually exit a storm sewer to a stream. Based upon the current data it is already known that the different land uses have different types and amounts of trash. The information needed is to determine what and how much trash is coming from which types of land use, and then loadings can be calculated and allocations performed.

There is a very severe problem of interstate transport of pollutants. The amount of trash and debris measured in Maryland exceeds what is found in DC. There needs to be a concerted effort in Maryland to achieve controls of trash and many other pollutants.

Based upon the outcome of prototype work and the implementation of the recommended plan in the smaller basins, this plan may need to be revised as more information and experience is gained.

CHAPTER 8
LONGTERM MONITORING PROGRAM

Introduction

The District of Columbia Department of the Environment should implement an ambient trash monitoring program for the waterways. The data collected for this report provides a good foundation to build upon so that the future data is able to detect trends in the effectiveness of the trash reduction program.

The long-term methodology chosen should be comprehensive enough to give valuable data on the sources of trash, the composition of trash, and the surrounding land use. The methodology chosen and data collected will significantly contribute to the institutional controls and the structural controls that DOE chooses to implement to reduce trash loads. Institutional controls for trash include: enforcement, public education, more trash receptacles, street cleaning, more frequent trash pickups and greater recycling rates. Structural controls include storm-drain catch basins, trash traps, and vegetative trash buffer zones. Both types of control measures will be needed to reduce trash. The institutional controls and structural controls have differing costs associated with implementation. Institutional controls will help reduce the actual source of trash entering the water while structural controls serve as "mitigation" for trash.

The long-term monitoring chosen and trash data composition will help prioritize DOE resources and gauge the effectiveness of trash controls chosen by DOE to implement.

After a through review of existing national and regional trash monitoring methodologies, the recommend long-term monitoring program recommend is the Simplified Program.

Below is a detailed review of four monitoring plans. The four plans were evaluated for cost and the value of data collected.

Four options are presented.

1. Simplified Program
2. Full Program as conducted by AWS
3. California State Water Control Board Assessment
4. MWCOG Survey Methods

1) Simplified Program

The simplified program takes a representation of trash. A majority of trash monitoring plans use a representative sampling of trash and is the industry-wide accepted survey methodology. This includes the data monitoring being conducted by Prince Georges and Montgomery Counties for the baseline data monitoring plan for the development of the Anacostia TMDL.

This simplified program takes the information gained in the original baseline survey of trash and reduces the number of stations down to a smaller number and reduces the length of the segments. The benefit of this program is that it can be accomplished in two days by a team of two people. The survey should be conducted quarterly, but can be done semi-annually. Based upon the data collected in this report, some of the categories in the survey form can be eliminated without materially affecting the accuracy of the method.

The data collected using the simplified plan, including the composition of trash, should be accurate enough to help DOE prioritize resources and chose the institutional and structural trash controls for implementation.

The recommended stations to be monitored are:

1. Anacostia – Mudflat above New York Avenue Bridge
2. Anacostia – Poplar Point
3. Kingman Lake – Below Benning Road Bridge
4. Fort Stanton – From end of the stream at the grate to 100 feet upstream
5. Ft Dupont - Minnesota Avenue to 100 ft down stream
6. Ft Davis 1 - From grate to 100 feet upstream
7. Texas Avenue - From grate to 100 feet upstream
8. Pope- From grate to 100 feet upstream
9. Nash - From Anacostia Drive to 100 feet upstream
10. Watts - From the foot bridge between Jay Street and Deanne Avenue in Kenilworth Park to a point 100 ft downstream.
11. Ft Chaplin - From grate at C Street to 100 feet upstream

Once a trash reduction plan, including institutional and structural controls, has been implemented in a tributary drainage basin, the tributary should be cleaned up and then monitored to insure that there are no uncontrolled sources remaining.

Recommendation

The simplified program is recommended for use by DOE and gathers the most accurate data and is the most cost-effective of the four plans represented in this document.

In the District of Columbia, The Clean City Coordinator Cleanliness Surveys are qualitative and do not seem to correspond well to the quantitative data. Their methodology is dated and should be revised to provide more useful information. A revised survey would augment the stream monitoring conducted by DOE very well.

