BALTIMORE COUNTY
NPDES - Municipal Stormwater Discharge Permit

2008 Annual Report

Management Programs
Fiscal Analysis
Monitoring Results
Pollutant Load Reduction

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Document Overview

This Document Overview provides a brief summary of the contents of the eleven sections included in Baltimore County's NPDES 2008 Annual Report. The major changes in this report this year include changes in the pollutant load calculations (Section 10.2), pollutant load reduction calculations, tracking progress in meeting Total Maximum Daily Loads (TMDLs) and the Maryland Tributary Strategies. Most of this changes occur in Section 10.

Section 1: Stormwater Management Program

Baltimore County implements a stormwater management program in accordance with the Annotated Code of Maryland, including implementation of the Maryland Stormwater Design Manual. This section of the report includes data on the number of plans reviewed and fees-in-lieu money received. There is information on the number of approved stormwater facilities and the type of facilities as well as the acreage of drainage area controlled by these facilities. This assists in determining watersheds in the County that may need additional stream erosion protection from stormwater. Data is also provided on inspections of facilities and the number and types of maintenance activities. The pollutant load reductions that result form the stormwater management program are calculated, as well as, the amount of impervious surface addressed through water quality stormwater management. This information fulfills section E.1 and E.2 of the NPDES permit.

Section 2: Sediment Control Program

Baltimore County implements a sediment control program in accordance with the Annotated Code of Maryland. This section of the report includes data on the number of plans reviewed and permits issued. Data is provided on the acreage of disturbed area and is categorized by watershed. Trends in the numbers of building and grading permits are examined. A summary of the number of inspections and enforcement actions is included. This section fulfills section E.4 of the NPDES permit.

Section 3: County Property Management, Road Maintenance and Recycling Activities

The activities accounted for in this section of the report are implemented by both the Department of Public Works (DPW) and the Department of Environmental Protection and Resource Management (DEPRM). Activities accounted for include; the Vac-Con Stormdrain Cleaning Program, the Street Sweeping Program, and hazardous waste recycling programs. This section includes a summary of the County Property Management as it relates to acquiring Industrial Stormwater General permits and preparation of Pollution Prevention Plans. Also reported in this section is data on the use of fertilizer, pesticide and deicing materials. This fulfills the NPDES permit requirement for section E.5 and E.6.

Section 4: Education Program

Baltimore County implements and maintains a public education and outreach program to reduce stormwater pollutants. Information provided in this section includes DEPRM's partnerships with other State programs, County level programs, as well as all interested local watershed groups. Baltimore County continues to lead the State in the number of

State Green School awards and implements a highly successful Tree-mendous Maryland program. DEPRM continues to expand its outreach to local school administrative staff through workshops. This program fulfills the requirements of section E.7 of the NPDES permit.

Section 5: Illicit Connections Program

This section of the NPDES report summarizes the detection, investigation, and remediation of illicit connections to the County's storm drain system. Data is provided on routine screenings and complaint investigations. Outfall screenings are presented by distribution priority and quantitative and qualitative problems. Details on complaint investigation results are separately listed. This information meets the requirements in section E.4 of the County's NPDES permit.

Section 6: Geographic Information System and Databases

This section describes the Geographic Information System (GIS) information and databases submitted with the report.

Section 7: Watershed Planning and Restoration Program

The Watershed Restoration Program continues to systematically assess the water quality within all of its urban watersheds. The data provided in this section satisfies, in part, section F. and G. requirements of the NPDES permit. A status is provided on watershed plans, the associated costs and the development of small watershed action plans. Documentation of capital restoration projects constructed by DEPRM is provided for each watershed. The summary includes the costs of each project and the projected pollutant reduction. Also included is an accounting of the amount of impervious surfaces addressed by DEPRM's capital restoration projects. Baltimore County is required to provide restoration of 10% of its impervious surfaces during this five-year permit period. The section also includes updates on the status of TMDL development for the various watersheds.

Section 8: Discharge Characterization and Assessment of Controls

This section describes the Scotts Level Branch monitoring plan and provides an analysis of the chemical, biological and geomorphological data. The section also presents the data derived from Windlass Run.

The Scotts Level Brach long-term monitoring site has been paired with sites in Upper Gwynns Falls and Powder Mill Run in a paired watershed design. The intent of this paired watershed design is to determine restoration effectiveness on a subwatershed scale in the realms of chemical load reduction, improvement in the biological community, and changes in stream erosion rates. The design will also determine the relative proportion of chemical pollutant load attributed to watershed washoff and stream erosion.

The ongoing Windlass Run monitoring to determine the effectiveness of the *2000 Maryland Stormwater Design Manual* is presented in this section this year. Previously, it had been accorded its own section. This section meets the reporting requirements for section H in the NPDES permit.

Section 9: Watershed and Restoration Monitoring

This section combines provides analysis of the chemical, biological, and geomorphological collected exclusive of the Scotts Level Branch and Windlass Run monitoring sites. In addition, a section on Submerged Aquatic Vegetation (SAV) data collected by the County has been included. The section summarizes chemical data collected through the County baseflow and tidal water monitoring program. It also summarizes the results from the stream restoration geomorphological monitoring program. Included are the results of the Stream Stability Assessments conducted during the reporting year. The portion of the report on the biological data includes results from the County Probabilistic Monitoring Program, stream restoration biological monitoring, and reference site monitoring. The SAV data is compared to the new Water Quality Standards for SAV coverage. The data provided in this section satisfies, in part, section F. and G. requirements of the NPDES permit.

Section 10: BMP Pollutant Load Reduction

Information provided in this section will meet the requirements of the NPDES Permit Part IV. Section A.1.e. The section summarizes the pollutant load reduction due to implementation of management programs. Much of the information will have already been provided in detail in the sections of the various management programs (Stormwater Management, Road Maintenance, and Watershed Restoration). This section provides the summary by watershed on the progress made in meeting pollutant load reductions from urban non-point sources.

There are a number of programs for which pollutant load reductions are not calculated or are only partially calculated e.g. Education, Illicit Connections, Street Sweeping (partial) and Storm Drain Cleaning (partial). This is due to the lack of information on the load reduction to allocate to those activities. The County in collaboration with others is making an effort to determine the effectiveness of storm drain and street sweeping program elements to correct the gap in knowledge on effectiveness. The determination of pollutant load reduction due to education activities and from the illicit connection program will be a more difficult undertaking.

Section 11: Permit Administration, Legal Authority, and Fiscal Analysis

This section includes the financial information regarding the County's capital, operational and maintenance expenditures related to compliance with the NPDES permit. Data is provided pertaining to DEPRM's organization and budgets. It also includes the county organization to address the NPDES permit requirements and an update on any legal authority changes. This portion of the report meets the requirements of sections A, B, and I. in the NPDES permit.

1.0 Permit Requirements

E.1. Stormwater Management

An acceptable stormwater management program shall be maintained in accordance with the Environment Article, Title 4, Subtitle 2, Annotated Code of Maryland. At a minimum, Baltimore County shall:

a. Implement the stormwater management design policies, principles, methods, and practices found in the *2000 Maryland Stormwater Design Manual* or other innovative stormwater management technologies approved by MDE;

b. Track progress toward implementing the *2000 Maryland Stormwater Design Manual* or other innovative stormwater management technologies approved by MDE and report annually the modifications needed to address any programmatic problems; and

c. Maintain programmatic and implementation information according to the requirement established as part of MDE's triennial stormwater program review.

E.2. Stormwater Management BMP Inspections

a. Within 6 months of this permit being issued, Baltimore County shall designate sufficient staff and resources to ensure that maintenance inspections are performed for all stormwater management BMPs in the County. At a minimum, the County shall:

i. identify the specific individual(s) responsible for BMP maintenance inspections;

ii. develop and implement specific written procedures for conducting routine maintenance inspections, preparing inspection reports, enforcing requirements, and following up to ensure that specified maintenance is performed for all BMPs in Baltimore County;

iii. perform routine maintenance inspections on all stormwater management BMPs in Baltimore County by June 15, 2007; and

iv. submit annually copies of all BMP maintenance inspection reports and a current database of all stormwater management BMPs in Baltimore County with each facility's maintenance status clearly described.

b. In its first report, Baltimore County shall report the progress toward completing the BMP maintenance inspections specified in Part III E.2.a. above. Based on Baltimore County's progress toward inspecting all BMPs, MDE will approve a maintenance inspection frequency for the remainder of this permit.

1.1 Introduction

The Stormwater Management Program addresses the impacts on stormwater quantity and quality resulting from new development after the construction phase is complete. These impacts are mainly associated with the increase in impervious area due to the installation of roadways and buildings. Effective July 2, 2001 the requirements of the new Maryland Stormwater Design Manual have been applied to new development. Baltimore County has been delegated authority by the State of Maryland to enforce stormwater management regulations. The Stormwater Management Program is located within the DEPRM – Stormwater Engineering Section. This program is periodically reviewed by the Maryland Department of the Environment (MDE) and has consistently passed the review requirements.

The Program contains several components, including:

- review of stormwater management facilities plans,
- review of variance and associated fee-in-lieu requests,
- as built inspections, and
- periodic inspections.

The Operations Program, located within the DEPRM Capital Program and Operations Section, performs inspections and maintenance on the stormwater management facilities owned by Baltimore County. Two inspectors and a supervisor were added in fiscal year 2006 to conduct three-year inspections of private stormwater management facilities. These personnel are located in the Stormwater Engineering Section.

1.2 Plan, and Variance and Fee-in-lieu Reviews

1.2.1 Plan Reviews

During the calendar year 2007 one thousand three hundred (1,300) plans were reviewed for stormwater management. Of these, two hundred and sixty-three (263) were approved, one thousand and thirty-four (1,034) were denied and one hundred and three (103) were pending at the end of the year. Most plans are not approved on the first submittal, and these numbers reflect multiple plan submittals for the same project.

1.2.2 Variance and Fee-in-lieu Reviews

A variance in accordance with Council Bill 51-01 may be approved for a project when exceptional circumstances are applicable to the site. A variance is only granted when the result is more beneficial for the watershed and it is accompanied by a fee-in-lieu. This option is only acceptable to Baltimore County if it is proven to be infeasible to provide SWM on site and a suitable outfall has been identified for the project. The fee-in-lieu money is used by DEPRM's Capital Program and Operations section for water quality restoration projects. Table 1-1 indicates the fee-in-lieu money received by watershed for the calendar year 2007.

Table 1-1: Fee-in-lieu money received in 2007

Watershed	# of Projects	Fee-in-lieu
Upper Western Shore		
Deer Creek	1	$5,800
Prettyboy Reservoir	4	$35,208
Loch Raven Reservoir	23	$165,261
Lower Gunpowder	6	$25,220
Little Gunpowder Falls	5	$26,960
Bird River	9	$95,680
Gunpowder River	9	$32,553
Middle River	1	$2,100
Upper Western Shore Total	**58**	**$388,782.00**
Patapsco/Back River		
Liberty Reservoir	1	$600
Patapsco	10	$110,977
Gwynns Falls	10	$89,240
Jones Falls	9	$54,690
Back River	9	$78,141
Baltimore Harbor	2	$11,000
Patapsco/Back River Total	**41**	**$344,648.00**
County Totals	**99**	**$733,430.00**

1.3 Approved Stormwater Management Facility Analysis

The database of approved stormwater management facilities indicates that 3,226 facilities have been approved through the end of 2007. Of the 3,226 approved facilities 2,018 have been built (871 public and 1,247 private). Table 1-2 lists approved facilities, but not necessarily built, by watershed, type and ownership. The last two sections of the table include both the total approved facilities by watershed and the number of built facilities by watershed.

The 3,226 approved facilities listed in Table 1-2 will if built serve 34,766 acres of urban land. Fifty-two (52%) percent of all approved facilities are privately owned and operated. The private facilities represent forty-five (45%) percent of the drainage area served by stormwater management facilities. The 2,018 built facilities serve 25,818 acres of urban land, with forty-three (43%) percent of the drainage area served by private facilities.

Stormwater management facilities classified as detention ponds provide minimal water quality. The database indicates that there are approved plans for 609 dry detention pond facilities serving 13,051 acres of urban land. There are 260 in public ownership and these represent 7,936 acres of the drainage area. These facilities present an opportunity for conversion in the future to other facility types with greater pollutant removal potential. An assessment of the existing stormwater management facilities and possibilities for conversion is a component of each watershed management plan. Conversions are typically cost effective only for facilities with greater than ten acres of drainage. Preparation of Small Watershed Action Plans (see Section 7) will result in assessing each built stormwater management facility for conversion possibilities.

Table 1-2: Approved Stormwater Management Facilities by Watershed Through 2007

Watershed	Detention Ponds (DP)				Extended Detention (ED, EDSD, EDSW)			
	Private		Public		Private		Public	
	N	D.A.	N	D.A.	N	D.A.	N	D.A.
Upper Western Shore								
Deer Creek	0	0	0	0	0	0	0	0
Prettyboy Res.	0	0	0	0	1	2	7	76
Loch Raven Res.	68	1,326	33	1,166	64	711	52	1,216
Lower Gunpowder	16	175	39	1,140	23	167	54	696
Little Gunpowder	3	3	0	0	5	16	11	113
Bird River	36	501	32	781	57	405	58	632
Gunpowder River	1	14	3	115	2	4	3	9
Middle River	11	96	3	138	3	5	4	26
UWS Totals	**135**	**2,231**	**110**	**3,340**	**155**	**1310**	**189**	**2,768**
Patapsco/Back River								
Liberty Res.	0	0	1	8	8	44	11	201
Patapsco River	36	489	37	1,357	53	732	53	546
Gwynns Falls	78	1,154	71	2,280	127	1,283	124	1,788
Jones Falls	33	816	21	720	57	633	23	497
Back River	60	396	18	145	65	447	38	368
Baltimore Harbor	7	144	2	86	7	22	1	14
Patapsco/Back R. Tot	**214**	**2,999**	**150**	**4,596**	**317**	**3,161**	**250**	**3,414**
County Totals	**349**	**5,230**	**260**	**7,936**	**472**	**4,471**	**439**	**6,182**

Watershed	Retention Pond (WP & SM)				Infiltration Basins, Trenches, Dry Wells, Porous Paving (DW, PP, IT, TTWQE & IB)			
	Private		Public		Private		Public	
	N	D.A.	N	D.A.	N	D.A.	N	D.A.
Upper Western Shore								
Deer Creek	0	0	0	0	0	0	0	0
Prettyboy Res.	0	0	0	0	1	13	0	0
Loch Raven Res.	10	289	5	94	53	188	15	136
Lower Gunpowder	2	300	5	96	4	11	5	28
Little Gunpowder	1	50	1	7	4	56	3	35
Bird River	21	724	9	188	13	30	13	55
Gunpowder River	4	0	7	84	1	11	8	13
Middle River	15	258	10	174	9	8	4	8
UWS Totals	**53**	**1621**	**37**	**643**	**85**	**317**	**48**	**275**
Patapsco/Back River								
Liberty Res.	1	22	0	0	10	22	0	0
Patapsco River	11	136	9	141	42	86	12	217
Gwynns Falls	16	289	6	167	55	61	22	46
Jones Falls	5	879	2	31	22	44	3	20
Back River	13	138	8	860	16	17	2	8
Baltimore Harbor	6	64	3	261	11	16	1	2
Patapsco/Back R. Tot	**52**	**1528**	**28**	**1460**	**156**	**246**	**40**	**293**
County Totals	**105**	**3,149**	**65**	**2,103**	**241**	**553**	**88**	**568**

Table 1-2: Approved Stormwater Management Facilities by Watershed Through 2007 (continued)

Watershed	Sand Filter and Bioretention (SF)				Underground Storage & Oil/Grit Separator (UGS, OGS, SC)			
	Private		Public		Private		Public	
	N	D.A.	N	D.A.	N	D.A.	N	D.A.
Upper Western Shore								
Deer Creek	0	0	0	0	0	0	0	0
Prettyboy Res.	0	0	3	18	0	0	0	0
Loch Raven Res.	66	222	68	594	80	193	1	25
Lower Gunpowder	20	93	20	124	18	50	1	2
Little Gunpowder	4	8	3	37	2	1	0	0
Bird River	31	90	52	298	26	65	5	25
Gunpowder River	3	4	4	16	0	0	0	0
Middle River	16	40	5	57	6	16	2	2
UWS Totals	**140**	**457**	**155**	**1144**	**132**	**325**	**9**	**54**
Patapsco/Back River								
Liberty Res.	12	18	14	98	4	2	0	0
Patapsco River	39	77	31	175	37	148	8	17
Gwynns Falls	89	265	49	227	102	281	4	32
Jones Falls	49	114	27	148	53	168	9	109
Back River	49	108	26	98	41	88	1	1
Baltimore Harbor	4	20	0	0	10	11	4	3
Patapsco/Back R. Tot	**242**	**602**	**147**	**746**	**247**	**698**	**26**	**162**
County Totals	**382**	**1059**	**302**	**1,890**	**379**	**1,023**	**35**	**216**

Watershed	Other (CD, GS, LS, O)			
	Private		Public	
	N	D.A.	N	D.A.
Upper Western Shore				
Deer Creek	0	0	0	0
Prettyboy Res.	0	0	1	1
Loch Raven Res.	5	10	21	61
Lower Gunpowder	3	7	3	12
Little Gunpowder	2	2	2	10
Bird River	3	36	5	10
Gunpowder River	0	0	1	1
Middle River	2	6	2	66
UWS Totals	**15**	**61**	**35**	**161**
Patapsco/Back River				
Liberty Res.	1	1	2	1
Patapsco River	7	9	1	0
Gwynns Falls	13	39	8	208
Jones Falls	8	15	7	9
Back River	8	15	5	16
Baltimore Harbor	1	1	0	0
Patapsco/Back R. Tot	**38**	**80**	**23**	**234**
County Totals	**53**	**141**	**58**	**395**

Table 1-2: Approved Stormwater Management Facilities by Watershed Through 2007 (continued)

Watershed	Total Approved SWM				Total Constructed SWM			
	Private		Public		Private		Public	
	N	D.A.	N	D.A.	N	D.A.	N	D.A.
Upper Western Shore								
Deer Creek	0	0	0	0	0	0	0	0
Prettyboy Res.	1	0	10	68	0	0	3	39
Loch Raven Res.	346	2,939	195	3,292	243	2,363	130	2,507
Lower Gunpowder	86	804	127	2,097	60	702	92	1,789
Little Gunpowder	21	137	20	202	8	118	14	136
Bird River	187	1,851	174	1,989	114	1,177	95	1,443
Gunpowder River	11	32	26	239	2	1	15	189
Middle River	62	428	30	470	27	271	14	276
UWS Totals	**714**	**6,191**	**582**	**8,357**	**454**	**4,632**	**363**	**6,379**
Patapsco/Back River								
Liberty Res.	36	109	28	307	14	66	10	150
Patapsco River	225	1,677	151	2,452	125	1,092	90	1,949
Gwynns Falls	480	3,372	284	4,748	316	2,542	185	3,947
Jones Falls	227	2,669	92	1,534	143	1,484	54	1,285
Back River	252	1,210	98	1,496	164	893	62	889
Baltimore Harbor	46	278	11	366	31	238	7	274
Patapsco/Back R. Tot	**1266**	**9,315**	**664**	**10,903**	**793**	**6,315**	**408**	**8,494**
County Totals	**1,980**	**15,506**	**1,246**	**19,260**	**1,247**	**10,947**	**771**	**14,873**

Figure 1-1 displays the number of approved facilities, both private and public, by watershed. The Gwynns Falls watershed continues to have the greatest total number of existing and newly approved facilities. The large number of facilities in the Gwynns Falls watershed can be attributed to the fact that Owings Mills has been designated as a growth area. Deer Creek, Prettyboy Reservoir, Liberty Reservoir, the Little Gunpowder Falls and the Gunpowder River watersheds have only a few facilities, which is reflective of fewer development projects and the small size of those watersheds. This pattern has not changed from past reports.

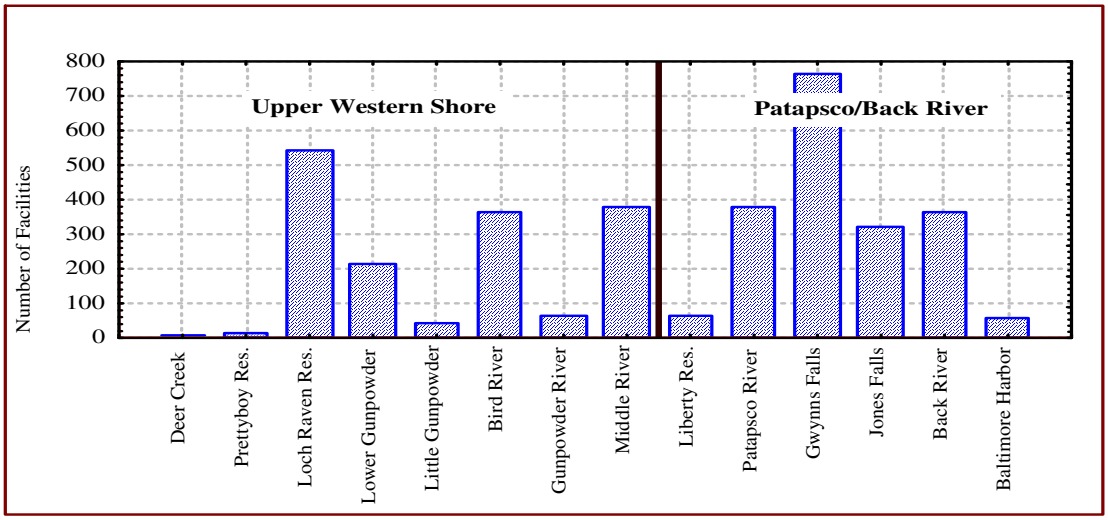


Figure 1-1: Number of Approved SWM Facilities by Watershed – Through Calendar Year 2007.

Figure 1-2 displays acreage to be served by approved private stormwater management facilities by watershed, and Figure 1-3 displays the same information for public facilities.

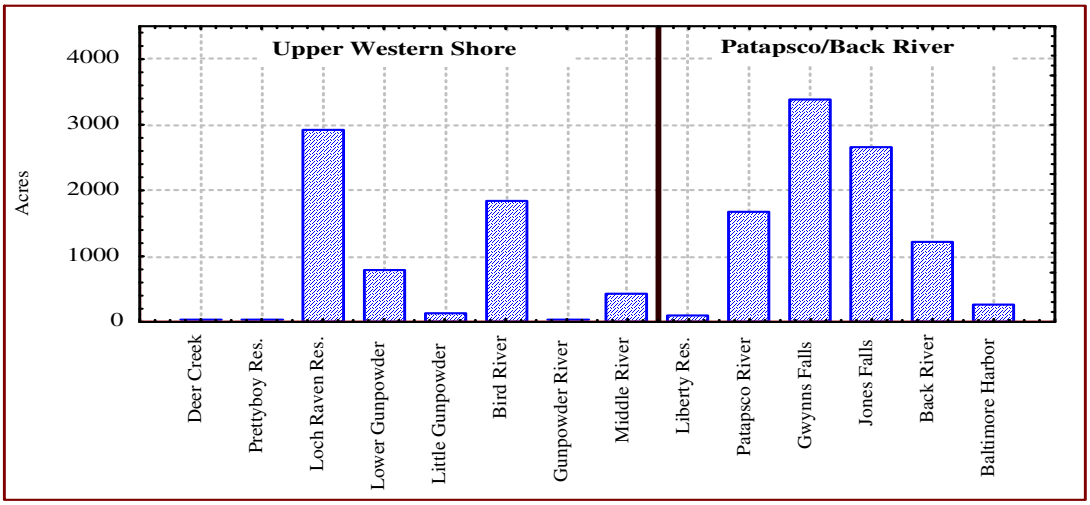


Figure 1-2: Acreage Served by Approved Private SWM Facilities by Watershed Through Calendar Year 2007.

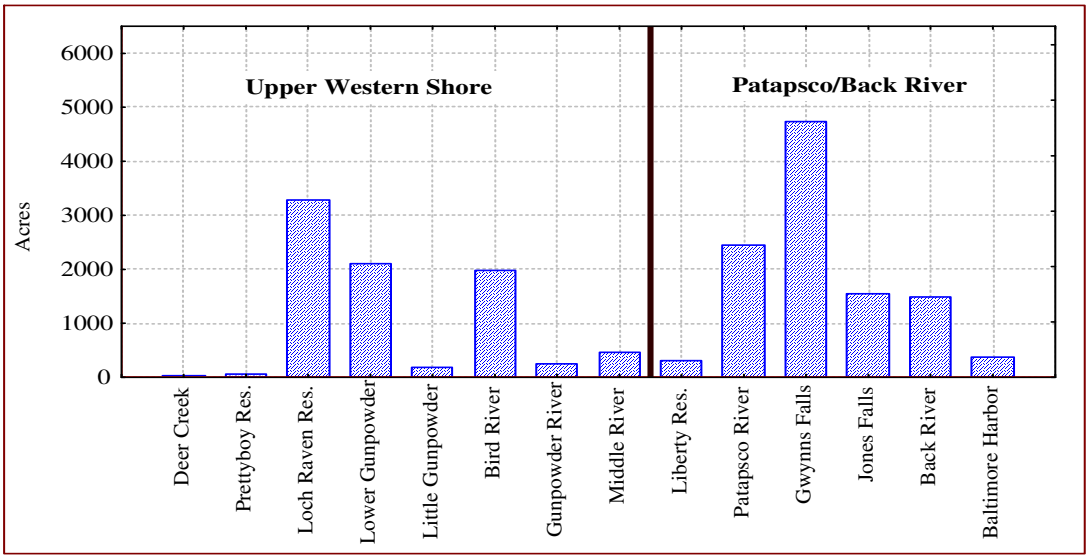


Figure 1-3: Acreage Served by Approved Public SWM Facilities by Watershed Through Calendar Year 2007.

1.4 Inspections

Inspections of stormwater management facilities are conducted by the Stormwater Engineering Section for private facilities and by the Capital Programs and Operations Section for public facilities. The Stormwater Engineering Section added two Engineering Associates III to conduct three-year inspections of private stormwater facilities in 2005. In addition, an existing Engineering Associate IV was reassigned as a supervisor to the private facility three-year inspection program. An Engineer III was added to the Stormwater Engineering Section to provide added staff for review of stormwater management designs for new development and redevelopment.

Table 1-3 presents the SWM facility inspections conducted by DEPRM during the calendar year 2007.

Table 1-3: SWM Inspections 2007

	As Built	One year	Three year	Totals
Stormwater Engineering Section	77	41	269	**387**
Capital Program and Operation Section	0	0	156	**156**
Totals	**77**	**41**	**425**	**543**

All as-built inspections and one-year inspections are completed by the Stormwater Engineering Section. A total of seventy-seven (77) as-built inspections were completed in calendar year 2007. A total of forty-one (41) one-year inspections were completed. Approval of the one-year maintenance inspection initiates the three-year maintenance inspection cycle. The Stormwater Engineering Section also completes three-year inspections for the facilities in private ownership. A total of two hundred sixty-nine (269) three-year inspections of private stormwater facilities were conducted.

The three-year inspection of publicly owned facilities is completed by the Capital Program and Operations Section. A total of one hundred and fifty-six (156) three-year inspections were completed for public ponds. This results in a total of four hundred and twenty-five (425) three-year inspections of all stormwater management facilities by DEPRM for the calendar year 2007. This represents 21% of the built facilities in Baltimore County and indicates that the program is below last year's inspection totals and not achieving its goal to inspect all built facilities every three years. The Stormwater Engineering Section was down one inspector during much of the year, but has now refilled that position. It is anticipated that the number of inspections will increase back to its expected goal.

1.5 Stormwater Management Facility Maintenance

The Baltimore County Department of Environmental Protection and Resource Management has an operations crew in the Capital Program and Operations Section. This crew consists of six environmental maintenance specialists and one supervisor. The crews are divided geographically into central, eastern and western districts. A database has been developed to track all routine maintenance and responses to complaints. Table 1-4 summarizes the number of maintenance visits due to complaints versus routine maintenance. There were one hundred and four (104) routine maintenance assessments and seventy-eight (78) complaint driven site assessments during the calendar year 2007.

Table 1-4: Stormwater Facility Maintenance Visits by Type 2007

Watershed	# of Routine Maintenance Visits	# of Complaint Maintenance Visits
Loch Raven Reservoir	12	5
Lower Gunpowder	20	6
Little Gunpowder	0	1
Bird River	6	3
Gunpowder River	0	3
Middle River	7	3
Liberty Reservoir	0	0
Patapsco River	13	11
Gwynns Falls	22	37
Jones Falls	8	4
Back River	16	5
Total	**104**	**78**

A summary of the maintenance activities for the time period by watershed and drainage basin is presented in Table 1-5. One hundred and ninety-six (196) facilities were maintained during the reporting time period. The total number of site visits was two hundred and eighty-five (285), indicating that some facilities required several visits. The most frequent activities are debris removal, cleaning of the riser, and cleaning the low flow channel. Appendix 1-1 contains the SWM maintenance data for the time period of January 1, 2007 through December 31, 2007. The data are arranged by watershed, with facility ID number, and by type of maintenance activity.

Table 1-5: SWM Pond Maintenance Activities for Calendar Year 2007

Watershed	# Ponds Maintained	Total # inspections	Tar- Riser	Repair Fence	Secure Gate	Clean Riser	Clean Low Flow	Remove Debris	Trim Fence	Clear Berm
Upper Western Shore										
Prettyboy	0	0	0	0	0	0	0	0	0	0
Loch Raven	24	34	2	10	16	18	12	22	16	9
Lower Gunpowder	43	65	4	5	35	40	39	41	32	15
Little Gunpowder	2	3	0	0	1	1	2	1	1	1
Bird River	23	34	3	7	14	13	19	23	16	6
Gunpowder River	5	7	0	1	2	4	4	6	3	0
Middle River	4	12	0	2	3	1	4	7	4	2
Upper West Shore. Total	**101**	**155**	**9**	**25**	**71**	**77**	**80**	**100**	**72**	**33**
Patapsco/Back River										
Liberty	1	1	0	1	0	1	1	0	1	0
Patapsco	28	37	1	7	11	18	27	26	15	21
Gwynns Falls	39	49	1	19	29	37	38	41	32	30
Jones Falls	8	10	1	2	5	7	9	9	6	0
Back River	19	33	2	6	15	14	14	23	16	5
Baltimore Harbor	0	0	0	0	0	0	0	0	0	0
Patapsco/Back River Total	**95**	**130**	**5**	**35**	**60**	**77**	**89**	**99**	**70**	**56**
County Totals	**196**	**285**	**14**	**60**	**131**	**154**	**169**	**199**	**142**	**89**

1.6 Constructed Stormwater Management Facility Data Analysis

An analysis of the databases related to stormwater management facilities indicated that a total of 2,018 facilities have been built to date. The 2,018 built facilities have a combined drainage area of 25,818 acres. The drainage areas of 1,276 built facilities were delineated and digitized into the County GIS. The drainage area for the 1,276 facilities that have been delineated is 22,445 acres or approximately 87% of the area served by the built stormwater facilities. The remaining 842 built facilities have a combined drainage area of 3,375 acres (13% of the area served by stormwater management). As new facilities are built their drainage areas will also be added to the GIS data layer. Overall, built stormwater management facilities serve 17% of the designated urban acreage (151,038 acres). The total urban acreage is based on the Maryland Department of Planning 2002 land use data.

The drainage areas were overlaid on the Maryland Department of Planning 2002 land use data to determine the specific land use draining to each facility. Table 1-6 presents a summary of the land use served by built SWM facilities by watershed. It should be noted that the date of the creation of the MDP GIS data layer might precede the building of a number of the stormwater management facilities. This fact will result in some error in the determination of land use draining to those facilities.

Table 1-6: Constructed SWM Facility Drainage Area Land Use (Acres) through Calendar Year 2007

Watershed	LDR	MDR	HDR	Commercial	Industrial	Institutional	Extractive	Open Urban	Agriculture	Forest and Wetlands	Bare Ground	Total
PR	21	0	0	0	0	0	0	0	1	1	0	23
LR	981	355	747	526	254	330	1	123	297	566	42	4222
GU	271	763	336	39	44	50	0	12	165	173	14	1867
LG	156	13	0	13	0	3	0	0	44	22	0	251
BI	42	624	503	194	177	77	0	49	54	333	13	2066
GR	0	87	29	4	0	0	0	0	0	16	0	136
MR	0	23	127	41	3	1	0	4	0	45	54	298
UWS	**1471**	**1865**	**1742**	**817**	**478**	**461**	**1**	**188**	**561**	**1156**	**123**	**8863**
LI	31	15	0	3	0	5	0	2	7	47	0	**110**
PA	185	728	552	143	255	89	0	94	91	389	7	**2566**
GW	502	1868	1068	580	401	176	0	102	115	520	54	**538686**
JF	897	668	529	213	25	169	96	86	158	414	52	**3307**
BR	333	243	148	316	443	78	0	63	19	239	15	**1897**
BH	1	71	6	66	65	48	0	48	0	40	0	**345**
P/B	**4891**	**7323**	**5787**	**2955**	**2145**	**1487**	**96**	**395**	**390**	**1649**	**374**	**13578**
County	**3420**	**5458**	**4045**	**2138**	**1667**	**1026**	**97**	**583**	**951**	**2805**	**251**	**22441**

LR = Loch Raven Reservoir
GU = Lower Gunpowder
BI = Bird River
PA = Patapsco River
GW = Gwynns Falls
MR = Middle River
BR = Back River

PR = Prettyboy Reservoir
LG = Little Gunpowder Falls
GR = Gunpowder River
LI = Liberty Reservoir
JF = Jones Falls
BH = Baltimore Harbor

LDR = Low Density Residential
MDR = Medium Density Residential
HDR = High Density Residential

The pollutant loads were determined by the methodology described in Section 10 for each of the 1,276 facilities that are currently built. The drainage areas for these facilities have been digitized into the GIS and are displayed in Table 1-7 by watershed for TSS, TP, and TN. The table is organized into watersheds and the two Tributary Strategy groups. A separate load is calculated for the Upper Western Shore and the Patapsco/Back River basins.

Table 1-7: Pollutant Loads to Constructed SWM Facilities by Watershed

Watershed	(#) TSS	(#) TP	(#) TN
Upper Western Shore			
Prettyboy Res.	3,386	21.0	193
Loch Raven Res.	748,034	3,213.0	32,115
Lower Gunpowder	302,928	1,485.5	14,851
Little Gunpowder	40,696	210.7	2,202
Bird River	372,680	2,049.9	18,300
Gunpowder River	22,424	104.4	989
Middle River	40,1615	304.9	2,646
Total	**1,891,763763**	**7,389.4**	**71,296**
Patapsco/Back River			
Liberty Res.	13,191	61.8	644
Patapsco	445,254	1,847.7	18,053
Gwynns Falls	1,027,924	4,280.1	40,541
Jones Falls	507,072	2610.0	24,843
Back River	447,594	1864.7	16,921
Baltimore Harbor	78,943	351.0	3,118
Total	**2,519,978**	**11,015.3**	**104,120**
County Total	**4,411,741**	**18,404.7**	**175,416**

The type of stormwater management facility has an influence on the percentage of a pollutant removed. Through a series of meetings conducted by the Chesapeake Bay Program – Urban Stormwater Workgroup a consensus was reached on the pollutant removal efficiencies by categories of practice for total suspended solids (TSS), total phosphorus (TP) and total nitrogen (TN). A copy of the resulting *Draft Recommendation for Storm Water Best Management Practice Categories and Pollutant Removal Efficiencies* document was included with Baltimore County's 2004 NPDES report. Table 1-8 reflects the pollutant removal efficiencies based on the consensus document. An additional change based on the *Draft Recommendation for Storm Water Best Management Practice Categories and Pollutant Removal Efficiencies* document is the type of facility to include in each practice category. The type of practice included in each category is indicated, along with the associated NPDES practice code, below Table 1-8. As shown in the table, there is a wide range of pollutant removal efficiencies by facility type as well as for pollutant type. Where there is a lack of data for a type of facility the removal efficiency for a particular pollutant was assumed to be zero. This will result in a conservative estimate of the actual amounts of pollutants removed.

Table 1-8: Percent Removal Efficiency of BMPs

BMP	Pollutants		
	TSS	TP	TN
Detention Facilities	10	10	5
Extended Detention Facilities	60	20	30
Wet Ponds	80	50	50
Infiltration Practices	90	70	50
Filtration Practices	85	60	40

Detention Facilities = Detention Pond and Hydrodynamic Devices (DP, OGS, and UGS)
Extended Detention Facilities = Extended Detention Ponds (EDSD, EDSW, ED)
Wet Ponds and Wetlands = Wet Pond and Shallow Marsh (WP and SM)
Infiltration Practices = Infiltration Trench and Infiltration Basins (IB, IT and ITWQC), Porous Paving (PP), and Dry Wells (DW)
Filtration Practices = Sand filters and Bioretention Facilities (SF, BIO)

The results of the analysis are displayed in Tables 1-9 through 1-11 for each of the three pollutants considered. The results for each of the 1,276 facilities are displayed in the same spreadsheet that contains the data for the land use served by each facility (see Section 6).

Table 1-9: Total Suspended Solids Removal by SWM Facility Type and Watershed

Watershed	Total # To SWM	Pounds of Removal by Facility Type					Total Removed	
		DP	EDP	WP	INF.	FIL.	#	%
Upper Western Shore Watersheds								
Prettyboy Res.	3,386	0	1,075	0	1,435	0	2,510	74
Loch Raven Res.	748,034	38,063	153,272	20,569	49,405	26,644	287,953	38
Lower Gunpowder	302,928	13,661	49,262	60,954	2,678	4,289	130,844	43
Little Gunpowder	40,696	206	11,086	5,729	10,461	1,170	28,652	70
Bird River	372,680	16,817	49,016	74,370	19,811	6,662	166,676	45
Gunpowder River	22,424	1,316	0	7,415	0	0	8,731	39
Middle River	40,161	1,741	548	8,166	1,054	8,890	20,399	51
Totals	**1,530,309**	**71,804**	**264,259**	**177,203**	**84,844**	**47,655**	**645,765**	**42**
Patapsco-Back River Watersheds								
Liberty Res.	13,191	98	5,634	948	1,430	40	8,150	62
Patapsco	445,254	26,470	72,965	34,537	9,165	4,754	147,891	33
Gwynns Falls	1,027,924	52,070	228,591	75,547	11,822	15,864	383,894	37
Jones Falls	507,072	26,158	91,306	54,974	6,493	14,776	193,707	38
Back River	447,594	14,715	88,269	108,127	2,605	12,986	226,702	51
Baltimore Harbor	78,943	4,853	7,830	13,301	620	43	26,647	34
Totals	**2,519,978**	**124,364**	**494,595**	**287,434**	**32,135**	**48,463**	**986,991**	39
Balt. Co. Totals	**4,050,560**	**196,168**	**758,854**	**464,637**	**116,979**	**96,118**	**1,632,756**	**40**

Table 1-10: Total Phosphorus Removal by SWM Facility Type and Watershed

Watershed	Total # To SWM	Pounds of Removal by Facility Type					Total Removed	
		DP	EDP	WP	INF.	FIL.	#	%
Upper Western Shore Watersheds								
Prettyboy Res.	21.0	0	5.8	0	6.6	0	12.4	59
Loch Raven Res.	3,213.0	162.1	552.2	70.3	113.6	111.1	1,009.3	31
Lower Gunpowder	1,485.5	71.9	217.5	141.9	11.7	18.3	461.3	31
Little Gunpowder	210.7	0.4	46.9	23.5	43.6	2.3	116.7	55
Bird River	2,049.9	94.8	227.4	246.9	73.3	29.3	671.7	33
Gunpowder River	104.4	6.6	0	19.0	0	0	25.6	25
Middle River	304.9	14.6	2.5	59.7	4.0	17.5	98.3	32
Totals	**7,389.4**	**350.4**	**10,52.3**	**561.3**	**252.8**	**178.5**	**2,395.3**	**32**
Patapsco/Back River Watersheds								
Liberty Res.	61.8	0.2	24.7	0.2	6.8	0	31.9	52
Patapsco	1,847.7	109.6	269.7	82.6	20.2	10.6	492.7	27
Gwynns Falls	4,280.1	207.4	895.8	133.6	46.8	48.4	1332	31
Jones Falls	2,610.0	127.1	397.9	209.6	25.7	52.2	812.5	31
Back River	1,864.7	56.9	306.6	287.3	3.9	61.5	716.2	38
Baltimore Harbor	351.0	28.2	11.6	22.1	0.9	0.1	62.9	18
Totals	**11,015.3**	**529.4**	**1,906.3**	**735.4**	**104.3**	**172.8**	**3,448.2**	31
County Total	**18,404.7**	**879.8**	**2,958.6**	**1,296.7**	**357.1**	**351.3**	**5,843.5**	**32**

Table 1-11: Total Nitrogen Removal by SWM Facility Type and Watershed

Watershed	Total # To SWM	Pounds of Removal by Facility Type					Total Removed	
		DP	EDP	WP	INF.	FIL.	#	%
Upper Western Shore Watersheds								
Prettyboy Res.	193	0	30	0	47	0	77	40
Loch Raven Res.	32,115	800	3,414	660	842	694	6,410	20
Lower Gunpowder	14,851	339	1,379	1,532	67	112	3,429	23
Little Gunpowder	2,202	2	333	196	315	12	858	39
Bird River	18,300	414	1,291	2,190	458	167	4,520	25
Gunpowder River	989	32	0	177	0	0	209	21
Middle River	2,646	64	14	491	29	110	708	27
Totals	**71,296**	**1,651**	**6,461**	**5,246**	**1,758**	**1,095**	**16,211**	**23**
Patapsco/Back River Watersheds								
Liberty Res.	644	1	147	17	50	1	216	34
Patapsco	18,053	547	1,551	753	132	73	3,056	17
Gwynns Falls	40,541	982	5,077	1,329	328	268	7,984	20
Jones Falls	24,843	610	2,217	1,920	160	434	5,341	21
Back River	16,921	259	1,685	2,590	40	342	4,916	29
Baltimore Harbor	3,118	120	84	205	10	1	420	13
Totals	**104,120**	**2,519**	**10,761**	**6,814**	**720**	**1,119**	**21,933**	21
County Total	**175,416**	**4,170**	**17,222**	**12,060**	**2,478**	**2,214**	**38,144**	**22**

While the load reductions are conservative numbers, it is apparent from an inspection of Table 1-10 and Table 1-11 (phosphorus and nitrogen loads) that the County has not achieved a 40% reduction of these two constituents for existing development served by

stormwater management facilities. This calculation does not include the nitrogen and phosphorus loads from development without stormwater controls.