The Alice Ferguson Foundation (AFF) has developed a Volunteer Visible Trash Survey(VTS) handbook and will be implementing the volunteer program in 2009. The AFF data sheet for the composition of trash was used in this report for the initial baseline monitoring of trash. The data collected by AFF would also augment the recommended simplified program.

2) Full Program

A full program would duplicate the survey done in this study. A full program would take three or four people at least a week, and with rain and snow could possibly take two weeks. A full program long-term monitoring strategy would be comprehensive, but have a significant dollar cost for staff time involved to implement.

As stated above, a majority of trash monitoring plans, including the data monitoring being conducted by Prince Georges and Montgomery Counties for the baseline data monitoring plan for the development of the Anacostia TMDL use a representative sampling of trash.

The District of Columbia is unique in the Anacostia watershed because of the small land mass located in its jurisdiction. DOE may chose to conduct trash monitoring outside of the Anacostia watershed at some point in time. Trash monitoring for the entire District of Columbia including the larger Potomac River watershed using the full program method would be very costly and an unrealistic alternative to the simplified plan.

Recommendation

The Full Program is not recommended for DOE use due to the financial costs associated with a long term monitoring plan.

3) California Method

The California method is very time consuming in the level of detail and meticulous nature of the counting. There are sometimes 82,000 pieces of broken glass in a segment of Watts Branch and the California method requires that they all be picked up, counted and hauled away. It would take forever to count all of the broken glass pieces in Watts Branch. The method is similar to the method used in this report but is much slower. The California method is simply economically infeasible for counting trash without modification.

RAPID TRASH ASSESSMENT PROTOCOL

Surface Water Ambient Monitoring Program
California Regional Water Quality Control Board, San Francisco Bay Region
Monitoring Design.

The rapid trash assessment can be used for a number of purposes, such as ambient monitoring, evaluation of management actions, determination of trash accumulation rates, or comparing sites with and without public access. Ambient monitoring efforts should provide information at sites distributed throughout a waterbody, and several times a year to characterize spatial and temporal variability. Additionally, the ambient sampling design should document the effects of episodes that affect trash levels such as storms or community cleanup events. Pre- and post-project assessments can assist in evaluating the effectiveness of management practices ranging from public outreach to structural controls, or to document the effects of public access on trash levels in waterbodies (e.g., upstream/downstream). Such evaluations should consider trash levels over time and under different seasonal conditions. Revisiting sites where trash was collected during previous assessments enables the determination of accumulation rates. This methodology was developed for sections of wadeable streams, but can be adapted to shorelines of lakes, beaches, or estuaries. Ultimately, the monitoring design will strongly affect the usefulness of any rapid trash assessment information.

Site Definition. Upon arrival at a designated monitoring site, a team of two people or more defines or verifies a 100-foot section of the stream or shoreline to analyze, associated with a sampling location or station. When a site is first established, it is recommended that the 100-foot distance be accurately measured. The length should be measured not as a straight line, but as 100 feet of the actual stream or shore length, including sinuous curves. Where possible, the starting and ending points of the survey should be easily identified landmarks, such as an oak tree or boulder, and noted on the worksheet ("Upper/Lower Boundaries of Reach"), or documented using a global positioning system (GPS), so that future assessments are made at the same location. The team should confer and document the upper boundary of the banks to be surveyed, based on evaluation of whether trash can be carried to the water body by wind or water (e.g., an upper terrace in the stream bank). The team documents the location of the high water line based on site-specific physical indicators, such as a debris line found in the riparian vegetation along the stream channel. If the high water line cannot be determined, it is suggested that bankfull height be documented, noting the high water line could not be determined. Trash located below the high water line can be expected to move into the streambed or be swept downstream during the next winter season. Visually extend all boundaries in order to encompass the 100' section. Defining site characteristics will facilitate the comparison of trash assessments conducted at the same site at different times of the year.

Survey. It is highly recommended that all trash items within an assessed site be picked up, so the site can be revisited and re-assessed for impairment and usage patterns. A survey, including notes and scoring, will take approximately one to two hours based on how much trash is at the site and how many people are working together. The first time a site is assessed, the process will generally take longer than on subsequent visits.

Begin the survey at the downstream end of the selected reach so that trash can be seen in the undisturbed stream channel. Tasks can be divided according to the number of team members. In one scenario of a team with two members, one team member begins walking along the bank or in the water (wear waders) at the edge of the stream or shore, looking for trash on the bank up to the upper bank boundary, and above and below the high water line. This person picks up trash and tallies the items on the trash assessment worksheet as either above or below the high water line based on the previously determined boundary. The other person walks in the streambed and up and down the opposite bank, picking up and calling out specific trash items found in the water body and on the opposite bank both above and below the high water line, for the tally person to mark down appropriately on the trash assessment sheet. All team members pick up the trash items as they are found. Keep in mind that the person tallying will not be able to pick up nearly as much trash as the other team members. All team members make sure to avoid injuries by using gloves. Avoid touching trash with unprotected hands!

The person tallying the trash indicates on the sheet whether the trash was found above the high water line on the bank, or below the high water line either on the bank or in the stream (i.e., tally dots or circles (•) for above high water line, tally lines (|) for below). If it is evident that items have been littered, dumped, or accumulated via downstream transport, make a note in the designated rows near the bottom of the tally sheet - this will help when assessing scores. A trash grabber, metal kitchen tongs, or a similar tool should be used to help pick up trash. Be sure to look under bushes, logs, and other plant growth to see if trash has accumulated underneath. The ground and substrate should be inspected to ensure that small items such as cigarette butts and pieces of broken glass or Styrofoam are picked up and counted. The tally count is an important indicator of trash impairment and should be used in conjunction with the total score to assist in site comparisons. It is important not to miss items that can affect human health such as diapers, fecal matter, and needles; these items can strongly affect the total score. When the team finishes tallying, use the tally sheet margins to count up two totals for each trash item line, one total for items found above the high water line, and one total for items found below the high water line.

Now sum the totals of above and below for each trash category, and write in next to each trash category. Be sure to complete the worksheets before leaving the site while everything is still fresh in the memory. The team should discuss each parameter and agree on a score based on a discussion of the condition categories. Discuss and document possible influential factors affecting trash levels at the site, such as a park, school, or nearby residences or businesses. Within each trash parameter, narrative language is provided to assist with choosing a condition category. The worksheet provides a range of numbers within a given category, allowing for a range of conditions encountered in the field. For instance, trash located in the water leads to lower scores than trash above the high water line. Not all specific trash conditions mentioned in the narratives need to be present to fit into a specific condition category (e.g., “site frequently used by people”), nor do the narratives describe all possible conditions. Scores of “0” should be reserved for the most extreme conditions. Once the scores are assigned for the six categories, sum the final score and include specific notes about the site at the end of the sheet. A site should be assessed several times in a given year, during different seasons, to characterize the variability and persistence of trash occurrence for water quality assessment purposes.

Trash Assessment Parameters. The rapid trash assessment includes a range of parameters that capture the breadth of issues associated with trash and water quality. The first two parameters focus on qualitative and quantitative levels of trash, the second two parameters estimate actual threat to water quality, and the last two parameters represent how trash enters the water body at a site, either through on-site activities or downstream accumulation.

1. Level of Trash. This assessment parameter is intended to reflect a qualitative “first impression” of the site, after observing the entire length of the reach. Sites scoring in the “poor” range are those where trash is one of the first things noticeable about the waterbody. No trash should be obviously visible at sites that score in the “optimal” range.

2. Actual Number of Trash Items Found. Based on the tally of trash along the 100-foot stream reach, total the number of items both above and below the high water line, and choose a score within the appropriate condition category based on the number of tallied items. Where more than 100 items have been tallied, assign the following scores: 5: 101-200 items; 4: 201-300 items; 3: 301-400 items; 2: 401-500 items; 1: 501-600 items; 0: over 600 items. Use similar guidelines to assign scores in other condition categories. Sometimes items are broken into many pieces. Fragments with higher threat to aquatic life such as plastics should be individually counted, while paper and broken glass, with lower threat and/or mobility, should be counted based on the parent item(s). Broken glass that is scattered, with no recognizable original shape, should be counted individually. The judgment of whether to count all fragments or just one item also depends on the potential exposure to downstream fish and wildlife, and waders and swimmers at a given site. Concrete is trash when it is dumped, but not when it is placed. Consider tallying only those items that would be removed in a restoration or cleanup effort.