In order to account for the impervious area served by state-of-the-art stormwater management, an analysis of the impervious area served by stormwater management facilities was performed. The drainage areas for facilities (742) that are considered to have higher pollutant removal efficiencies and to have little or no conversion potential were overlaid on the Baltimore County impervious cover data layer. The facility types included in this analysis are wet ponds, shallow marsh, extended detention facilities, sand filters, bioretention, and infiltration facilities. Underground facilities and dry ponds were not included. The former were excluded due to low pollution removal efficiencies and the latter due to the possibility of conversion to a type of facility that has higher pollution removal efficiency. The impervious cover layer for Baltimore County does not include sidewalks and driveways. It does include all roadways and parking lots, as well as all buildings based on aerial photography obtained in the mid 1990s. This is the same data layer used to determine the impervious acreage needed to be addressed for NPDES permit conditions. The results of this analysis are presented in Table 1-12. The 2,360 acres of impervious cover addressed by advanced stormwater management represents ~76% of the impervious cover (3,100 acres) that the County must address during one 5-year term of the permit.

Table 1-12: Impervious Cover Addressed by Advanced Stormwater Management Facilities

Watershed	Road Impervious Acres	Building Impervious Acres	Total Impervious Acres
Prettyboy	2	1	3
Loch Raven	350	180	531
Lower Gunpowder	101	77	178
Little Gunpowder	14	8	22
Gunpowder River	8	5	13
Bird River	189	116	305
Middle River	33	11	44
Liberty	3	1	4
Patapsco	113	58	171
Gwynns Falls	350	180	530
Jones Falls	132	102	234
Back River	268	188	456
Baltimore Harbor	34	9	43
Total	**1,597**	**936**	**2,534**

1.7 Summary

Baltimore County operates a comprehensive stormwater management program. DEPRM has always taken a firm stand on requiring water quality treatment even when quantity management was not required. With the implementation of the new stormwater regulations DEPRM continues to require all projects to explore and implement methods for water quality treatment. DEPRM now has the option to accept a fee-in-lieu payment if an exhaustive search has resulted in no practicable opportunities.

The operation of the public stormwater management facility maintenance program within DEPRM's Capital Program and Operations Section has continued to inspect and maintain publicly owned facilities. This group has compiled an extensive database of inspections

and maintenance operations for the County's publicly owned stormwater facilities. These inspections, and the resulting actions, are improving the overall pollutant reduction efficiency of all public stormwater facilities.

Constructed stormwater management facilities serve ~17% of the total urban land, 151,038 acres (84,814 P/B and 66,223 UWS), in Baltimore County. For the areas served by these facilities a significant amount of pollutants are removed annually. Facilities designed and constructed for water quantity management represent an opportunity for water quality improvement through conversion to water quality facilities that will be explored through the Small Watershed Action Plan planning process (Section 7). However, many of the facilities either have no conversion potential (underground facilities) or are already designed to provide water quality. Those facilities designed for water quality are serving 2,360 acres of impervious cover of the County's 31,000 acres of impervious area. With the issuance of the new permit on June 15, 2005 the County is now required to address ~6,200 acres of impervious cover by 2010. The 2,360 acres of impervious cover served by state of the art water quality facilities represent ~38% of this requirement.

Appendix 1-1: Public Stormwater Facility Maintenance by Type for Calendar Year 2007

Date	Watershed	Pond #	Repaired Fence	Secured Gate	Cleaned Riser	Cleaned Low Flow	Removed Debris	Trimmed Fence	Cleared Berm	Tar Riser
03/26/2007	Back River	164	X							
07/12/2007	Back River	164								
07/30/2007	Back River	164	X							
05/07/2007	Back River	170	X	X						
10/17/2007	Back River	181	X	X	X		X	X		
03/28/2007	Back River	315								X
07/02/2007	Back River	553			X	X		X	X	
07/02/2007	Back River	554				X		X	X	
09/24/2007	Back River	554		X		X	X	X		
01/26/2007	Back River	624					X			
11/13/2007	Back River	832			X	X		X	X	X
01/26/2007	Back River	932					X			
01/25/2007	Back River	1380	X	X			X	X	X	
04/05/2007	Back River	1380	X							
06/12/2007	Back River	1380	X							
10/22/2007	Back River	1380	X	X			X	X		
04/05/2007	Back River	1547	X							
09/25/2007	Back River	1608		X			X	X		
05/01/2007	Back River	2300			X		X	X		
09/21/2007	Back River	2300			X		X	X		
06/07/2007	Back River	2915	X	X	X		X	X		
10/16/2007	Bird River	205	X		X		X	X		
01/09/2007	Bird River	348		X	X	X	X			
04/02/2007	Bird River	478								
12/26/2007	Bird River	573		X			X	X		
10/18/2007	Bird River	610	X	X		X	X	X		
03/23/2007	Bird River	754			X		X		X	
06/27/2007	Bird River	874	X		X		X			
06/07/2007	Bird River	1487	X	X			X	X		
01/10/2007	Bird River	1633			X	X	X	X		
01/08/2007	Gunpowder River	1167	X							
06/08/2007	Gunpowder River	1167	X							
08/07/2007	Gunpowder River	1167			X		X	X		
06/21/2007	Gwynns Falls	25		X	X	X	X	X	X	
05/07/2007	Gwynns Falls	33		X	X	X	X	X	X	
05/03/2007	Gwynns Falls	39		X	X	X	X	X	X	
09/13/2007	Gwynns Falls	44		X	X	X	X	X		
10/12/2007	Gwynns Falls	45		X	X	X	X	X	X	
02/12/2007	Gwynns Falls	46	X	X		X	X	X	X	
03/26/2007	Gwynns Falls	46	X							
04/10/2007	Gwynns Falls	48							X	

Date	Watershed	Pond #	Repaired Fence	Secured Gate	Cleaned Riser	Cleaned Low Flow	Removed Debris	Trimmed Fence	Cleared Berm	Tar Riser
01/16/2007	Gwynns Falls	93			X	X	X	X	X	
09/27/2007	Gwynns Falls	93	X							
08/03/2007	Gwynns Falls	110		X	X	X	X	X	X	
01/10/2007	Gwynns Falls	150		X	X	X	X	X	X	
02/12/2007	Gwynns Falls	150							X	
02/12/2007	Gwynns Falls	150							X	
04/05/2007	Gwynns Falls	150								
10/11/2007	Gwynns Falls	150								
09/21/2007	Gwynns Falls	151		X	X	X	X	X	X	
10/19/2007	Gwynns Falls	152	X	X	X	X	X	X	X	
06/06/2007	Gwynns Falls	157	X		X	X	X	X	X	
11/08/2007	Gwynns Falls	172	X	X	X	X	X	X		
11/16/2007	Gwynns Falls	173	X	X	X	X	X			
11/21/2007	Gwynns Falls	174	X		X	X	X			
05/16/2007	Gwynns Falls	219	X		X	X	X	X	X	
04/20/2007	Gwynns Falls	226	X	X	X	X	X	X	X	
04/24/2007	Gwynns Falls	227	X	X	X	X	X	X	X	
11/30/2007	Gwynns Falls	236		X	X	X	X			
08/09/2007	Gwynns Falls	238	X	X	X	X	X	X	X	
07/24/2007	Gwynns Falls	251		X	X	X	X	X		
01/02/2007	Gwynns Falls	270	X	X	X	X	X	X	X	
05/24/2007	Gwynns Falls	276	X		X	X	X	X	X	
05/18/2007	Gwynns Falls	277	X	X	X	X	X	X	X	
05/02/2007	Gwynns Falls	424	X	X	X	X	X	X	X	
06/05/2007	Gwynns Falls	432								
09/18/2007	Gwynns Falls	629		X	X	X	X	X	X	
10/16/2007	Gwynns Falls	738			X	X	X	X	X	
07/31/2007	Gwynns Falls	849	X	X	X	X	X	X		
10/03/2007	Gwynns Falls	865				X	X		X	
07/17/2007	Gwynns Falls	925	X	X	X	X	X	X	X	
08/08/2007	Gwynns Falls	967		X	X	X	X	X	X	
07/27/2007	Gwynns Falls	993		X	X	X	X	X	X	
05/30/2007	Gwynns Falls	1112	X	X	X	X	X	X	X	
07/25/2007	Gwynns Falls	1115	X	X	X	X	X	X	X	
08/28/2007	Gwynns Falls	1144	X	X	X	X	X	X	X	
08/23/2007	Gwynns Falls	1145		X	X	X	X	X	X	
03/26/2007	Gwynns Falls	1191	X	X	X	X	X	X	X	
07/10/2007	Gwynns Falls	1239			X	X	X	X		
03/29/2007	Gwynns Falls	1462	X		X	X	X		X	
11/16/2007	Gwynns Falls	1462	X		X		X			
05/02/2007	Gwynns Falls	1602	X	X	X	X	X	X		
07/11/2007	Gwynns Falls	1656			X	X	X	X	X	
06/26/2007	Gwynns Falls	1687	X	X	X	X	X	X	X	
06/26/2007	Gwynns Falls	1688	X	X	X	X	X	X	X	

Date	Watershed	Pond #	Repaired Fence	Secured Gate	Cleaned Riser	Cleaned Low Flow	Removed Debris	Trimmed Fence	Cleared Berm	Tar Riser
07/16/2007	Gwynns Falls	2031			X	X	X	X	X	
11/27/2007	Gwynns Falls	2145		X	X	X	X	X	X	
05/08/2007	Gwynns Falls	2198		X	X	X	X		X	
08/30/2007	Gwynns Falls	2204	X	X	X	X	X	X	X	
09/10/2007	Gwynns Falls	2204			X	X	X		X	
08/13/2007	Gwynns Falls	3269	X	X	X	X	X	X	X	
04/25/2007	Gwynns Falls	4393					X			
12/18/2007	Jones Falls	62		X	X	X	X		X	
12/14/2007	Jones Falls	64		X	X	X	X			
03/28/2007	Jones Falls	111								X
01/30/2007	Jones Falls	169	X	X	X	X	X	X	X	
09/26/2007	Jones Falls	500				X				
09/26/2007	Jones Falls	501				X			X	
07/03/2007	Jones Falls	547	X							
01/04/2007	Jones Falls	548			X	X	X	X		
05/24/2007	Jones Falls	1192	X	X	X	X	X	X	X	
09/18/2007	Jones Falls	1192								
01/11/2007	Jones Falls	1340	X		X	X		X		
12/19/2007	Jones Falls	1881		X		X	X		X	
03/30/2007	Little Gunpowder	2225				X	X			
06/15/2007	Loch Raven	38			X	X	X		X	
09/24/2007	Loch Raven	66				X	X		X	
03/13/2007	Loch Raven	83				X				
06/25/2007	Loch Raven	156			X	X	X		X	
12/03/2007	Loch Raven	239	X	X	X	X		X		
01/12/2007	Loch Raven	707		X		X	X	X		
03/27/2007	Loch Raven	1063				X				
11/02/2007	Loch Raven	1063			X	X	X			
03/27/2007	Loch Raven	1064	X				X			
11/02/2007	Loch Raven	1064	X	X	X	X	X	X		
09/18/2007	Loch Raven	1565								
11/02/2007	Loch Raven	1825	X		X	X	X	X	X	
11/28/2007	Loch Raven	1991			X	X				
10/25/2007	Loch Raven	2095	X							
10/25/2007	Loch Raven	2099								
08/31/2007	Loch Raven	2879				X	X	X	X	
08/07/2007	Loch Raven	2903			X			X	X	
05/07/2007	Lower Gunpowder	340	X	X						
03/13/2007	Lower Gunpowder	525				X				
03/26/2007	Lower Gunpowder	525				X				
09/24/2007	Lower Gunpowder	525			X	X		X	X	
07/31/2007	Lower Gunpowder	557				X	X	X		
08/01/2007	Lower Gunpowder	729			X		X	X		
11/13/2007	Lower Gunpowder	733	X		X	X	X	X	X	X

Date	Watershed	Pond #	Repaired Fence	Secured Gate	Cleaned Riser	Cleaned Low Flow	Removed Debris	Trimmed Fence	Cleared Berm	Tar Riser
04/30/2007	Lower Gunpowder	741				X	X	X		
09/19/2007	Lower Gunpowder	815		X		X	X	X		
03/28/2007	Lower Gunpowder	846			X	X	X		X	
04/18/2007	Lower Gunpowder	954					X			
10/31/2007	Lower Gunpowder	955			X					
09/25/2007	Lower Gunpowder	1003		X			X	X		
10/22/2007	Lower Gunpowder	1003	X	X			X	X		
05/07/2007	Lower Gunpowder	1233	X	X						
04/02/2007	Lower Gunpowder	1406	X							
10/03/2007	Lower Gunpowder	1406		X		X	X	X		
03/26/2007	Lower Gunpowder	1407	X							
03/26/2007	Lower Gunpowder	1408	X							
10/03/2007	Lower Gunpowder	1408	X	X		X	X	X		
08/01/2007	Lower Gunpowder	1473		X	X	X		X		
08/02/2007	Lower Gunpowder	1634	X	X				X		
04/03/2007	Lower Gunpowder	1789	X							
01/02/2007	Lower Gunpowder	1842				X			X	
10/31/2007	Lower Gunpowder	1842			X	X	X	X		
06/26/2007	Lower Gunpowder	2032	X	X		X	X		X	
10/17/2007	Middle River	591			X	X	X	X		
01/17/2007	Middle River	950			X	X	X		X	X
01/30/2007	Middle River	950	X							
01/30/2007	Middle River	950	X							
07/31/2007	Middle River	950		X			X	X		
02/06/2007	Middle River	4208					X	X		
02/06/2007	Middle River	4208					X	X		
06/12/2007	Middle River	4208					X			
04/17/2007	Middle River	4254								
06/05/2007	Middle River	4254					X	X		
08/29/2007	Patapsco	202		X	X	X	X	X	X	
09/17/2007	Patapsco	278		X	X	X	X	X	X	
11/30/2007	Patapsco	358			X	X				
04/03/2007	Patapsco	359					X			
12/17/2007	Patapsco	421	X	X	X	X		X	X	
03/20/2007	Patapsco	454				X	X			
08/22/2007	Patapsco	596		X	X	X	X	X	X	
10/04/2007	Patapsco	785	X		X	X	X	X	X	
08/16/2007	Patapsco	994			X	X	X	X		
08/20/2007	Patapsco	995		X	X	X	X	X	X	
10/22/2007	Patapsco	1132	X	X	X	X	X	X	X	
08/14/2007	Patapsco	1204			X	X	X	X	X	
08/01/2007	Patapsco	1237			X	X	X		X	
10/30/2007	Patapsco	1335		X	X	X	X	X		
10/01/2007	Patapsco	1339	X		X	X	X	X	X	

Date	Watershed	Pond #	Repaired Fence	Secured Gate	Cleaned Riser	Cleaned Low Flow	Removed Debris	Trimmed Fence	Cleared Berm	Tar Riser
04/27/2007	Patapsco	1555	X	X	X	X	X	X	X	
11/29/2007	Patapsco	1560		X	X	X	X	X	X	
09/19/2007	Patapsco	1564	X		X	X	X	X	X	
06/29/2007	Patapsco	1700	X	X	X	X	X	X	X	
09/14/2007	Patapsco	1817			X	X	X		X	
04/30/2007	Patapsco	2228	X	X	X	X	X	X	X	
04/05/2007	Patapsco	3575	X							
06/12/2007	Patapsco	3575	X							
09/07/2007	Patapsco	4390				X	X	X	X	

2.0 Permit Requirement

E.3. Erosion and Sediment Control

An acceptable erosion and sediment control program shall be maintained in accordance with the Environment Article, Title 4, Subtitle 1, Annotated Code of Maryland. At a minimum, Baltimore County shall:

a. Address needed program improvements identified during MDE's evaluation of Baltimore County's application for the delegation of erosion and sediment control enforcement authority;

b. At least three times per year, conduct "responsible personnel" certification classes to educate construction site operators regarding erosion and sediment control compliance. Program activity shall be recorded on MDE's "green card" database and submitted with the Baltimore County annual report; and

c. Report quarterly information regarding earth disturbances exceeding one acre or more. Quarters shall be based on calendar year and submittals shall be made within 30 days following each quarter. The information shall be specific to the permitting activity for the preceding three months.

2.1 Introduction

The Erosion and Sediment Control Program is implemented by DEPRM's Inspection and Enforcement Section. This program is periodically reviewed by the Maryland Department of the Environment and has consistently met the review requirements. The Erosion and Sediment Control Program contains several components:

- review of building and grading permit applications
- field inspection and enforcement of grading and sediment control regulations
- citizen complaint investigation, and
- training program for certification of responsible personnel.

Baltimore County has been given the authority to enforce sediment control regulations by the State of Maryland. The main function of the Erosion and Sediment Control Program is to reduce pollutant loads from new development and redevelopment during the construction phase. This goal is achieved using sediment control best management practices (BMPs) as specified in the sediment and erosion control plan for each development site. Sediment control plans are required for any construction activity disturbing an area greater than 5,000 square feet. The standard plan for Sediment and Erosion Control is used for residential construction activity disturbing less than 30,000 sq. ft. and all other construction activity disturbing less than 20,000 sq. ft.

2.2 Program Analysis - Plans Review

Currently, Sediment and Erosion Control Plans are reviewed for adequacy by the Baltimore County Soil Conservation District while DEPRM's Stormwater Management Section coordinates

the approval process. The Sediment and Erosion Control Plans are also reviewed by DEPRM's Environmental Impact Review Section to ensure that there is no encroachment on the forest buffers or forest conservation areas that are protected by County regulations.

Each Sediment and Erosion Control Plan is required to have an associated Grading Plan indicating the final topographic contours of the development site. The Grading Plans are reviewed by DEPRM and the Baltimore County Soil Conservation District.

2.3 Program Analysis - Inspection and Enforcement

The Inspection and Enforcement Section maintains records of issued grading permits, conducts routine inspections of active construction sites, and issues correction notices, violation notices, and stop work orders to enforce compliance of sediment and erosion control and grading plans. Prior to the issuance of grading permits, a pre-construction meeting is held at the site. This meeting is attended, at a minimum, by the DEPRM inspector and the construction site foreman. The foreman must be certified through the "responsible personnel in erosion and sediment control" training program which is described in section 2.4. The meeting covers the sequence of operations for the grading involved with the overall site development. This meeting is intended to forestall any future problems.

2.3.1 Grading and Building Permits Issued

Grading permits and building permits are reviewed by DEPRM. Grading Permits are required for any disturbance over 5,000 square feet or for grade changes in existing neighborhoods.

Baltimore County building permits are required for any new construction, additions, or alterations. This Department reviews building permits, to ensure that the final drainage patterns will not impact adjacent properties and that the onsite drainage will direct stormwater away from building structures and to stormwater management facilities. These permits are also reviewed to ensure that they are in compliance with other environmental regulations, such as, Critical Area requirements and Forest Buffer requirements.

During the calendar year 2007, two hundred and twelve (212) grading permits were issued. This represents a slight decrease in the number of grading permits from the previous year. However, there was a significant reduction in the acreage of disturbance from 1,147 acres to 698 acres. This is the lowest acreage since reporting began in 1998. The number of grading permits approved and the acreage of disturbance are displayed by watershed in Table 2-1 and Figure 2-1. Approximately 96 acres representing 13% of the total acreage of disturbance occurred in the drainage areas of the three drinking water reservoir watersheds Prettyboy Reservoir (0.0 acres), Loch Raven (80.2 acres), and Liberty (16.19 acres). This disturbed acreage is the same as last year. These watersheds comprise ~47 % of the drainage area in Baltimore County. Baltimore County has been promoting redevelopment of its older communities. This renaissance has finally come to fruition and is apparent by these permit numbers. The watersheds with the greater number of permits are the ones that are within growth areas or contain older existing communities.

Table 2-1: Number of Grading Permits and Acreage of Disturbance by Watershed for 2007.

Watershed	Number of Permits	Acreage of Disturbance
Upper Western Shore		
Deer Creek	1	0.1
Prettyboy Reservoir	0	0.0
Loch Raven Reservoir	33	80.2
Lower Gunpowder Falls	17	119.2
Little Gunpowder Falls	3	26.6
Bird River	13	82.4
Gunpowder River	3	5.5
Middle River	17	11.9
UWS Totals	**87**	**325.9**
Patapsco/Back River		
Liberty Reservoir	4	16.1
Patapsco River	28	98.6
Gwynns Falls	24	86.8
Jones Falls	20	47.0
Back River	32	62.2
Baltimore Harbor	17	61.4
Patapsco/Back R. Totals	**125**	**372.1**
County Totals	**212**	**698.0**

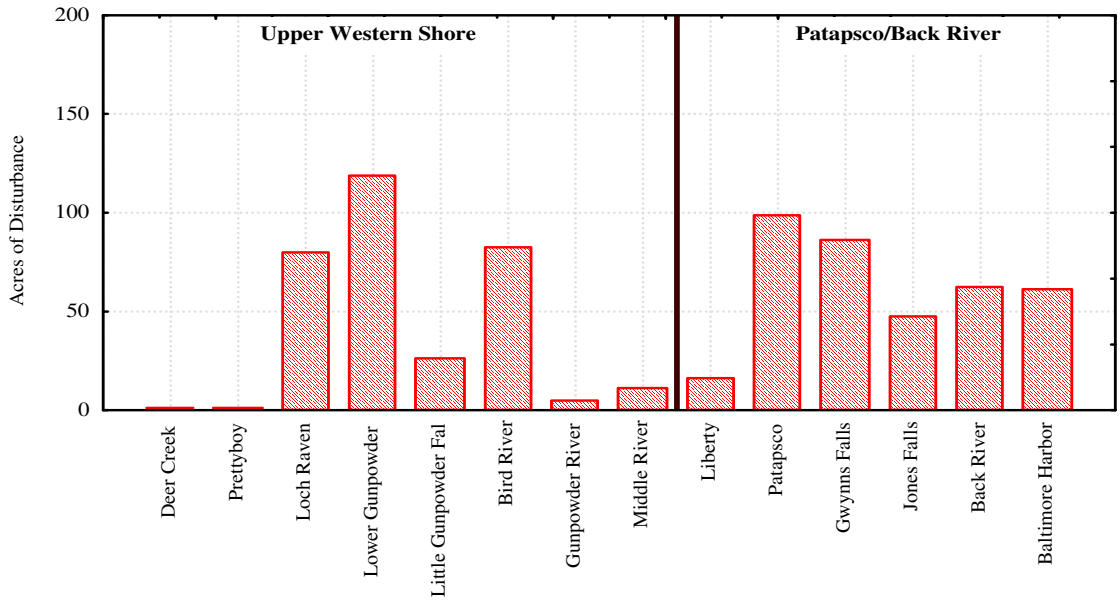


Figure 2-1: Acres of disturbance through approved grading permits by watershed for 2007.

During the calendar year 2007, 1,191 new residential building permits were issued. The distribution of building permits by watershed is displayed in Table 2-2 and Figure 2-2.

As indicated above, Baltimore County has been advocating redevelopment of its older communities. For calendar year 2007, a greater number of permits are located in watersheds with existing development.

Table 2-2: Number of Building Permits by Watershed Approved in 2007.

Watershed	Number of Permits
Upper Western Shore	
Deer Creek	2
Prettyboy Reservoir	11
Loch Raven Reservoir	131
Lower Gunpowder Falls	130
Little Gunpowder Falls	14
Bird River	193
Gunpowder River	15
Middle River	87
Upper Western Shore Totals	**583**
Patapsco/Back River	
Liberty Reservoir	15
Patapsco River	131
Gwynns Falls	120
Jones Falls	124
Back River	191
Baltimore Harbor	27
Patapsco/Back River Totals	**608**
County Totals	**1,191**

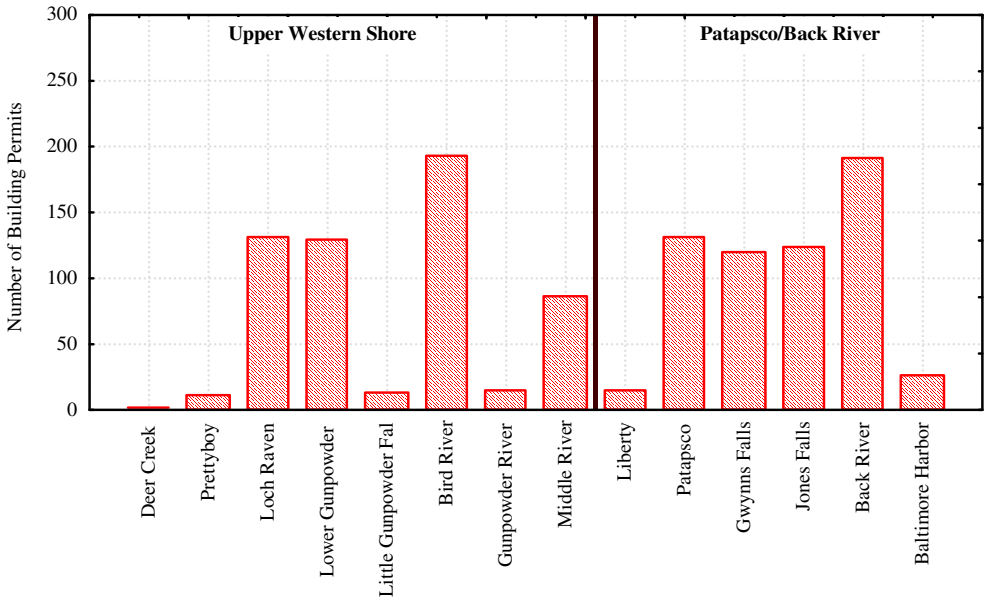


Figure 2-2: Number of building permits issued in 2007 by watershed.

Displayed in Table 2-3 and Figure 2-3 are the trends in building and grading permits, as well as acres of disturbance for a ten-year period. It shows a peak in 1999 followed by a gradual downward trend and then a greater downward trend last year.

Table 2-3: Number of Grading and Building Permits by Year

Year	Grading Permits	Acres of Disturbance	Building Permits
1998	256	1,173	2,705
1999	364	1,115*	2,747
2000	256	1,081	2,419
2001	232	1,209	1,869
2002	216	1,093	1,915
2003	258	916	1,708
2004	249	905	1,731
2005	217	1,083	2,085
2006	230	1,147	1,713
2007	212	698	1,191

*Excluding a single permit for 6,060 acres of disturbance associated with the Colonial Pipeline maintenance project.

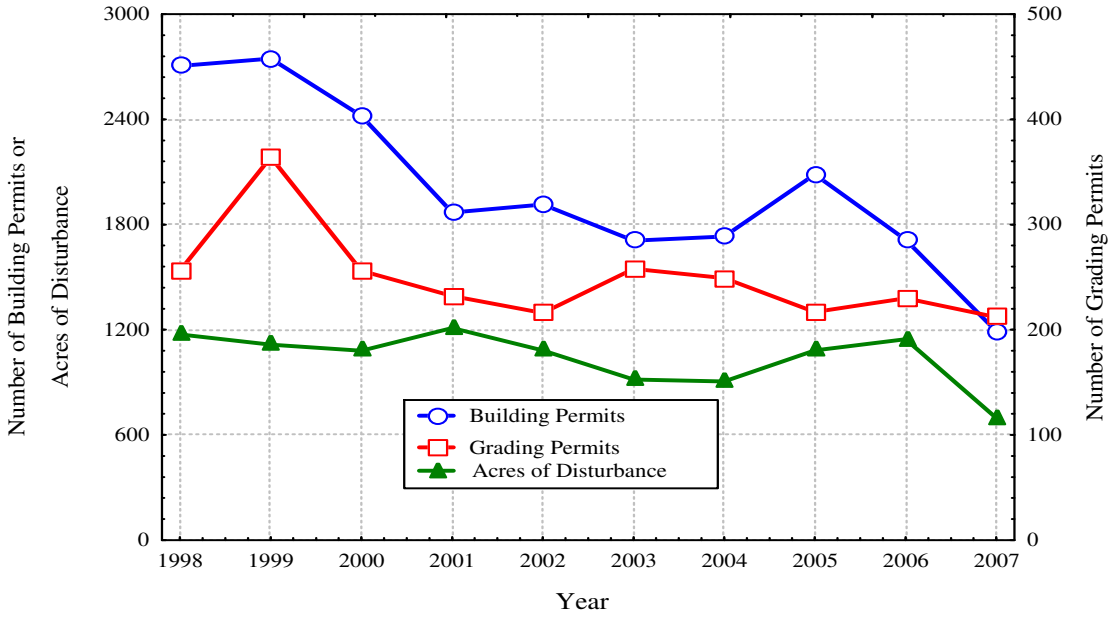


Figure 2-3: Approved Grading and Building Permits for the Period 1998 – 2007.

2.3.2 Inspections, Complaints and Enforcement

After construction begins, an inspector inspects the site an average of once every two weeks during the active constructive phase. Table 2-4 displays the number of inspections by month and type for the calendar year 2007. These inspections are also shown in Figures 2-4 and 2-5. The data are broken down into two categories, enforcement actions and inspections.

In 2007, 1,331 enforcement actions were logged (Table 2-4, last column and Figure 2-4), and 11,462 inspections were logged (Table 2-4, seventh column and Figure 2-5). These numbers represent a slight decrease in comparison with the activities in 2006.

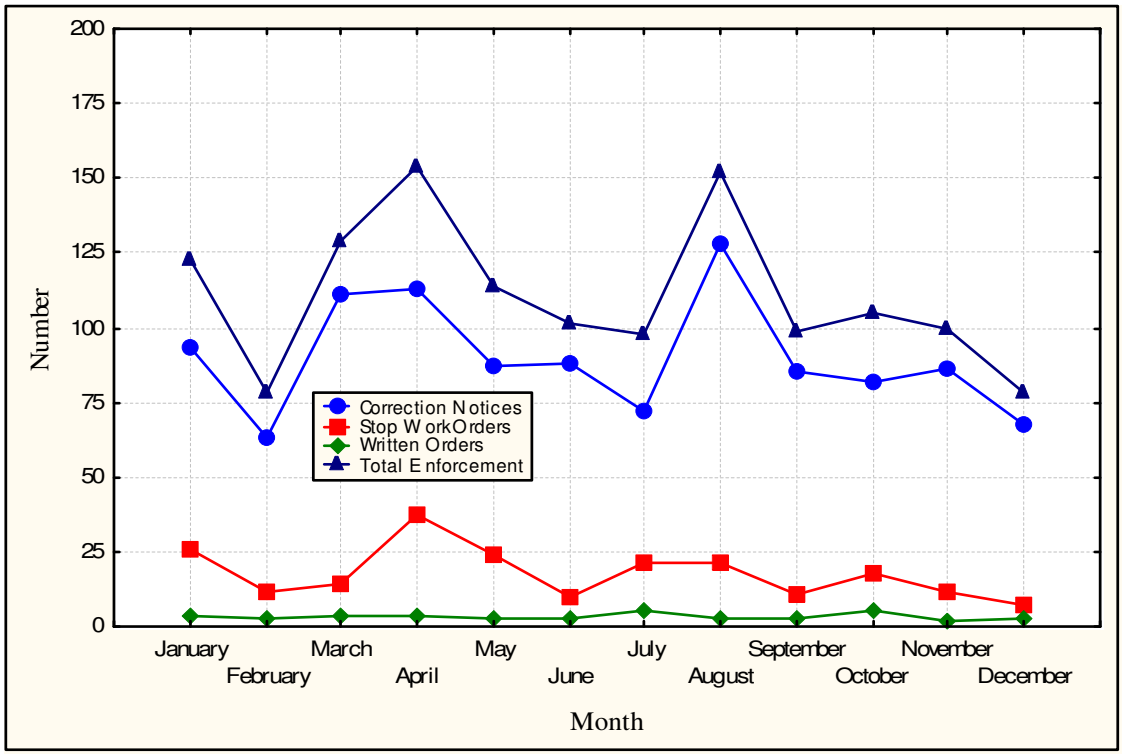


Figure 2-4: The number of sediment control enforcement actions by month for the calendar year 2007.

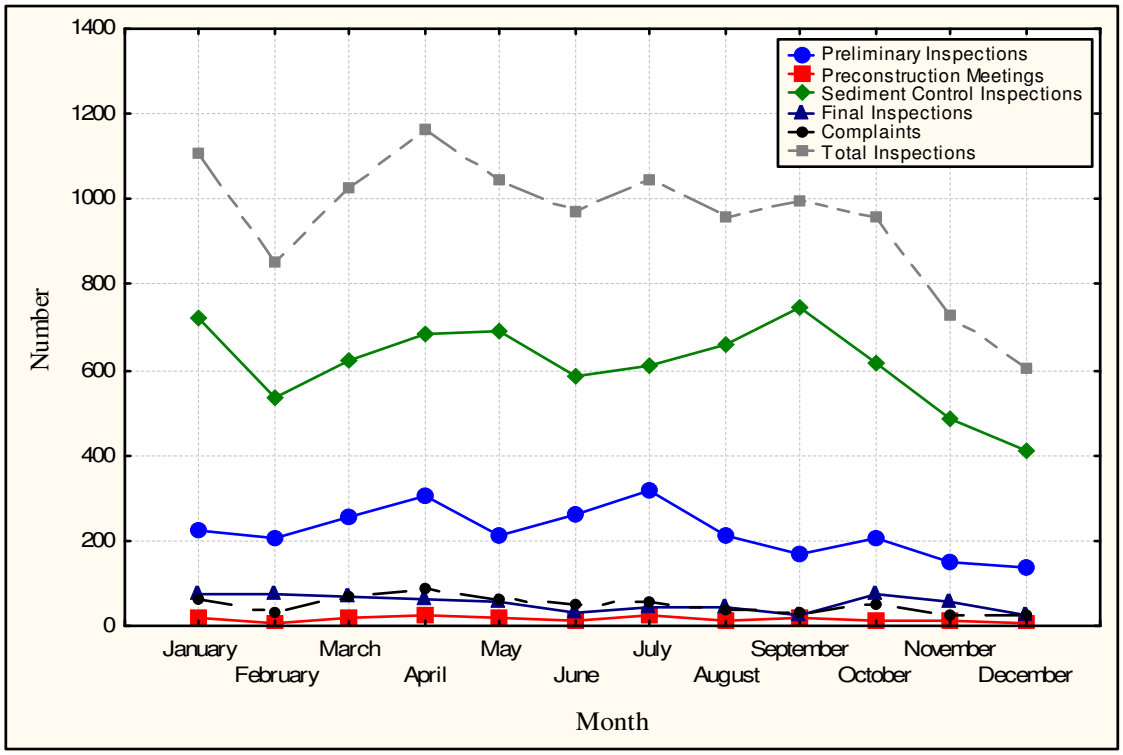


Figure 2-5: Number of sediment control inspections and the total number of inspections by month for the calendar year 2007.

Table 2-4: Sediment Control Inspection Data for 2007

Month	Prelim.	Pre Constr.	S.C. Inspt.	Final Inspt.	Complaint	Total Inspt.	Correct. Notice	Stop Work Order	Written Orders	Totals Enforce
January	227	21	723	737	64	1,108	93	26	4	123
February	208	7	534	72	31	852	63	12	3	78
March	254	17	622	67	69	1,029	111	14	4	129
April	306	23	684	63	88	1,164	113	37	4	154
May	211	21	689	58	64	1,043	87	24	3	114
June	264	13	588	61	47	973	88	10	3	101
July	318	23	607	42	57	1,047	72	21	5	98
August	209	11	658	43	40	961	128	21	3	152
September	170	21	748	25	30	994	85	11	3	99
October	207	12	616	73	49	957	82	18	5	105
November	147	11	486	57	27	728	86	12	2	100
December	137	7	410	28	24	606	68	7	3	78
Totals	**2658**	**187**	**7,365**	**662**	**590**	**11,462**	**1,076**	**213**	**42**	**1,331**

Sediment controls are only seventy to ninety percent effective when they are properly installed and maintained. Therefore a successful sediment control inspection and enforcement program is essential for achieving maximum effectiveness.

2.4 Program Analysis - Training Program

Four (4) Responsible Personnel Certification training sessions were held in 2007: February 14, and February 22, March 12, and March 15. One hundred and four (104) people attended these sessions. A list of individuals receiving certification is presented in Appendix 2-1. The training program is offered to construction site operators in Baltimore County on an as-needed basis. Baltimore County maintains an interest list on file and offers the certification class when enrollment requests justify the need.

2.5 Summary

An overall decrease in inspections for fiscal 2007 is contributed to the vacancy of two (2) inspection officer positions.

In the fall of 2007, the Maryland Department of the Environment Water Management Administration conducted an Erosion and Sediment Control Program Evaluation of DEPRM's Erosion and Sediment Control Program. DEPRM's program received good marks in all categories and based on the effectiveness of Baltimore County's program, continued delegation has been extended to June 30, 2010. The letter reaffirming delegation is in Appendix 2-2. Additional changes to the program will be made as necessary. DEPRM will reapply for delegation no later than October 1, 2009.

Appendix 2-1: List of Individuals Receiving Certification

LAST NAME	FIRST NAME	DATE	CERT NUM
CHRISTENSEN	PETER J.	02/14/2007	28529
WITT	STEVEN P.	02/14/2007	28536
WATSON	JONATHAN C.	02/14/2007	31032
WALLACE	SCOTT C.	02/14/2007	28534
SHREWSBURY	JEFFREY L.	02/14/2007	28533
KLINE	WILLIAM B.	02/14/2007	28532
DERUGGIERO	ANTHONY T.	02/14/2007	28531
BOWERS	RANDALL L.	02/14/2007	28528
COFFMAN	RICHARD D.	02/14/2007	28530
WOODHURST	STEPHEN L.	02/14/2007	28537
COOK	JAN M.	02/22/2007	28547
SAMPLE	TRAVIS D.	02/22/2007	30963
WILCOX	DEWITT G.	02/22/2007	30970
JOHNSON	MAURICE A.	02/22/2007	30957
MARCONI	RICHARD A.	02/22/2007	30958
MYERS	GABRIELLE S.	02/22/2007	30959
PAJAK	JOSHUA A.	02/22/2007	30960
HECKERT	WILLIAM B.	02/22/2007	28555
ROSSMAN	THEODORE L.	02/22/2007	30962
HAWKINS	JASON M.	02/22/2007	28554
SMITH	JOSEPH L.	02/22/2007	30964
TERHUNE	PHILLIP T.	02/22/2007	30965
TRIBETT	KYLE D.	02/22/2007	30966
WHEELER	JEFF W.	02/22/2007	30967
WHITE	JOHN F.	02/22/2007	30968
FISHER	JAMIE L.	02/22/2007	28549
RAGER	CHRISTOPHER M.	02/22/2007	30961
BROSH	MEGAN A.	02/22/2007	28545
ARMSTRONG	CHRIS W.	02/22/2007	28538
BAILEY	DEANNA C.	02/22/2007	28539
BEVARD	STEVE	02/22/2007	28540
BLALOCK	DAN M.	02/22/2007	28541
BOUCHER	ANTHONY B.	02/22/2007	8542
HILDEBRANDT	CHAD M.	02/22/2007	28556
BROGZKOWSKI	JEFFREY	02/22/2007	28544
WOOD	GREGORY N.	02/22/2007	30971
CAMPBELL	JUSTIN M.	02/22/2007	28546
DOYLE	MICHAEL P.	02/22/2007	28548
GENITO	DENNIS	02/22/2007	28550
GEARY	JARED P.	02/22/2007	28551
GOODWIN	DAVID J.	02/22/2007	28552
GRACEY	ROBERT N.	02/22/2007	28553
BOWMAN	JONATHAN D.	02/22/2007	28543
ZECK	JOHN S.	02/22/2007	30972
WICHMAN	RICHARD E.	02/22/2007	30969

LAST NAME	FIRST NAME	DATE	CERT NUM
ZINK	ADAM N.	03/12/2007	31000
SHOEMAKER	TIMOTHY C.	03/12/2007	30993
SHEVLAND	NICHOLAS E.	03/12/2007	30992
MCALLISTER	BILL	03/12/2007	30986
GUTTMAN	DAVID O.	03/12/2007	30981
COX, JR	DARREL E.	03/12/2007	30978
BOSLEY	EDWARD A.	03/12/2007	30975
BURDICK	EDWARD A.	03/12/2007	30977
MEISTER	VANCE E.	03/12/2007	30987
EGLISKIS	MICHAEL J.	03/12/2007	30979
JUDGE	JAMES P.	03/12/2007	30983
WALSKY	PAUL S.	03/12/2007	30997
OLIVER	TOMMY L.	03/12/2007	30989
ROLAND	JOSEPH R.	03/12/2007	30990
SNYDER	MARK F.	03/12/2007	30994
ALLEN	VINCENT T.	03/12/2007	30973
BAILEY	JOE R.	03/12/2007	30974
WIRTANEN	MICHAEL	03/12/2007	30999
MOORE	MARK D.	03/12/2007	30988
MASON, JR	JOSEPH E.	03/12/2007	30985
HOPKINS	DAVID R.	03/12/2007	30982
ALLEN	VINCENT T.	03/12/2007	30973
BRAUN	LOUIS R.	03/12/2007	30976
WENTWORTH	CHRISTOPHER J.	03/12/2007	30998
SOETLE	RICHARD L.	03/12/2007	30995
TWELE	MATTHEW AL	03/12/2007	30996
RYAN	MARY E.	03/12/2007	30991
FELDER	CLARENCE	03/12/2007	30980
ALTMEYER	KEVIN M.	03/12/2007	31001
BAILEY	JOE R.	03/12/2007	30974
BOYER III	DONALD A.	03/15/2007	31005
HARRISON	TIMOTHY J.	03/15/2007	31013
SHEPPERD JR.	DOUGLAS W.	03/15/2007	31027
POWERS	MICHAEL R.	03/15/2007	31025
PETERKIN	RODNEY K.	03/15/2007	31023
MOSKOWSKY	PETER A.	03/15/2007	31022
MCEVOY	DOUG D.	03/15/2007	31021
LEMMON	TYRONE	03/15/2007	31020
LANE	DAVID P.	03/15/2007	31019
KUDRNA	JOSEPH E.	03/15/2007	31018
JOHNSON	JERMAINE L.	03/15/2007	31016
SNYDER	JOHN W.	03/15/2007	31028
HEINLE	DAVID M.	03/15/2007	31014
SEIBEL	ARTHUR W.	03/15/2007	31026
HAMILTON	LAURIE A.	03/15/2007	31012
FRANK	JACOB M.	03/15/2007	31011

LAST NAME	FIRST NAME	DATE	CERT NUM
FONDNAZIC	CHRISTINE M.	03/15/2007	31010
ENSOR	BRYAN R.	03/15/2007	31009
CENIDOZU	DAVID J.	03/15/2007	31008
CAMPBELL	REGINALD	03/15/2007	31006
BOWEN	TRACEY E.	03/15/2007	31004
BLUM	WILBUR P.	03/15/2007	31003
KRAFT	THOMAS R.	03/15/2007	30984
HYMAN	MICHAEL A.	03/15/2007	31015
UNFRIED	MARK C.	03/15/2007	31030
THOMPSON	MARK D.	03/15/2007	31029
BENNETT	TIMOTHY P.	03/15/2007	31002
CARRERAS	FRANCISCO S.	03/15/2007	31007
PISTORIO	JASON C.	03/15/2007	31031

Appendix 2-2: Letter from MDE Reaffirming Program Delegation

MDE

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101

Martin O'Malley, Governor
Anthony G. Brown, Lieutenant Governor

Shari T. Wilson , Secretary
Robert M. Summers, Ph.D., Deputy Secretary

JAN 14 2008

RECEIVED
DEPRM
ADMINISTRATION
JAN 16 2008

Mr. David A.C. Carroll, Director
Department of Environmental Protection and Resource Management
Baltimore County Government, Courts Building
Towson, Maryland 21204

Dear Mr. Carroll:

The Maryland Department of the Environment, Water Management Administration (MDE/WMA) has completed the review of Baltimore County's application for continued delegation of erosion and sediment control enforcement authority. I would like to thank you and your staff for their assistance during the review process. A copy of our evaluation is attached for your use.

Results of the field inspection of active construction sites found most to be in good condition and in compliance with erosion and sediment control requirements. Therefore, I am pleased to grant your request for continued delegation of erosion and sediment control enforcement authority. This delegation of authority becomes effective July 1, 2008. Continuation beyond June 30, 2010 requires reapplication to MDE by October 1, 2009.

If you have any questions or comments regarding our review, please call me at (410) 537-3567 or have a member of your staff contact Mr. Kenneth L. Pensyl, Sediment, Stormwater, and Dam Safety Program at (410) 537-3543.

Sincerely,

Jay G. Sakai, Director
Water Management Administration

Enclosure

cc: Mr. Jim Ensor, District Manager, Baltimore County Soil Conservation District

3.0 Permit Requirements

E.5. County Property Management

Baltimore County shall identify all County–owned facilities requiring NPDES stormwater general permit coverage and submit Notices of Intent (NOI) to MDE for each. The status of pollution prevention plan development and implementation shall be submitted annually.

E.6. Road Maintenance

A plan to reduce pollutants associated with road maintenance activities shall be developed and implemented. At a minimum, an annual progress report shall be submitted that documents the following activities:

a. Street sweeping;

b. Inlet cleaning;

c. Reducing the use of pesticides, herbicides, fertilizers, and other pollutants associated with roadside vegetative management practices through the use of integrated pest management (IPM); and

d. Controlling the overuse of winter weather deicing materials through continual testing and improvement of materials, equipment calibration, employee training, and effective decision-making.

3.1 Introduction

Baltimore County has established several programs to control the amount of pollution that reaches the stream systems and landfills: a Storm Drain Cleaning Program, a Street Sweeping Program, and a Hazardous Waste Collection Program. Both the Storm Drain Cleaning Program and the Street Sweeping Program are the responsibility of the Baltimore County Department of Public Works (DPW). Within the Department of Public Works, the Bureau of Utilities handles the Vac-Con program. Vac-Con was originally created to remove the sediment from the storm drain systems in the watersheds of dredged tidal creeks, thereby increasing the longevity of the original dredging. The Program has since been expanded to clean the County's entire storm drain system, including the drain inlets, connecting pipes and outfalls. Debris, sediment, and pollutants can also be taken off the streets before they enter the storm drain system. This is accomplished with the Street Sweeping Program that is managed by the Bureau of Highways.

3.2 County Property Management

Over the last few years, three meetings of the Baltimore County NPDES Management Committee were held. The first meeting in December 2005 presented the requirements of the renewed NPDES permit to the Management Committee, including the requirement that certain County owned facilities acquire an NPDES Industrial Stormwater General Permit. A NPDES Management Committee meeting in February 2006 covered how to fill out the Notice of Intent (NOI) and the elements of the pollution prevention plan. A third meeting in May covered in more detail the elements of a Pollution Prevention Plan and used a highway shop to demonstrate how to conduct a site assessment and the types of controls that should be considered in the

pollution prevention plan. A sample Pollution Prevention Plan in draft form is included on the enclosed CD.

3.2.1 County Facility NPDES Permit Compliance

Baltimore County DEPRM has been assisting other County Departments to gain compliance with NPDES general stormwater permit requirements. Table 3-1 shows the status of County Facilities that we have started assisting. DEPRM is still identifying all County –owned facilities requiring NPDES stormwater general permit coverage. DEPRM estimates approximately 30 facilities may be included. As facilities are identified, we will assist them in submitting a Notice of Intent (NOI) to MDE and assist in the preparation of a Pollution Prevention Plan.

Table 3-1: NPDES Permit Compliance Status

County Department	Facility Name	Notice of Intent (NOI)	Pollution Prevention Plan (PPP)
Community College of Baltimore County	Catonsville, Essex, and Dundalk Campuses	Yes	In progress
Community College of Baltimore County	Essex Campus	Yes	No
Community College of Baltimore County	Dundalk Campus	Yes	No
Department of Public Works Highways	All 11 Shops	Yes	In progress for the Clark's Lane and Middleton Shops
Resource Recovery Facility	Texas Facility	Yes	No
Baltimore County Public Schools	Arbutus Shop	Yes	No
Baltimore County Public Schools	Providence Shop	Yes	No

3.3 Vac-Con Storm Drain Cleaning Program

3.3.1 Vac-Con Overview

The Baltimore County storm drain system consists of approximately 2,040,000 linear feet (388 miles) of storm drainpipe, 14,400 inlets, and 3,460 outfalls. In order to keep the entire system clean of trash, debris, and sediment, the Department of Public Works maintains three Vac-Con vehicles and employs three crews of two men each on a daily basis to clean the storm drains and pipes. Removing the material from the storm drain system reduces street flooding, a potential safety hazard, and aids in the detection of illicit connections.

Each time a crew cleans an inlet or pipe the amount of debris removed is recorded on a data sheet that typically contains all cleaning records for that particular location. Completed data sheets are sent to the Department of Environmental Protection and Resource Management

(DEPRM), where the data is entered into a database. The database facilitates reporting for NPDES purposes.

3.3.2 Vac-Con Data Analysis

The data entered into the database are analyzed for a number of measures, including the amount of material removed per inlet, the amount of material removed per linear foot of pipe cleaned, total amount of material removed by watershed, the amount of pollutants removed as a result of the program.

Inlet data are reported as the average annual cubic feet of material removed per inlet, and pipe data are reported in cubic feet of material removed per linear foot of pipe. The removal rates for 1993 to 2007 are presented in Table 3-2. Figure 3-1 shows a yearly comparison of the number of inlets cleaned and the total volume of material removed. Figure 3-2 shows the mean volume of debris removed per inlet. Figure 3-3 shows a yearly comparison of the length of pipe cleaned and the amount of material removed, and Figure 3-4 shows the mean volume of debris removed per linear foot of pipe.

Table 3-2: Removal Rates of Vac-Con Inlet and Pipe Cleaning by Year

Year	Inlet Vol. Cu. yd.	# Inlets	Vol. / Inlet Cu. yd	Pipe Vol. Cu. yd.	Length in feet	Vol. / Ft. Cu. yd.
1993	760	8,955	0.08	1,186	68,830	.0172
1994	769	2,615	0.29	347	21,193	.0164
1995	642	1,532	0.42	306	14,491	.0211
1996	1,536	1,347	1.14	1,558	67,676	.0230
1997	1,731	1,485	1.17	2,822	119,900	.0235
1998	2,059	1,178	1.75	988	93,918	.0105
1999	662	462	1.43	446	38,451	.0116
2000	689	580	1.19	672	89,145	.0075
2001	902	746	1.21	585	46,319	.0126
2002	919	602	1.53	409	34,384	.0118
2003	660	428	1.54	519	30,374	.0171
2004	898	653	1.37	1,169	54,795	.0213
2005	1,385	888	1.56	1,001	53,069	.0189
2006	950	659	1.44	538	30,891	.0174
2007	429	223	1.92	179	10,257	.0175
Totals	**29,553**	**36,915**		**27,287**	**788,255**	

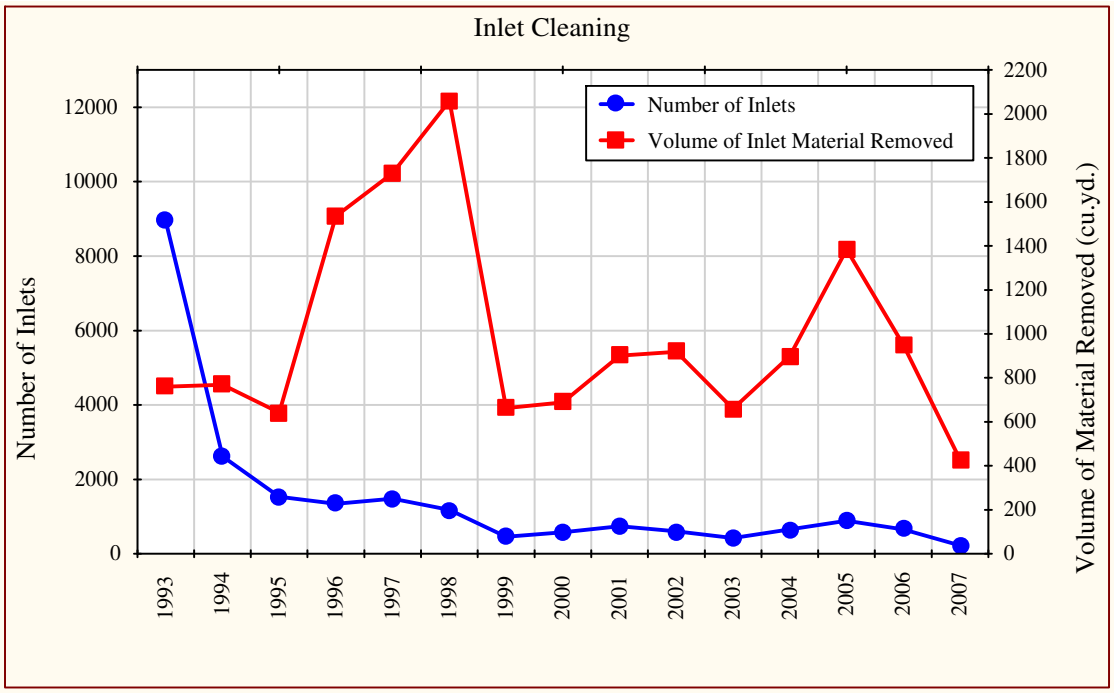


Figure 3-1: Vac-Con Summary Report for Inlets

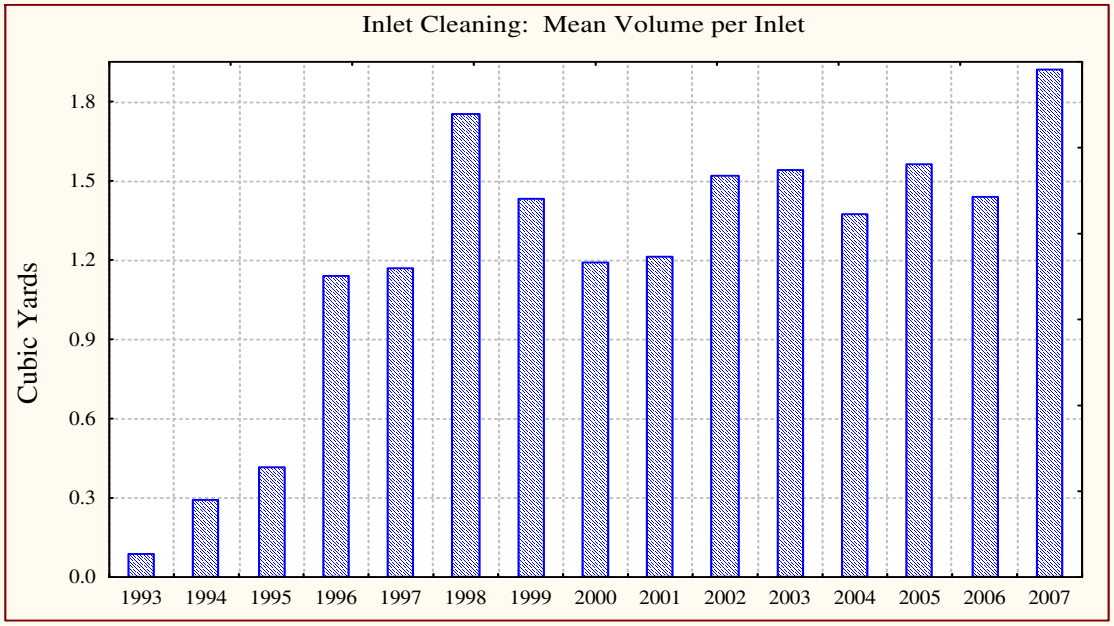


Figure 3-2: Vac-Con Annual Inlet Debris Removal Rates

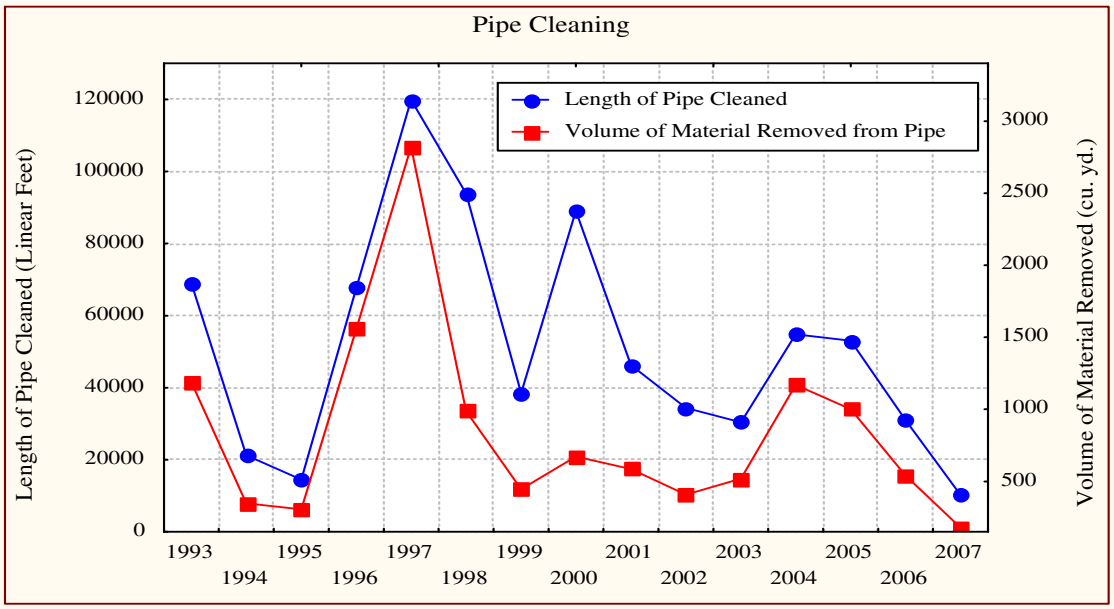


Figure 3-3: Vac-Con Summary Report for Pipes

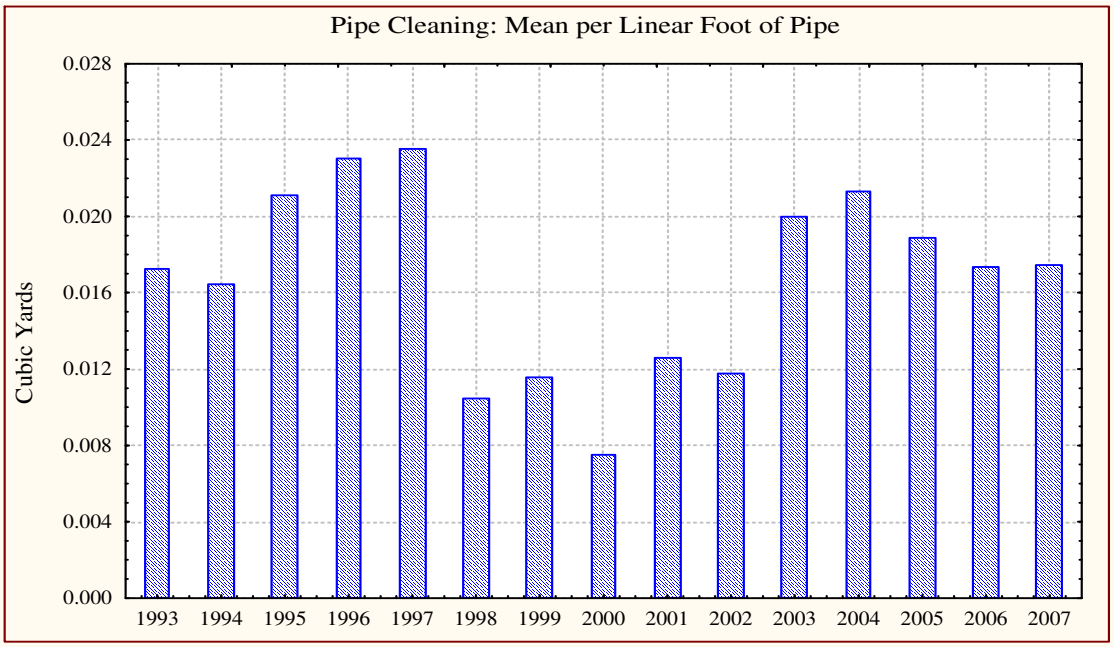


Figure 3-4: Vac-Con Annual Pipe Debris Removal Rates

While the number of inlets cleaned has declined since 1998, the volume removed per inlet has increased significantly and is now fairly consistent. For the period from 1993 through 1998, the average number of inlets cleaned was ~2,850 per year in contrast to ~582 per year in the 1999-2007 time period. The average amount of material removed per inlet increased from ~0.8 cubic yards per inlet to ~1.5 cubic yards per inlet for the same two time periods. In the early years of the program (1993-1995), all inlets within the County were cleaned, some with little or no accumulation of material. This resulted in low volumes of material removed per inlet cleaned. This method was changed after 1995. The current method does not include routinely cleaning storm drains; they are cleaned based on comments or complaints received. During the winter

months (Nov - Mar), they respond only to emergencies due to the temperature. Therefore the numbers of pipes and inlets cleaned out after 1995 varies each year.

The volume of material removed from inlets grew beginning in 1993 and peaked in 1998, at over 2,000 cubic yards of material removed (Figure 3-1). The total amount of material removed was lower for the years 1999 through 2003. There was an upward trend in 2004 and 2005 that has fallen and continued to fall in 2007.

The largest amount of material removed from pipes was in 1997. This was also the greatest length of pipe cleaned (see Figure 3-2). The average length of pipe cleaned in the time period 1993 through 1998 was ~64,500 linear feet compared to ~43,076 linear feet in the 1999 through 2007 time period. The volume removed per linear foot decreased from .019 cubic yards to ~.015 cubic yards for those two time periods. This is in contrast with the cleaning of inlets that showed an increase in the amount of material removed per inlet for the latter time period.
It should also be noted that drought conditions from 1999 through 2002 might have resulted in less material being washed into the storm drain system. That material was likely removed by street sweeping. Conversely, the increase in removal rates in the 2003 to 2005 was probably due to above normal levels of precipitation.

3.3.3 Vac-Con Data by Watershed

The Vac-Con data for 2007, showing the total number of inlets and lengths of pipe cleaned for each of Baltimore County's fourteen (14) major watersheds, are displayed in Table 3-3.

Table 3-3: 2007 Material Removed in Cubic Yards by Watershed

Watershed	Inlets Cleaned	Inlet Volume Cleaned (Cu. yd.)	Length of Pipe Cleaned (Ft.)	Pipe Volume Cleaned (Cu. yd.)	Total Volume (Cu. yd.)
Deer Creek	1	0.7	115	2.4	3.1
Prettyboy Reservoir	0	0.0	0	0	0
Loch Raven Reservoir	9	11.8	750	9.0	20.8
Lower Gunpowder River	1	0.8	100	0.9	1.7
Little Gunpowder Falls	0	0.0	0	0	0
Bird River	14	12.8	750	8.9	21.7
Gunpowder River	2	8.5	60	1.1	9.6
Middle River	17	45.5	985	21.8	67.3
UWS Totals	**44**	**80.1**	**2,760**	**44.1**	**124.2**
Patapsco/Back River					
Liberty Reservoir	0	0	0	0	0
Patapsco River	28	43.4	1,245	18.8	62.2
Gwynns Falls	49	83.8	1,645	38.8	122.6
Jones Falls	12	18.8	1,275	18.9	37.7
Back River	26	56.8	1,130	19.0	75.8
Baltimore Harbor	64	145.9	2,202	39.0	184.9
Pat./Back R. Totals	**179**	**348.7**	**7,297**	**134.5**	**483.2**
County Totals	**223**	**428.8**	**10,257**	**178.6**	**607.4**

Over 79% of the material removed from the storm drain system was removed from the heavily urbanized Patapsco/Back River Basin with Gwynns Falls and Baltimore Harbor having the highest amounts removed.

In the fall of 2005, a study was initiated on the pollutant removal effectiveness of street sweeping and storm drain cleaning. This study is funded by the Chesapeake Bay Program and is being led by the Center for Watershed Protection and UMBC. Both Baltimore County and Baltimore City are partners in this research effort. Baltimore County specifically is looking at the storm drain cleaning portion of the study by measuring monthly accumulation rates in 100 inlets and conducting sampling and chemical analysis of the material from a subset of the inlets on a quarterly basis. The results from this study will be used to estimate pollutant load reductions from street sweeping and storm drain cleaning activities. In the interim, the preliminary results from the storm drain analysis will be used to estimate pollutant load reduction for this year's report.

The composition of 16 inlets sampled in spring and fall of 2006 was divided into three categories; sediment, leaves (organic matter), and trash. The weight and volume of each component was determined for each inlet sampled. In the spring, sediment accounted for 63.5%, leaves 28.8% and trash 7.7% of the material accumulated in the inlets. In the fall, sediment accounted for 61.3%, leaves 31.0%, and trash 7.7% of the material accumulated in the inlets. The average bulk density for the spring was 330.7 pounds/cubic yard of material and for the fall 331.4 pounds/cubic yard of material. In past reports, a bulk density of 548.3 pounds/cubic yard was used. This weight was determined based a waste haulers handbook. There may be a seasonal component to the material in the inlets. The results of the full study should clarify the seasonal variation in materials and bulk density, as well as, the chemical composition.

The following formula was used to determine kilograms of material per cubic yard:

331 pounds/cubic yard x 0.45 kilograms/pound = 148.95 kilograms/cubic yard

The derived kilograms/cubic yard was then multiplied by the total cubic yards of material removed from each watershed in 2006 to determine the total kilograms of material removed. These results were then multiplied by the preliminary average concentrations for each pollutant to determine the milligrams of pollutant removed. The concentrations used were 1825.92 mg/kg total nitrogen and 707.95 mg/kg total phosphorus. Finally, the milligrams of pollutant were back calculated for pounds of pollutant removed.

The amount of each pollutant removed from each major watershed in the county during 2007 is shown in Table 3-4. The pollutants removed from the Patapsco/Back River Basin watersheds were nearly 5 times the amounts removed from the Upper Western Shore watersheds. DEPRM in the future may consult with the Department of Public works to discuss refocusing efforts.

Table 3-4: 2007 Pollutant Removal (Pounds) by Watershed Attributed to the Vac-Con Program

Watershed	TN	TP	TSS
Upper Western Shore			
Deer Creek	1.9	0.7	1,026.1
Prettyboy Reservoir	0.0	0.0	0
Loch Raven Reservoir	12.5	4.8	6,884.8
Lower Gunpowder River	1.0	0.4	562.7
Little Gunpowder Falls	0.0	0.0	0
Bird River	13.0	5.0	7,182.7
Gunpowder River	5.8	2.2	3,177.6
Middle River	40.4	15.6	22,276.3
UWS Totals	**74.5**	**28.9**	**41,110.2**
Patapsco/Back River			
Liberty Reservoir	0.0	0.0	0
Patapsco River	37.3	14.5	20,588.2
Gwynns Falls	73.5	28.5	40,580.6
Jones Falls	22.6	8.8	12,478.7
Back River	45.5	17.6	25,089.8
Baltimore Harbor	110.9	43.0	61,201.9
Patapsco/Back R. Tot	**289.8**	**112.4**	**159,939.2**
County Totals	**364.3**	**141.3**	**201,049.4**

3.3.4 Program Summary - Vac-Con

In sixteen years, the Vac-Con storm drain-cleaning program has removed over 56,800 cubic yards of material from the Baltimore County storm drain system. At 331 pounds per cubic yard, that amounts to approximately 18.8 million pounds. Without intervention, this material would have eventually entered our waterways.

3.4 Street Sweeping

3.4.1 Street Sweeping Overview

Removing materials such as trash, sediment, and debris, from public streets also results in a reduction of in the pollutant load (toxins and nutrients) that could have entered waterways. Baltimore County removes these materials by utilizing a street sweeping program managed by the Bureau of Highways. Seven employees operate seven sweepers on a daily basis, following prescribed routes.

The data on how many street miles are swept and tonnage collected is recorded by the Department of Public Works and submitted to DEPRM on an annual basis. Table 3-5 shows this data for each of the past seventeen years. The removal rates or productivity is also expressed in a tons-per-mile ratio for each year in the table. Approximately ½ ton of material was collected each mile from 1991 through 1995, with a spike to 0.88 in 1994. In 1994, during a particularly severe winter, the county experienced a salt shortage and found it necessary to utilize slag to provide traction on the icy roads. Subsequently, the material removed per mile spiked to the highest-ever that year. In 1996, the one half ton per mile average began to decrease, reaching its lowest point of 0.112 tons/mile in 1998. The decreasing trend began in 1996 and leveled off in 1998 through 2001 at approximately 0.11 tons/mile and staying at that level through 2001. Since then the efficiency has been stable at 0.30 tons/mile.

Table 3-5: Annual Street Sweeping Summary

Year	Miles Swept	Tons Collected	Tons/Mile
1991	7,566	3,792	0.50
1992	6,663	3,161	0.47
1993	6,300	3,108	0.49
1994	8,532	7,473	0.88
1995	5,333	2,990	0.56
1996	8,605	2,990	0.35
1997	14,785	3,177	0.21
1998	24,863	2,792	0.11
1999	24,968	2,880	0.12
2000	21,949	2,491	0.11
2001	12,147	1,395	0.12
2002	7,800	2,364	0.30
2003	8,640	2,592	0.30
2004	6,617	1,985	0.29
2005	6,126	1,838	0.30
2006	6,306	1,892	0.30
2007	5,133	1,540	0.30
Totals	**182,333**	**48,460**	**17 yr avg = 0.34**

Figure 3-5 provides graphic displays of the information contained in Table 3-5.

Even with the fluctuations in productivity, tonnage removed each year has been relatively consistent as shown in Figure 3-5. However, the mileage needed to collect each ton of sediment increased greatly from 1997 through 2000 while the productivity continued a decline that began in 1996. Although experiencing a slight decrease in 2000, mileage began significantly decreasing in 2001 and returned to the approximate mileage recorded early in the program. Although the tonnage remained relatively steady in 2002 and 2003, the mileage declined enough to raise the productivity to about two-thirds of the rate in the first five years of the program.

The decline in productivity does not necessarily indicate a serious problem. It may simply indicate that the bulk of sediment and debris accumulated over many years was removed during the early years of the program, as might be expected. Absent any major sediment influx (e.g. more cinders used for snow removal), street sweeping efficiency may have reached a maintenance level where it is simply keeping up with the average annual loading. Optimizing the program's performance may now depend mostly on fine-tuning the interrelated activities, for example a route analysis could lead prioritizing and redefining the sweeping routes, and concentrating efforts more on the commercial areas.

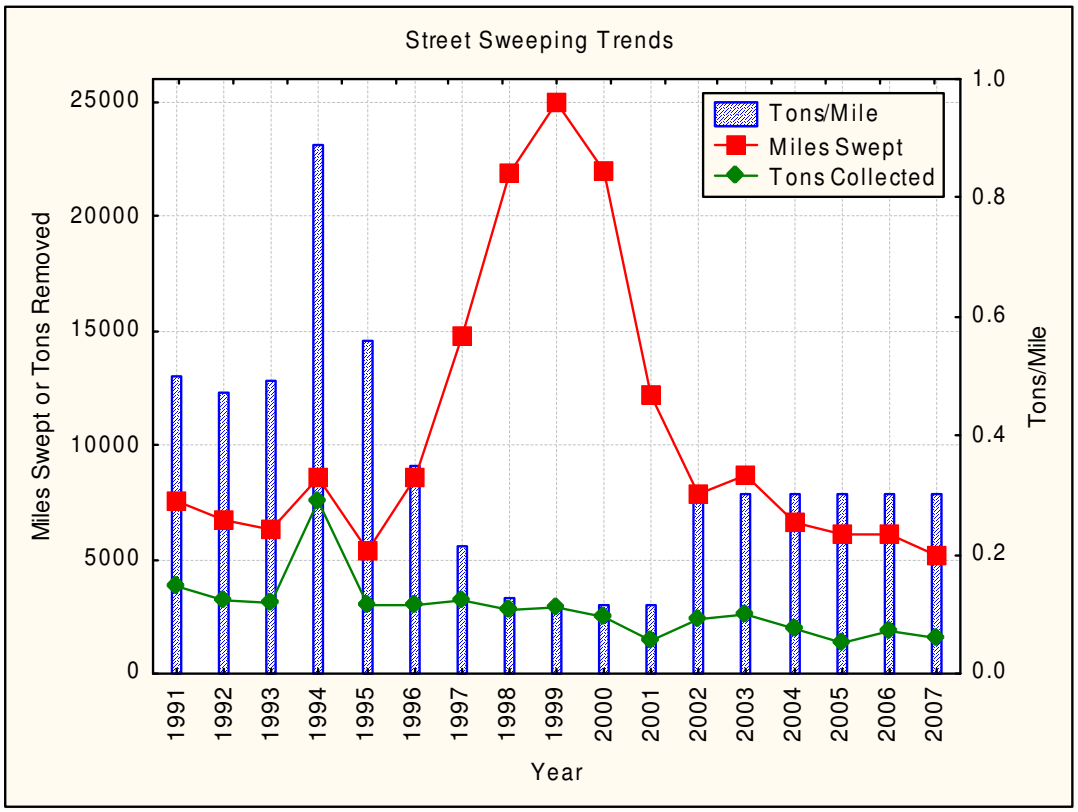


Figure 3-5: Miles of Street Swept, Tons of Material Removed and Tons/Mile Swept

3.4.2 Street Sweeping by Watershed

Utilizing the same methodology used to calculate Vac-Con pollutant removal rates, the reduction in pollutant loading attributable to the Street Sweeping Program was also quantified. The tonnage of material removed is reported on a countywide basis. In order to determine the material removed by watershed, it is assumed that the pollutant loading per pound of debris did not vary among watersheds or land uses. The street sweeping routes were digitized into a GIS map and then overlaid with the watershed boundaries to determine the proportion of swept miles per watershed. The tonnage of swept material per watershed was then determined by multiplying the total tonnage by the proportion of miles in each watershed. The results are displayed in Table 3-6. The breakdown into watersheds is based on the actual miles available for sweeping, without regard to the number of repeat visits.

Table 3-6: 2007 Street Sweeping Program – Tons Removed from Watersheds

Watershed	Route Miles (1 circuit)	Percent of Total Miles	Tons Removed
Upper Western Shore Watersheds			
Deer Creek	0.0	0.0	0.0
Prettyboy Reservoir	0.0	0.0	0.0
Loch Raven Reservoir	142.8	11.5	177.1
Lower Gunpowder Falls	78.8	6.4	98.6
Little Gunpowder Falls	17.0	1.4	21.6
Bird River	72.6	5.9	90.9
Gunpowder River	7.7	0.6	9.2
Middle River	27.2	2.2	33.9
Totals for UWS	**346.1**	**28%**	**431.2**
Patapsco/Back River Watersheds			
Liberty Reservoir	6.9	0.6	9.2
Patapsco River	170.0	13.8	212.5
Gwynns Falls	321.4	26.0	400.4
Jones Falls	68.3	5.5	84.7
Back River	229.0	18.5	284.9
Baltimore Harbor	93.8	7.6	117.0
Totals for Pat/Back R.	**889.4**	**72%**	**1,108.8**
Totals	**1,235.5**	**100%**	**1,540**

Unlike the Vac-Con program, the exact location where the material is collected is not known. A basic assumption was made that material swept from the county's streets was the same, as far as pollutants are concerned, to the material that washes off the streets and into its storm drains. Using the preliminary pollutant concentrations from the on-going Street Sweeping- Inlet Cleaning study, the distribution of pounds of pollutants removed in 2007 from each of the major watersheds in the County were calculated and are shown in Table 3-7.

Table 3-7: 2007 Street Sweeping Program Pollutant Removal (Pounds)

Watershed	TN	TP
Upper Western Shore		
Deer Creek	0.0	0.0
Prettyboy Reservoir	0.0	0.0
Loch Raven Reservoir	646.9	250.8
Lower Gunpowder River	360.1	139.6
Little Gunpowder Falls	78.9	30.6
Bird River	332.0	128.7
Gunpowder River	33.6	13.0
Middle River	123.8	48.0
UWS Totals	**1,575.3**	**610.8**
Patapsco/Back River		
Liberty	33.6	13.0
Patapsco River	776.1	300.9
Gwynns Falls	1,462.4	567.0
Jones Falls	309.4	119.9
Back River	1,040.6	403.5
Baltimore Harbor	427.3	165.7
Patapsco/Back R Totals	**4,049.5**	**1,570.1**
Annual County Totals	**5,624.8**	**2,180.9**

3.4.3 Program Summary - Street Sweeping

From 1991 to 2007, the Street Sweeping program removed almost forty-eight thousand five hundred tons of debris from Baltimore County streets (Table 3-5). Without this program, this debris would have entered waterways.

The Street Sweeping program appears to have reached a maintenance level and now needs to be evaluated to determine where the most significant amounts of sediments are consistently collected. The number of times each route is swept each year, the land use, and other variables need to be factored into the program to increase its efficiency.

Both the Vac-con and Street Sweeping programs make a contribution to the County's overall goal of reducing sediment and other pollutants, including toxics and nutrients that enter the waters of the State. The tonnage collected by the street sweepers and Vac-Con trucks is not just pollutant-laden sediment, but includes significant amounts of paper, plastic, glass, wood, aluminum cans, and metal objects. During rainy weather the lighter, more floatable debris gets washed into the storm drains to be removed by the Vac-Con program instead of by the street sweepers.

3.5 Household Hazardous Wastes (HHW)

Household Hazardous Wastes are specifically exempted from the Maryland State Recycling Act. The Household Hazardous Waste Recycling Program was initiated by Baltimore County DEPRM in response to numerous requests from County citizens and elected officials concerned with disposal of hazardous wastes from their own homes.

Baltimore County citizens can drop off household hazardous waste materials for recycling or proper disposal at a permanent processing facility located at the Eastern Sanitary Landfill Solid Waste Management Facility. This facility is operated by DEPRM, in cooperation with the Department of Public Works (DPW), Monday through Saturday, from April through November. Materials dropped off for processing include unwanted household chemicals, such as paints, flammable cleaning solvents, automotive fluids, pesticides, pool chemicals, acids, mercury thermometers, gasoline, corrosive material, etc. Table 3-8 provides a listing of material collected and amounts since 1998. DEPRM holds two one-day collection events annually, in the spring and fall, at different locations around Baltimore County.

Table 3-8: Household Hazardous Waste Recycled (2002-2007)

Material Type	2002	2003	2004	2005	2006	2007	Total*
Total Liquids (gal)							
Flammables	5,830	3,685	9,570	8,910	9,130	7,495	58,425
Ammonia	10	5	2	7	22	5	81
Corrosive	550	495	**	**	**	**	2,860
PCBs	0	0	0	0	0	0	165
Gasoline	2,203	2,393	2,914	2,043	2,727	2,202	20,320
Motor oil	110,149	93,251	100,735	93,277	85,565	86,055	845,784
Antifreeze	4,100	5,815	5,874	5,378	4,214	6,808	47,363
Paint (Latex)	6,036	5,815	14,480	16,060	12,685	12,445	79,506
(liquid) totals	128,878	111,459	133,575	125,675	114,343	115,010	1,054,504

Material Type	2002	2003	2004	2005	2006	2007	Total*
Total Solids (lbs.)							
Corrosive	**	**	5,250	5,744	8,860	8,740	28,594
Pesticides	12,458	8,930	14,140	16,150	13,630	18,256	62,176
Batteries (auto)	0	280,000	294,300	160,920	358,040	219,640	1,032,900
Batteries (rechargeable)	***	***	***	***	***	578	578
Cylinders (propane)	0	79,480	38,980	29,720	42,420	28,660	139,780
Mercury	25	168	125	50	40	112	327
Reactives	35	10	40	15	19	15	89
Toxics	65	40	360	105	14	199	773
Oxidizers	385	459	1,240	1,985	1,422.5	1,664	6,312
Freon	***	***	***	***	***	923	923
(solids) totals	12,978	369,091	354,505	214,714	424,446	278,787	1,272,452
Total Solids (number of items)							
Fluorescent Light bulbs	***	***	***	***	***	2,564	2,564
Ammunition (rounds)	***	***	***	***	***	1,011	1,011
(solids) totals	***	***	***	***	***	3,665	3,665

Table 3-8 (cont.): Household Hazardous Waste Recycled (2002-2007)
* Includes 1998-2001, which are not shown on table.
** Corrosives changed from reporting in gallons to pounds in 2004
*** Not recorded for these years

Motor oil remains the most abundant and frequently recycled household hazardous waste. Motor oil and antifreeze are recycled throughout the County at drop-off facilities operated by the Baltimore County Department of Public Works (DPW), in cooperation with the Maryland Environmental Service (MES). Statistics for recycled motor oil and anti-freeze for all participating collection facilities have been reported since 1991. DEPRM provided assistance in establishing the motor oil and antifreeze recycling program at the DPW facilities. County drop-off sites include landfills, transfer stations, two rural DPW Highways shops. The Bowley's Quarters Marina also is a collection site for this program.