3. Threat to Aquatic Life. As indicated in the technical notes, below, certain characteristics of trash make it more harmful to aquatic life. If trash items are persistent in the environment, buoyant (floatable), and relatively small, they can be transported long distances and be mistaken by wildlife as food items. Larger items can cause entanglement. Some discarded debris may contain toxic substances. All of these factors are considered in the narrative descriptions in this assessment parameter.

4. Threat to Human Health. This category is concerned with items that are dangerous to people who wade or swim in the water, and with pollutants that could accumulate in fish in the downstream environment, such as mercury. The worst conditions have the potential for presence of dangerous bacteria or viruses, such as with medical waste, diapers, and human or pet waste.

5. Illegal Dumping and Littering. This assessment category relates to direct placement of trash items at a site, with "poor" conditions assigned to sites that appear to be dumping or littering locations based on adjacent land use practices or site accessibility.

6. Accumulation of Trash. Trash that accumulates from upstream locations is distinguished from dumped trash by indications of age and transport. Faded colors, silt marks, trash wrapped around roots, and signs of decay suggest downstream transport, indicating that the local drainage system facilitates conveyance of trash to water bodies, in violation of clean water laws and policies.

Technical Notes on Trash and Water Quality

Trash is a water pollutant that has a large range of characteristics of concern. Not all litter and debris delivered to streams are of equal concern to water quality. Besides the obvious negative aesthetic effects, most of the harm from trash in surface waters is imparted to aquatic life in the form of ingestion or entanglement. Some elements of trash exhibit significant threats to human health, such as discarded medical waste, human or pet waste, and broken glass. Also, some household and industrial wastes may contain toxic substances of concern to human health and wildlife, such as batteries, pesticide containers, and fluorescent light bulbs that contain mercury. Larger trash such as discarded appliances can present physical barriers to natural stream flow, causing physical impacts such as bank erosion. From a management perspective, the persistence and accumulation of trash in a waterbody are of particular concern, and signify a priority area for prevention of trash discharges. Also of concern are trash “hotspots” where illegal dumping, littering, and/or accumulation of trash occur.

Rapid Trash Assessment. Trash assessment includes a visual survey of the waterbody (e.g., streambed and banks) and adjacent areas from which trash elements can be carried to the waterbody by wind, water, or gravity. The delineation of these adjacent areas is site-specific and requires some judgment and documentation. The rapid trash assessment worksheet is designed to represent the range of effects that trash has on the physical, biological, and chemical integrity of water bodies, in accordance with the goals of the Clean Water Act and the California Water Code. The worksheet also provides a record for evaluation of the management of trash discharges, by documenting sites that receive direct discharges (i.e., dumping or littering) and those that accumulate trash from upstream locations.

Trash Characteristics of Concern. For aquatic life, buoyant (floatable) elements tend to be more harmful than settleable elements, due to their ability to be transported throughout the waterbody and ultimately to the marine environment. Persistent elements such as plastics, synthetic rubber and synthetic cloth tend to be more harmful than degradable elements such as paper or organic waste. Glass and metal are less persistent, even though they are not biodegradable, because wave action and rusting can cause them to break into smaller pieces. Natural rubber and cloth can degrade but not as quickly as paper (U.S. EPA, 2002). Smaller elements such as plastic resin pellets (a by-product of plastic manufacturing) and cigarette butts are often more harmful to aquatic life than larger elements, since they can be ingested by a large number of small organisms which can then suffer malnutrition or internal injuries. Larger plastic elements such as plastic grocery bags are also harmful to larger aquatic life such as sea turtles, which can mistake the trash for floating prey and ingest it, leading to starvation or suffocation. Floating debris that is not trapped and removed will eventually end up on the beaches or in the ocean, repelling visitors and residents from the beaches and degrading coastal and open ocean waters.