The various industries that reuse the materials, recycled oils and metals in particular, pay the market-based price for them. Because the material is essentially donated by people that recycle, the current rates generate sufficient revenue to pay the administrative costs of the program, which is facilitated by Maryland Environmental Service (MES). Individual commercial facilities that do not participate in the program, such as garages, gasoline stations, and tire and auto centers, are not included. They are typically paid directly by scheduled collectors.

Figure 3-6 displays the estimated statistics for recycled combustibles, gasoline and pesticides. After three years of steady increases, the amount of recycled gasoline has remained relatively steady in a range of 2,000 to 3,000 gallons per year. The amount of pesticides recycled declined in 2003, however, this could be due to the cancellation of the fall collection event caused by hurricane Isabel. Similar reductions in toxic materials, corrosives, latex and solvent-based paints

were also attributed to the cancellation of the same event. The 2005 collection results in an increase in pesticides collected to its highest level, 16,150 pounds.

Flammables had shown an increase each year until 2003, when amounts declined significantly, by 2,145 gallons. These decreases were also the result, at least in part, to the cancellation of the fall event due to hurricane Isabel. Paint sludge is now bulked together into the same drums with other combustible material and labeled as flammable. These categories were first combined for the 2002 report, making that year the largest amount recycled so far. In previous reports, these two materials were reported separately. This explains the dramatic increase in flammables recycled in 2002. The greatest volume, 9,570 gallons, was recycled in 2004 with a slight decrease in 2005 to 8,910. For 2007, the totals for all three categories declined.

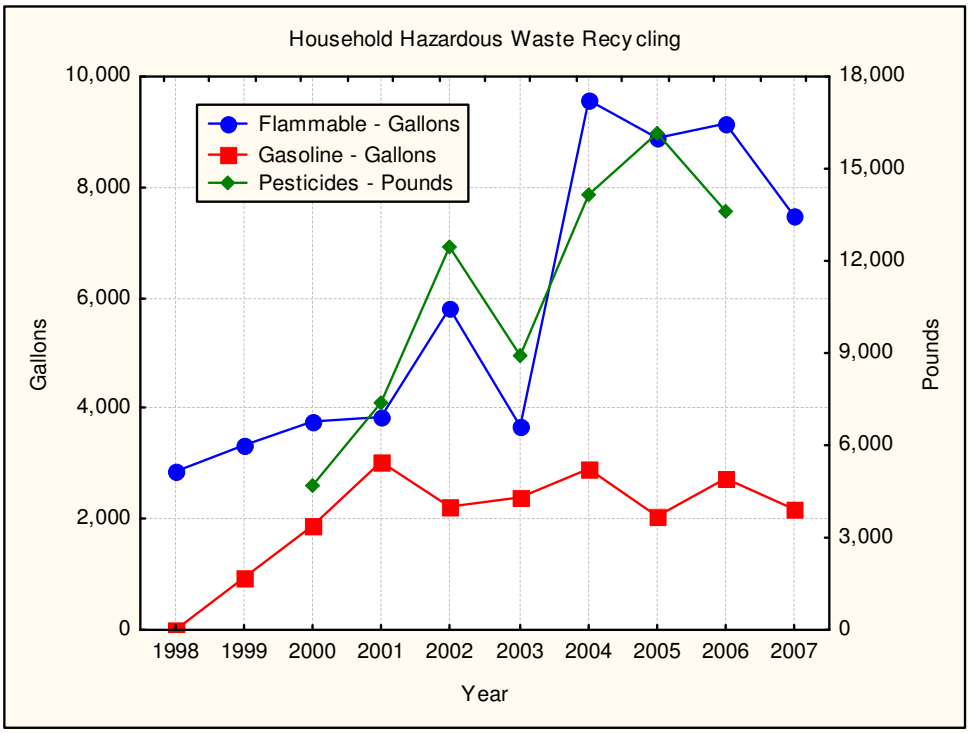


Figure 3-6. Household Hazardous Waste Recycling of Flammables, Gasoline, and Pesticides.

Mercury was added to the list of solid wastes in 2001, showing a steady increase from 20 pounds in 2002 to a peak of 168 pounds in 2003. An increase to 112 pounds this year has occurred after several years of decline from the 2003 peak. There are mercury TMDLs for the Prettyboy, Liberty and Loch Raven Reservoirs and this program helps to meet that criteria.

Oil and antifreeze recycling is reported through Maryland Environmental Service, local government, and private facility partnership efforts. Additional unreported recycling of oil and anti-freeze occurs through a network of 65 private sector collection centers across the County, most of which are neighborhood gas/service stations. As can be seen in Figure 3-7 the recycling of motor oil has been around 100,000 gallons since 1998, holding steady for 2007 at 86,055 gallons. A total of nearly 1.5 million gallons of motor oil has been collected for recycling since 1991. The annual volume of recycled anti-freeze, as shown in Figure 3-7, is typically between 4,000 to 5,000 gallons. Following an initial increase in 1992, antifreeze amounts reached this

average by 1993. 2007 was the exception with an increase to 6,808 gallons. Over 80,600 gallons of anti-freeze have been recycled in Baltimore County since 1991.

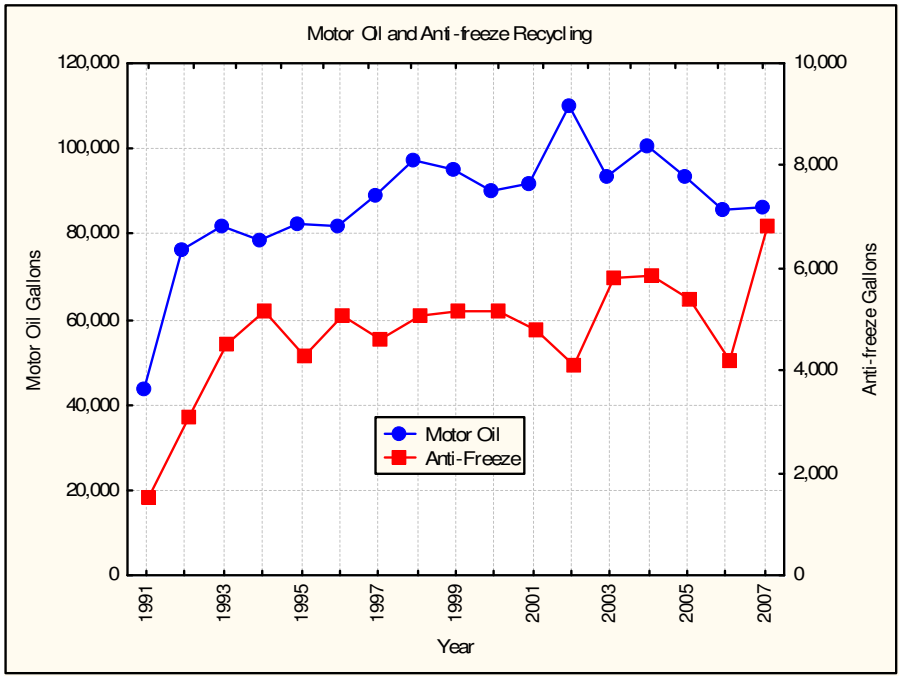


Figure 3-7. Waste Oil and Anti-freeze Recycled from 1991 through 2007

As evidenced by the continued citizen participation, DEPRM's recycling program for Household Hazardous Wastes continues to be a successful program. The contribution to reducing nonpoint source pollution remains significant.

3.5.1 Recycling Program Summary

Baltimore County, through its recycling programs, has made steady progress in reducing toxins in the environment through the DEPRM Hazardous Household Waste Recycling Program and in diverting recyclable materials from landfills through the Maryland State Recycling Act (MRA) solid waste recycling program.

Baltimore County's Recycling Program has achieved significant progress and continues to be a success story of state and local governments working in partnership with private citizens and local businesses. For 2007, 28,856 tons of paper and 7,274 tons of plastic, aluminum, and glass bottles were collected.

3.6 Fertilizer, Pesticide, and Deicing Statistics

Members of the Baltimore County NPDES Management Committee have submitted statistics for usage of fertilizers, pesticides and deicing materials. Quantities of fertilizers and pesticides are reported in pounds, tons, gallons, and ounces. All results have been converted to pounds for this report. Fluid measure is assumed to have a density of 7.0 pounds per gallon. The statistics for 2007 by individual agencies are presented in Table 3-9. The amounts used by the entire County are presented in Table 3-10.

Among the County agencies that fertilize and use pesticides, golf courses are consistently the biggest users of these materials. Deicing materials are also used throughout County agencies.

Logically, because of its responsibility to clear roads, the DPW– Bureau of Highways remains the biggest user of deicing materials. In 2007, the Bureau of Highways accounted for 99.6% of the deicer material used.

Table 3-9: 2007 County Agency Fertilizer, Pesticide and Deicing Materials Use (lbs.)

Agency	Fertilizer	Pesticide	Deicing
Golf Courses:			
Diamond Ridge	36892.6	5,070.9	0
Greystone	460	388.1	25
Gunpowder Falls	10,615	2,088	0
Rocky Point	29,745	10,610	0
Longview	582	3,713.9	0
Woodlands	46,138	5,619.2	0
Golf Course Totals	**124,433**	**27,490**	**25**
Catonsville Comm. Coll.	300	14	160,500
Essex Comm. Coll.	2,000	72.3	59,000
Dundalk Comm. Coll.	2,000	20	85,520
County Public Schools	1,500	576.1	66,800
Bureau of Utilities	0	25	0
Bureau of Highways	0	2,100	156,184,406
Recreation and Parks	2,000	166.6	133,800
Non-Golf Course Totals	**7,800**	**2,974**	**156,690,026**
Totals Pounds =	**131,191**	**26,362**	**156,690,026**

Table 3-10 shows the annual usage of fertilizer, pesticides and deicing material from 1999 through 2007. The 58 inches of snow in the calendar year 2003 resulted in the highest salt usage recorded. The amount of deicing materials used depends not only on snowfall but also the number of events.

Table 3-10: Annual Fertilizer, Pesticide and Deicing Materials Used By County Agencies (in Pounds)

Calendar Year	Fertilizer	Pesticide	Deicing Mat.	Snowfall (in.)	Number of Winter Weather Events
1999	275,400	34,320	83,978,000	12.4	8
2000	213,114	21,028	94,467,750	27.2	5
2001	221,609	21,509	48,566,400	7.4	4
2002	200,060	21,229	100,437,859	12.0	5
2003	191,726	22,137	205,164,341	58.0	6
2004	227,309	34,762	147,537,040	8.7	2
2005	133,881	20,899	185,118,740	24.5	10
2006	166,870	29,607	23,888,950	13.1	2
2007	131,191	26,362	156,690,026	14.4	7
Totals	**1,761,160**	**231,853**	**1,045,849,106**		

4.0 Permit Requirements

E.7. Public Education

A public education and outreach program shall be implemented to reduce stormwater pollutants. As part of this program, Baltimore County shall develop material and make it available for distribution to the public by watershed associations and at community events. These efforts are to be documented and summarized in the County's annual reports. At a minimum, Baltimore County shall:

a. Establish and publicize a compliance hotline for the public reporting of suspected illicit discharges, illegal dumping, and spills.

b. Provide information regarding the following water quality issues to the general public:

   i. Water conservation;
   ii. Stormwater management facility maintenance;
   iii. Erosion and sediment control;
   iv. Household hazardous waste;
   v. Lawn care and landscape management (e.g., the proper use of herbicides, pesticides, and fertilizers, ice and snow removal, cash for clippers," etc.);
   vi. Litter control, recycling, and composting;
   vii. Car care, mass transit, and alternative transportation;
   viii. Pet waste management.

c. Provide information regarding the following water quality issues to the regulated community:

   i. NPDES permitting requirements;
   ii. Pollution prevention plan development;
   iii. Proper housekeeping; and
   iv. Spill prevention and response.

4.1 Introduction

Baltimore County DEPRM has designated *environmental education (EE), outreach, action,* and *stewardship through partnerships,* as high priorities in its suite of services to citizens. The County's integrated watershed approach to resource management and its intention to work with and support local citizen watershed organizations, offers many opportunities for effective community partnerships. Baltimore County DEPRM's *Let's Be Partners* and *Getting Greener Schools* environmental education and outreach programs provide the coordination and focus for these efforts.

On June 28, 2000, the Chesapeake Bay Program adopted a new bay agreement, *Chesapeake 2000: A Watershed Partnership*. This document, designed to guide the Bay restoration efforts from 2000-2010, outlines a "rigorous" process of public participation. Recognized in 1997 and again in 2006 as a Chesapeake Bay Partner Community at the

Gold level, Baltimore County is committed to continue to improve, and expand its efforts to reduce stormwater pollutants through environmental education and outreach to the community.

As in past years, each component of the *Let's Be Partners/Getting Greener Schools* program carried the pollution prevention message. Special attention was given to the direct connection between the purchase, use, and disposal of household and commercial toxic materials, pesticides, herbicides, and fertilizers, landscape maintenance and cleaning procedures, pet waste, soil erosion, and water quality in local streams, drinking water reservoirs and the Chesapeake Bay. Emphasis was placed on cost-effective prevention over pollution regulation, structural controls, and cleanup. Recognizing the multiple benefits gained from planting projects (increased diversity, energy saving, erosion control, education and stewardship opportunities, scenic values, habitat restoration, recreation, etc), continued emphasis was placed on encouraging and facilitating the restoration of natural native vegetation on public and private lands for the inherent water quality benefit. In 2007, new school and community partnerships were created to facilitate public awareness, education and outreach.

Assessment of the County's multi-faceted outreach program is ongoing and guides the process of updating, improving, and enhancing program components. In 2007, following an assessment of program participation by schools and organizations, new initiatives were undertaken in targeted areas to broaden the geographic distribution of services. These included new and expanded community and school partnerships for environmental program planning; outreach to faith communities; expanded professional development opportunities; support for public school principals K-12, administration, supervisors, and landscape facilities managers; wider offerings on the County's webpage; new displays and GIS presentational materials; school maps and local data sets; student internships; environmental career events; and new handouts and brochures.

Increasingly, since 1995, this environmental education program has assisted individual citizens and families, students, teachers, school administrative staff and facilities managers, businesses, homeowners and apartment dwellers, and faith communities and other local organizations. Initiatives in 2007 identified and targeted specific populations, expanded cooperation with local watershed organizations, and developed new local and regional partnerships to better facilitate work in watershed communities. As a result of the *Baltimore Watershed Agreement* first signed by Baltimore County and Baltimore City in October 2003, re-negotiated and signed on December 14th, 2006, an increasing number of Baltimore County's environmental education initiatives have extended across political boundaries into watersheds shared with Baltimore City.

As part of its successful *Maryland Green School* program initiative: *Getting Greener Schools,* Baltimore County continued to use *The Maryland Green School Awards Program* to provide a framework for integrating environmental learning and community involvement in local schools. DEPRM maintained its statewide leadership in this initiative and expanded its effort to target schools in the 2007-08 school year and beyond. DEPRM's workshops and site-based support for teachers provided local and regional resources to enhance staff development opportunities and increase the environmental awareness and interest of local school principals, teachers, and facilities managers.

Baltimore County's 33 recognized *Maryland Green Schools* and *Green Centers* provided important models for environmental awareness and community stewardship.

Long term partnerships with established local *Green Schools,* recognized *Maryland Green Centers* and other organizations and agencies such as the *Maryland Association for Environmental and Outdoor Education (MAEOE), the Herring Run Watershed Association (HRWA), The Irvine Nature Center, The Gunpowder Valley Conservancy,* and the *Jones Falls Watershed Association (JFWA)* brought expertise, technical support, volunteers and stakeholders to assist schools and citizens as they explore water quality issues, discuss stewardship opportunities, and make plans. *Small Watershed Action Plans* (SWAP) involve citizens and stakeholders in identification of activities and projects that will improve local water quality.

These partnerships with citizens and community groups resulted in sustained volunteer participation involving donations of time and materials. Increasingly, citizens and organizations volunteered to take the *Let's Be Partners* and *Getting Greener Schools* materials for use at their community festivals, events, and meetings and to share with their local schools. To heighten environmental awareness among homeowners during the spring planting season, the County again joined with the Alliance for the Chesapeake Bay (ACB) and the Towson Gardens Day Committee (TGD) to present BayScaping recognitions to citizens and organizations that model functional conservation landscaping and maintenance techniques. The popular *Growing Home Campaign*, a partnership between the county and local businesses to promote the planting of trees on private property, was expanded.

New planning partnerships with local faith communities involved the Christian community's *Chesapeake Covenant Congregations* (CCC) initiative and the Jewish community's *Baltimore Jewish Environmental Network of Synagogues* (BJENS). Both the CCC and BJENS are working to identify specific goals and objectives with the intent of encouraging congregations and their affiliated schools and organizations to commit to environmental stewardship in "caring for creation."

To underscore its commitment to promote meaningful environmental education, DEPRM holds a board position in The Maryland Association for Environmental and Outdoor Education (MAEOE) and county staff takes a leadership role at the state level serving as chair of the MD Green School committee.

In January 2005, Baltimore County Executive James T. Smith, Jr. announced *Green Renaissance*, a series of cutting-edge environmental initiatives to insure the protection of natural resources through collaboration with communities, businesses, government agencies, environmental groups, and the development community. Baltimore County's education and outreach activities, including its *MD Green School* initiatives, *Growing Home Campaign*, and *Tree-Mendous Program* in Baltimore County support *Green Renaissance* goals and objectives.

In 2007, environmental education program activities were accomplished by one part-time staff person working approximately 33 hours/week. Other DEPRM staff members, staff from other County agencies, student interns, citizen volunteers, and program partners provided additional assistance.

The *Let's Be Partners/Getting Greener Schools* education program, as well as other ongoing outreach efforts initiated by DEPRM, and all supporting materials developed or used in the program to date have been fully described and exhibited in previous NPDES Annual Reports 1995-2006. The following section introduces new or expanded components and initiatives; describes the 2007 program implementation; outlines the roles played by program partners; discusses public response and the results of program evaluation/assessment; and suggests actions to update materials, expand certain successful components, and develop new initiatives.

4.2 Program Description

4.2.1 Baltimore County DEPRM's Environmental Education Programs

"Let's Be Partners...Water Pollution: What We Can Do To Reduce and Prevent It"
"Getting Greener Schools" The MD Green School Program in Baltimore County

New or Expanded Program Components: In order to increase effectiveness and deliver the pollution prevention message to a wider audience, the following initiatives were developed or expanded:

4.2.1.1 School Initiatives

Support for all schools: To provide for professional development and enhance opportunities for high quality, effective, authentic environmental education and community stewardship at public and private schools Pre K-12 in Baltimore County, DEPRM provided the following:

Staff development: In 2007, DEPRM participated in approximately 70 sessions and presentations at training workshops for staff development held in Baltimore County and in the region. Topics included *The MD Green Schools Program*, *Envirothon*, schoolyard landscape design for water quality enhancement, schoolyard habitat restoration, schoolyard maintenance protocols, conservation landscaping components, invasive species removal, and developing partnerships for stewardship. In cooperation with BCPS Office of Science, site-based assistance and training was also provided for teachers in use of technical equipment, enhancement of field skills, identifying and strengthening curriculum connections, and developing lesson plans and timelines. Emphasis was placed on using the environment as a context for learning across grade levels and disciplines. Teacher training was accomplished at statewide and regional conferences including the North American Association for Environmental Education (NAAEE), the Association of Independent MD Schools (AIMS), The National Science Teacher's Association (NSTA), Irvine Nature Center's Habitat Stewards Training, and The MD Association for Environmental and Outdoor Education (MAEOE).

As described in the 2006 report, "From My School to the Bay…A Chesapeake Bay Watershed Adventure" was a major initiative in the summer of 2005. Recognizing the critical role that principals play in how their school interacts with community, in 2007, DEPRM enhanced its partnership with the BCPS Office of Science, Chesapeake Bay Trust, and the Irvine Nature Center to follow-up on this professional development experience in environmental education for the principals of 25 local schools. Goals of the initiative were to (1) garner "top-down, administrative buy-in" for site-based, experiential

education that uses the environment as an integrating context for learning, (2) show how the school building and landscape can model best management practices, and (3) demonstrate how community partnerships can enhance learning. There is significant indication that the effort was a success in jumpstarting more effective and sustained environmental education in schools. Four of the schools that participated in 2005 submitted successful Green School applications in 2006. A number of others initiated the process. Of these, Norwood ES, Logan ES, Dundalk ES, plan to apply in April 2008 or 2009.

The following workshops and events targeting educational staff are currently being planned for 2008-09:

With Irvine Nature Center: Habitat Stewards Fall 2008, 09.

With BCPS, Schoolyard Habitat for elementary, middle and high schools, Green Schools curriculum development summer 2008-9; AP Environmental Science.

With MAEOE, 2008 and 2009 conference workshops and short sessions, mentoring for prospective Green Schools, pre-application review sessions, displays.

With MAEOE, St Paul's School for Girls and The Jemicy School: The Association of Independent Maryland Schools (AIMS) Conference for private schools; special topic workshops.

With BCPS, MAEOE conference sessions and workshops, and a conference track for principals and administrative staff;

With MAEOE, training sessions for nature centers and outdoor schools in 2008-9.

With parochial schoolteachers, workshop at the annual conference for Catholic schoolteachers in the Archdiocese of Baltimore, fall 2008.

With MSDE and MAEOE, workshop for principals at their annual meetings in August 2008 or 2009.

With MAEOE, a series of workshops with the Howard County Conservancy.

<u>Planning and assessment tools</u>: DEPRM provided over 100 enhanced aerial photographs for site analysis of school properties and the surrounding neighborhood. All were titled to highlight the school's "watershed address." These GIS products, rolled or mounted on foam core board, displayed watershed boundaries, land use, streams, riparian buffer zones, forest cover, impervious surfaces, soils, and/or topography. They were designed for planning and display purposes and were provided at no cost to the schools. DEPRM, in cooperation with BCPS, the Forestry Board, the DNR, and local universities and watershed organizations, provided additional technical support and assessment tools. For school and schoolyard assessments, DEPRM provided copies of the DNR's *Check-up for Schools.* The latest edition is expanded to include assessment for schoolyard habitat.

DEPRM provided copies of the USFW publication *Native Plants for Wildlife and Conservation Landscaping* to schools as a reference guide for planning school and community habitat restoration projects. DEPRM also provided *Plant Invaders of Mid-*

Atlantic Natural Areas for distribution to schools and communities interested in (1) identifying troublesome plants and (2) using environmentally sound prevention and control methods, and (3) identifying appropriate native plants for installation following removal of invasive plants. Other fact sheets and brochures were made available upon request.

Presentations, demonstrations, and demonstration sites: PowerPoint, interactive events, and demonstration programs were conducted for teachers, students, and principals for the purpose of highlighting opportunities and inviting discussion. To promote more sustainable landscape improvements on school properties and enhance water quality in local streams, DEPRM developed PowerPoint presentations highlighting the process of identifying opportunities to act, how to establish partnerships to assist in accomplishing projects, and how to engage school administrations and facility managers. Additional topics such as Integrated Pest Management (IPM), BayScaping with Native Plants, Schoolyard Habitat Restoration, Controlling Invasive Plants, Water Quality Monitoring, Exploring Environmental Careers, and other titles were also made available. For schools interested in adopting the *MD Green School* model, staff provided information and guidance for school administration, faculty, PTA, and students. Information was provided to potential program partners for schools, such as local colleges and universities, garden clubs, scout troops, watershed organizations, faith communities, and businesses. These programs served as models for other counties and states in the region.

The DEPRM BayScape demonstration garden outside their Baltimore County Courthouse office (Figure 4-1) was maintained as a visible demonstration of conservation landscaping. For several years, Baltimore County DEPRM has provided funding for planting stock and mulch applications.

Figure 4-1: DEPRM staff members volunteered time for maintenance of DEPRM's demonstration BayScape garden. This garden demonstrates how native plants can be used effectively in the more formal landscape settings that are often available in urban and suburban communities.

Special school events, service learning, internships, volunteering and other opportunities:

- Envirothon: DEPRM staff trained teachers from fourteen local public schools in preparation for this event; DEPRM developed and administered the testing component.
- Local school festival events: DEPRM provided interactive events for children and families highlighting environmental and watershed topics.
- Environmental Career Exploration: DEPRM hosted or participated in elementary, middle and high school level career fairs. Several paid internships were made available for students at targeted local high school and college students. The internship opportunities at DEPRM allowed students to work with resource professionals, gaining valuable experience in watershed planning and monitoring, GIS, education and outreach, environmental health, ground water and stormwater management, and agricultural preservation. Due to the program's success, it will be continued in 2008.
- In 2007, DEPRM staff supported numerous internships that provided opportunities for broad employment experience, volunteerism, and service at events and activities hosted by the department and its watershed partners. Some of the activities/venues included: data collection, watershed festivals, school and faculty presentations, tree plantings, Project Clean Stream, Maryland Green Schools Programs, and working with local watershed organizations.

- Capital Projects near schools: DEPRM encouraged and facilitated school awareness and participation in DEPRM's capital projects to enhance water quality.
- MD Green Schools in Baltimore County: DEPRM provided ongoing program support for special programs hosted by Baltimore County's recognized Green Schools. Successful school events such as BayDays at Hereford Middle School, Field Day at Sparks Elementary, and Earth Day and World Water Monitoring Day at Towson High School are used as models. Many of the county's 31 recognized MD Green Schools served as mentors to other schools in the county and region. Teachers at Sparks ES, Hereford MS, and Towson HS continue to take the lead in these efforts.
- DEPRM fostered partnerships between schools, local watershed organizations, businesses, and the community to increase participation by DEPRM's program partners.
- DEPRM assisted with Chesapeake Bay Trust grant writing.
- DEPRM assisted in the preparation of *MD Green School*, *DNR PLANT* Award and other awards and recognitions.
- GIS maps: DEPRM provided GIS aerial maps and site analyses of local schools for the purpose of watershed awareness, landscape analysis/assessment and development of a plan for resource management and demonstrations on the sites.
- Program model: DEPRM presented the MD Green School program model at the 2007 MAEOE Conference, at the North American Association for Environmental

Education (NAAEE), and for other states: Delaware, West Virginia, Virginia, North and South Carolina.

Books, materials: DEPRM provided technical assistance, projects lists, plant lists, enhanced aerial photography of school properties and their watersheds, planting guides, site-assessment tools, Green School applications/information, posters, videos, and books. All materials obtained or developed to assist schools are made available upon request and at no charge.

Networking: DEPRM provided assistance in locating programs and resources, contacts for planting stock, mulch, funding, technical support, partnerships, and other assistance.

Information about the *Green Schools/Green Center* program: DEPRM conducted programs to introduce the *MD Green School/Green Center* model, provide professional development, find community partners, help with preparing applications, and provide assistance in *Green School* projects and activities. DEPRM assisted with facilities communication concerning planned schoolyard habitat and stormwater management projects on school properties. Staff assisted the Pearlstone Center, Marshy Point, Parks and People Foundation, and many local schools including St. James Academy, McDonogh MS, Prettyboy ES, and St. Paul's School for Girls with their 2007 Green School/Center applications. Website access to program information was maintained on the county site and with a link to www.maeoe.org.

Recognition: DEPRM provided recognition for schools and individuals that were involved in responsible environmental actions and that served as models in their community. In 2007, the recognitions included *MD Green School* and *Green Center* awards, Towson Gardens Day awards, Green Renaissance awards for the County's Green Schools and Green Centers, County Executive Proclamations, and in cooperation with DNR, Governor's Citations. A large laminated map identifying and highlighting all the *MD Green Schools* in Baltimore County was provided for exhibit in the DEPRM lobby, the offices of BCPS Office of Science and the Baltimore County Superintendent of Schools, and at public presentations at schools and organizations around the County.

Three nominations for special award recognitions are particularly notable. To acknowledge outstanding contributions by individual teachers at Baltimore County *Green Schools*, Mr. John Sandkuhler of the Forbush School at Sheppard Pratt (Figure 4-2) was nominated for the *2007 Chesapeake Bay Trust Teacher of the Year* at the high school level. Ms. Elizabeth Fair from Sparks ES was nominated at the elementary level by her principal. Both teachers received top honors and were formally recognized at ceremonies in Annapolis and at the MAEOE Conference in February 2007 in Ocean City, MD.

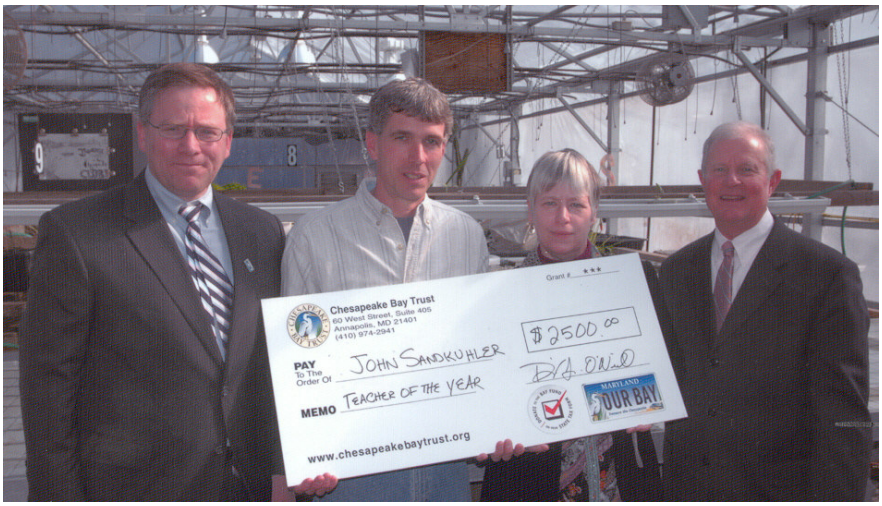


Figure 4-2: Baltimore County Executive James T. Smith, Rebecca Bell (MSDE), and David O'Neill (CBT) join John Sandkuhler of the Forbush School at Sheppard Pratt in Towson. Baltimore County nominated Mr. Sandkuhler for recognition as the 2007 Teacher of the Year at the high school level.

Mr. Gene Flanagan of the Rosedale Alternative School, received the *Tawes Award for a Clean Environment* for his remarkable work with at-risk youth and his activities to protect and restore County watersheds. All three of these teachers are leaders of environmental initiatives at their schools and work to enhance opportunities for environmental education. John Sandkuhler and Elizabeth Fair mentor other schools and assist Baltimore County in promoting the MD Green School model.

Recognizing the importance of citing outstanding achievement in environmental education and stewardship, DEPRM continues to explore award opportunities and promote and submit names for local awards such as the DNR's PLANT community award, Tawes Award for a Clean Environment, School Facility Manager of the Year, CBT Teacher of the Year, and the annual Bob Finton Award for outstanding non-classroom environmental educator.

Support for stewardship projects: In 2007, DEPRM highlighted tree-related topics at over 90 school and community presentations. Services provided included: site assessments, assisting with planting projects and removal of invasives, conducting environmental education programs about the benefits of trees, teacher training, leading planting demonstrations, providing technical assistance with species and site selection, funding opportunities, providing tree order delivery at no cost to schools, and $10 citizen discount coupons through the county's *Growing Home Campaign.* DEPRM assisted in planning and advertising local stewardship projects such as Project Clean Stream hosted by the Alliance for the Chesapeake Bay. Students and scouts potted seedlings at the County's nursery. Baltimore County's 31 Green Schools received a 1:1 match on all DNR Tree-Mendous Maryland tree orders.

Green Schools in Baltimore County:

As instituted in 1999, *The Maryland Green School Award Program* recognizes schools that (1) use the environment as an integral part of the

instructional program, (2) model conservation best management practices (BMPs) in the school building and grounds, and (3) address environmental issues through partnerships in the community.

Baltimore County leads the state in developing and recognizing model schools. As of April 2007, thirty-one public and private schools had attained *MD Green School* status. Baltimore County's *Green Schools* set an example for the community. They plan, implement, and maintain schoolyard and community projects that provide stormwater management, water conservation, sediment control, integrated pest management, and other water quality benefits. Table 4-1 provides examples of some the educational projects in which they have been involved. DEPRM works with potential *MD Green School*s to provide training, develop program, find community partners, and assist with projects.

Table 4-1: Examples of School and Community Environmental Education Projects Implemented by public and private Green Schools Located in Baltimore County

Environmental Learning Project	St Paul's School for Girls (2007)	Ruxton Country School (2007)	St. James Academy (2007)	Prettyboy ES (2007)	McDonogh MS (2007)
Site analysis	✓	✓	✓	✓	✓
Tree planting	✓		✓	✓	✓
Riparian planting	✓				
Bioretention planting	✓			✓	
Air pollution control		✓	✓		
Agricultural projects			✓		
Butterfly garden	✓		✓	✓	
Environmental issue investigation	✓	✓	✓	✓	✓
Native plants	✓		✓	✓	✓
Turf reduction	✓		✓	✓	✓
Water quality monitoring		✓		✓	
Energy Conservation	✓	✓	✓	✓	✓
Water Conservation					✓
Habitat restoration	✓	✓	✓	✓	✓
Litter control	✓	✓			
Outdoor learning structures/signs	✓	✓	✓	✓	✓
Recycling	✓	✓	✓	✓	✓
Environmental Celebrations	✓	✓	✓	✓	✓
Mentoring	✓				

The MD Green School Award Program provides a balanced framework for planning environmental learning, making the curriculum connections, and accomplishing pollution prevention on school landscapes. Recognizing the uneven distribution of *Green Schools* in the County previous to 2006, DEPRM explored new ways to promote and facilitate the integration of environmental learning and awareness in local schools Countywide by geographic and special population targeting. This initiative included special workshops

for independent schools. A map of MD Green School locations in Baltimore County 1999-2007 is provided in Exhibit 4-1.

In order to introduce the *MD Green School* concept and initiate the process, in 2007, staff met with school administration, teachers, and/or students of over 100 of the County's public and private schools. Follow-up meetings were held to select activities, identify BMPs, develop community partnerships, obtain technical support, identify resources, and in some cases, proceed through the award application process. Although several schools were working towards submitting a *Green School* application in the future, many schools were at "entry level." Staff and students were just beginning to explore ways to establish curriculum connections and enhance environmental education opportunities for all students at the school. A goal for 2008 through 2010 is that these schools be ready to consider application for *MD Green School* recognition. A long-term goal is to have all schools in Baltimore County operating as *Green Schools*, many receiving full recognition as a *MD Green School,* and all recognized *Green Schools* re-applying regularly to maintain their status. Additionally, all outdoor education facilities and nature centers should operate and be recognized as *Maryland Green Centers*.

In 2007, the *Getting Greener Schools* effort in Baltimore County involved enhanced program awareness and new partnerships working with students, staff, parents, and community partners at local schools as they planned and carried out the activities that must be documented in a *Green School* application. In May 2007, 1 new Green Center and 6 new Green Schools were recognized. They include: Prettyboy ES, Ruxton Country School, St. Paul's School for Girls, St. James Academy, McDonogh MS, St. Clare School, and the Pearlstone Center. DEPRM sustains a working relationship and continues to work with all Baltimore County's *Green Schools* and centers and will be ready to assist the any that are eligible for re-application in 2007 and 2008. In the coming years, several will have re-applied for the second time and will be eligible for "emeritus" status.

All newly awarded *Green Schools* received a *MD Green School* Flag, a Maryland Governor's Citation, and Baltimore County Executive Citation, a 5 ft native tree (courtesy of DNR Tree-Mendous MD), field guides for their classrooms, recycling bins, and other gifts. In addition, as long as *MD Green School* or *Green Center* status is maintained, the school or center may receive up to 50 free trees/year with free delivery in a 1:1 match incentive offer provided through cooperation of the MD DNR Tree-Mendous MD Program and DEPRM. This incentive, first offered in Baltimore County, is made available statewide for all schools and centers that maintain their *MD Green School/Green Center* status. Schools re-applying receive a plaque, citation, and other gifts. Schools re-certifying for the second time (sustaining their Green School operations for 8 years) received a limited series framed photograph with an environmental theme.

Many of Baltimore County's *Green Schools*, their staff and students, accepted DEPRM's invitation to participate as mentors at the 2007-8 MAEOE conferences and at upcoming staff development workshops. Following DEPRM's lead, MAEOE will send a letter of recognition to all school superintendents in Maryland to increase program awareness, and recognize the accomplishments of their newly awarded *MD Green Schools*.

In order to assure programmatic support for schools working to integrate environmental education across disciplines, a model for *MD Green Centers* was promoted. Nature centers and outdoor education facilities receive statewide recognition for efforts to support *Green Schools*, model conservation best management practices, and maintain community partnerships.

As of spring 2007, there are 16 recognized *MD Green Centers* in the state. The Irvine Nature Center located in Stevenson, MD, recognized as Baltimore County's first *Green Center*, was joined in 2007 by the Pearlstone Center in Reisterstown. Staff at these centers promote the *MD Green School* model, model best practices, host annual festivals and workshops, and provide services to Baltimore County and City schools. They assist Baltimore City and County public and private schools with *MD Green School* applications. DEPRM is currently working to promote the *Green Center* program to potential *MD Green Centers* in the County including Benjamin Banneker Park, the proposed Herring Run Watershed Association Education Center, Marshy Point Nature Center, and Oregon Ridge Nature Center. In recognition of the Baltimore County/Baltimore City Watershed Agreement, DEPRM assisted the Parks and People Foundation (Baltimore City) in their preparation to submit a *Green Center* application in 2006. This organization participates in a task force with the Irvine Nature Center and other stakeholders to promote sustainable operations and the Green School model in city schools.

This excellent program, *MD Green Schools/Green Centers*, as implemented in Baltimore County, raises environmental awareness among school administrators, facilities managers, teachers, students, parents, school neighbors, and nature centers. It promotes and rewards the implementation of conservation best practices, and environmental stewardship. Because of the prominent location of schools in all neighborhoods, *MD Green Schools* are highly visible models for other schools and the community at large. The federal Environmental Protection Agency (EPA), and surrounding states and jurisdictions (VA, DC, PA, WVA, DE, OR, WI, SC, NC) continue to explore this program as a program model for implementation. Further information about the *MD Green School/Green Center* program is available on the MAEOE website: www.maeoe.org or Baltimore County DEPRM's webpage at www.baltimorecountymd.gov/go/deprm. Statewide funding support is provided by MAEOE, MD DNR, Constellation Energy Group, and Recreation Equipment, Inc. (REI).

Leadership in MAEOE: MAEOE, with its broad-based membership, is the preeminent environmental education organization in the State of Maryland. It provides a forum for the exchange of information, sponsors the *MD Green School Awards Program,* the *Schoolyard Habitat Partnership,* maintains a website, and hosts an annual 3-day environmental education conference. This conference is the largest state-level environmental education conference in the

MAEOE
Maryland Association for Environmental and Outdoor Education

nation. MAEOE's primary mission is to provide professional development for classroom teachers and non-traditional outdoor educators. In 2007, it developed new initiatives to provide higher quality, more accessible environmental education for all students in Maryland. These include 1) the certification of non-formal environmental education teachers, and 2) partnering with other stakeholders to develop a state level environmental literacy initiative.

Because of Baltimore County's leadership and success in promoting environmental education 1999-2007, DEPRM has maintained a position on the governing board of MAEOE and staff chairs the *MD Green School* Committee. The organization brings together a wide variety of players from public, private, and non-profit sectors for the purpose of promoting environmentally literate and active schools and communities. Through its participation in MAEOE, Baltimore County has a voice in planning and directing the course of environmental education in Maryland. The county's success and leadership serves as a model for the State and other Maryland counties.

During 2007, working in committee with representatives from the MAEOE Board, DNR, the Chesapeake Bay Trust, classroom teachers and administrators, and representatives from environmental organizations around the State, the *MD Green Schools* program was reviewed and evaluated. Actions to streamline the application process, to identify additional incentives and awards, and to develop the capacity to sustain support for recognized *Green Schools* were accomplished. Locally, a partnership was forged whereby the BCPS Office of Science will lead a group to actively promote the *MD Green School* program for the 165 public schools in its system. A curriculum development committee was formed in cooperation with MSDE and BCPS to strengthen curriculum connections and align *Green School* activities with the Voluntary State Curriculum (VSC).

Other School initiatives:

<u>Outreach to faith-based school systems and organizations</u>: An evaluation of the geographic distribution of *MD Green Schools* and the number of independent schools partnering with the County, led to an initiative to reach out to faith-based schools Pre K-12. A series of presentations at the Association of Independent Maryland Schools (AIMS) Conferences were designed to reach these audiences.

Efforts were made to maintain a dialogue and provide support to Catholic schools operating as *MD Green Schools*. A series of meetings were held with the director of environmental education for Jewish schools and community centers in the County and Baltimore City. DEPRM served in an advisory role for planning environmental education and outdoor programs for Jewish school children and families at the Pearlstone Center near Reisterstown. DEPRM provided a Green School program display for the 2nd annual Jewish environmental festival and conference. As part of the Baltimore Jewish Environmental Network of Synagogues (BJENS) staff has been invited to participate in planning to encourage environmental stewardship and *MD Green School* activities at several schools in the Jewish community, including Krieger-Schechter Day School and the Beth Tfiloh High School. Teachers were encouraged to attend the 2008 MAEOE conference for professional development. As a result of these initiatives in 2007, the

newly recognized Green Center and Green Schools are predominantly faith-based or independent, rather than public.