Trash in water bodies can threaten the health of people who use them for wading or swimming. Of particular concern are the bacteria and viruses associated with diapers, medical waste (e.g., used hypodermic needles and pipettes), and human or pet waste. Additionally, broken glass or sharp metal fragments in streams can cause puncture or laceration injuries. Such injuries can then expose a person’s bloodstream to microbes in the stream’s water that may cause illness. Also, some trash items such as containers or tires can pond water and support mosquito production and associated risks of diseases such as encephalitis and the West Nile virus. Leaf litter is trash when there is evidence of intentional dumping. Leaves and pine needles in streams provide a natural source of food for organisms, but excessive levels due to human influence can cause nutrient imbalance and oxygen depletion in streams, to the detriment of the aquatic ecosystem. Clumps of leaf litter and yard waste from trash bags should be treated as trash in the water quality assessment, and not confused with natural inputs of leaves to streams. If there is a question in the field, check the type of leaf to confirm that it comes from a nearby riparian tree. In some instances, leaf litter may be trash if it originates from dense ornamental stands of nearby human planted trees that are overloading the stream's assimilative capacity for leaf inputs. Other biodegradable trash, such as food waste, also exerts a demand on dissolved oxygen, but aquatic life is unlikely to be adversely affected unless the dumping of food waste is substantial and persistent at a given location. Wildlife impacts due to trash occur in creeks, lakes, estuaries, and ultimately the ocean. The two primary problems that trash poses to wildlife are entanglement and ingestion. Marine mammals, turtles, birds, fish, and crustaceans all have been affected by entanglement in or ingestion of floatable debris. Many of the species most vulnerable to the problems of floatable debris are endangered or threatened by extinction.

Entanglement results when an animal becomes encircled or ensnared by debris. It can occur accidentally, or when the animal is attracted to the debris as part of its normal behavior or out of curiosity. Entanglement is harmful to wildlife for several reasons. Not only can it cause wounds that can lead to infections or loss of limbs; it can also cause strangulation or suffocation. In addition, entanglement can impair an animal's ability to swim, which can result in drowning, or in difficulty in moving, finding food, or escaping predators (U.S. EPA, 2001).

Ingestion occurs when an animal swallows floatable debris. It sometimes occurs accidentally, but usually animals feed on debris because it looks like food (i.e., plastic bags look like jellyfish, a prey item of sea turtles).
Ingestion can lead to starvation or malnutrition if the ingested items block the intestinal tract and prevent digestion, or accumulate in the digestive tract, making the animal feel "full" and lessening its desire to feed. Ingestion of sharp objects can damage the mouth, digestive tract and/or stomach lining and cause infection or pain. Ingested items can also block air passages and prevent breathing, thereby causing death (U.S. EPA, 2001). Common settled debris includes glass, cigarettes, rubber, construction debris and more. Settleables are a problem for bottom feeders and dwellers and can contribute to sediment contamination. Larger settleable items such as automobiles, shopping carts, and furniture can redirect stream flow and destabilize the channel.

In conclusion, trash in water bodies can adversely affect humans, fish, and wildlife. Not all water quality effects of trash are equal in severity or duration, thus the trash assessment methodology was designed to reflect a range of trash impacts to aquatic life, public health, and aesthetic enjoyment. When considering the water quality effects of trash while conducting a trash assessment, remember to evaluate individual items and their buoyancy, degradability, size, potential health hazard, and potential hazards to fish and wildlife. Utilize the narratives in the worksheet, refer to the technical notes and trash parameter descriptions in the text as needed, and select your scores after careful consideration of actual conditions.

Recommendation

The California Method is not recommended for DOE use. It is comprehensive, but not recommended due to the financial cost associated with a long term monitoring program. However, the interpretation of the effects of trash outlined above can be applicable for DOE when choosing intuitional and structural controls for trash and should be considered.

4) Metropolitan Washington Council of Governments (MWCOG) Method

A draft manual was prepared by Metropolitan Washington Council of Governments (MWCOG) and it is presented below. The MWCOG method was modified and used to collect the data for this report. The major modification is the detailed data sheet such that one is able to categorize the types of trash.

Anacostia Stream Trash Surveying Methodology and Indexing System

A. Pre-Survey Considerations and Preparation

Seasonal factors and rainfall/stream discharge conditions can significantly affect trash generation and accumulation rates (Syrek, 1986); therefore, a given stream reach should be surveyed at approximately the same time each year. Note, stream access and surveying will typically be easier during late winter and early spring due to a reduction in vegetation along stream banks. Surveying should be conducted on dry days and at least two to three days after the last significant storm event so that the stream is running clear and trash items within the stream and its channel are clearly visible. Furthermore, every attempt should be made to organize volunteer teams so that all survey sites within a sub-basin are surveyed during approximately the same time period (i.e., preferably within the same one to four week period).