Outreach to Private Schools and Local Colleges: In 2007, DEPRM targeted local colleges, universities, and those private schools and serving students with special needs as well as providing regular Pre K-12 programs. College and university participation involved classroom instruction, mentoring graduate students, summer workshops, and campus festivals. These activities increased environmental awareness, professional development, and local stewardship projects.

Because non-public schools operate as independent entities, efforts were made to reach individual schools to raise awareness about the environmental education opportunities available to them. In 2007, many were involved in schoolyard and community projects for habitat restoration or water quality enhancement. They hosted education programs and festivals. In fall 2006, DEPRM partnered with MAEOE and Jemicy School to provide a workshop for independent schools at the annual AIMS Conference (Association of Independent MD Schools). This conference is an annual event that draws broad participation from most of the independent schools in Maryland. As a direct result of this outreach effort, the County saw an increase in *MD Green School* applications from independent schools in April 2007.

Environmental Career Exploration and Internships: Again in 2007, students from targeted county high schools were offered paid summer internships working with DEPRM staff. Additional internships were provided for several college students. An effort was made to provide a varied set of experiences including: GIS mapping, stream monitoring, site assessment and field work, environmental education and outreach experience, policy development, and work on agricultural and environmental health projects. DEPRM staff provided environmental career information and ”practice” interviews at numerous school career fairs around the county. To support these efforts and promote environmental careers, DEPRM used two fliers on the topics: internship opportunities, an introduction to environmental careers, job titles, and suggested coursework. “Take Your Child to Work Day” was celebrated in late April as an opportunity to introduce young people to environmental careers.

4.2.1.2 Outreach to Homeowners, Citizen Groups, Businesses, and Landscape Managers

Through workshops, presentations, community meetings and festivals, contact with chambers of commerce, local coalitions, and individual businesses and trade associations, DEPRM sought voluntary commitments to the adoption of best practices and alternative landscape design and maintenance protocols to reduce the flow of pollutants to local waterways, drinking water reservoirs and the Chesapeake Bay. Citizens were reached through multi-media presentations in a variety of settings in an effort to encourage the planning and installation of functional sustainable landscaping. Through DEPRM’s Growing Home Campaign and participation on the Urban Nutrient Management Workgroup, and the Chesapeake Conservation Landscaping Coalition, the department has access to representatives in the lawn care and nursery industries and the opportunity to contribute to presentations at trade shows and training workshops for these audiences. Increasingly in 2007, DEPRM took every opportunity to work through coalitions to affect

policy decisions and strategic planning that will result in long term goals and objectives related to environmental protection and resource management.

Green Renaissance: In early 2005, the Baltimore County Executive announced the *Green Renaissance* Program. It involves a series of environmental initiatives to ensure the protection of natural resources through increased collaboration with communities, businesses, government agencies, environmental groups, and the development community. Actions and initiatives included adopting the *Montreal Process-Criteria and Indicators* to develop a strategy for forest sustainability, the *Growing Home Campaign*, and the *Rural Residential Stewardship Project*. The goal of these efforts, supported by Chesapeake Bay Small Watershed Grants, is to educate smaller-lot rural residential owners about their role as "managers" of common forest and stream systems, implement reforestation projects through the Rural Residential Stewardship Project and to develop and implement a program to increase urban forest cover using market incentives through the *Growing Home Campaign*. Other major components of *Green Renaissance* will involve an enhanced land preservation strategy and water quality/watershed management program.

The *Maryland Green School Program* in Baltimore County is aligned with the *Green Renaissance* goals and objectives. In June 2006, the Baltimore County Executive invited principals, teachers, and students from the County's *Green Schools* and *Green Centers* to a garden reception. *Green Renaissance* citations were presented in recognition of their leadership and accomplishments. The County's Office of Communications arranged for media coverage. This event will be repeated in June 2008.

Conservation and Sustainable Landscaping information: DEPRM continued its literature distributions at educational events, festivals, the County's public libraries, schools, Department of Permits and Development Management, and DEPRM's lobby. In addition, BayScapes color brochures were distributed by DEPRM's Environmental Impact Review, Critical Areas, and Marina sections. This brochure is provided in cooperation with The Alliance for the Chesapeake Bay (ACB).

DEPRM distributed copies of five environmental publications for citizens and organizations "Native Plants for Wildlife Habitat and Conservation Landscaping", "Plant Invaders of Mid-Atlantic Natural Areas", the *"Growing Home"* program brochure, and "From My Backyard to the Bay", and "Choosing a Lawn Care Company". These were made available to citizens, County libraries, schools, and community groups.

DEPRM and the Alliance for the Chesapeake Bay sponsored the annual BayScaping awards as part of the 2007 Towson Gardens Day Festival. Two awards were presented. One award was presented to a local homeowner who has established native plantings on two properties. A second award was presented to the Maryland Presbyterian Church in Towson for its stewardship of several acres of church property (removal of invasive plants, re-establishment of native trees, stormwater and erosion control, raingardens, and other activities). The awards included a framed certificate, a native shrub, species description, planting instructions, and a BayScaping color brochure. In addition to the community award presentation, Towson Gardens Day in April was designated "Arbor Day in Baltimore County" by the reading of an official County Executive Proclamation.

DEPRM hosted a tree planting and conservation landscaping display, provided information and printed literature, and gardening advice for citizens. This day is also proclaimed "Take Your Child to Work Day", an opportunity DEPRM uses to introduce young people to environmental careers. In behalf of the citizens of Baltimore County, the County Executive accepted the National Tree City USA recognition.

New Materials: The following new materials were developed or updated: Environmental careers and internships flyers, *Growing Home* materials, all Maryland Green School materials, *State of Our Forests- 2007*, "Household Hazardous Waste" program flyers, and various informational PowerPoint and display presentations. A new flyer for distribution is being developed for distribution in 2008: "Managing Yard Materials". Some additional materials were obtained from other sources and distributed by the county. They addressed the following topics: pet waste, recycling, transportation issues, and landscape design and maintenance.

Community Events and Public Outreach: DEPRM sponsored and supported a wide variety of interactive events for families, informational displays, and presentations highlighting water quality, stormwater topics, and stewardship opportunities. Major highlights included a variety of water quality issues, water conservation, erosion and sediment control, environmental temporary tattoos, a Flyswatters (IPM) craft, storytelling, and other interactive games and activities.

Two Household Hazardous Waste Collection Events were held in spring and fall 2007. Approximately 2,300 drop-offs of a variety of hazardous materials were made. In addition, citizens were able to drop off hazardous waste items at the County's Eastern Sanitary Landfill from April through October (see Section 3.5 for a summary of material collected).

DEPRM hosted booths and interactive activities at numerous festival events in local neighborhoods and schools throughout the County. Tree planting, partnering with a local *Green School*, the BayScapes program, and conservation landscaping were topics highlighted at many community group meetings. DEPRM lent its support to local watershed organization events in several watersheds including the Jones Falls, Patapsco, Gwynns Falls, and Herring Run. Additional presentations were made to faith communities, garden clubs, scouts, as well as Countywide and regional audiences. A listing of these community events is included in Appendix 4-1.

Community Partnerships: In 2007, DEPRM strengthened its partnerships with local watershed organizations, adjacent jurisdictions, non-profit environmental organizations, and other County agencies to achieve common water quality and public education goals. Since the first signing of the *Baltimore Watershed Agreement* on October 3, 2002, Baltimore County has shared databases and other resources. With the re-signing of the agreement, DEPRM staff provided presentations to Baltimore City public and private schools, other non-Baltimore County schools, and other regional audiences on over 30 occasions. DEPRM staff participated in the Herring Run Watershed Association (HRWA) education program planning workgroup. This group provided recommendations for a new community and school environmental education program to be unveiled at the opening of the new building in spring 2008. The HRWA provides site-

based environmental education and technical support to schools and the community. The new building under construction has the potential for LEED certification and will model best practices and sustainable operations with a green roof, and other features. The Association plans to apply for *MD Green Center* recognition in April 2008.

Baltimore County Public Libraries: DEPRM's environmental education materials and presentations have often been used at County libraries. In 2007, information about tree availability through the Tree-Mendous MD Program in Baltimore County was made available in bulk to the 16 branch libraries for distribution to citizens as well as County senior centers, and parks and recreation facilities. Over 15,000 *Growing Home Campaign* brochures with the $10.00 coupon were distributed. *Growing Home* posters with two themes "Plant Your Own Family Tree" and "Who Says Money Doesn't Grow on Trees?" were displayed at these County facilities.

Federated Garden Clubs and Master Gardeners*:* Since 1994, DEPRM has provided many presentation programs for local garden clubs and Master Gardener's groups. In 2007, garden clubs hosted conservation landscaping and pollution prevention presentations using DEPRM materials at garden clubs, schools, and in communities around the County and region. At the request of Federated Garden Clubs of MD, "garden clubs" were added to the list of local resources available to schools (as provided on DEPRM's PowerPoint presentation and a handout). A Master Gardeners program in the County would provide additional technical support for schools and community groups.

Boy and Girl Scout projects: To assist scouts in planning and implementing environmental projects for their Eagle Badge or Gold or Silver Awards, a list of potential projects was provided to scout organizations and individual scouts upon request. Scouts volunteered at the County's nursery to pot up seedlings and assist in nursery maintenance. Presentations and demonstrations were provided for many scout troop meetings and community events. DEPRM staff worked to coordinate planting projects with Boy Scout troops and served as environmental consultant to Girl Scouts of Central MD (GSCM), providing planning assistance for local Baltimore County troops for their annual April encampment.

Communication media and County Webpage: In an attempt to reach a broader audience, environmental videos, program reports, and news items were broadcast in cooperation with the County Office of Communication and Comcast Cable. They aired on the County's cable channel 4-5 times each week both regularly and seasonally during 2007. A representative of Comcast Cable reports 240,000 local County subscribers. The County's *Growing Home Campaign* aired ten-minute educational segments daily throughout the month of May 2007.

Additional media and press coverage during 2007 included: WJZ TV, Fox 45 TV, WBAL TV, WCBM Radio, Patuxent Publishing, Dundalk Eagle, Baltimore Sunpaper, The Baltimore Examiner, The Bay Journal, Baltimore County Senior Digest, The Jewish Times, Baltimore County's E-News Stream, the BCPS Principal's Bulletin, and The Sierran.

Tree-Mendous MD information, *MD Green School* information and applications, pollution prevention messages, environmental careers, and additional program services were incorporated into the department's website: www.baltimorecountymd.gov/go/deprm. Web offerings include: Kid's Pages, environmental topic information, resources, environmental careers, internships, related links, volunteer and stewardship opportunities.

The *Growing Home Campaign* website www.baltimorecountymd.gov/go/trees was introduced in April 2006. In 2007, the information included environmental education on the multiple benefits of planting trees, including: (1) slowing stormwater runoff and reducing the cost of controlling stormwater, especially in urban areas, (2) reducing erosion, (3) filtering air and water by absorbing air pollutants and fertilizer and pesticide runoff. A cash incentive for homeowners to plant a tree in their yard in the form of a $10 coupon redeemable toward the purchase of a qualifying tree was available online. The $10 coupon and a 4 page educational brochure titled 'Plant Your Own Tree' were available for printing. The *Growing Home Campaign* website www.baltimorecountymd.gov/go/trees includes environmental education related to the benefits of planting trees.

DEPRM Lobby Displays: In 2007, an array of printed educational materials of interest to citizens, homeowners and businesses was available in DEPRM's office lobby. The display included functional landscaping, IPM, fertilizer application, mosquito control, native plants, invasive plants, well and septic systems, nutrient reduction, soil erosion control, toxic material disposal, Household Hazardous Waste collection events, and other general topics that increase environmental awareness and promote responsible action.

To make effective use of the available lobby space and to reach the >100 people who pass through the area on an average day, a series of seasonal displays were exhibited. Topics included: Environmental Tips for the Winter Holidays, Planting for Winter Landscapes, *Green Schools*, BayScaping with Native Plants, DEPRM Department Functions and Services, Mosquito Control, Fertilizer Recommendations for Fall, Providing Winter Wildlife Habitat, Household Hazardous Waste, Community Health, and Air Quality, Green Renaissance, responsible lawn care, and the *Growing Home Campaign* brochures and posters. Display vases with examples of native plants, accompanied by descriptive signs and plant lists, were displayed seasonally. Chesapeake Bay Trust brochures and grant forms, information about the MD Tributary Strategies Teams and other environmental awareness information materials were also made available.

Urban Nutrient Management Workshops: As part of DEPRM's contribution to the Urban Nutrient Management Workgroup (UNMWG), staff participated in the planning and promotion of nutrient management workshops targeting professional landscape managers and turf technicians on public and private landscapes. Staff provided information about DEPRM's integrated watershed approach to resource management, its monitoring programs, and its education and outreach activities, and provided contacts for the purpose of expanding participation on the group. An arrangement was made to have a representative from MDA represent the agency on the MD Green School steering committee. The agency will assist in efforts to promote sustainable operations on school landscapes.

Topics addressed by the UNMWG in 2007 included promoting the training sessions for grounds supervisors and technicians; working with the "Green industry" (Scotts Lawn Care, Tru-Green/Chemlawn) to affect policy, product development, and marketing; and nutrient education messages for public schools. Guidelines for golf courses were reviewed in preparation for a training session held in 2007. The brochure "How to Choose a Lawn Care Service That's Right for You…and the Chesapeake Bay" was made available for distribution to citizens.

Program use: As Baltimore County's environmental education opportunities and programs continue to evolve, they have remained popular and in demand by citizens, community groups, businesses, and schools. Regionally, they served as models for other communities and jurisdictions. Due to staffing constraints, the selection of events in 2007 was based upon the size and type of audience, the subject matter requested, and the likely degree of effectiveness in reaching desired pollution prevention environmental education outcomes.

In 2007, in approximately 250 presentations, various components of the county's educational messages were presented. Over half of these were scheduled as a result of referrals or requests for return visits. Again this year, DEPRM made use of the County's cable channel to reach a broader audience through regular and frequent airing of videos produced by the County in cooperation with Comcast Cable. DEPRM also expanded its office lobby display to take advantage of the potential audience passing through the office each day. In 2007, in the schools, less emphasis was placed on direct individual classroom involvement and greater emphasis was placed on venues for site assessment, teacher training, facilities management, and school administration (public and private schools).

As part of the County's integrated, comprehensive approach to watershed management, watersheds where comprehensive plans are being implemented were targeted for program presentations. In many instances, opportunities to reach Countywide or regional audiences became available. In some cases, those participating lived within the boundaries of watersheds that Baltimore County shares with neighboring jurisdictions.

The number of events accomplished for specific watershed audiences is shown in Table 4-2. A majority of the events (76%) occurred in 7 urban watersheds: Back River, Middle River, Baltimore Harbor, Patapsco, Loch Raven, Gwynns Falls, and Jones Falls. The Baltimore Harbor watershed is an area where population and high rate of imperviousness suggest significant urban impact on local water resources. The Baltimore Harbor Watershed Plan recommends increased efforts in public awareness, education, and outreach to citizens and groups in this watershed. In 2002, one event specifically targeted audiences in this watershed. Increased efforts to reach audiences in this watershed and others in Baltimore County in 2007 are shown below. In 2007, an effort was made to conduct environmental outreach and education activities to reach citizens in all county watersheds.

Table 4-2: Education Events Conducted for Residents of the County and Region by Watershed Audience, 2007

Watershed	# Events	Watershed	# Events	Watershed	# Events
Back River	**38**	Jones Falls	**38**	Patapsco	**27**
Baltimore Harbor	**14**	Liberty	**3**	Prettyboy	**12**
Bird River	**14**	Little Gunpowder	**3**	Countywide	**83**
Deer Creek	**8**	Loch Raven	**53**	Regional	**63**
Gunpowder River	**5**	Lower Gunpowder	**20**	International	**0**
Gwynns Falls	**32**	Middle River	**10**		

Presentations were made to a wide variety of groups. In 2006, DEPRM placed a special emphasis on school audiences K-12. Table 4-3 reports presentation events by type of audience.

Table 4-3: Education Events by Type of Audience*, 2007

Type of Group/Audience	# Events for each audience
Citizens, Community Group, or Association	71
Public Schools*	121
Private Schools*	25
Special Needs Education	6
College/University	7
Government Agency, facility, group	22
DEPRM Lobby, Duty room*	6250
Public Library	32
Festival/Show	19
Conference, Workshop, Training sessions	49
Business	5
TV	6 tapings
International	0
Countywide	83
Regional	63

*Notes: Many individual schools were represented at conference and training events; these audiences were logged as one single entry for a public or private school audience, not as individual school presentations. Contact with individual citizens (as opposed to groups) by phone or site visit often provides valuable opportunities for environmental education and outreach. Access to lobby displays is estimated to be approximately 100 people/day. The number of conferences with DEPRM office duty room staff is estimated to be 25 people/day for 50 weeks. *Individual conversations*, although significant, are not currently tracked. Some presentations and events addressed audiences that included several of the groups listed above and thus were entered in more than one category.

A general listing of program presentations conducted in 2007 is provided in Appendix 4-1. An additional listing of school presentations on the topic of "recycling" (conducted by the Baltimore County Department of Public Works, Recycling Division), is provided in Appendix 4-2.

By June 2008, over 80 events were accomplished or scheduled in advance for the 2008 reporting year. An additional 3,000 citizens have conferred with DEPRM staff in the Department's Duty Room.

The *Let's Be partners* and *Getting Greener Schools* programs are becoming well known in the community and region. In 2007, more than one out of every two presentations or events resulted from referrals or were return engagements requested due to the success of a previous visit. Increasingly, individuals, groups, and schools asked for the opportunity

to take components of the program into their community or organization for presentations. Baltimore County Public Schools and other organizations requested copies of DEPRM's PowerPoint presentations and other *Green School* materials created by DEPRM to distribute to individual county schools. Notably, program directors and supervisory staff of BCPS outdoor education and elementary science requested materials and planning meetings for the purpose of strengthening formal partnerships with DEPRM to enhance environmental education in County public schools. In 2007 new BCPS curriculum piece requiring environmental issue investigation and a habitat restoration project was fully implemented for 3rd, 4th, and 5th grade students Countywide. DEPRM participated in ongoing teacher training sessions in preparation for this new requirement. Local and regional *MD Green Centers* including the Irvine Nature Center in Stevenson, MD and the National Aquarium in Baltimore City regularly request the use of DEPRM's presentations at multiple events every year.

In the spirit of the County's 2002 Baltimore Watershed Agreement, re-signed in 2006, Baltimore County has shared data, staff expertise, and many components of its successful programs. As a result, the number of events held in regional settings and including audiences outside Baltimore County has increased.

Program evaluation: Currently, all sections in DEPRM are involved in outreach at some level. In 2007, environmental education and outreach activities were supported by increased use of the web, local community newspapers, the County cable channel, the update of certain departmental brochures, the provision of enhanced aerials for site assessments, numerous conferences and workshop presentations, and the development or redesign of several displays.

Formal and informal mechanisms for program evaluation and assessment are built into DEPRM's environmental education program. Informal user evaluations have contributed constructive suggestions for revision of the presentation materials and the method of delivery. Contact with Baltimore County public and private school teachers who have reviewed or used program components yielded valuable suggestions for improvement or enhancement. Continued requests for the program as a local and regional model, is an indication of the perception of program quality and effectiveness.

Some indications of education program success in 2007 include:

- *Supporting research and anecdotal reporting leads to increased program participation:* A 2004 research study conducted by MAEOE comparing standardized test scores of *MD Green Schools* and non-*Green Schools* found that students at *MD Green Schools* displayed a higher academic performance level in reading and math than those at non-*Green Schools* (MSPAP). After controlling for socioeconomic variables and the percent of students receiving special education services, a positive, statistically significant relationship between higher reading and math achievement was indicated. The increase in student achievement is attributed to factors inherent in the nature of environmental education. The full report is available online at www.maeoe.org. A follow-up study is planned for 2008.

Other studies show similar results. In June 2005 the California Department of Education released the results of an American Institutes for Research study showing improved

science scores and other benefits among at-risk sixth grade students in southern California. Students participating in this short term educational study showed significantly higher gains in cooperation, conflict resolution skills and after six to ten weeks, were still engaging in positive environmental behaviors (e.g., recycling) at home. Teachers reported large gains in self-esteem, problem-solving skills, motivation, and behavior compared to students who did not participate. Pre and post surveys showed that science scores improved by 27%. The full study is available at www.air.org.

Locally, teachers at the Regional Institute for Children and Adolescents (RICA) in Baltimore City, report that their *MD Green School* activities have resulted in major changes in student interest, appropriate behavior, and student achievement. Staff and students at RICA submitted a successful *MD Green School* application in April 2007.

Increasingly, school principals are finding these studies and reports enlightening and are using them in the decision making process related to making the curriculum connections and offering *MD Green School* activities at their school.

- *Getting Greener Schools* program: DEPRM has had notable success in its outreach to schools. As shown in Table 4-4, Baltimore County is a State leader in a number of recognized Green Schools during 1999-2007. Through its leadership in MAEOE, Baltimore County serves in an advisory capacity for other jurisdictions. Currently, 19% of *MD Green Schools* are located in Baltimore County.

Table 4-4: *Maryland Green Schools* by Jurisdiction 1999-2007

# Green Schools Awarded	Maryland Jurisdiction
8	Garrett
2	Allegany
1	Washington
2	Frederick
10	Baltimore City
12	Carroll
10	Howard
20	Harford
11	Anne Arundel
31	Baltimore County
12	Montgomery
11	Prince Georges
3	St. Mary's
5	Charles
13	Calvert
3	Queen Anne's
4	Worcester
1	Dorchester
3	Cecil
1	Wicomico
Total: 165	

In 2007, DEPRM initiated *Green School*-type activities at professional workshops and at many public and private schools around the County. Approximately 15 local schools and/or centers are expected to be ready to apply or re-apply in April 2008. As of April 2007, Baltimore County had an 73% success rate for re-application by eligible schools.

Eleven out of 15 schools eligible for re-application have sustained their operation as a Maryland Green School. The four schools that were eligible but have not re-applied have experienced major changes in staff during the months or years following their initial recognition as a *MD Green School*. DEPRM, in cooperation with BCPS Office of Science is working with these schools to support their efforts.

- *BCPS Green School Committee:* BCPS has adopted a policy of working towards having all of its schools PreK-12 operate as *MD Green Schools*. To date, 22 of the 165 public schools in the County have received recognition as *MD Green Schools*. Many additional schools have begun the process, in part due to an increase in presentations directly to school faculty and the establishment of a formal committee to promote and support *Green Schools*,

- *Professional development:* Invitations for DEPRM staff to present at seminars and training workshops hosted or sponsored by other environmental organizations have increased.

- *Facilities operations:* Through professional development sessions, staff meetings, and workshops, DEPRM has led the effort to highlight the important role played by facilities managers. Schools are encouraged to establish and maintain a dialogue with facilities managers and field technicians. The BCPS Office of Facilities reports favorable results from increased communication and awareness of grounds procedures and protocols.

- *Children with special needs:* In 2007, *MD Green Schools* programs were initiated and/or sustained and supported at these public and private schools serving Baltimore County children and adolescents with special needs: The RICA School near Catonsville, the Forbush School at Sheppard Pratt, the Rosedale Center, the Jemicy School, the Harbour School at Baltimore.

- *School Building and Schoolyard projects:* Schoolyard and community landscape design and maintenance projects initiated by Baltimore County *Green Schools* have resulted in an increase in: environmental awareness, turf reduction, tree and forest cover in school communities, bio-diversity, wildlife habitat, bio-retention and other SWM, sediment control and other environmental benefits. Since 1999, the 31 *MD Green Schools* and 2 *Green Centers* located in Baltimore County have accomplished over 525 projects on school properties or in local communities. Refer to Table 4-1 on page 4-10 for examples of some of these activities.

- *Schoolyard assessments:* Through the processes involved in schoolyard assessments, problems such as erosion and stormwater management issues, invasive and noxious plants, and other concerns are being identified (by students) on school properties. As part of the process, and through dialogue with facilities managers, students are finding opportunities for appropriate placement of sustainable schoolyard habitat projects.

Schoolyard assessments were conducted to explore teaching opportunities on the schoolyard, identify erosion problems on school grounds, potential planting sites, appropriate locations for rain gardens and stormwater management, and best locations for outdoor classrooms. Teachers and students discussed the opportunities identified, the possible reasons and impacts for problems identified, and then invited their school's

facility manager and County experts to visit and confer. This is one example of how teachers are increasingly recognizing curriculum connections and help students become involved in research and problem solving related to these issues. Making curriculum connections between classroom instruction and the schoolyard, the neighborhood, and the watershed is one essential component of a school's *MD Green School* application.

- *Habitat restoration projects:* An increasing number of public and private schools show interest in removing unused turf areas on their schoolyard campuses and replacing it with no-mow zones, trees, and other habitat restoration. In recent years, over 300 local schools have sent staff to schoolyard habitat workshops or expressed interest in habitat restoration. Most schools involved in projects in their schoolyard routinely coordinate actions with their facility/grounds manager. The habitat workshops sponsored by MAEOE have provided valuable technical support for these activities. In 2007, a series of "Grounds for Teaching" summer workshops included MD Green School program models and were specially targeted to Baltimore County teachers. They were well-attended by both public and private school teachers.

- *Program use:* In 2007, as in past years, program presentations were requested by a wide variety of groups. Over 1,820 group presentations have been conducted since 1994, and an additional 6,250 individual conferences per year related to reduction of the environmental impact of proposed landscape alterations. County staff use these opportunities to provide information and suggest sustainable landscape design components and other best practices for use on private property. The County enjoys high rates of referral and invitations for return visits. In 2007, approximately 250 presentations were conducted as a result of requests from citizens, schools, groups, government agencies, non-profit organizations, other counties and agencies, and in watersheds specifically targeted by DEPRM.

- *Program model:* DEPRM's environmental educational presentations and materials continue to be requested by public and private schools K-12, colleges, local and regional organizations, and for training of teachers and group leaders. Many environmental education fact sheets and other materials have been used as models by other organizations and agencies.

- *Program partners:* In 2007, requests for new or continued cooperation or partnerships in environmental education efforts continued. A current list of program partners include:

Alliance for the Chesapeake Bay
Anne Arundel Co Outdoor School at Arlington Echo
Association of Independent Maryland Schools (AIMS)
Baltimore City "Greening Schools" initiative
Baltimore City schools and communities
Baltimore County Forestry Board
Baltimore County Government agencies
Baltimore County Public Library System
Baltimore County Public Schools (BCPS)
    Office of the Superintendent

Office of Science
Office of Facilities
Baltimore County Senior Centers
Baltimore Ecosystem Study (BES)
Baltimore Gas and Electric Company (BGE)
Baltimore Jewish Environmental Network of Synagogues (BJENS)
Boy Scouts of America
Camp Milldale, Jewish Community Center
Carroll County Outdoor School at Hashawha
Chesapeake Bay Program
Urban Nutrient Management Workgroup
Tributary Strategy Teams
Chesapeake Bay Trust
Chesapeake Conservation Landscape Coalition (CCLC)
Chesapeake Covenant Congregations (CCC)
Comcast Cable
Community Colleges of Baltimore County (CCBC)
Envirothon
Federated Garden Clubs of Maryland
Girl Scouts of Central MD
Goucher College
Herring Run Watershed Association
Irvine Nature Center
Jemicy School
Jewish Community Family Education Center
Jones Falls Watershed Association
Living Classrooms Foundation (LCF)
Local and regional watershed associations
Local Chambers of Commerce
Local community associations and coalitions
Local nurseries and garden centers (30)
Marshy Point Nature Center
MD Cooperative Extension (MCE)
MD Association of Environmental and Outdoor Education (MAEOE)
MD Department of Agriculture (MDA)
MD Department of the Environment (MDE)
MD Department of Natural Resources (DNR),
DNR Forest Service, Tree-Mendous Maryland Program
MD Landscape and Nursery Association
MD Public Television
MD State Department of Education (MSDE)
MD State Fair
Master Gardeners (outside Baltimore County)
National Aquarium at Baltimore
North American Association for Environmental Education (NAAEE)

Oregon Ridge Nature Center
Pearlstone Conference and Retreat Center
Prettyboy Watershed Alliance
Professional lawn care industry
Towson Garden Day Committee
Schoolyard Habitat Providers Partnership
Soil Conservation Service
Smithsonian Environmental Research Center
US Environmental Protection Agency
US Fish and Wildlife Service, Chesapeake Bay Field Office
US Forest Service
Towson University
Washington Suburban Sanitary Commission (WSSC)
Weyerhauser Foundation

- *Higher education*: Where program components were used at the college/university level, teachers report final examination test results, class projects, seminar discussions and anecdotal comments consistently indicate that stewardship and water quality/action alternative messages are being understood.

- *Green Industry:* Opportunities for dialogue with representatives of the lawn care industry provided through participation on the Urban Nutrient Management Workgroup have raised industry awareness concerning the connection between lawn care and water quality. A partnership with the Scotts Company, the industry leader in lawn care products for the homeowner, has resulted in environmental messages on fertilizer bags, nutrient information at point-of-sale, and the introduction of no-phosphorus and low phosphorus fertilizer products in the mid-Atlantic regional market.

- *Volunteer actions:* The estimated number* of volunteer action projects and community outreach initiatives occurring as a direct result of the county's partnerships and projects:

1994-95	3	(pilot)
1996	7	
1997	>300	
1998	>600	
1999	>500	
2000	>460	
2001	>725	
2002	>470	
2003	>400	
2004	>400	
2005	>400	
2006	>460	
2007	>525	

*Notes: the fluctuations in # of actions listed are directly related to the changes in programs offered or emphasized in any year. Reporting in 1997-2001 included individual Pledge Program actions and those occurring as a result of educational presentations; the decline following 1998 and 2001 is due a shift in

program emphasis and tracking mechanisms. 2001 included individual citizen pledges and the work of Baltimore County's *Green Schools*. In 2002, due to the high cost in staff time, individual pledges were not sought. Action projects tracked include *MD Green Schools* and other community activities in which DEPRM was involved.

Due to the summer-fall drought in 2002 and Hurricane Isabel in fall 2003, many planting activities scheduled for 2004 were postponed or cancelled. In 2004, teacher training, outreach to supervisors, administrators and facility managers was emphasized over individual classroom and community projects. Action projects in 2005-7 included those accomplished by the Baltimore County *Green Schools and Green Centers*, other schools, watershed groups and community organizations with whom the County has worked. Overall, these numbers grossly under-represent the actual number of volunteer projects accomplished in Baltimore County.

- *Community response:* The increasing number of unsolicited requests for DEPRM's environmental education programs and materials indicate:

  (1) Community interest in the environment in general, and water quality in particular is rising.
  (2) Citizens want to know more about what they can do and which actions will make a difference.
  (3) Citizens are ready to become active at home, at school, at work, and in their neighborhoods.
  (4) Local public school administrators and supervisors have now integrated environmental and outdoor education in standard curricula. This integration is aligned with or exceeding the Voluntary State Curriculum (VSC) standards for Maryland.
  (5) Many teachers now use the local environment as context for learning across disciplines and grade levels. It is BCPS policy to encourage and assist all of its 165 public schools in initiating sustainable operations according to the *MD Green School* model.
  (6) There is an increased interest demonstrated by faith-based organizations and schools. Some host annual festivals, conferences, and workshops and have expressed interest in assisting schools in adoption of sustainable operations and increased opportunities for environmental education.

- *Curriculum development*: The BCPS Office of Science has developed a series of curriculum changes for grades 3, 4, and 5. They involve an increasingly sophisticated and challenging set of outdoor investigations and experiences built into the basic required curriculum for all students. DEPRM assisted in the professional development sessions provided to prepare teachers for these new initiatives.

- *Website access:* In response to citizen requests and in an effort to increase the easy availability of information, DEPRM continues to re-focus and expand its web offerings. Many items supporting DEPRM programs and projects are available on the Department's webpage, as well as links to other programs and agencies; the update and expansion of web offerings are ongoing.

- *Venues, participation, and materials distributed*: In 2007, shifts in program emphases, method of delivery, and some program components have resulted in the changes noted in Table 4-5 below.

Past experience and program evaluation has shown that DEPRM's participation in certain large community festivals did not result in significant opportunity for environmental education and outreach. As a result, fewer of these events were scheduled for 2007. The total number of festivals and materials distributed reflects this shift in emphasis. However, DEPRM continued to participate in local watershed festivals sponsored by watershed organizations and events sponsored by the County's *Green Schools* and *Green Centers* and has placed increased emphasis on teacher training. Thus the amount of printed materials distributed through workshops and conferences has increased. Many of these workshops were conducted in partnership with the BCPS and MAEOE. Copies of DEPRM's materials for teachers were often provided to the school system. Videos and other media productions had wide audience exposure on the County cable channel. A conservative estimate of viewership (based on the county's and Comcast's tracking) was used. Individual copies of videos, CDs, and some booklets were distributed to individuals, communities and organizations. These distributions are not being tracked at this time.

Table 4-5: Presentations, Participants, and Materials, 1994-2007

Year	# Presentations and Events	# Participants	# Literature Distributed
1994	4	100	387
1995	16	414	1,036
1996	22	1,009	2,576
1997	89	4,889	13,519
1998	107	12,415	18,128
1999	79	15,141	18,243
2000	112	21,191	21,178
2001	147	29,193	36,378
2002	165	224,800	32,000
2003	172	425,642	34,301
2004	174	309,030	35,320
2005	155	290,000	20,000
2006	166	317,170	20,100
2007	246*	373,950*	23,422

* With this report, the total number of presentations and participants include additional presentations made by the Baltimore County Department of Public Works, Recycling division. Literature distribution by that Department is not included.

- *Support materials:* Partnerships for program support materials: It has been the policy of this department to keep abreast of new educational materials available through outside sources. When other agencies or non-profit organizations make certain titles available for distribution, it is cost effective to obtain copies rather that re-create the item. The BayScapes brochures, provided for distribution through a partnership with the Alliance for the Chesapeake Bay, is one of several titles that continue to be useful and popular with citizens. These color brochures were distributed through: Baltimore County Public Libraries, Department of Permits and Development Management, DEPRM Duty Room, DEPRM Lobby display, Federated Garden Clubs, and community festival and education events. They are also available on DEPRM's webpage.

Detailed native plant lists and information about controlling invasive species developed by the US Fish and Wildlife Service and the MD Native Plant Society were provided to interested schools, citizens and groups.

The booklet, "From My Backyard to Our Bay", a homeowner's guide targeting rural landowners, was produced in partnership with the Baltimore County Soil Conservation District and the University of MD Cooperative Extension. 2,000 copies were available through DEPRM and additional copies distributed to rural school children through partnership with BCPS.

Through the *Growing Home Campaign*, a homeowner brochure with comprehensive education about the multiple benefits of planting trees was produced. More than 10,000 copies of the brochure were widely distributed. Color posters were widely distributed to participating nurseries, public libraries, and recognized *MD Green Schools* and *Centers*.

Program Recommendations: The number of requests, user comments, and increasing number of volunteer commitments indicate that Baltimore County's environmental education and outreach program continues to be attractive, popular, and filling a need for local, County-specific information and environmental educational opportunities.

An increasing effort has been made to structure presentations in a way to reach those audiences not traditionally "in the choir." As with the 2007 initiative with faith communities and nature centers, DEPRM should continue to identify new audiences and venues where reasonable, cost-effective environmental action alternatives can be explored. One possible option would be to work with Baltimore County Office of Communications to schedule additional personal interviews with DEPRM staff to air on the County's cable channel. Discussions would highlight program components and citizen action opportunities.

Given limited staffing, creative ways must be found to meet the demand and offer the program message in a cost-effective manner. Careful screening of requests to determine the best situations for learning and stewardship should continue. Increased use of the County's cable channel and website should provide information for citizens, describe services and program offerings, and list upcoming volunteer opportunities.

Joining with local and regional partners to build on successful initiatives such as the *BCPS Principal's initiative* and the *workshop for institutional grounds and facilities managers,* targeting local school populations and staff should be continued even if the efforts do not immediately result in *MD Green School* applications. Experience has shown that the move to adopt environmentally sustainable school operations is one that requires changes in policy, cooperation, advance planning and budget considerations, and is usually accomplished in phases over time, usually about 2-3 years.

To further facilitate "top down" support, every effort should be made to build upon the growing partnership with administrative offices. The BCPS Office of Science/supervisors, the BCPS Office of Outdoor Education, and the Office of Grounds and Physical Facilities have sought and welcomed DEPRM's participation in the planning of in-service learning for County teachers and have requested assistance in preparing central office staff for working with prospective *MD Green Schools.* A BCPS Green

Schools committee is operational. DEPRM should reach out to the superintendent of Catholic Schools in the Archdiocese of Baltimore to promote enhanced environmental education opportunities in local Catholic Schools. Offering workshops at the annual conference for Catholic schoolteachers would be a good approach.

The professional development event for principals in summer 2005 highlighted topics such as watershed awareness, stormwater issues, the *MD Green School Program,* the correlation of environmental education and standardized test scores, successful schoolyard projects, schoolyard habitat opportunities, funding opportunities, tech support, and other topics. Following this joint initiative to reach BCPS principals on the east and west sides of the County, the comments and initial feedback were positive. Several principals who participated felt that it was important to reach all BCPS principals. This initiative proved to be successful in producing new *MD Green Schools,* 4 in 2006, and more expected in 2008. The County should consider additional joint initiatives in other targeted watersheds or similar means to reach school administrators. A possible venue would be the annual summer meetings and workshops that principals must attend each year. A similar set of meetings is held each year for science supervisors.

Expansion of similar offerings to an entire school population (high school and its middle and elementary school feeder schools in a targeted geographic area) would provide continuity for the student population and maximize the long-term benefit to the community.

Following these successful initiatives, additional school populations should be considered. In 2007-10, the Lansdowne HS, MS, and ES on the west of the County and Sparrows Point HS and its feeder schools on the east side would be appropriate targets for future initiatives. These sets of public schools, located in highly urbanized sections of the Patapsco, Baltimore Harbor, and Back River watersheds, share close geographic proximity and are characterized by large traditionally maintained landscapes (turf, minimal trees, high impervious, and athletic fields).

Cooperation with the BCPS Office of Science, Outdoor Science Team in its *BCPS Green School* committee is essential. This task force, composed of teachers, administrators and resource personnel will serve as mentors, develop curriculum, host workshops, provide promotion, and present at the annual August Principal's meetings, develop an in-service course for credit, develop web links, and provide materials and equipment. Incentives such as stipends would be instituted. DEPRM should continue to participate.

Currently, Constellation Energy Group and Recreation Equipment, Inc (REI)) provide funding support for the *MD Green School* Program. However, business partnerships are largely untapped resources that could provide additional technical and funding support for schools, landscapes for demonstration sites, audiences for environmental education, local award recognitions, and visible commitments to community stewardship. They should be pursued at the local school and community level. Recognition should be developed to call attention to those businesses that support a local school's *MD Green School* initiatives. Currently, the MD DNR is the only public agency providing funding support for the *MD Green School Award Program*. Local and state agencies should provide basic

funding support to assist MAEOE in program promotion and delivery, and in providing a PT Green School program coordinator.

With the *MD Green School* designation lasting three full school years, guidelines and incentives currently in place for re-application should be periodically evaluated. Information gathered through focus groups and other formal and informal means should continue to guide recommendations for program improvement. The "Healthy School Environment" best practice option should be revised and expanded to include indoor air quality and other food and health issues.

Further expanding and focusing the *MD Green School* initiative and adapting it as a model for future *Green Colleges/Universities* and *Green Faith-community* initiatives may be the best way to achieve high visibility of sustainable landscapes in all neighborhoods. The individual efforts now underway in the Christian and Jewish faith communities should be supported in the same manner as the county provides support to other community organizations. Informational signage should be installed at all BayScapes and conservation landscaping demonstration sites. The feasibility of developing a series of tours to highlight model projects should be identified, mapped, and promoted. A handout should be produced to provide a map, describe projects and explain the environmental benefit gained.

Additional incentives and rewards, especially cash donations; certificates for free field trips (example: Living Classrooms Foundation and Chesapeake Bay Foundation boat trips); field guides, storybooks, and other library resources on environmental topics; environmentally friendly products; presentation trees; tools; rainbarrels and other items should be considered.

The *Getting Greener Schools* initiative offers the opportunity to retrofit old style non-functional school landscapes to create attractive, functional, more sustainable, outdoor learning landscapes that serve as models for the community. Obtaining approval and permission and working closely and effectively with school facility operations staff is essential to the success of any undertaking. Continued efforts should be made to contact public and private school administrations and school facilities supervisors to raise awareness and enlist support for functional landscape projects on school properties. The 2004 landscape manager's workshop held at Towson University and the 2005 initiative for principals are successes that should lead to further dialogue and partnership.

New methods to assist schools and institutions in the costly removal of old, excessive, and no longer functional impervious surfaces should be explored. The success of the Baltimore City initiative *Greening Schools* (targeting 6 city schools for impervious removal and stabilization with turf plantings) should be monitored. Funding mechanisms and school curriculum connections, when developed, may be a program example that could be utilized in Baltimore County. A school's successes in obtaining grant funding to replace turf with native plants, bears watching.

DEPRM should continue to track actions accomplished by citizens and *MD Green Schools* in local watersheds. Developing a brief questionnaire and re-contacting a percentage of citizens who have participated in DEPRM's environmental outreach

programs and initiatives would be useful in measuring the level of behavior modification achieved. Student interns and volunteers could assist with these tasks.

The *Schoolyard Reforestation and Wildlife Habitat Program* as implemented by the Forestry Board provides a working framework and a successful track record for affecting change on school properties. The Forestry Board's past experience and success in working with school staff and facility managers is notable. The Forestry Board has served as an important partner with DEPRM in school environmental outreach. Recent changes in Board leadership may result in changes in the level or type of services offered to schools and communities and should be monitored.

With the capacity of Baltimore County's grow-out nursery in Chase expanding, the potential for providing native trees and shrubs at no cost to schools and organizations should be explored. Demonstrations, planting projects, and community service projects using stock from this nursery involved local Girl and Boy Scout communities in the past few years. These plantings should be tracked and the participating organizations recognized. A formal commitment between the Scout organizations and BC DEPRM may be advisable.

Individual citizens, educational and resource professionals, and volunteers who make outstanding contributions should be more formally and publicly recognized. The Herring Run Watershed Association has assumed the role of providing demonstrations, technical support, and planting stock at no cost to groups within its watershed boundaries. Through application to MAEOE as a *MD Green Center*, its efforts can be recognized as a model for other organizations. As DEPRM demonstrated in 2005-7 with successful recognition of Gene Flanagan, Margaret Paul, and John Sandkuhler, every year individuals should be considered for nomination in established award categories such as the CBT Teacher of the Year; the Tawes Award for a Clean Environment; MAEOE's Facility Manager of the Year, Bob Finton Award, and Best Schoolyard Habitat Project the Year; Woman of the Year, and others.

New technical support services and funding mechanisms for schools, communities and private properties should be explored. State and local agencies, strapped by budget constraints find it difficult to commit skilled staff in support for school projects. Baltimore County should support bringing the Master Gardeners Program to the County. Through the funding of this program sponsored by the UM Cooperative Extension, additional resources for a basic level of technical support could be made available. Partnerships with local watershed organizations should be strengthened and expanded.

If local watershed organizations are to be encouraged to assist in providing technical support for conservation landscaping projects in their watersheds, there is a need to raise the level of expertise in these groups. DEPRM should explore the potential of a partnership with the CBT, MAEOE SY Habitat Provider's Partnership, Irvine Nature Center's Habitat Stewards Program, MAEOE, and other stakeholders to host a training workshop for watershed groups in Baltimore County. Watershed organizations should be the target audience and topics on the agenda would include: use of native plants, landscaping design for water quality, raingardens and bioretention, storm water

management, etc. In recognition of the Baltimore Watershed Agreement, an invitation should be extended to interested organizations and citizens in Baltimore City.

Baltimore County should continue to lead by example as it sets policy for maintenance in public buildings and properties. With promotion of the *MD Green School/Green Center* program Baltimore County, facilities at Days Cove, Marshy Point, Oregon Ridge, Banneker Park, and Cromwell Valley should utilize this model to institute conservation and maintenance best practices, provide educational staff development, and provide program opportunities in support of local schools. Since 2003, sixteen outdoor education/nature centers have been recognized as *MD Green Center*s; to date, two, the Irvine Nature Center and the Pearlstone Center are located in Baltimore County. The other fourteen regional centers however, do model conservation best management practices, and provide high quality environmental learning opportunities for Baltimore County teachers and students through the hosting of field trips and professional development seminars that are open to regional participation. All centers in Baltimore County should apply for recognition as a *MD Green Center*.

The Watershed Management Program in DEPRM is developing a series of Small Watershed Action Plans (SWAPs). These plans will supplement existing water quality management plans by involving stakeholders into the process and exploring a broader range of strategies for meeting the water quality goals of this region. This is a collaborative effort between the stakeholders, which include County staff, community members, watersheds associations, institutions, and businesses. Specific actions to be implemented by the businesses and citizen volunteers along with DEPRM Capital projects will be listed in each plan. This will provide site-specific activities that citizens can undertake to improve water quality and help reduce non-point pollution in their watershed.

Measuring progress achieved through environmental education and outreach programs is a challenging task. Creative ways to determine program effectiveness must be explored and utilized. Measurement resources for outcome based program evaluations should be examined. Two sources include: http://mapnp.org/library/evaluatn/outcomes.htm and http://mapnp.org/library/evaluatn/fnl_eval.htm. Examination of other EE assessments conducted in the region could be useful. The Evaluation of the Chesapeake Bay Foundation's Conservation Education Programs, published in 2001, is one example.

Measurement tools, such as the "Logic Model" and those described in the Water Environment Research Foundation (WERF) Final Report, Project 98-WSM-2, and Watersheds and Ecosystems: Tools to Measure Source Control Program Effectiveness should be further explored. An additional WERF document, Residential and Commercial Source Control Programs to Meet Water Quality Standards Project 95-IRM-1 may also prove useful.

Program Recognition: In 2007, for accomplishment through cooperation with the *Baltimore County Community – School Partnership Network*, the Department of Environmental Protection and Resource Management received recognition for its "Exemplary and Dedicated Service" to Baltimore County Public Schools.

In the recent Island Press book, Nature Friendly Communities: Habitat Protection and Land Use Planning (May, 2005) by Chris Duerksen and Cara Snyder, Baltimore County is described at having "one of the most ambitious and successful land management and environmental protection programs in the country" and "a model for local governments everywhere". Baltimore County was included among the nine major case studies and eleven focused case studies selected nationwide. The County's programs involve "an impressive combination of tools and strategies - land use regulation, land acquisition, an urban growth boundary, education…" and other initiatives in its integrated approach to watershed management.

Baltimore County has received statewide and regional recognitions that include the Chesapeake Bay Partner at the Gold Level, the national Tree City USA, and the DNR's PLANT Community Award. In addition, the county continues to lead Maryland with more of its schools operating as *MD Green Schools* than in any other Maryland jurisdiction. County staff received formal recognition in the form of letters, certificates, and citations from the Superintendent of Baltimore County Public Schools, the BCPS Office of Science, and the Governor of Maryland.

Recognition letters and certificates were received from the BCPS administration and from individual students and teachers around the County; including artwork by students at Hereford MS in thanks for DEPRM's continued support of its environmental programs and activities. In addition, letters have been received from citizens and community groups noting the value of DEPRM's environmental education efforts. A significant indication of positive recognition is the high rate of referrals and repeated invitations from an organization.

Leading the state with more certified *MD Green Schools* than any other jurisdiction, Baltimore County has been particularly successful in promoting community and governmental partnerships and developing incentives to support its previously awarded and potential *MD Green Schools.* Components of its *Getting Greener Schools* initiative were used as models statewide. The DNR/DEPRM cooperative incentive 1:1 match offer for Tree-Mendous Program tree orders by *Green Schools* was again offered statewide to all designated *MD Green Schools*. In 2007, the Baltimore County Executive and the Department of Public works chose one of the county's notable MD Green Schools, St. Paul's School for girls, as a location to announce a new Countywide recycling outreach campaign, thus further recognizing and underscoring the importance of these schools.

The County's environmental education programs are in demand as models. In early 2007, the department's environmental education presentation proposals were again selected for a half-day workshop and short sessions for teachers at the annual MAEOE conference. These sessions provided hands-on activities related to sustainable schoolyard reforestation, stormwater management on school property, wildlife habitat projects and the process of applying for *MD Green School* status. This annual conference promotes, facilitates, and enhances environmental education statewide. Staff representing several Baltimore County public and private schools, MAEOE, USFW, and the BCPS Office of Science helped facilitate the effort. Additional selected presentations included The Association of Independent Maryland Schools (AIMS), National Science Teachers Association (NSTA), Baltimore Jewish Environmental Conference, Delaware

Educational Delegation, Forest Issues Events, and the Chesapeake Covenant Congregations meetings, among others.

As a result of Baltimore County's success rate in developing and recognizing model schools, DEPRM staff maintained positions of leadership in MAEOE and in the upcoming evaluations of the *MD Green School Awards Program*. In 2007, new initiatives in program direction and expansion; marketing; developing local and statewide organizational support; streamlining the application process; providing meaningful and tangible incentives; and development of recognitions and awards were undertaken. The promotion and facilitation of mentoring by successful schools for the benefit of potential *MD Green Schools* was also planned. DEPRM staff and representatives from successful Baltimore County *Green Schools* will continue to participate.

In 1998, the Chesapeake Bay Program, Toxic Subcommittee and the Local Government Advisory Committee highlighted the *Let's Be Partners* program in its *Local Government Pollution Prevention Toolkit* (May 1998). References to this document and periodic calls from outside the County continue to indicate that the use of this publication, which recommends programmatic models, is ongoing.

Again in 2007, DEPRM was recognized for its efforts in community forestry. The DNR PLANT Community and the National Tree City USA awards recognized Baltimore County's efforts in protecting and restoring urban and suburban tree cover and important forest ecological values. These annual awards are sponsored by the MD DNR and the MD Community Forest Council. DEPRM actively promotes these award recognitions in schools and community groups Countywide as part of its established program for schools and community groups, its *Tree-Mendous MD* program in the County, and its ongoing *MD Green Schools* initiative.

4.2.2 Secchi Disk Monitoring Program

In the summer of 2007 Baltimore County contracted for the development of a Citizens Secchi Disk Monitoring Program. The contractor for this program was Bayland, Inc. This program is intended to encourage community participation in the monitoring of their tidal waters. The program was piloted with the communities along the Bird River. The citizens each received a monitoring disk, a training session and an instruction guide. A web page was created for them to enter their data and to send questions as they occurred. The consultant is still completing the final report, however we have decided to continued the program for the citizens that are interested. These communities have a long standing interest in their river and enjoy engaging in the water quality monitoring activity. The data should be helpful to DEPRM to evaluate trends in response to updated water quality standards.

4.2.3 The Stream Watch Program

The Stream Watch Program is intended to develop citizen stewardship through participation of citizen volunteers in the program who actively assume the role of caring for segments of the stream network by observing changes in the system, by providing stream clean-ups, and participating in planting activities. The Stream Watch Program also includes identification of potential restoration projects for possible inclusion in the

Waterway Capital Improvement Program and can provide a valuable addition to our Illicit Connection Program through reports by Stream Watch participants.

The Stream Watch Program is being implemented throughout the County with the *Watershed Association Restoration Planning and Implementation Grant* program (Section 4.2.4, below). One of the provisions of the grant is to administer the Stream Watch Program in the organizations activities. The County provides support to the watershed associations for implementation of the Stream Watch Program. This includes field training and use of the GIS system for stream reach segmentation.

4.2.4 Watershed Association Restoration Planning and Implementation Grant Program

At the end of 2004 the County developed a new grant program entitled, *Watershed Association Restoration Planning and Implementation Grant* Program. This grant program was developed to address staffing needs of local Watershed Associations. The intent of the grant is to provide funding for staff time to participate in County restoration planning, support for the Stream Watch program, identification of restoration projects, implementation of restoration projects, educational activities, and the ability to leverage additional funding. Annual funding is limited up to $30,000 with a minimum of 1000 hours of staff time to be expended on projects. Funding will be provided for salaries, fringe, and overhead (limited to 10%). Funding is not provided for restoration materials and supplies.

In order to be eligible for a Watershed Association Citizen Restoration Planning and Implementation Grant the organization must meet the following qualifications:

- The organization must be a locally based Watershed Association with membership in Baltimore County.
- The organization must have 501(c)(3) private, non-profit status.
- The organization must have a demonstrated history of identifying and conducting citizen based restoration projects.

4.2.5 The Baltimore Watershed Agreement

Baltimore County and Baltimore City have renewed their commitment to work together to protect and restore shared watersheds. The *Baltimore Watershed Agreement* was signed October 2002 and re-affirmed in 2006. The new agreement calls for workgroups in five topic areas: trash, public health, stormwater, greening, and redevelopment. Baltimore County and Baltimore City have completed the development of goals for each of the five topics and presented them to the Committee of Principals in December 2007. A conference was held in March 2008 to present the goals to the County Executive, the Mayor and the citizens. The next step is the development of action strategies.

4.2.6 Tree-Mendous Maryland Program in Baltimore County

Baltimore County continues to partner with the MD DNR to actively promote the Tree-Mendous Maryland Program. This state administered tree planting program is designed to provide citizens, schools, and community groups with an inexpensive way to obtain mostly native tree and shrub species for planting on public street tree easements, other public lands, and within community open spaces. DEPRM aggressively promotes the

program in Baltimore County through twice-yearly, traditional and electronic mailings to over 800 individual citizens, schools, greening committees, and other interested groups. Each spring and fall, DEPRM provides assistance to groups and individuals planning tree-planting projects in the County. This may include technical advice, information about required permits, project coordination, and free tree delivery. Telephone and e-mail contact with citizens and "greening" committees is made to underscore the need for careful planting, watering, and maintenance, while frequent contact between DEPRM and the DNR staff is maintained to ensure a smooth delivery process.

In 2007, DEPRM provided technical assistance and received requests for free delivery of 11 orders, totaling 230 trees. A major benefit of the Tree-Mendous Maryland Program, as expanded and enhanced in Baltimore County, continues to be citizen education. Contact with citizens, schools, and greening committees provides opportunities to increase environmental awareness, especially concerning the value of trees and forests for managing water movement in watersheds. Tree planting and mulching demonstrations, seedling donations, and education programs for school children and communities are offered as a complimentary component to the *"Let's Be Partners..."* program. The Maryland DNR honors community tree planting efforts with annual *Maryland PLANT (*People Loving and Nurturing Trees*) Community Awards*.

In addition, Baltimore County's *Green Schools* Program in partnership with the Tree-Mendous Maryland program, provides participating schools with free trees at a 1:1 match for every Tree-Mendous tree purchased for planting on the school properties or on community open space. In 2007, two Baltimore County public schools and two community organizations benefited from participation in the *Green School* program by receiving 113 free trees, doubling the number of trees enhancing the ecological and aesthetic value of school properties and county and state parks.

The Tree-Mendous Maryland program in Baltimore County continues to be a valuable component of the effort to increase urban, suburban, and rural forest cover in Baltimore County. During the course of the 35 planting seasons since the program has been in existence, DEPRM has delivered over 12,000 trees in 491 orders requesting free delivery, serving school and neighborhood groups in hundreds of communities. Figure 4-3 below indicates the numbers of trees delivered by Baltimore County since program inception. Since 2004, DEPRM has been tracking the total number of Tree-Mendous trees ordered by Baltimore County groups versus the number delivered free by DEPRM. When tree orders that did not request free delivery are factored in for the years 2004 to 2006, the approximate number of Tree-Mendous trees planted yearly in the County remains at about 1,200 trees.

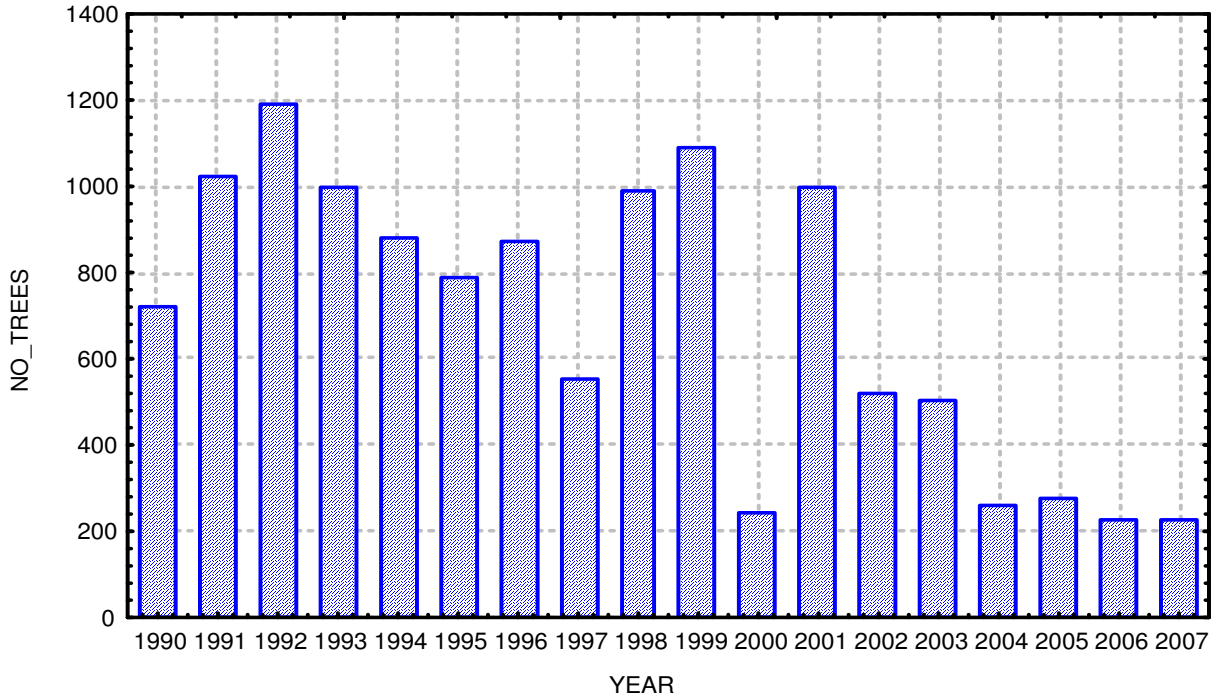


Figure 4-3: Number of trees obtained through the Tree-Mendous Maryland Program with technical assistance and free tree delivery by DEPRM between 1990 and 2007

4.2.7 The Baltimore County Forest Conservancy District Board

Urban, suburban, and rural forests play an important role in the protection and enhancement of the County's water resources. For over 50 years, volunteers serving on the Forestry Boards in Maryland have been working to sustain valuable forest resources. Forestry Boards have always realized the value of forests in providing forest products. In recent years, Baltimore County's Forestry Board has also recognized a growing awareness of the ecological values and benefits of trees and forests for retarding soil erosion, recycling nutrients, improving water quality, providing essential habitats for the region's forest-dependent wildlife, and for adding beauty to the landscapes of the region.

This Board has provided leadership for environmental improvement throughout the County through its tree planting and maintenance events and through its educational programs and opportunities highlighting watershed protection and the benefits of trees and forests. In recognition of the value of these programs, Baltimore County DEPRM has provided support through annual financial grants to the Board. Certain programs, developed and implemented in cooperation with the Maryland DNR and with the support of DEPRM, offer excellent opportunities for environmental education. A brief summary of Forestry board activities includes the following:

- Promotion of and support for community "greening," and for the state-sponsored Tree-Mendous Maryland Program;
- Participation in the Department of Parks and Recreation forest buffer restoration activities, Senior Expo, BCPS Advanced Placement and MD State Fair events

- Maintenance of the Board's website www.bcfb.sailorsite.net/ providing a range of information on tree and forests topics, updated 4 times/year;
- Contribution of funds to the Maryland Smokey the Bear fire prevention campaign;
- Donation of scholarships for three high school students interested in environmental science careers to attend the annual Natural Resources Career Conference at Camp Hickory in Garrett County, Maryland;
- Annual seed collection activities for the State John Ayton tree nursery;
- Distribution of seedlings in cooperation with DNR;
- Processing of the 2007 Tree City USA award for Baltimore County's commitment to a community forestry program, a forest and tree conservation ordinance and set of regulations, support of the County's Forest Conservancy District Board's environmental education programs, and an annual Arbor Day celebration;
- Facilitating the annual *Maryland PLANT Community* award: a DNR recognition program, recognizing the greening committees, schools, and groups that meet established criteria. This award is automatically presented to recipients of the Tree City award;
- Providing technical assistance and tree donations to school groups for planting projects at County parks;
- Providing technical assistance and donations of soils and fertilizers to schools for planting projects on school properties;
- Providing support for the annual Envirothon competition for high school students in cooperation with Baltimore County Department of Education, the Natural Resources conservation Service (NRCS), and DEPRM. Annual topics include forestry, soils, wildlife, aquatic and a fifth rotating topic on current pertinent issues, some of which have included wetlands, agricultural lands preservation, cultural landscapes, exotic, invasive species, natural resource management in urban environments, and in 2007, Alternative/Renewable Energy. Since 2000, DEPRM staff has served as teaching experts in training sessions for Envirothon participating students in the aquatics and fifth rotating issue topics.
- Serving on the steering committee for DEPRM's forest sustainability initiative using the Montreal Process criteria and ecological indicators;
- Developing an urban forestry scholarship program in partnership with the University of MD.

4.2.8 The Baltimore County Growing Home Campaign

The *Growing Home Campaign*, Baltimore County's urban tree planting and education project, was introduced to the public in spring 2006 and expanded in 2007. The *Growing Home Campaign* is an innovative approach to expanding urban tree canopy on private residential properties in Baltimore County. As a successful public-private partnership between Baltimore County, local retail nurseries and garden centers, and homeowners, the *Campaign's* goal since inception in Spring 2006 is to motivate homeowners to plant 10,000 new trees on private residential property. *Growing Home* is a social marketing campaign that addresses behavior change at the homeowner level through (1) **targeted homeowner education** about planting native and other selected urban-tolerant trees in private yards, and (2) a **financial incentive** in the form of a point-of-purchase $10

discount from participating area nurseries and garden centers toward the cost of a qualifying tree costing $25 or greater. The coupons also serve as a mechanism to track the success of the *Campaign* to add trees to targeted tree deficient areas by geo-coding information and mapping the results using GIS software.

Homeowners play an important role in the *Campaign* by 1) purchasing trees to plant in their yards, and 2) transporting, watering and maintaining the trees. Local nurseries play an important role in the *Campaign* by 1) contributing a cost share of $5 for each reimbursed coupon, 2) promoting tree planting, 3) stocking a diverse selection of trees that are appropriately sized and priced for the average homeowner to transport and plant, and 4) offering customers knowledgeable horticultural advice about their tree selections. The *Growing Home Campaign* supported local retail nursery businesses and provided education about trees and tree purchase discounts for homeowners. The *Campaign* also leveraged about $19 of total private sector investment per dollar of County cost share funds. During 2007, the program was funded in part by the Chesapeake Bay Program and its federal partners, including the U.S. Forest Service with corporate support from Baltimore Gas & Electric Company and the Weyerhaeuser Company Foundation.

The overall goal of the *Growing Home Campaign* is to increase much needed tree cover in Baltimore County, especially in the urban areas of the County. Older Baltimore County communities within the URDL (Urban Rural Demarcation Line) are in great need of additional trees. Baltimore County has identified target areas within the County's URDL (Urban Rural Demarcation Line) where there is an existing tree deficit. An in depth assessment of the urban tree canopy in Baltimore County is currently being completed. However, preliminary analysis was conducted in 2002 to define the "tree deficit" for the urban area of the County and to compare the County's urban tree cover to thresholds recommended by American Forests. Overall, Baltimore County's 130,700 acres of urban area support only 22,099 acres of significant tree canopy (16.9%). This falls below the American Forests' guideline of 40% overall for urbanized areas, as well as the guidelines for urban residential areas (25%) and suburban residential areas.

Growing Home provides a needed alternative for the control of urban non-point source pollution. There are approximately 100,000 acres of residentially zoned land within Baltimore County's urban area (the URDL). Overall only about 20% of the County's urban areas, including non-residentially zoned urban land totaling an additional 32,000 acres, is managed by stormwater facilities, half of which are older stormwater detention ponds providing no significant water quality functions. Additional significant acreage of residential development exists outside the URDL at lower densities. DEPRM's watershed water quality management plans have identified a relatively small number of feasible locations for construction of stormwater water quality retrofits on public land. This program is one way the County is gaining stormwater benefits from private lands and with a cost share component.

Homeowner outreach for the *Growing Home Campaign* includes comprehensive education about the value of adding trees within existing neighborhoods, guidance about site considerations and species selection, and tree planting and maintenance instructions. Also included is information on the multiple environmental benefits of planting trees including: (1) slowing stormwater runoff and reducing the cost of controlling stormwater,

especially in urban areas, (2) reducing erosion, (3) filtering air and water by absorbing air pollutants and fertilizer and pesticide runoff. The educational information will be distributed as a printed brochure titled "Plant Your Own Tree" widely distributed throughout the County and on the *Growing Home Campaign* website www.baltimorecountymd.gov/go/trees.

Homeowners are also offered a financial incentive in the form of a $10 coupon redeemable toward the purchase of a tree from a local participating retailer. The County will reimburse participating retailers $5 for each coupon used to purchase a qualifying tree. *Growing Home Campaign* brochures with the *Growing Home* Coupon are widely available through County libraries, Senior Centers, and Recreation and Parks Centers, as well as online at www.baltimorecountymd.gov/go/trees.

The sections below describe in detail the activities accomplished of the *Growing Home Campaign* during 2007:

The *Growing Home* coupon applied to qualifying trees costing at least $25. The estimated average cost of trees purchased by homeowners through the program was $75. The number of trees purchased and planted using the $10 *Growing Home* coupon during the 2007 sales season from March 1st through December 31st was 1,047

The *Growing Home Campaign* resulted in a significant "first investment" in increasing the urban tree canopy in Baltimore County. A majority of the trees sold were planted in the more urbanized areas in the County. Baltimore County and retailer cost share for trees totaled $10,470, and homeowner after-discount tree purchases totaled $68,556 for a total investment of $79,026. Labor provided by homeowners for transporting, planting, and maintaining trees is estimated at an additional $26,175 ($25 per tree). Estimated total impact was $105,201. There were 30 participating *Growing Home* retail nurseries and garden centers in 2007.

Assessment of public outreach for the *Growing Home Campaign:*

Baltimore County has a population of over 801,000. Citizens were reached in a variety of ways. Printed educational material distributed to the general public - Baltimore County citizens included:

Publications

Growing Home Campaign Brochure- "Plant Your Own Tree" with $10 Tree coupon.

- 30,000 printed and over 15,000 distributed during 2007 spring season, remainder distributed during fall 2007 campaign.

Growing Home Campaign Posters- 3 different themes.

- "Plant Your Own Family Tree" – 250 printed and distributed.
- "Who Says Money Doesn't Grow on Trees?" – 250 printed and distributed.
- "Fall for a Tree" – 300 printed and distributed

Internet

Growing Home Campaign website www.baltimorecountymd.gov/go/trees

- There were 2,802 views of the website homepage.
- There were 2,582 downloaded *Growing Home* $10 tree coupons and "Plant Your Own Tree" brochures (which contained the $10 tree coupon).
- There were 1,183 downloaded copies of *Growing Home* recommended tree species list.

Media Coverage

Television

- Interview (10 minute) with *Campaign* Coordinator on Comcast Public Access 'Hello Baltimore County' Spring 2007 (aired 20 times in April) and Fall 2007(aired 20 times in October).
- Interview (5 minute) with *Campaign* Coordinator on Comcast CNN 'Newsmakers' Spring 2007 (aired in April) and Fall 2007(aired in October).

Newspapers and Community Newsletters

Coverage in Baltimore Sun, Examiner, Patuxent Publishing Baltimore County, several Community Association newsletters, several watershed association newsletters.

Internet

Coverage on several websites including but not limited to: Herring Run Watershed Assoc., Jones Falls Watershed Assoc., Chesapeake Bay Trust.

E-mail Newsletters

Distribution- sent to over 1,500 email addresses with request to forward to interested persons.

- *"The Growing Home Campaign*: Increasing the Urban Tree Canopy" 3/07
- "Remember Mother Nature too this Mother's Day- Plant Mom a Tree through the *Growing Home Campaign*" 5/07.
- "Got Shade? Thank a Tree. Got Clean Air and Birds Singing in Your Neighborhood? Thank a Tree." 6/07.

Email newsletter contact with the following:

- Environmental groups- at least 532 contact representatives
- Community associations- at least 470 contact representatives

Distribution: Baltimore County Agencies distributing information to employees and the public**:**

- 16 Libraries
- 17 Senior Centers

- 16 Recreation and Parks facilities
- 7,000 Baltimore County employees reached by email and payroll inserts.
- Baltimore County Public and Private Schools- 389 contact representatives
- Elected officials- 37 contact representatives

Festivals And Other Public Events:

- Maryland Home and Garden Show, Timonium Fairgrounds

  Extent of the outreach: meeting attendance 6,000, publications 600 brochures
- Towson Garden Days / Arbor Day Celebration

  Extent of the outreach: meeting attendance 300, publications 100 brochures
- Baltimore County Waterfront Festival

  Extent of the outreach: meeting attendance 1000, publications 100 brochures
- Cromwell Valley Fall Festival

  Extent of the outreach: meeting attendance 500, publications 100 brochures
- Maryland State Fair, Timonium Fairgrounds

  Extent of the outreach: attendance thousands, publications 1,000 brochures

Growing Home Campaign Information Communicated to Key Partners:

Retail Nursery and Garden Center Businesses: There was a high level of participation from nurseries and garden centers in Baltimore County and surrounding jurisdictions: a total of 30. Virtually all independent retail nurseries in Baltimore County as well as 5 locations of a major home improvement retailer participated. One independent nursery in Baltimore City and 6 located in neighboring counties also participated, although generally there was limited activity at businesses outside Baltimore County. Participating retailers contributed $5 toward each $10 coupon.

Nursery and Garden Center Retailer outreach:

- 37 site visits with participating *Growing Home Campaign* retailers
- Maintained open communication with participating retailers by phone, email, FAX and postal service throughout the *Campaign*.
- Green Renaissance award presented by Baltimore County Executive to all participating nurseries in recognition of their contribution to increasing tree canopy in the county. Public ceremony Arbor Day 4/26/2007.

Surveys:

- Retailer Survey to participating *Growing Home* retailers in January 2007.
- Participating *Growing Home* Nursery Retailer Surveys: Evaluation of the 2007 spring program and recommendations for the 2007 fall *Campaign* and 2008 season.

Maryland Nursery and Landscape Association:

- *Growing Home Campaign* presentation to the Maryland Nursery and Landscape Association annual meeting. Mid Atlantic Nursery Trade Show 1/10-12 /2007
- Maintained open communication with MNLA by phone, email, FAX and postal service throughout the *Campaign*.
- *Green Renaissance* award presented by Baltimore County Executive to Maryland Nursery and Landscape Association in recognition of their contribution to increasing tree canopy in the county. Public ceremony Arbor Day 4/26/2007.

Meetings and Events With Environmental Groups:

- Jones Falls Watershed Association Annual meeting. Meeting attendance 150, publication circulation 50
- Pataspco Valley Watershed Association annual meeting. Meeting attendance 50, publication circulation 25
- Herring Run Watershed Association – Project Clean Stream and Annual Plant Sale. Meeting attendance 200, publication circulation 150
- Project Clean Stream 4/15/2007. Watershed groups involved: Herring Run Watershed Assoc., Jones Falls Watershed Assoc., Prettyboy Watershed Assoc., Friends of Gwynns Falls, Friends of Patapsco Valley, Gunpowder Valley Conservancy. Meeting attendance 400, publications 300

Business Contacts:

- Baltimore Gas and Electric Company: Maintained open communication with BGE by phone, email, throughout the *Campaign*. Collaborated with BGE office of communication on inclusion of Growing Home Campaign information in a BGE billing insert. Extent of the outreach: publication circulation- 1.5 million households in Central Maryland.
- Weyerhauser Company Foundation. Publication circulation 700 brochures

Outreach for Expansion of the *Growing Home Campaign*

During this reporting period, Baltimore County DEPRM shared information about the *Growing Home Campaign* with (1) surrounding jurisdictions in Maryland: Baltimore City, Harford County, Carroll County, Anne Arundel County, Howard County, Montgomery County, and with (2) Pennsylvania (DNCR Urban Forestry), Delaware (Forest Service Delaware Forestry Council), Indianapolis, Indiana, Nashville Tennessee, New York City (Million Trees NYC), and representatives from other cities and states attending the Partners in Community Forestry National Conference, November 14-16, 2007.

During 2007, Baltimore County DEPRM shared information about the *Growing Home Campaign* with Baltimore City, which culminated in a partnership for expansion of the *Growing Home Campaign* to residents of Baltimore City beginning in 2008 as an

outgrowth of the Baltimore Watershed Agreement and as part of the City's effort to increase urban tree canopy.

Beginning in 2007, Baltimore County DEPRM has shared information about the *Growing Home Campaign* with Indianapolis, Indiana about developing a program modeled on the *Growing Home Campaign* to increase urban tree canopy on private residential land as a partnership between homeowners, local retail nurseries, and local government. Indianapolis, through Keep Indianapolis Beautiful, launched their program, *My Tree and Me*, in April 2008. There has been an ongoing collaboration between Baltimore County DEPRM and Indianapolis during 2008 regarding the Indianapolis program.

4.2.9 Additional Educational Efforts

In addition to the activities described above, DEPRM staff acted on potential opportunities for informal environmental education as they became possible through contact and interaction with citizens.

As citizens routinely visit DEPRM for permits or development review, the opportunity is used to share environmental information and make recommendations. Over 100 telephone calls and email messages per week resulted in opportunities to answer questions and provide environmental education. Responses by phone, fax, email, and traditional mail were followed information packets available on the webpage, faxed, or sent through the mail. Recycling and grasscycling actions were promoted in the *Let's Be Partners* education program and detailed information was distributed by the Baltimore County DPW, Bureau of Solid Waste Management, Recycling Division. The BC DPW Recycling division conducts school programs, approximately 20/year. Substantial support was provided to local watershed associations in the form of grant funding, organizational guidance, identification of stakeholders, training, educational presentations, brochures, data, GIS maps, and participation at local festival events.

Brochures, maps, and specific information promoting citizen education on the topic of stormwater pollutants were also distributed by staff in the following DEPRM sections: Waste Management, Environmental Health, Watershed Management and Monitoring, Field Operations, Capital Improvement, Environmental Impact Review/Critical Areas/Marinas, Stormwater Engineering, and Groundwater Management.

DEPRM staff attended local Tributary Strategy meetings and participated in the Tributary Strategies Team's Education and Outreach Committee.

4.3 Summary

Baltimore County has fully developed and implemented its education programs for reducing the use of pesticides, herbicides and fertilizers, controlling of stormwater pollutants, and disposing of toxic wastes. Its initiatives and programs are multi-faceted and developed for flexibility so that the message may be easily adapted to a variety of educational settings involving school administration and staff, facility managers, students, homeowners, community groups, watershed coalitions, faith communities, and businesses in various geographic settings around the County and region.

A number of important new components and materials have been developed or enhanced in order to better reach certain target audiences. Through local initiatives by individual

watershed organizations, the *MD Green Schools/Green Centers* initiatives, and special professional development projects for school staff, continued emphasis has been placed on institutional landscape design, maintenance, and conservation landscaping concepts such as the benefits of native plants, integrated pest management (IPM), and removal of impervious surfaces. Pet waste, grass clippings, improper application of fertilizer, and other sources of nutrients in urban and suburban neighborhoods have been highlighted. The County's *Green Renaissance* and *Growing Home Campaign* initiatives were promoted.

In its broad-based school initiatives, DEPRM has shifted emphasis from hosting individual classroom events to teacher training, outreach to supervisors and facility staff, and working with community coalition groups to foster new partnerships, provide a wider range of services, and reach more citizens.

Partnerships with other Baltimore County offices and agencies enhanced the level of communication, avoided duplication of services, and increased overall effectiveness and efficiency. Supporting materials developed by the department and by outside organizations were distributed at educational events, in DEPRM's lobby, through the mail, and increasingly via the County web site: www.baltimorecountymd.gov/go/deprm. Surveys, questionnaires, user feedback, and informal review have been used as assessment tools. Volunteer citizen participation in pollution prevention and stewardship was promoted in all components of the program.

Through *BayScaping, MD Green School, MD Green Center, CBT Teacher of the Year,* and other awards, citizens, organizations, and schools were recognized for committing to actions that will improve water quality. Educators, nominated by DEPRM for special awards, were honored for their significant contributions. Outstanding citizens and teachers will again be identified and nominated for statewide award recognition.

Options for program modification and expansion are being reviewed and the update is ongoing. Recommendations resulting from the current program assessment will guide future program implementation. Continued expansion of the partnerships involving businesses and schools throughout the County is planned for 2008. New school populations on the east and west sides of the County will be targeted for increased education and outreach. Targeted outreach to private independent and parochial schools will be conducted. Additional potential *MD Green Centers* will be targeted.

DEPRM will identify ways to increase its support of local watershed organizations and recognized *MD Green Schools* and *Centers*. New opportunities to increase awareness, interact with school administration at all levels, and affect policy will be pursued. Additional tracking and evaluative strategies will be identified.

In 2007, many components of Baltimore County's *Let's Be Partners/Getting Greener Schools* program were used as a models for program development by other counties, agencies and jurisdictions. The County continues to be a leader in providing effective, innovative environmental education and outreach to its citizens, schools, and organizations.

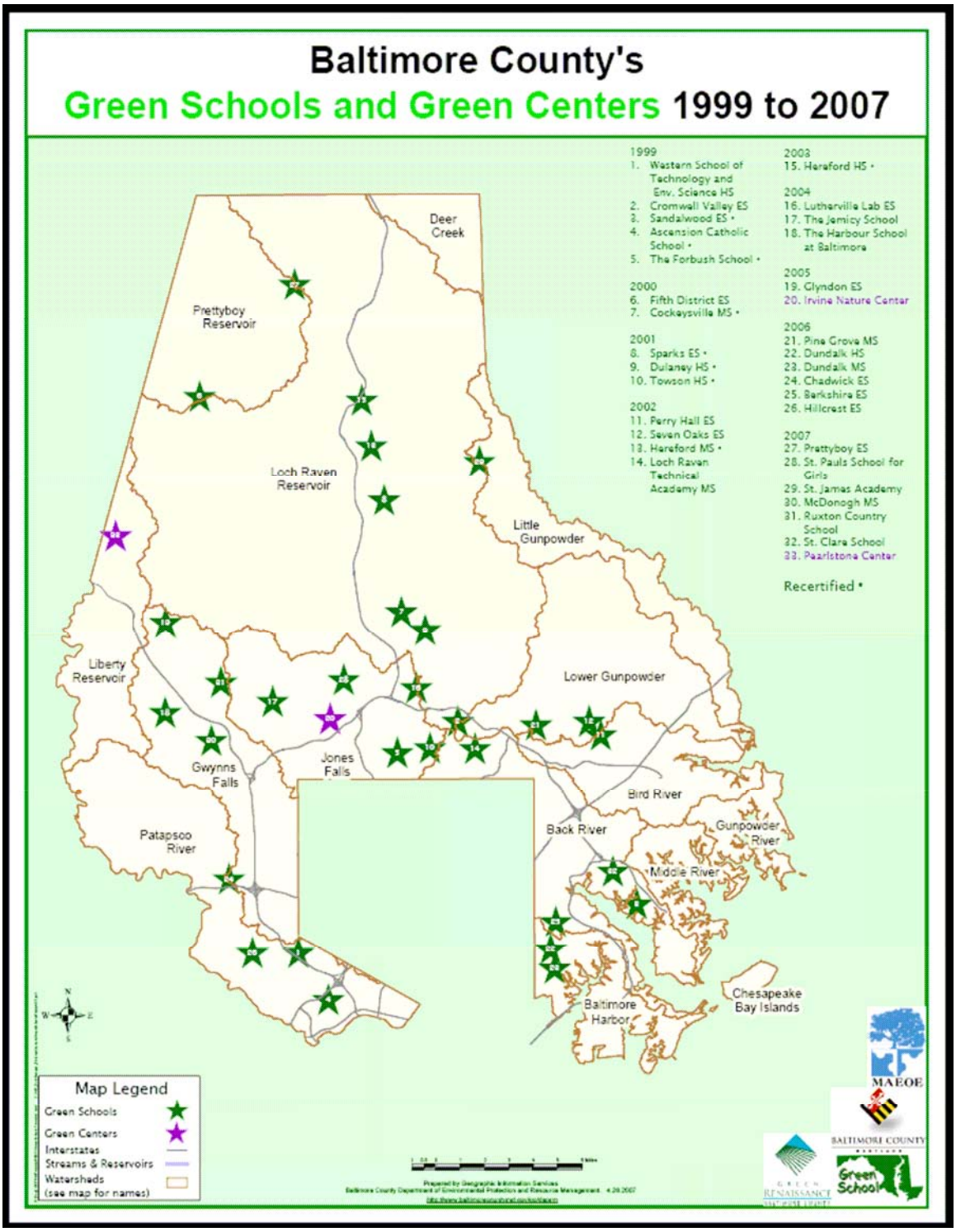
As stated in the Bay agreement, Chesapeake 2000,

> The Chesapeake Bay is dependent upon the actions of every citizen in the watershed, both today and in the future. We recognize the cumulative benefit derived from community-based watershed programs is essential for continued progress toward a healthier Chesapeake Bay.

Paralleling the tenets of the Bay agreement, Baltimore County continues to:

- Make a significant commitment to education, outreach, and stewardship.
- Provide the information and assistance that citizens need to act at home, at school, at work, and in their local watersheds.
- Use new communication technologies, such as the worldwide web and cable television, to provide information for citizens, businesses, and schools.
- Promote and facilitate meaningful outdoor interactive and investigative environmental experiences for young people.
- Provide programmatic models for the state and region.
- Work in partnerships to provide valuable assistance to public and private schools.
- Work towards "government by example," that is, the implementation of conservation design strategies and sustainable landscaping techniques on publicly owned and managed properties to serve as models for the community.