B. Equipment

Essential equipment for trash surveyors include the following:

- water-resistant or water-proof boots, or hip-waders if available,1
- hand-held tally counter,
- Anacostia Tributary Trash Survey form,
- clip board,
- mechanical pencil.2

As an option, a large-scale, planning-level topographic map (1 in. = 200 ft.) may be used to highlight conditions and measure distances. Finally, if available, a camera equipped with color slide film provides excellent photo-documentation of representative conditions and/or notable areas observed while surveying.

C. Surveying Procedures and Counting Guidelines

As COG staff discovered during their pilot survey of Sligo Creek, the best vantage point for observing and counting trash is generally within the stream channel. However, due to varying and unpredictable water depths along even a short stretch of stream, this option is only possible if hipwaders are available. The second best option is to employ two surveyors, one on each stream bank. The third and final option requires the lone surveyor to record while walking along one side of the stream channel.

Using a hand-held tally counter, the surveyor(s) walks within the stream channel or along the stream bank counting each trash item that is bottle cap size or larger (i.e., approximately one inch diameter or larger). Surveyors should count only those trash items observed within the bankfull channel (i.e., everything from top-of-bank to top-of-bank including items visible within the stream itself). As a general rule, surveyors should not count very small trash items (i.e., items smaller than a bottle cap, such as cigarette butts, styrofoam packaging chips or bits of paper) unless several are observed. If two surveyors are walking within the stream channel each should count only those trash items from the middle of the stream channel to his or her respective bank. If two surveyors are walking along opposite banks, one person should count both the trash items observed along his or her stream bank and those within the stream itself, while the other should count only those items on his or her bank. Finally, if only one surveyor is available and cannot survey within the stream channel, he or she should be aware that many trash items along the opposite bank could be hidden from view. To avoid overlooking these trash items, the surveyor should stop intermittently at points that offer a clear view of the opposite bank. Items of special interest and concern (e.g., oil quart containers, tires, etc.) should be tallied during the survey. Once the stream reach has been surveyed, the surveyor(s) should complete the trash survey form by noting the total number of trash items counted, the different categories of trash items observed, and the three categories of greatest abundance. When possible, noteworthy areas should be photo-documented.

III. Stream Trash Indexing System

In an effort to standardize the reporting of trash levels observed along Anacostia tributaries, COG staff developed a simple, relative trash indexing system. COG's Stream Trash Indexing System uses a verbal ranking to characterize the number of trash items observed per 100 feet of stream surveyed. The system ranks the level of trash as follows:

No. Items/100 ft.	Verbal Ranking
0 - 10.0	None - Very Light
10.1 - 25.0	Light
25.1 - 50.0	Moderate
> 50.1	High

COG staff developed this indexing system during its pilot trash survey of Sligo Creek watershed. A total of twenty survey reaches within the Sligo Creek watershed, distributed along its mainstem and major tributaries, were surveyed. In addition, reference streams assumed to have low trash levels based on low population densities and low development levels within their drainage areas were selected and surveyed to provide baseline trash levels for a clean stream. The surveyed reference streams include: Mary Bird Branch (a tributary of South Fork Quantico Creek in Prince William Forest Park, Prince William County, and Virginia), the Talbot Farm Tributary (a tributary to South Fork Catoctin Creek, Loudoun County, Virginia) and sections of Upper Paint Branch (Montgomery County, Maryland).

Recommendation

The MWCOG Anacostia Stream Trash Surveying Method is not recommended for DOE use. Its Indexing System is weak in the data collection sheet because it does not include a comprehensive composition of trash. The MWCOG methodology is dated and was developed using the Syrek method, but does not include improvements in trash monitoring developed after they defined their methodology. MWCOG is in the process of concluding their baseline monitoring for Prince George's and Montgomery Counties in the development of the Anacostia trash TMDL. Their updated monitoring plan was requested for review. MWCOG's baseline monitoring methodology is not complete and therefore was not available for review for inclusion in this document.

Conclusion and Recommended Long Term Monitoring Program for DOE

The long-term monitoring program chosen and trash data composition will help prioritize DOE financial resources, staff resources and gauge the effectiveness of trash controls chosen by DOE to implement.

After a through review of existing national and regional trash monitoring methodologies, the recommend long-term monitoring program recommend is the Simplified Program. The data collected from a Simplified Program will meet the needs of DOE for long term monitoring of trash.