Exhibit 4-1: Baltimore County's *Maryland Green Schools and Green Centers*, 1999-2007



Appendix 4-1: Education Program Presentations and Events, 2007
Accomplished by
Baltimore County Department of Environmental Protection and Resource Management (DEPRM)

DATE	ORGANIZATION	LOCATION	WATERSHED (Audience)	# PEOPLE
Jan-Nov	Lobby Display (6 topics) Ongoing throughout 2007	Towson	Countywide, Regional Jones Falls	2,450
Jan-Dec	DEPRM Duty Room	Towson	Countywide	6,250
Jan-Dec	Comcast video: "Down to Earth"	Countywide	Countywide, Regional	Est 130,000
Jan-Dec	Comcast video: "Our land Our Legacy"	Countywide	Countywide, Regional	Est 130,000
Jan-Dec	BC Public Libraries (16)	16 branches	Countywide	1,600
01/04/07	Boy Scout Explorer Troop #9907	Cockeysville	Loch Raven	20
01/08/07	Green School/Green Center presentation at Pearlstone	Reisterstown	Liberty	25
01/10/07	Mid-Atlantic Nursery and Landscape Trade Show (MANTS)	Baltimore City	Countywide, Regional	250
01/11/07	Mid-Atlantic Nursery and Landscape Trade Show (MANTS)	Baltimore City	Countywide, Regional	500
01/12/07	Mid-Atlantic Nursery and Landscape Trade Show (MANTS)	Baltimore City	Countywide, Regional	500
01/18/07	Jewish Community	Pikesville	Countywide	3
01/20/07	Prettyboy Community Meeting	North County	Prettyboy	65
01/22/07	Pearlstone	Reisterstown	Loch Raven	5
01/22/07	Bird River Community Meeting		Bird River	12
01/23/07	RICA School	Baltimore City	Gwynn Falls	5
01/23/07	BCPS Green Schools Committee		Countywide	10
01/26/07	Vegetable Crop Day	North County	Loch Raven, Prettyboy	100
01/27/07	Prettyboy WRAS Meeting	North County	Prettyboy	50
01/29/07	Cedarmere Elementary School	Reisterstown	Gwynn Falls	25
02/02/07	MAEOE workshop	Ocean City	Countywide, Regional	40
02/03/07	MAEOE sessions (2)	Ocean City	Countywide, Regional	40
02/03/07	MAEOE Display	Ocean City	Countywide, Regional	550
02/12/07	Jewish Community Education Meeting	Pikesville	Jones Falls, Countywide	10
02/20/07	Rosedale Center HS Faculty #1	Rosedale	Countywide	70
02/20/07	Rosedale Center HS Faculty # 2	Rosedale	Countywide	60
02/20/07	BCPS Green School Committee	Towson	Countywide	20
02/21/07	Towson Garden Day	Towson	Jones Falls, Bird River	25
02/23/07	Sparks ES	Sparks	Loch Raven	100
02/23/07	Forbush School	Towson	Jones Falls	60
02/26/07	Jewish Green School Initiative		Jones Falls	3
02/28/07	BCPS Green School Committee	Towson	Jones Falls	20
03/01/07	Lutherville ES	Lutherville	Loch Raven Gwynns Falls	60

DATE	ORGANIZATION	LOCATION	WATERSHED (Audience)	# PEOPLE
03/03/07	BCPS STEM Fair	Timonium	Countywide	600
03/06/07	Lutherville HOA Facilities Group	Lutherville	Jones Falls	8
03/06/07	Duty Room Bayscapes	Towson	Countywide	100
03/09/07	Maryland Home and Garden	Timonium	Countywide, Regional	1000
03/10/07	Maryland Home and Garden	Timonium	Countywide, Regional	1000
03/12/07	Maryland Home and Garden	Timonium	Countywide, Regional	1000
03/14/07	Golf Course Workshop	Annapolis	Countywide, Regional	100
03/14/07	McDonogh School	Owings Mills	Gwynn Falls	10
03/15/07	Gwynnbrooke Avenue Residents	Reisterstown Owings Mills	Gwynns Falls	6
03/15/07	Hereford HS Career Fair	Parkton	Loch Raven	24
03/16/07	Envirothon Training; Sparrows Point HS (3 teams)	Monkton	 Back R, Balto. Harbor	30
03/16/07	EPA interview	Towson	Regional	5
03/17/07	Chesapeake Covenant Congregations	Towson	Regional	40
03/21/07	Carney Improvement Association	Carney	Bird R, Back R Lower Gunpowder	35
03/22/07	Western Tech HS Career Fair	Catonsville	Patapsco	50
03/27/07	Boys Latin GS	Baltimore City	Jones Falls	20
03/28/07	ACB- Bayscapes	Towson	Countywide	30
04/03/07	Lutherville Lab ES Science Fair	Lutherville	Jones Falls	200
04/05/07	Career Day Parkville HS	Parkville	Bird River, Back River	500
Apr-Oct	HHW Drop-off continuing seasonal	Eastern	Countywide	6327
04/02/07	CNN Newsmakers taping for Growing Home	White Marsh	Countywide, Regional	Est 1000
04/06/07	Comcast taping for Growing Home Program airing month of April	White Marsh	Countywide	Est 1000
04/07/07	HHW Spring Event	Eastern	Countywide	1200
04/10/07	Agriculture Program event	North County	Loch Raven	250
04/11/07	Greenbriar Garden Club: Invasives control	East Towson	Back R, Lower Gunpowder	25
04/14/07	Project Clean Stream	Countywide	Countywide, Prettyboy, Jones Falls, Gwynns Falls, Back R, Patapsco,	35
04/16/07	Cromwell ES	Towson	Lower Gunpowder	100
04/16/07	Envirothon School Teams (training): Catonville HS Western HS (2 teams) Sparrows Point HS Eastern HS Milford Mill HS	Monkton	 Patapsco Patapsco Back R, Balto Harbor Back R, Middle R Gwynns Falls	55
04/18/07	Green School Application Review	Annapolis	Regional	35
04/24/07	7th District ES	Parkton	Loch Raven Deer Creek Prettyboy	15

DATE	ORGANIZATION	LOCATION	WATERSHED (Audience)	# PEOPLE
04/25/07	Career Day Timonium ES	Timonium	Jones Falls, Loch Raven	50
04/26/07	Arbor Day in Baltimore County Bayscapes Awards	Towson	Jones Falls, Countywide	500
04/26/07	Towson Gardens Day	Towson	Jones Falls, Countywide	1000
04/26/07	Take Your child to Work: Career Ed.	Towson	Jones Falls, Countywide	15
04/26/07	2006-7 Envirothon School Teams (test): Catonville HS (2 teams) Western HS (2 teams) Sparrows Point HS (2 teams) Eastern HS Milford Mill HS Chesapeake HS (2 teams) Kenwood HS Perry Hall HS (2 teams) Hereford HS Towson HS	Days Cove	 Patapsco Patapsco Back R, Balto Harbor Back R, Middle R Gwynns Falls Back R, Middle R Back R, Middle R Bird R, Lwr Gnpowder Loch Raven, Deer Cr Prettyboy, Liberty Back R, Jones Falls, Loch Raven, Lwr Gunpowder	115
04/27/07	Earth Day Towson HS	Towson	Back River	1500
04/28/07	"Caring for Creation" Episcopal. Cathedral of Incarnation	Baltimore	Countywide, Regional	50
05/09/07	Lower Spring Branch Community Mtg	Timonium	Loch Raven	25
05/11/07	Boyscout Troop	Churchville	Regional	15
05/12/07	Waterfront Festival	East County	Countywide	Est 3000
05/12/07	Smithsonian Env. Research Center	Edgewater	Countywide	200
05/16/07	Pot Spring ES Earth Day	Timonium	Loch Raven	600
05/22/07	Northrup Grumman		Countywide, Patapsco	600
05/31/07	GS Ceremony	Catonsville	Regional	400
05/31/07	Hereford MS Bay Days	Hereford	Prettyboy , Loch Raven Deer Creek	100
06/02/07	Marshy Point Spring Fest	East County	Countywide	50
06/05/07	Chase Elementary School w/ Northrup Grumman	Baltimore	Gunpowder River	80
06/07/07	JFWA Green School Presentation	Towson	Jones Falls	3
06/09/07	Eagle Scout Planting	Essex	Middle River	60
06/13/07	Park School GS	Baltimore	Jones Falls	4
06/14/07	Pearlstone Site Visit/Meeting w/ Staff	Reisterstown	Regional	30
06/19/07	Fairview Teachers GS Workshop	Clear Spring	Regional	75
06/20/07	Secchi Disk Monitoring Class	White Marsh area	Bird River	19
06/25/07	Secchi Disk monitoring Training class	White Marsh area	Bird River	19
06/26/07	Goucher Teacher Training	Towson	Loch Raven	25

DATE	ORGANIZATION	LOCATION	WATERSHED (Audience)	# PEOPLE
06/26/07	SWAP stakeholder meeting	Towson	Regional, Back River Jones Falls	40
06/27/07	St Patricks Project Residents	Overlea	Back River	30
06/27/07	Sandy Plains ES	Dundalk	Baltimore Harbor	80
06/27/07	Environmental Matters Tour House of Delegates	Central/east county	Lower GP, Countywide Middle River	35
07/03/07	Sulgrave Homeowners	Pikesville	Jones Falls	20
07/20/07	BES Teacher Training	Baltimore City	Countywide	15
07/23/07	Grounds for Teaching	Sparks	Countywide Loch Raven	25
07/24/07	Grounds for Teaching	Chesapeake Bay	Countywide, Regional	25
07/25/07	Grounds for Teaching	Rocky Point	Middle, Gunpowder, Bird	25
07/26/07	Grounds for Teaching	Annapolis	Countywide, Regional	25
07/2707	Grounds for Teaching	Marshy Point	Gunpowder River	25
07/30/07	Grounds for Teaching	Marshy Pt	Countywide Gunpowder River	25
07/31/07	Grounds for Teaching	Marshy Pt	Countywide Gunpowder River	25
08/1/07	Grounds for Teaching	Sparks	Loch Raven Countywide	25
08/2/07	Grounds for Teaching	Annapolis	Countywide	25
08/3/07	Grounds for Teaching	Marshy Pt	Countywide Gunpowder River	25
08/13/07	Gilman School GS presentation	Baltimore City	Jones Falls	10
08/21/07	Jacksonville ES	Jacksonville	Loch Raven	50
08/24-9/3	MD State Fair (13)	Timonium	Countywide, Regional Loch Raven	60,000
09/03/07	Grounds for Teaching	Sparks	Loch Raven, Countywide	25
09/07/07	Comcast taping for Growing Home airing through September	White Marsh	Countywide	Est 1000
09/15-16	Harford Comm. College Youth event	Belair	Regional	300
9/20/07	Gwynns Falls Watershed Event	Baltimore City	Gwynns Falls, Regional	12
09/30/07	BJENS Conference-invasives	Reisterstown area	Gwynns Falls Jones Falls Countywide, Regional	50
09/30/07	Green Schools for BJENS Growing Home Display	Reisterstown area	Gwynns Falls Jones Falls Countywide, Regional	500
09/30/07	Eastfield Stansbrook event	Dundalk	Baltimore Harbor	300
10/03/07	Westowne ES Faculty	Catonsville	Patapsco	68
10/03/07	Westowne ES PTA	Catonsville	Patapsco	55
10/03/07	Westowne ES GS Committee	Catonsville	Patapsco	12
10/06/07	Gwynns Falls Watershed Festival	Baltimore City	Gwynns Falls Regional	500
10/6-7/07	Irvine/Oregon Ridge Honey Fest	Oregon Ridge	Loch Raven	500

DATE	ORGANIZATION	LOCATION	WATERSHED (Audience)	# PEOPLE
10/11/07	Grounds For Teaching	Marshy Point	Countywide Gunpowder River	25
10/11/07	Manor Garden Club	Glen Arm	Loch Raven	20
10/13/07	Gunpowder State park		Lower Gunpowder	34
10/13/07	Cromwell Fall Fest/Harvest Fest	Towson	Lower Gunpowder	937
10/13/07	GPSP event (JHU, scouts)	East county	Lower Gunpowder	30
10/14/07	Cromwell Fall Fest/Harvest Fest	Towson	Lower Gunpowder	800
10/17/07	Dogwood ES Recycling Program	Woodlawn	Patapsco, Gwynns Falls	200
10/17/07	Sussex ES Faculty presentation	Essex	Back River	90
10/19/07	Krieger Schechter Day Sch	Pikesville	Jones Falls	18
10/24/07	Krieger Schechter Day Sch Faculty	Pikesville	Jones Falls	110
10/24/07	Gwynnbrooke Avenue Residents	Reisterstown Owings Mills	Gwynns Falls	3
10/25/07	Irvine Habitat Stewards	Stevenson	Jones Falls Countywide, Regional	20
10/26/07	Millbrooke ES	Pikesville	Jones Falls Gywnns Falls	100
10/29/07	Lauraville Festival	Baltimore City	Back River Regional	300
10/30/07	Dundalk Waterfront Property Owners	Dundalk	Baltimore Harbor	80
10/30/07	Howard County Conservancy- Master Gardeners	Howard County	Regional	50
11/01/07	Lutherville Garden Club	Lutherville	Jones Falls Loch Raven	40
11/02/07	Comcast taping for MD Green School Program airing through November	White Marsh	Countywide	Est 1000
11/03/07	Household Hazardous Waste Day	Timonium	Countywide	1200
11/05/07	Cromwell Valley Park Volunteers	Providence	Lower Gunpowder	200
11/06/07	BC DPW Recycling Division	Towson	Countywide	8
11/08/07	Master Gardeners	Providence	Lower Gunpowder, Countywide	31
11/10/07	BCPS STEM event	Woodlawn	Countywide	500
11/13/07	St Pauls Sch for Girls GS Celebration	Brooklandville	Jones Falls, Countywide Regional	600
11/07/07	Dundalk Waterfront Property Owners	Dundalk	Baltimore Harbor	80
11/14/07	Dundalk Waterfront Property Owners	Dundalk	Baltimore Harbor	80
11/14-16	Partners in Community Forestry	Baltimore City	Regional	500
11/17/07	N American Assoc for Env Education	Norfolk, VA	Regional	800
11/19/07	St Michaels Catholic School	Overlea	Back River	400
11/20/07	Paradise Ave Homeowners	Catonsville	Patapsco	4

DATE	ORGANIZATION	LOCATION	WATERSHED (Audience)	# PEOPLE
11/20/07	2007-8 Envirothon Training: Franklin HS (2 teams) Catonsville HS Western (2 teams) Sparrows Point HS (2 teams) Eastern HS (2 teams) Patapsco HS Chesapeake HS Hereford HS Towson HS New Town HS Perry Hall HS (2 teams) Kenwood Dulaney Owings Mills	Monkton	Gwynns Falls Patapsco Patapsco Back R, Balto Harbor Back R, Middle R Back R, Balto Harbor Back R, Middle R Loch Raven, Liberty, Deer Creek Loch Raven Lower Gunpowder Jones F, Back R Gwynns Falls Bird Lower Gunpowder Middle R, Back R Loch Raven Gwynns Falls	133
11/20/07	The Conservation Fund	Annapolis	Regional	15
11/26/06	Holidays Enviro-tips DEPRM Lobby (display through mid-January)	Towson	Countywide	250
11/27/07	Fort Howard Waterfront Property Owners	Fort Howard	Baltimore Harbor	80
11/28/07	MSDE Briefing	Upper Marlboro	Regional	350
12/03/07	Sussex ES Faculty Mtg	Essex	Back River	100
12/03/07	Westchester ES Faculty	Oella	Patapsco	68
12/03/07	Westchester ES PTA	Oella	Patapsco	40
12/05/07	Field Crop Day	North County	Pretty Boy, Loch Raven, Liberty	125
12/10-12	National Roundtable on Sustainable Forests (3)	Cockeysville	Loch Raven Countywide, Regional	200
12/10/07	Howard County Teachers and Administrators	Howard County	Regional	400
12/11/07	Fort Howard Waterfront Property Owners	Fort Howard	Baltimore Harbor	80
12/11/07	Beth Tfiloh HS	Pikesville	Jones Falls, Countywide, Regional	32
12/17/07	St Pauls School for Boys	Brooklandville	Jones Falls, Countywide, Regional	11
12/18/07	WSSC citizens event	Laurel	Regional	20

Appendix 4-2: Education Program: Recycling Presentations, 2007
Accomplished by
Baltimore County Department of Public Works, Recycling Division (DEPRM)

Date	School	City	Grade	Audience Size
01/09/07	Logan Elementary	Dundalk	K-3	350
01/17/07	Jacksonville Elementary	Phoenix	1	90
02/06/07	Rodgers Forge Elementary	Baltimore	2	90
02/23/07	Winand Elementary	Baltimore	1	80
03/06/07	Hernwood Elementary	Randallstown	3	75
03/21/07	Cedarmere Elementary	Reisterstown	K	65
03/21/07	St. Claire School	Essex	K-8	245
03/29/07	Timonium Elementary	Timonium	1	65
04/19/07	St. Paul's Lutheran School	Lutherville	K	20
04/20/07	Relay Elementary	Baltimore	2	85
04/26/07	Chapel Hill Elementary	Baltimore	K	125
04/27/07	Relay Elementary	Baltimore	K	60
05/02/07	Dogwood Elementary	Baltimore	K	100
06/29/07	Hernwood Elementary	Randallstown	2-5	30
07/20/07	Edgemere Elementary	Baltimore	K-5	30
09/04/07	Catonsville Elementary	Baltimore	4	70
09/06/07	Cedarmere Elementary	Reisterstown	K	65
09/27/07	Church Lane Elementary	Randallstown	K-2	175
10/03/07	7th District Elementary	Parkton	K-3	270
10/03/07	7th District Elementary	Parkton	4-5	105
10/11/07	Oakleigh Elementary	Baltimore	3	80
10/16/07	Southwest Academy	Baltimore	8	15
10/17/07	Dogwood Elementary	Baltimore	1	120
10/22/07	Winfield Elementary	Baltimore	2	75
10/25/07	Milbrook Elementary	Baltimore	2	78
10/31/07	Sussex Elementary	Baltimore	PreK-3	250
10/31/07	Sussex Elementary	Baltimore	4-5	110
11/05/07	Sandalwood Elementary	Baltimore	3-5	225
11/05/07	Sandalwood Elementary	Baltimore	K-2	225
11/09/07	Timonium Elementary	Timonium	4-5	200
11/09/07	Timonium Elementary	Timonium	K-3	200
11/30/07	Winand Elementary	Baltimore	1	60

5.0 Permit Requirements

E.4. Illicit Discharge Detection and Elimination

Baltimore County shall maintain its illicit connection detection and elimination program to ensure that all discharges to and from the municipal separate storm sewer system that are not composed entirely of stormwater are either permitted by MDE or eliminated. The County shall follow the minimum requirements listed below or propose alternative methods for MDE approval:

a. Field screen at least 150 outfalls annually. Each outfall having a discharge or suspected of having an illicit discharge shall be sampled using a chemical test kit;

b. Conduct routine surveys of commercial and industrial watersheds for discovering and eliminating pollutant sources;

c. Maintain a program to address illegal dumping and spills;

d. Use appropriate enforcement procedures for investigating and eliminating illicit discharges, illegal dumping, and spills. Significant discharges shall be reported to MDE for enforcement and/or permitting; and

e. Report illicit discharge detection and elimination activities as specified in PART IV of this permit. Annual Reports shall include any requests and accompanying justifications for proposed modification to the illicit discharge detection and elimination program.

5.1 Introduction

The NPDES - Municipal Stormwater Discharge Permit program required full implementation of the County's stormwater outfall screening schedule by September 30, 1997. The *Manual of Practice for Detection and Removal of Illicit Connections* was completed on January 30, 1997 and guides the implementation of this project. The Watershed Monitoring Section of DEPRM is currently responsible for performing the outfall screenings, reporting screening data, and coordinating remedial actions. Specific correction measures may be the responsibility of DEPRM, the Department of Public Works (DPW), or both, depending upon the nature and sources of detected discharges. Certain illicit connections are referred to the Maryland Department of the Environment (MDE) for permitting or enforcement if there are indications that existing permit limits are being exceeded. Water main leaks are referred to Baltimore City Department of Public Works for correction. Because chlorine is extremely toxic to the fauna in a stream, it is of particular concern when leaks or discharges occur from the public distribution system. High volume, chlorinated leaks can go undetected or remain uncorrected for quite some time. This can affect any water quality monitoring projects being conducted downstream.

5.2 Program Status

The results of this reporting period are presented as three separate components: analysis of routine outfall screenings, analysis of illicit connection investigations conducted by WMM staff, and analysis of illicit connection investigations conducted by DEPRM's Regional Environmental Health Program staff. Although the regional program typically focuses on complaint-driven community hygiene issues, a small percentage of those investigations involve illicit connections.

During the calendar year 2007, the Watershed Monitoring Section of DEPRM staff conducted 159 routine outfall screenings in which 35 required further investigative or remedial actions. WMM staff investigated 29 citizen complaints. Based on an analyses of complaints investigated by DEPRM's regional staff over the past five years, approximately 13% the complaints usually involve potential illicit connections.

As revealed in the analysis in the following section, routine outfall screenings for detection of illicit connections appear to compliment citizen complaints of problems they observe. Aside from the benefits of greater public involvement and the resolution of complaints, citizens provide surveillance at a level beyond that of the monitoring staff. A majority of the time citizens call while they are actually observing a problem and often can provide immediate local information that increases the chance of eliminating illicit connections. The routine outfall screenings catch the chronic problems that may be missed by the public, such as chlorine leaks from the municipal water supply.

5.3 Analysis of Outfall Screenings

A routine outfall screening consists of:

(1) A quantitative analysis of the effluent. This includes measuring the effluent flow rate, temperature and pH, and field-testing with the LaMotte NPDES test kit. This includes parts per million tests for copper, chlorine, and phenol. A qualitative assessment of the effluent, the outfall structure and the receiving channel, noting such conditions as water color, odor, vegetative condition, sedimentation, erosion, damage, etc.

(2) A visual inspection of each outfall, noting any structural damage.

If the problem is severe enough to warrant immediate correction, then an investigation begins immediately. Some sites are determined to have problems severe enough to warrant immediate investigation and/or corrective action after only one screening.

In Baltimore County, there are approximately 3,610 total outfalls. There are two types of outfalls: major and minor. Major outfalls are >36" and minor outfalls are <36". There are 705 major outfalls in our database and 554 have been prioritized. This includes the 33 outfalls that we have found not to exist or are not in a location where they can be sampled. The minor outfalls are just starting to become prioritized, 52 have been completed so far. There is a greater number of them (Approximately 2,904), so they will be dealt with in phases. Concentration will be on the small outfalls in the area where the Small Watershed Action Plans (Section 7) are being focused.

Outfalls are chosen by their priority. The prioritization system works as follows: Outfalls that have not yet been screened twice have not been prioritized. Outfalls that have been screened two or more times are assigned one of three priority ratings. Outfalls with major problems that require immediate correction and/or close monitoring, or outfalls with recurrent problems will be

assigned a *Priority 1 (Critical)* rating. Outfalls with moderate to minor problems that have the potential to become severe are assigned a *Priority 2 (High)* rating. Outfalls with minor or no problems that do not require close monitoring are given a Priority 3 *(Low)* rating. Outfalls categorized as "Low Priority" are on a ten-year screening cycle, "High Priority" outfalls are screened once each year, and "Critical" outfalls are screened four times each year. This system allows for a more streamlined approach in selecting outfalls to screen, and provides a more efficient use of manpower. Outfall priority may be changed if it improves or degrades. The small outfalls will be prioritized after one screening, due to there being many more of them than the major outfalls.

Table 5-1 lists the number of outfalls 36 inches or larger in diameter by watershed and by the priority classification described above. To date, 118 of the outfalls 36 inches or larger in diameter have not been sampled sufficiently to be prioritized. Additional screening effort will allow the County to assess and prioritize the status of these outfalls.

Table 5-1: Major Outfalls by Watershed and Priority Classification

Watershed	Priority 1	Priority 2	Priority 3	Total
Upper Western Shore				
Loch Raven	5	35	31	71
Lower Gunpowder	2	17	7	26
Gunpowder River	0	0	0	0
Little Gunpowder Falls	0	2	0	2
Bird River	2	9	28	39
Middle River	0	8	5	13
Total	9	71	71	151
Patapsco-Back River				
Patapsco	2	8	65	75
Gwynns Falls	6	41	99	146
Jones Falls	0	18	35	53
Back River	5	46	56	107
Baltimore Harbor	4	9	9	22
Liberty Reservoir	0	0	0	0
Total	17	122	264	403
Grand Total	26	193	335	554

The locations of the prioritized major outfalls and those remaining to be prioritized are shown in Figure 5-1. As can be noted from the figure, the majority of the outfalls occur within the Urban-Rural Demarcation Line. There is no consistent pattern of outfall location in relation to the prioritization category.

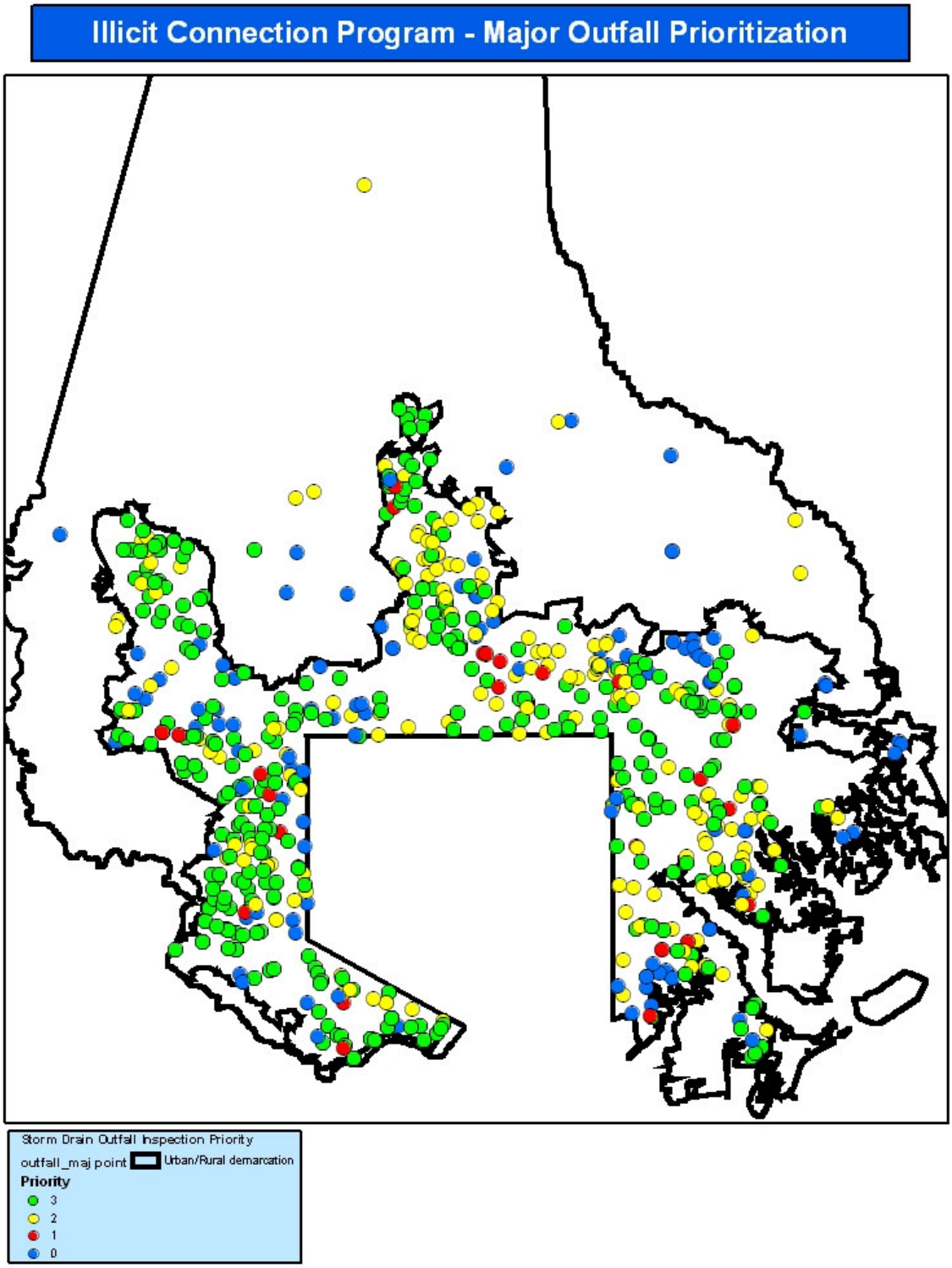


Figure 5-1. Major Outfall Prioritization. Note most outfalls are inside the Urban-Rural Demarcation Line (URDL).

The percentages of the 554 outfalls, which have been given a rating, in each category are shown in Figure 5-2.

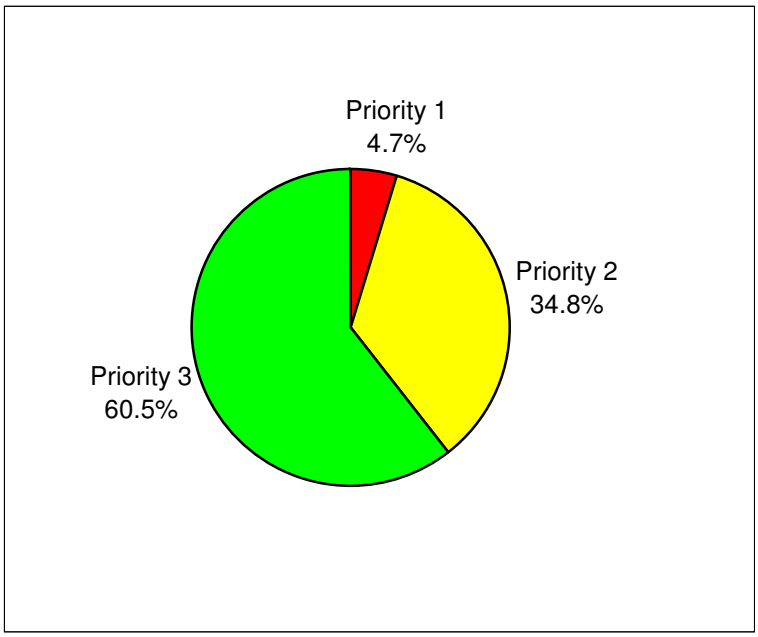


Figure 5-2: Major Outfall Screening Priority Distribution

Of the 158 outfalls screened during 2007, 138 were major outfalls and 20 were minor outfalls. They were selected from the newly prioritized database based on the following criteria:

- Citizens who called or wrote to express concern about stream water quality, but the indicated conditions did not warrant an immediate investigation; and
- Previous screenings indicated water quality problems might exist.

Figure 5-3 shows the quantitative problems and Figure 5-4 shows the qualitative problems found. As indicated in Figure 5-3, by the bar labeled "*none detected*", 116 out of the 158 routine outfall screenings had no detectable quantitative problems. Phenol, chlorine, and copper are considered as indicators if they are above zero. Temperature is considered a potential problem if it exceeds 75 degrees F (23.9 degrees C), which occurred in 26 outfalls. The criteria used to determine if pH is out of range is if it is under 6.0 or above 9.0, and a problem was detected at one outfall. Copper was detected at eight outfalls and phenol was detected at three outfalls. Chlorine was detected at nine outfalls. There were a total of 47 quantitative problems.

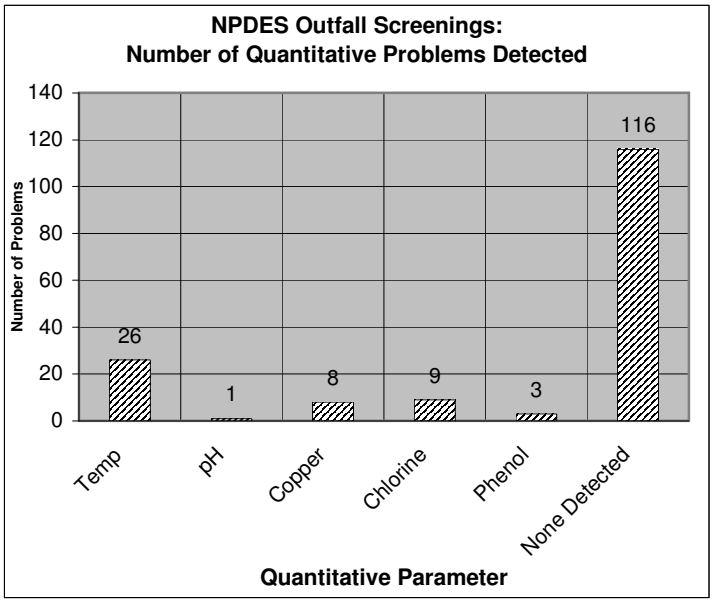


Figure 5-3. Number of *quantitative* problems detected.

Figure 5-4 illustrates incidences of problems observed during *qualitative* assessments such as: visual evidence of sewage, oil, and structural problems. Qualitative and "visual problems" were those most frequently encountered which included observations regarding color, odor, clarity, and receiving water characteristics and sediment deposition immediately at and below each outfall. Trash, erosion, and sediment deposition were observed at 122, 57, and 133 outfalls, respectively. Of the total 158 outfalls screened, there were a total of 364 qualitatively assessed problems, however, 14 had no observed or qualitatively assessed problems. Many of the outfalls screened had more than one problem.

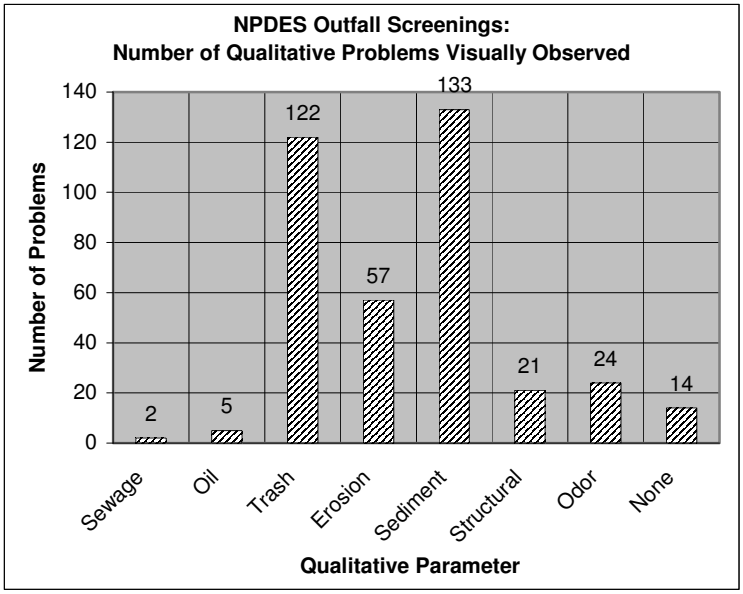


Figure 5-4. Number of *qualitative* problems visually observed.

As described above, routine outfall screenings include a quantitative analysis, a qualitative assessment and a visual inspection. Based on these three procedures, a total of 413 problems were encountered during the 158 routine outfall screenings during this reporting period. Many of the outfalls had more than one problem. Observations regarding the receiving channel within the immediate vicinity of the outfall were also included.

During 2007, outfall screening was distributed among seven watersheds as follows: Gwynns Falls (39), Back River (44), Baltimore Harbor (6), Patapsco (8), Liberty (2), Loch Raven (23), Bird River (5), Little Gunpowder (2), Lower Gunpowder (23), and Jones Falls (6).

5.4 Illicit Connections Investigations and Corrections

During the calendar year 2007, the Watershed Monitoring section processed eighty-seven complaints, of which seventeen were citizen complaints. Forty-one cases were referred to other agencies. Of those forty-one, fourteen are still ongoing. DEPRM is handling the remaining forty-six complaints. Of those, thirty-seven have been closed and nine remain ongoing investigations. These complaints and their status are detailed in Table 5-2.