BIBLIOGRAPHY

Municipal Best Management Practices for Controlling Trash and Debris in stormwater and Urban Runoff, California Coastal Commission and Algalita Marine Research Foundation.

Anacostia 2032: Plan for a Fishable and Swimmable Anacostia River, District of Columbia Department of the Environment, 2007

A Rapid Trash Assessment method Applied to the Waters of the San Francisco Bay Region: Trash Measurement in Streams, California Regional Water Quality Control Board, January, 2007

An Update of the 1999 Catch Basin Retrofit Feasibility Study Technical Memorandum**,** Santa Clara Valley Urban Runoff Pollution Prevention Program, June 26, 2002

Sligo Creek Trash Reduction Plan, Department of Environmental Programs, Metropolitan Washington Council of Governments, January, 2000

Anacostia Stream Trash Surveying Methodology and Indexing System, John Galli and Kathy Corish, Department of Environmental Programs, Metropolitan Washington Council of Governments, May 19, 1998

AMAFCA/Albuquerque MS4 Floatable & Gross Pollutant Study, ASCG Consulting, October, 2005

Fort Chaplin Subwatershed Restoration: 2003 Baseline Stream Assessment Study – Physical, Chemical, and Biological Conditions, 2004

Fort Dupont Subwatershed Restoration: 1999 Baseline Stream Assessment Study – Physical, Chemical and Biological Conditions, 2000

Fort Dupont Watershed Implementation Plan, District of Columbia Department of the Environment, Watershed protection Division, October, 2003

Fort Dupont Subwatershed Restoration: 1999 Baseline Stream Assessment Study – Physical, Chemical and Biological Conditions, Department of Environmental Programs Metropolitan Washington Council of Governments, April, 2000

Hickey Run Watershed Implementation Plan, District of Columbia Department of the Environment, Watershed protection Division, July, 2005

Draft Alternatives Report Hickey Run Stormwater Pollution Abatement Project, Earth Tech, Inc., June, 2005

Subwatershed Restoration Action Strategy (WRAS) Watts Branch, District of Columbia, Department of the Environment, Watershed protection Division, June, 2000

Watts Branch TMDL, District of Columbia, Department of the Environment, January, 2003

Pope Branch Watershed Implementation Plan (Draft), District of Columbia, Department of the Environment, Watershed Protection Division, March, 2004

Pope Branch Subwatershed Restoration: 2002 Baseline Stream Assessment Study – Physical, Chemical, and Biological Conditions Department of Environmental Programs Metropolitan Washington Council of Governments, May, 2003

Fort Chaplin Subwatershed Restoration: 2003 Baseline Stream Assessment Study – Physical, Chemical, and Biological Conditions Department of Environmental Programs Metropolitan Washington Council of Governments, October, 2004

Assessment of Proprietary and Nonproprietary Products for Pretreatment of Larger Discharges, Thomas Schueler

Roscoe Moss Company, http://www.roscoemoss.com/stormwater.html

Anacostia TMDL, District of Columbia, Department of the Environment, 2003

Anacostia TMDL Implementation Plan, District of Columbia, February, 2005

WASA Floatables PowerPoint, Water and Sewer Authority, 2005

WASA, Email, 2008

Trash And Debris Best Management Practice (Bmp) Evaluation, Orange County Storm Water Program, RBF Consulting, June, 2003

High Trash-Generation Areas And Control Measures, City of Los Angeles, Department of Public Works, Bureau of Sanitation, Watershed Protection Division, January, 2002

Draft Trash Total Maximum Daily Loads for the Los Angeles River Watershed, California Regional Water Quality Control Board, March, 2007

Street Sweeping For Pollutant Removal, Meosotis C. Curtis, Watershed Management Division, February, 2002

An Overview of Carryout Bags in Los Angeles County, County of Los Angeles, August, 2007

Proposed Plastic Bag Reduction Ordinance, Baltimore

Street Sweeping, Department of Public Works, Email, 2008

Litter Enforcement, Department of Public Works, Personal communication, 2008

Litter Enforcement, Department of Consumer & Regulatory Affairs, Web site

Litter Enforcement, Department of Environment, Personal communication, 2008

Litter Enforcement, Clean City Coordinator, Personal communication, 2008

Baysaver, Baysaver.com, 2008

CDS, Contech Inc website, 2008