Table 5-2: Complaints Processed from January 1, 2007 through December 31, 2007

Case No.	COMPLAINT / DATE	ACTION TAKEN	STATUS	LOCATION
07-001	Citizen complained about lack of fish in stream. 1/11/07	Investigated and found poor fish habitat.	Took water samples to be certain habitat is the only limiting factor. Nitrate levels were high but within limits, otherwise water quality was fine. **Case closed**	Benson Mill Rd. and Yeoho Rd. 11-E1
07-002	Routine outfall investigation; excessive algae and foul smell found. 1/24/07	Traced phenols to a manhole near several businesses.	Need to do dye testing to find which business is the source. **On-going**	27 H-6, right across from 695 ramp on Cromwell Bridge Road

07-003	Citizen complained of flooding downstream of bridge. 1/31/07	Citizen seemed to think the cause was cut trees blocking the stream.	The trees did not seem to be causing a problem. Referred to CIP. **On-going**	Race Road bridge at Stemmers Run. 37 B-6
07-004	Recreation and Parks complained of stream erosion. 1/31/07	Stream restoration project has come apart, erosion continues. Recreation and parks are worried about bridge stability.	Referred to CIP. **On-going**	Entrance road to Double Rock Park off Belair Road. 28 H12
07-005	Citizen complained of orange water. 1/17/07	Found that the orange color came from clay deposition. Water was running clear, looked like old deposition. Talked to Sediment Control and no construction is going on in the area. Also talked to property manager of 1001 Cromwell Bridge Rd.	Caused by pipe flushing. **Case Closed**	Beaverbank and Cromwell Bridge Rd. 27 H6
07-006	Citizen complaint of playhouse built in wildlife preserve. 1/16/07	The playhouse was encroaching on stream and several trees had been cut down.	Brian Lindley reported that DPW would remove the playhouse. It is located on Baltimore County property and none of the homeowners will claim it. **Case closed**	Between 11716 and 11748 Mayfield Dr. next to stream. 18 F12
07-007	Citizen complaint of trash in stream/tidal area. 1/23/07	Some of the waste is large and has possible hazardous materials (fridge and microwave).	Environmental Health found site to be clean. A no dumping sign is unnecessary because the site is on a busy residential street. **Case closed**	163 Riverside Road. 37 A9
07-008	Citizen complaint of Owings Mills Car Wash dumping trash and discharging into stream. 1/29/07	Will do more water quality test to determine is algae is from an illicit connection.	PDM issued violation and trash was cleaned up. **On-going**	11629 Reisterstown Road. 16 D12
07-009	Citizen complaint of orange colored water. 1/30/07	Visited stream and determined orange stain and color to be iron bacteria.	More water quality tests supported the conclusion of iron bacteria, which is natural. **Case closed**	Behind 9914 Orbitran. 28 F9
07-010	Routine inspection found outfall ¾ full of concrete/rock debris. There were also covered blue drums sitting in grass swale that drains outfall. 1/16/07	Referred to DPW and Environmental Health.	Blue drums were empty except one, which contained motor oil and is being removed. SHA is looking into who is responsible for maintenance on this outfall. **On-going**	End of Landstreet Road. 18 J10
07-011	Routine inspection found outfall pipe had broken and was now sitting crooked. 3/9/07.	Apron is missing and a deep hole is forming below the outfall.	Referred to DPW Storm Drain Design Section. **On-going**	Behind 959 Shirley Road. 16 D10

07-012	Routine inspection found outfall 100% submerged. 3/20/07	Sediment deposition in stream is causing water to pool around outfall.	DPW ditched outfall and stream. **Case closed**	Owings Mills Blvd. and Kendig Mill Rd. 16 G10
07-013	Routine inspection found outfall separated from pipe at joint. 3/20/07	Referred to DPW.	Since this is not a safety issue it will be repaired when a crew is available. **Case closed**	Gwynnwest and Knight. 16 G9
07-014	While doing fieldwork DEPRM staff found a pvc pipe draining to stream buffer. 3/28/07	Pipe seemed to be pool drainage.	Environmental Health inspected and pipe was not pool drainage. **Case closed**	8214 Marcie Drive. 25 J6
07-015	Received complaint of cloudy white discharge coming from an outfall. 3/27/07	Suspect the drainage was from hotel across the street that was painting.	Found no evidence of dumping, but still educated the citizen on proper disposal of paint. **Case closed**	8225 Town Center Road. 29 E11
07-016	Received copy of BGE permit from MDE for stream water withdrawal for hydrostatic testing. 4/2/07	Wanted to see where the water was getting discharged to after the test and whether another permit was required.	Spoke to MDE Industrial Waste and they said the water was discharged back into the stream and no other permit was needed; the discharge water is considered clean. **Case closed**	Gum Spring and Trumps Mill Road. 36 J1
07-017	While doing fieldwork received complaint of stream erosion from landowner. 3/27/07	Owner of land adjacent to stream is concerned about erosion undermining trees and carport.	Not severe enough to warrant project. Recommended homeowner stop mowing to stream and plant buffer. **Case closed**	3525 Barton Oaks Rd. 25 H11
07-018	While doing fieldwork DEPRM staff witnessed a pool being drained into a storm drain inlet. 4/2/07	Waltham Woods Apartments had an industrial hose draining into the gutter, which was running across the sidewalk into the storm drain.	Advised owners of property on proper disposal and told them they needed a permit to discharge to the storm drain and gave them MDE contact information. **Case closed**	Townhill Road. 28 C6
07-019	Routine outfall inspection found stream with excessive trash. 3/1/07	Referred to Environmental Health.	No violations were found at time of inspection. Business owners were advised to keep dumpster lid closed. **Case closed**	Behind 9920 York Rd. 18 J8
07-020	Routine outfall inspection found excessive trash. 3/21/07	Source of trash is a dumpster behind a liquor store.	PADM investigated, not enough trash present to issue correction notice. **Case closed**	Behind 9645 Reisterstown Road25 A5
07-021	Routine outfall inspection found excessive trash. 3/21/07	Source of trash are dumpsters behind Fairground plaza. Trash has been blown and is	Notice given for misc. trash and litter. Inspector went back and they are now in	Behind Fairgrounds Plaza. 18 K12

		stuck to fence.	compliance. **Case closed**	
07-022	Routine outfall inspection found water discharging from outfall had bubbles in it and water was cloudy. 3/28/07	Traced water to an inlet that had pipes from sidewalk draining into it. Suspect it to be overflowing wastewater from houses.	Environmental Health investigated and found that discharge was from a sump pump, not washwater. **Case closed**	Woodland and First. 28 E/F8
07-023	Complaint of pipe in stream discharging black water with bad smell periodically. 3/20/07	Suspect pipe is possibly connected to neighbors septic system.	Water samples did not show anything unusual. Environmental Health investigated neighbor's septic tank and it is in working order. Advised complainant that when he saw the black water again to call us so we could get a sample. **Case closed**	4405 Butler Road. 16 D5
07-024	Complaint of foam in the stream behind Pot Spring Elementary School. 3/28/07	Visited site and determined the foam to naturally occurring.	**Case closed**	19 B9
07-025	Citizen volunteering at a tree planning noticed algae on a sanitary sewer stack in creek. 4/12/07	Algae are bright green and present even in extreme cold weather.	Environmental Health could not locate the sewer stack, left message with complainant for help in locating it. **Case closed**	25 H/J9. Old Court Road and Herring Way
07-026	Complaint of road salt affecting a well. 3/28/07	Took water sample at stream above his well at Pleasantville and Fork.	Sent citizen lab results and letter explaining the results of the county evaluation of the problem. **Case closed**	2 Forkspring Court. 21 D2
07-027	Routine outfall investigation found excessive iron bacteria. 4/26/07	Traced to inlet above outfall. Sanitary sewer manhole is located next to inlet, could possible be leaking.	No sanitary sewer leaks, iron bacteria naturally occurring. **Case closed**	8113 Clydebank Rd. 27 H9
07-028	Citizen complained of foul smelling, discolored water after storm events. 4/18/07	Examined stream and took water samples. Nothing unusual came back in the lab results and stream looked normal.	Told citizen to call WMM directly next time it happens. If we can witness it, we may be able to determine what is happening. **Case closed**	3114 Lightfoot Drive.
07-029	Citizen complaint of slimy orange material in stream. 5/1/07	Examined stream and found no evidence of material. Most likely were iron bacteria, which are naturally occurring.	Emailed citizen our findings and advised him to notify us if it was seen again. **Case closed**	Sudbrook Park near Shamrock Lane. 25 D12
07-030	Illegal sump pump hook-up. 6/8/07	DPW asked that we make sure the homeowners have done the repair.	PDM plumbing inspection reports that problem has been corrected. **Case closed**	6816 Old Pimlico Rd. 26 C10

07-031	Stream has an unusual odor. 4/18/07	Visited site and determined the unusual smell was gas in the nearby storm drain inlet.	BGE repaired the leaking gas main. **Case closed**	2219 Dalewood Road. 19 D10
07-032	Routine outfall visit found crack in the apron and severe stream erosion. 6/11/07	Referred cracked apron to Storm Drain Design and erosion to CIP.	**On-going**	Outfall #677, Waltham Woods Road 28 C6
07-033	Routine visit found outfall filled 100% with sediment. 6/26/07	Referred to DPW to be cleaned out.	**On-going**	Outfall # 517. Near railroad tracks at Arbutus Ave.
07-034	Complaint of milky white colored stream water. 4/6/07	Investigated and did not find the discolored water. Lab samples showed nothing unusual.	Left message to notify citizen of findings. **Case closed**	Fairways Apartments. 27 G9
07-035	Volunteers cleaning stream noticed sewage smell. 6/3/07	Referred to Environmental Health	Manhole on top of concrete sewer pipe was missing its lid; it has been replaced by DPW. **Case closed**	Near 6 Oella Avenue. 40 F4
07-036	Tree in danger of falling and stream eroding. 6/18/07	Referred tree to DPW Highways and erosion to CIP.	Tree was removed. **On-going**	322 Worthington Avenue. 27 E9
07-037	Bad odor and cloudy water observed at outfall. 7/5/07	Investigated and referred to DPW.	Sanitary sewer system operating fine. The smell is coming from a stagnant storm water pond. Cloudy water came from some contractors dumping down the storm drain. **Case closed**	9414 Tulsmere Road. 24 D10
07-038	Routine visit found outfall #535 filled 75% with debris. 7/17/07	Referred to DPW Highways.	DPW Highways will be cleaning this outfall. **Case closed**	42 K9
07-039	Routine visit found outfall #710 had apron damage. 7/17/07	Referred to DPW Storm Drain Design Section.	**On-going**	42 A11
07-040	Routine outfall visit found large items of trash dumped and plunge pool containing black water. 8/2/07	Referred trash to PDM, will investigate the black water.	Black water was the result of sulpher oxidizing bacteria, which are naturally occurring. PDM forwarded trash to DPW and the local community association. **On-going**	36 E4
07-041	Illegal dumping. 8/2/07	Referred to PDM.	Dirt has been mounded to close area to vehicles and trash has been removed. **Case closed**	36 E11
07-042	Routine visit found outfall #683 75% full of sediment. 7/10/07	Referred to CIP.	This outfall was hit by a car and thrown off, it is on the list to be corrected by a contractor. **Case closed**	18 H7

07-043	Large items of trash dumped behind 3167 Jeffland. 7/18/07	Referred to PDM	**On-going**	33 C4
07-044	Stream water colored milky white. 9/5/07	Investigated and found little evidence remaining of color or source.	Spoke to MDE who also investigated the case and has been unable to locate the source due to intermittent nature. DEPRM checked up on the site once more and found no problems. **Case closed**	26 K7
07-045	Routine outfall visit found chlorine present. 6/22/07	Traced chlorine to a storm drain inlet in front of 7425 Ricksway Road.	Referred to Baltimore City. Notified MDE of the city's noncompliance with multiple requests for repair. **On-going**	33 D1
07-046	Homeowner complained of severe erosion in her backyard. 8/29/07	Referred to CIP.	**On-going**	6713 Queensferry Rd. 27 G10
07-047	Citizen complained of soapy water in stream. 9/10/07	Visited the site twice and found no evidence of soapy discharge. Checked nearby schools for evidence of dumping and found nothing.	Told citizen to call us if she saw it again. **Case closed**	Padonia Road where stream crosses road, across from the Dulaney Valley Memorial Gardens. 19 B9
07-048	Significant trash and debris on property that washes into Cooper's Run. 9/5/07	Referred to PDM.	Notice was issued to remove a small amount of trash. **Case closed**	409 Oella Avenue. 40 H3
07-049	Trash from property getting into Miller's Run. 9/5/07	Referred to Environmental Health.	Inspector will be contacting regional manager of Bedding Barn to have the litter cleaned up and maintained in the future. **Case closed**	6613 Baltimore National Pike. 40 K1
07-050	Trash from property getting into Miller's Run. 9/5/07	Referred to PDM.	Inspector found the area to be very clean. **Case closed**	6619 Baltimore National Pike. 40 K1
07-051	Trash from property getting into Miller's Run. 9/5/07	Referred to PDM.	Violation was issued to clean up area around dumpster. **Case closed**	6631 Baltimore National Pike. 32 J13
07-052	Abandoned car in woods. 9/17/07	Referred to PDM.	Inspector did not locate any abandoned vehicles. **Case closed**	Wooded area next to 9920 Quad Avenue. 36 F11
07-053	Outfall 75% submerged. 9/17/07	Referred to DPW.	Outfall will be shoveled out and routinely maintained. **Case closed**	Wooded area next to SWM. 36 G11
07-054	Outfall found to have rusted holes in metal apron. 9/7/07	Referred to DPW.	**On-going**	Next to 9629 Harford Road. 28 E/F7
07-055	Low levels of copper	Investigated and found no	**Case closed**	Outfall 547. 28 C4

	found during routine outfall screening. 9/7/07	sources of copper. Determined that copper is from non-point sources.		
07-056	Outfall pipe coming apart at seam. 9/13/07	DPW sealed the joint inside the pipe.	**Case closed**	Outfall 037. 44 J3
07-057	Carts dumped in stream and chlorine present. 9/13/07	Will investigate the source of the chlorine.	PDM will hire contractor to clean up carts and bill BGE who owns the property. **On-going**	Outfall 038. 44 J3
07-058	Couches dumped in stream. 9/13/07	Referred to PDM.	Inspector did not find any couches. **Case closed**	Outfall 506. 44 H1
07-059	Trash dumping in stream. 10/5/07	Referred to PDM.	Inspector issued a notice to clean up trash by 12/9 or violation will be issued. **Case closed**	Outfall 628. 33 E3
07-060	Exposed pipe on eroded stream bank. 10/18/07	Referred to DPW Utilities.	Only a clean out pipe for home. **Case closed**	Outfall 607. 16 D13
07-061	Severe erosion downstream of outfall and chlorine detected. 10/5/07	Referred erosion to CIP. Referred chlorine leak to DPW. Referred landscape dumping to EIR.	Landscape dumping will be cleaned up by apartment maintenance. Notified MDE of the city's noncompliance with request for repair. **On-going**	Outfall 630. 33 E6
07-062	Trash dumping behind shopping center. 9/17/07	Referred to Environmental Health.	Violation issued. **Case closed**	Outfall so-954. 28 A11
07-063	Excessive trash dumping and abandoned cars in undeveloped wooded lot. 10/22/07	Referred to Environmental Health.	**On-going**	Outfall 250. 36 E11
07-064	Excessive trash on abandoned property. 10/22/07	Referred to Environmental Health	Violation issued. **Case closed**	Outfall 657. 36 J1
07-065	Staff noticed several violations in sediment control and building on a construction site. PVC pipe leading right to stream for purposes of draining the pool. 11/8/07	Referred pipe drainage to Environmental Health. Referred violations to Environmental Enforcement and Sediment Control.	Homeowners had permits for everything. Pipe was discharging surface water during construction of pool, had already been removed. **Case closed**	3619 Woodvalley Dr. 25 G7 0
07-066	Mulch and sediment dumped in stream buffer from landscaping. 10/16/07	Referred to Sediment Control.	No violation issued at this time, neighborhood is under close watch for the future. **Case closed**	25 K9
07-067	Ground around sewer manhole is very mushy and water is coming up from the ground and pooling. 10/10/07	Called Utilities emergency sewer line.	Sewer manhole is functioning properly. No chlorine present. Water is naturally occurring spring. **Case closed**	Behind 3311 Terrapin. 25 H9
07-068	Citizen complained of outfall with cloudy water	Visited site and water was clear.	Determined foam to be naturally occurring.	840 Oella Mills. 40 F3

	discharging to the Patapsco. Also concerned about foam coming from upstream. 11/5/07		Plume was from concrete trucks being washed out, the site inspector has been made aware of the situation. **Case closed**	
07-069	Routine outfall testing found high pH. 10/18/07	Probably due to natural condition of algae in pond. Will do more water quality tests to be certain.	**On-going**	Outfall 584. 16 H13
07-070	During fieldwork found a construction site with sediment fences that had fallen down. 11/13/07		Referred to Sediment Control. **On-going**	26 A10
07-071	During fieldwork found severe erosion that was undermining the gabion basket at an outfall. 10/23/07		Stormwater Engineering issued a correction notice for several violations. **Case closed**	26 B8
07-072	Excessive trash in stream buffer coming from bottling plant. 10/5/07	Referred to PDM.	Inspector did not find excessive trash. **Case closed**	Behind 1620 Whitehead Court. 33 D9
07-073	Field staff witnessed contractors working on culvert dumping buckets into stream. 12/4/07	Referred to MDE.	**On-going**	Culvert at 83 near Coppermine Terrace. 26 E9
07-074	Homeowners remodeling and dumping debris into the stream. 12/4/07	Referred to Environmental Health.	Violations were found**.** **Case closed**	Behind 6606 and 6610 Falls Road. 26 E9
07-075	Water bubbling up from road and running into a storm drain inlet. 12/18/07	Referred to Baltimore City Public Works.	Water line has been repaired. **Case closed**	604 Alleghany Avenue. 27 B6
07-076	Businesses dumping construction debris into stream. 12/11/07	Referred to Environmental Health.	**On-going**	1408 Shoemaker Road. 26 E/F9
07-077	Chlorine found while screening outfall. 8/2/07	Referred to Baltimore City DPW.	**On-going**	Outfall #315. 27 E7
07-078	Citizen complaint of gray stream water. 12/07	Investigated and found water to be clear. Told citizen to call again if he sees the problem.	**Case closed**	9204 Chenoak. 28 D7
07-079	Area posted with forest conservation sign is being mowed. 12/27/07	Referred to Baltimore City Forestry	Area is actually private property. **Case closed**	End of Altamont. 26 G11
07-080	Field staff witnessed dump truck full of bags being unloaded in to forest buffer. 12/11/07	Referred PDM.	PDM will not investigate without an exact address and this parcel does not have one. **Case closed**	Near Railroad Avenue. 26 G11
07-081	Outfall 75% blocked by sediment and debris. 12/18/07	Referred to DPW	**On-going**	Belmar Park. 36 E2
07-082	Outfall apron damaged. 12/18/07	Referred to DPW	**On-going**	Outfall 135. 36 G4

07-083	Citizen complaint of blue-green colored stream. 4/6/07	Visited the site twice and did not observe unusual color. Water quality tests confirmed no pollution problem.	**Case closed**	1400 Coppermine Terrace. 26 E9
07-084	Outfall was discharging an unusually high amount of water. 12/07	Tested outfall and found it was chlorinated water.	Referred to Baltimore City. **On-going**	3018 Lightfoot. 25 K10
07-085	Routine outfall inspection found excessive iron bacteria. 6/19/07	Tests and inspection determined iron bacteria to be naturally occurring.	**Case closed**	Outfall 460. 42 A5
07-086	Citizen complained of stream flooding due to sediment build-up. 10/23/07	Referred to DPW Highways.	Problem is not severe enough to warrant action at this time. **Case closed**	Outfall 174. 28 B10
07-087	Trib to Gunpowder Falls full of silt. 5/7/07	Visited twice and could not find any sources of sediment.	Determined sediment to be from stream erosion and non-point sources. **Case closed**	Falls Road. 7 A6

5.5 Regional Illicit Connections Investigations and Complaint Database

For many decades, Baltimore County health inspectors have investigated complaints that are now categorized as potential illicit connections. These complaints include septic systems, leaky refuse and grease containers, the dumping of used motor oil, leaky engines, and industrial maintenance activities among others. Because these investigations are only a small percentage of the thousands of complaints received each year by the regional programs, it was difficult to separate complaints with a potential illicit connection from the rest of the caseload. These thousands of complaints were analyzed and broken down into the categories seen in Figure 5-5. After looking at the data from the past five years, it was determined that the breakdown into categories is approximately the same each year and we can assume these numbers will continue to be the same in the future; therefore, starting this year we will not analyze the cases by category.

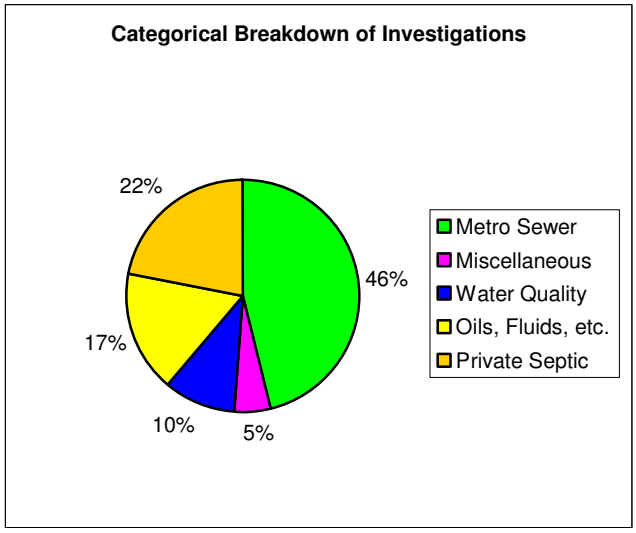


Figure 5-5. Involvement of the Regional Programs in the Investigation of Illicit Connections. This is the approximate breakdown of cases based on past data.

5.6 Summary

The Outfall Prioritization Program has increased efficiency in detecting pollutants. A database is used to assign a priority rating for each outfall based on past screening data and the potential for having illicit connections. Outfalls are screened periodically based on their priority rating, which is assigned or appropriately changed when information is entered. The type and severity of pollution determines the outfall's position in the queue. The combination of citizen involvement, routine outfall screenings and the regional staff complaint investigations is working well to our continuing goal of preventing and eliminating illicit connections.

6.0 Permit Requirements

C. Source Identification

Sources of pollutants in stormwater runoff shall be identified and linked to specific water quality impacts on a watershed basis. This process shall be used to develop watershed restoration plans that effectively improve water quality. The following information shall be submitted in geographic information system (GIS) format with associated tables as required in PART IV of this permit.

1. Storm drain system: major outfalls, inlets, and associated drainage areas;
2. Urban best management practices (BMP): stormwater management facility data including locations and delineated drainage areas;
3. Impervious surfaces: delineated controlled and uncontrolled impervious areas;
4. Monitoring locations: locations established for chemical, biological, and physical monitoring of watershed restoration efforts and the *2000 Maryland Stormwater Design Manual* or other innovative stormwater management technologies approved by MDE; and
5. Watershed restoration: restoration project descriptions and locations.

PART IV. PROGRAM REVIEW AND ANNUAL REPORTING OF PROGRESS

A. **Annual Reporting**

2. To further judge the effectiveness and progress of implementing this permit, the following information shall be submitted on databases (in a format) consistent with Attachment A. Annually, except where noted, the following shall be submitted:
   a. Storm drain system mapping (PART III. C.1.);
   b. Urban BMP locations (PART III. C.2);
   c. Impervious surfaces (PART III. C.3);
   d. Watershed restoration project locations (PART III. C.5);
   e. Chemical monitoring (PART III. C.4. and PART III. H.1);
   f. Illicit Discharge Detection and Elimination activities (PART III. E.4);
   g. Responsible personnel certification information (PART III. E.3)
   h. Grading permit information – quarterly (PART III. E.3); and
   i. Fiscal analyses – cost for NPDES related implementation (PART III. I.)

This section describes the Geographic Information System (GIS) data layers and the databases submitted with the Annual Report. The GIS data layers are described in

Section 6.1. Section 6.2 describes the databases that have been created for the NPDES Report, along with data sources and limitations.

6.1 Source Identification – Geographic Information System Data Layers

6.1.1 Storm Drain System

A series of data layer related to the storm drain system can by found on the accompanying CD under GIS Data Layers//Storm Drain System/StormDrainDataOld. These datalayers represent the Baltimore County storm drain system based on a set of keysheets maintained prior to the development of GIS. The layer was created by a consultant based on the keysheets and available aerial photography. The datalayer is incomplete and does not extend north to the Hunt Valley area of the County. In addition, there are errors in the depiction of the storm drain system, with some systems having no outfalls. The GIS data layer for storm drain system is scheduled to be updated. A pilot project is currently underway to determine the accuracy of the construction drawings in capturing the locations of the inlets, manholes, and outfalls. Preparation of the new storm drain data layer will begin this fall.

The storm drain system is also represented by two files for the out fall locations; Major_outfalls and Minor_outfalls. The drainage areas to the major outfalls are presented in the outfall_drainage.lyr file.

6.1.2 Urban Best Management Practices

The urban best management practices are represented by two datalayers, 2008_SWM_Facilities.shp and SWMDrainage2008.shp. These layers are located under GIS Data Layers/Urban Best Management Practices. The swm06 layer displays the locations of the stormwater management facilities, while the swmDA displays the drainage areas to built facilities.

The location datalayer will have errors due to coordinates either being missing or wrong. Some of this is historical, as until 2000 the County required engineers to submit drawings based on the Baltimore County coordinate system. Conversion to Maryland State Plan resulted in errors.

6.1.3 Impervious Surfaces

The impervious surfaces in Baltimore County are represented by two separate datalayer, building_poly and roads_poly. These layers are located under GIS Data Layers/Impervious Surfaces. The layers were created based on aerials flown in three phases between 1994 and 1996. The building datalayer includes all residential, commercial, and industrial buildings. It also includes sheds, barns and other accessory structures. The roads datalayer includes all roads and parking lots. It does not include driveways, except in rural areas. Sidewalks are not depicted.

The County is currently updating the impervious datalayers, based on aerial photography flown in 2005. It is anticipated that the updated datalayers will be available for next years report.

6.1.4 Monitoring Locations

Monitoring locations for Baltimore County are presented in the three separate files, one for chemical monitoring, one for biological monitoring, and one for geomorphological monitoring. The files are located under GIS Data Layers/Monitoring Site, with a separate file folder for each type of monitoring.

6.1.5 Watershed Restoration

Two data layers are submitted with this report. The file cip.shp displays the locations of the various Capital Restoration Projects along with their type and their status. Cip_drainage_new.shp presents the drainage area to the various restoration projects. This layer is used to calculate the pollutant load reductions that result from restoration efforts associated with stormwater management facility conversions and stormwater management facility retrofits. It is also used to determine the amount of impervious area addressed by restoration activities.

6.2 Databases

All databases can be found on the accompanying CD under the file folder named Data. Each type of monitoring has its own folder under the Data folder.

6.2.1 Chemical Data

Five databases are included with this report. One data base contains the tidal water monitoring data, a second contains the baseflow monitoring data, while a third contains the storm event monitoring data. Also included is the database containing the Scotts Level Branch in-stream gage data and the calculated pollutant concentrations and loads at 15 minute intervals. The final data base contains the calculated EMCs for each storm at the Scotts Level Branch in-stream monitoring site.

6.2.2 Biological Data

The biological data is presented in an Access97 database titled – Benthic EDAS 2007.mdb. This Access application was created by Tetra Tech, Inc for the specific purposed of calculating biological and habitat metric data in accordance with the Maryland Biological Stream Survey (MBSS) protocols. The data base contains biological macroinvertebrate, fish assemblage, and habitat data collected by Baltimore County from 2003 through 2007.

6.2.3 Geomorphological Data

Four Excel spreadsheet files contain the geomorphological data. These files are:

- Scotts Level 2008.xls – This file contains data from the 20 cross section in Scotts Level Branch, including the overlay charts from previous years, and the calculations of cut/fill volumes,
- ScottsLvlProfiles08.xls – Contains the profile data for Scotts Level Branch,
- Windlass Run CX 2008.xls – Contains the cross section data for Windlass Run, and

- Powder Mill 2008.xls – Contains the cross section data for Powder Mill Run. This data was not included in this years report, but will be included in future reports.

6.2.4 Illicit Discharge Detection and Elimination

The results from the illicit discharge monitoring are presented since the inception of the program.

6.2.5 Responsible Personnel Certification Information

A database of Responsible Personnel Certification has not been submitted with this report the information is displayed in Appendix 2-1.

6.2.6 Grading Permit Information

Grading permit information is submitted on a quarterly basis and has not been resubmitted with this report.

7.0 Permit Requirements

F. Watershed Assessment and Planning

Baltimore County shall continue to update and revise watershed assessments that have been developed for its 10 urban watersheds (Baltimore Harbor, Bird River, Back River, Gwynns Falls, Jones Falls, Little Gunpowder, Loch Raven, Lower Gunpowder River, Middle River, and the Patapsco River). The overall goal is to ensure that each County watershed is thoroughly evaluated and has an action plan to maximize water quality improvements. Additionally, the County shall encourage the public to participate in the development and implementation of watershed restoration activities. At a minimum, the County shall:

1. Continue to perform and update detailed assessments in all of its urban watersheds. These watershed assessments shall include:
    a. Determining current water quality conditions;
    b. Identifying and ranking water quality problems;
    c. Identifying all structural and non-structural water quality improvements opportunities;
    d. Reporting the results of a visual watershed inspection;
    e. Specifying how the restoration efforts will be monitored; and
    f. Providing an estimated cost and a detailed implementation schedule for those improvement opportunities identified above.

2. By 6/15/2006, the County shall complete the prioritization process for selecting subwatersheds for restoration started during the previous permit term. These subwatersheds shall contain at least 20% of the County's impervious cover. Restoration efforts resulting from this prioritization process shall be in addition to typical stormwater management facility maintenance; and

3. By the end of this permit term, the County shall propose for restoration subwatersheds containing another 10% of the County's impervious surface area with poor or no stormwater management. These sub-watersheds shall be in addition to the 20% already proposed for restoration under the requirements above.

G. Watershed Restoration

The County shall implement those practices identified in Part III. F. above to control stormwater discharges to the maximum extent practicable. The overall goal is to maximize the water quality in the County's urban watersheds, using efforts that are definable and the effects of which are measurable. At a minimum, the County shall:

1. Complete the implementation of those restoration efforts that were identified and initiated during the previous permit term to restore 10% of the County's impervious surface area.

2. Within one year of permit issuance, begin to implement restoration of an additional 10%

of the County's impervious surface area. .

3. Annually, Baltimore County shall update its impervious surface restoration accounting sheets for each of its urban watersheds. At a minimum, these data shall include:

   a. Total impervious acres for each urban watershed;

   b. A schedule and cost estimate for the design, construction, and completion for each retrofit project;

   c. The impervious acres controlled or restored within each watershed; and

   d. The monitoring data and surrogate parameter analyses used to determine water quality improvements.

J. Total Maximum Daily Loads

Stormwater BMPs and programs implemented as a result of this permit must be consistent with available waste load allocations (WLA's)[see 40 CFR122.44(d)(1)(vii)(B)] developed under a Total Maximum Daily Load (TMDL). MDE has determined that owners of storm drain systems that implement the requirements of this permit will be controlling stormwater pollution to the maximum extent practicable. Therefore, satisfying the conditions of the permit will meet WLA's specified in TMDL's developed for impaired water bodies. If assessment of the stormwater management program indicates TMDL WLAs are not being met, additional or alternative stormwater controls must be implemented to achieve WLAs.

7.1 Introduction

Environmental consultants managed by the Department of Environmental Protection and Resource Management (DEPRM) – Watershed Management and Monitoring Section have prepared watershed management plans for 10 of the 14 8-digit watersheds located in Baltimore County. The remaining four watersheds do not have significant urban components and therefore are not required to have watershed management plans for this permit. These watershed management plans and the four watersheds that do not have plans will be enhanced through the creation of Action Plans that will set restoration goals, identify steps to achieve those goals, provide an implementation schedule and a monitoring plan. The Action Plans will be prepared with the input from stakeholders within the planning area and identify opportunities for citizen based watershed restoration. The Action Plans will include the identification of potential stormwater management conversion sites, capital projects, as well as citizen based stream restoration opportunities, operational program implementation, and an implementation schedule. In 2004, DEPRM hired a consultant to assist in engaging stakeholders in development of the Action Plans.

This section includes updates on the status of the watershed management plans, SWAPs and Capital Improvement Program's (CIP) restoration projects. Although the major focus of the implementation of the watershed management plans centers on capital projects, this component cannot alone satisfy water quality improvement. In Baltimore County water quality improvement is a multi-faceted effort involving other components such as sediment control, storm drain inlet cleaning, street sweeping, recycling, solid & hazardous waste management, illicit connection reduction, citizen education, sanitary sewer system infiltration/exfiltration reduction and others. These County-wide programs are described in other sections of this report.

The County's capital budget includes the current budget year and the subsequent 5 years. The capital budget is on a two-year cycle tied to bond referenda. Additional funding for these projects is provided by the Maryland Department of the Environment (MDE) through the Small Creeks and Estuaries and the Stormwater Pollution Control Cost-share Programs, the 319 program, and by the EPA Chesapeake Bay/Habitat Restoration Program. Starting in FY09, additional funding will be available through the Chesapeake and Atlantic Coastal Bays 2010 Trust Fund. Section 11 details the entire funding budget for watershed planning and restoration implementation in Baltimore County.

7.2 Status of Watershed Management Plans

7.2.1 Water Quality Management Plans

Water quality management plans have been completed for ten of the fourteen major watersheds in Baltimore County. The four remaining watersheds have limited urban development and therefore are not required by the NPDES – Municipal Stormwater Discharge Permit to have water quality management plans. However, recognizing the benefits of a watershed management plan, Baltimore County has completed the development of a Prettyboy Watershed Plan under the State's Watershed Restoration Action Strategy (WRAS) process. Harford County in conjunction with stakeholders has also completed the WRAS process to develop a watershed plan for Deer Creek watershed. Table 7-1 presents the watersheds and the year of completion of the water quality management plan. The recently completed Gwynns Falls Watershed Management Plan was a cooperative effort between Baltimore County and Baltimore City.

Table 7-1: Status of Watershed Management Plans

Watershed	Watershed Plan Status	Completion Date
Upper Western Shore		
Deer Creek	WRAS	6/30/07
Prettyboy Reservoir	WRAS	1/4/08
Loch Raven	Complete	9/30/96
Lower Gunpowder Falls	Complete	9/30/98
Little Gunpowder River	Complete	3/31/02
Bird River	Complete	3/29/96
Gunpowder River	Not Required	
Middle River	Complete	3/30/01
Patapsco/Back River		
Liberty Reservoir	Not Required	
Patapsco	Complete	9/30/98
Gwynns Falls	Complete	12/1/04
Jones Falls	Complete	9/30/96
Back River	Complete	9/30/96
Baltimore Harbor	Complete	3/30/01

Baltimore County enlisted the services of consultants for the preparation of the Watershed Management Plans. While the details of each plan vary, a common framework is incorporated into each plan. This framework includes:

1. watershed modeling using US EPA Storm Water Management Model (SWMM);
2. stream stability assessment using Rosgen classification methodology Levels I,II,III;
3. identification and ranking of water quality problems;
4. development of non-point source control management strategies;
5. prioritization of programs and projects; and

6. preparation of the final document, integrating the above tasks and preparing maps and tables to relate results.

Two of the watershed management plans (Middle River and Baltimore Harbor) did not include a stream stability assessment due to the limited mileage of open stream channels. These two watershed management plans did, however, include tidal estuarine water quality models, which were not a component in any of the other plans. The completed watershed management plans have been previously submitted to MDE and may be consulted for greater detail.
Table 7-2 indicates the consultants that have prepared the plans and the cost associated with each plan. The total cost for the preparation of the watershed management plans is slightly over two million dollars.

Table 7-2: Watershed Management Plans Consultants and Costs

Watershed	Consultant	Cost
Loch Raven Reservoir	Tetra Tech, Inc.	$180,827
Lower Gunpowder Falls	Parsons, Brinkerhoff, Quade & Douglas, Inc.	$262,461
Little Gunpowder Falls	Biohabitats, Inc.	$210,076
Bird River	Dames & Moore, Inc.	$165,450
Middle River	Versar, Inc.	$155,224
Patapsco River	Tetra Tech, Inc.	$284,100
Gwynns Falls*	Parsons Brinkerhoff	$326,422
Jones Falls	Dames & Moore, Inc.	$168,251
Back River	Camp, Dresser & McKee, Inc.	$149,905
Baltimore Harbor	Roy F. Weston, Inc.	$145,021
Total Cost		**$2,047,737.00**

*Includes Cost for Baltimore City Portion of the Plan

7.2.2 Small Watershed Action Plans (SWAPs)

In 2005, Baltimore County initiated a new round of watershed planning, entitled Small Watershed Action Plans (SWAPs). The SWAP planning process is meant to bring together the many mandates that the County is charged to meet in each individual watershed, including the requirements of the NPDES – Municipal Stormwater Discharge Permit, Total Maximum Daily Loads (TMDLs), goals in the Chesapeake 2000 and the Tributary Strategies, the Reservoir Management Program and the Baltimore Watershed Agreement. The small watershed action planning process is designed to bring all these individual mandates together at a subwatershed level that will help residents understand the intent of each program, how to most efficiently meet the goals, and define the roles of the partners. The SWAPs will build on the previously completed technical Water Quality Management Plans (Section 7.2.1).

Planning areas were selected on similarity of impacts within each area, allowing focus on specific issues related to the stakeholders that live and work within each planning area. Twenty-four planning areas have been delineated. Based on staffing constraints, it has now been determined that only two plans will be under development at any one time. The schedule presented previously has proven to be unrealistic. While the planning will be completed as expeditiously as possible, no schedule is proposed at this time.

Five SWAPs are currently under development. The Goodwin-Hunt Valley-Loveton SWAP in the Loch Raven Watershed, the Towson Run/Roland Run SWAP in the Jones Falls Watershed, and the Lower Patapsco SWAP in the Patapsco River Watershed are currently on hold due to staffing levels. The Lower Jones Falls and Upper Back River SWAPs are in active development

with funding from an U.S. Environmental Protection Agency – Region III Water Quality Cooperative Assistance grant. This funding has permitted the hiring of contractual staff and Center for Watershed Protection to assist in the development of the Action Plans. These two SWAPs are being developed in conjunction with Baltimore City, Herring Run Watershed Association, and Jones Falls Watershed Association. The two active SWAPs are anticipated to be completed in the late summer of 2008.

Stakeholders are invited to participate in the development of each SWAP. A series of three meetings are held over the course of the development of each SWAP. The first introduces the stakeholders to the process and solicits their input on the characterization of the planning area and goals. The second meeting presents the final characterization document and solicits input on preferred restoration options. The third meeting presents the SWAP, which includes not only County actions and projects, but also citizen based and business based restoration activities and options.

7.3 Upper Western Shore Watersheds

The Upper Western Shore watersheds include: Deer Creek in the Susquehanna River Basin, and Prettyboy Reservoir, Loch Raven Reservoir, Lower Gunpowder Falls, Little Gunpowder Falls, Bird River, Gunpowder River and Middle River in the Gunpowder Falls River Basin. Five of the eight watersheds require watershed management plans based on NPDES requirements on the amount of urban development within the watershed.

The calculation of pollutant load reductions due to stream restoration where based on the re-analysis of the Spring Branch data presented in the NPDES 2006 Annual Report, which resulted in the following pollutant load reduction estimates:

- Total Nitrogen – 0.202 pounds per linear foot of stream restoration
- Total Phosphorus – 0.0107 pounds per linear foot of stream restoration
- Total Suspended Solids – 3.58 pound per linear foot of stream restoration

Section 10.2 describes the calculation of pollutant loads for both watersheds and for the drainage area to stormwater management facilities. The pollutant load reductions for stormwater management facility retrofits and conversions uses the loads calculated in accordance with Section 10.2 and the pollutant removal efficiencies based on facility type found in Section 1 – Table 1-8.

7.3.1 Deer Creek

Due to the rural nature of this watershed a watershed management plan is not required by the NPDES – Municipal Stormwater Discharge Permit. Baltimore County's portion of this watershed is approximately eleven square miles. There are no capital improvement projects currently planned for this watershed. Deer Creek is part of the Susquehanna River Basin. The predominate land use in the watershed is agriculture. A Deer Creek WRAS was prepared by Harford County. Baltimore County participated in that effort.

7.3.2 Prettyboy Reservoir

The Prettyboy Reservoir serves as a holding reservoir for the Loch Raven Reservoir. When the Loch Raven Reservoir water levels are low, water is released from Prettyboy Reservoir to maintain the levels in Loch Raven. Water is also released from Prettyboy Reservoir during the

summer to maintain the low temperatures necessary to support the trout fishery in Gunpowder Falls.

The Prettyboy Reservoir watershed in Baltimore County is approximately thirty-seven square miles. Its predominate land uses are agriculture and forest. The Prettyboy Reservoir watershed has been listed as impaired by Maryland Department of the Environment for nutrients, mercury in fish tissue, heavy metals, bacteria, and biological impairment. In 2003 a Water Quality Analysis for heavy metals, that indicated no impairment was submitted to EPA and approved. A copy of the document can be found on the web at:
http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/ApprovedFinalTMDL/WQA_prettyboy_final_metals.asp

A TMDL for mercury in fish tissue was prepared and submitted to EPA and approved in 2004. The major source of mercury is from air deposition due to discharges from power plants and incinerators. As such, the major factor in reducing mercury contamination in Prettybory Reservoir is reductions in emissions, with secondary actions including hazardous waste collection days and "e-cycling". The document may be found on the web at:
http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/ApprovedFinalTMDL/TMDL_final_prettyboy_Hg.asp

The nutrient TMDL for Prettyboy has been prepared and was approved by EPA in March 2007. The TMDL calls for a 54% reduction in Total Phosphorus in order to maintain chlorophyll a levels below eutrophic levels and to maintain dissolved oxygen above the limit of 5mg/l. It was determined through the modeling effort that reductions in nitrogen would have limited effect on the chlorophyll a and dissolved oxygen concentrations. The draft document may be found on the web at:

http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/Pub_Notice/tmdl_PN_Gunpowder_P_Sed.asp#TMDL_Prettyboy_Reservoir_Nut

The bacteria TMDL has not been prepared for the Prettyboy Reservoir watershed at this point, but Maryland Department of the Environment envisions the preparation of the Bacterial TMDL over the summer of 2008.

The draft *2008 Integrated Report of Surface Water Quality in Maryland* includes a revised non-tidal stream biological listing criteria. Based on the revised criteria, the Prettyboy Reservoir watershed has been delisted for biological impairment. An examination of the biological data would seem to indicate that while the entire watershed is not biologically impaired, the Prettyboy Branch in the south eastern-portion of the watershed is biologically in a poor condition.

With this budget cycle capital money has been proposed for fiscal years 2010 and 2012 for the design and construction of a stream restoration project as indicated in Table 7-3.

Table 7-3: Prettyboy Reservoir Watershed – CIP Status

Capital Improvement Projects Through 2007 Prettyboy Reservoir Watershed								
Project	Facility Type	DA (LF)	Cost	Date	Removal Rate (lb./year)			Impervious Acres
					TN	TP	TSS	
Completed Projects								
Projects Under Design or Construction								

Projects in the Capital Budget								
Prettyboy SR (Design)	SR		225,000	10				
Prettyboy SR (Const.)	SR		450,000	12				
Totals			675,000					

Abbreviations
CNV: SWM Pond Conversion
NWET: New Wet Pond
SR: Stream Restoration
HAB: Habitat improvement
RET: Retrofit
NEXT: New Extended Detention Pond
SCR: StormCeptor
SE: Shoreline Enhancement
TBD: To Be Determined

In calendar year 2002 Baltimore County participated in a study that examined this watershed to identify threats to the source water resource. Additional participants in this study included Baltimore City, Trust for Public Lands (TPL), USDA Forest Service, University of Massachusetts, and the Baltimore Metropolitan Council of Governments. GIS was used extensively to target areas for preservation and conservation. A draft report was prepared in November of 2002 and a final one completed in 2003. Residents have organized an environmental organization called the Prettboy Watershed Alliance and are actively engaged in restoration and resource management activities within the watershed.

The Prettyboy watershed was selected by Maryland Department of the Environment for the preparation of a Watershed Restoration Action Strategy (WRAS). The WRAS was completed in January 2008. The WRAS specifically addressed the nutrient TMDL, along with other stakeholder-identified goals. The completed WRAS can be found on the CD accompanying this report.

To expand the County's overall restoration strategy DEPRM developed the *Watershed Association Restoration Planning and Implementation Grant* Program. This grant program was developed to address staffing needs of local Watershed Associations. The intent of the grant is to provide funding for staff time to volunteer groups to participate in County restoration planning, identification of restoration projects, implementation of restoration projects, identify Stream Watch participants, offer educational activities, and the ability to leverage additional funding. Annual funding is limited up to $30,000 with a minimum of 1000 hours of staff time to be expended on projects. Funding is provided for salaries, fringe, and overhead (limited to 10%). Funding is not provided for restoration materials, supplies, or the Executive Director's salary.

The Prettyboy Watershed Alliance (PWA) applied for and received their second grant under this program in August of 2007, with a second grant was awarded in October 2007. The organization intends to use the funds to increase their membership, expand their base of volunteers, engage citizens with Stream Watch, participate in the Prettyboy WRAS, and develop partnerships with local schools.

7.3.3 Loch Raven Reservoir Watershed

The Loch Raven Reservoir watershed is listed as impaired by heavy metals, mercury, nutrients, sediment, and biological impairments. In 2008, the draft *2008 Integrated Report of Surface Water Quality in Maryland* listed Loch Raven Reservoir watershed as impaired by bacteria, and with the new biological listing criteria listed the entire watershed as biologically impaired, but removed the individual impairment listing for 12-digit watersheds.

A Water Quality Analysis for heavy metals was performed and submitted to EPA for approval. No impairment for heavy metals was found. The document may be found on the web at: http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/ApprovedFinalTMDL/WQA_lochraven_final_metals.asp

A TMDL for mercury in fish tissue was prepared and submitted to EPA and approved in 2004. The major source of mercury is from air deposition due to discharges from power plants and incinerators. As such, the major factor in reducing mercury contamination in Loch Raven Reservoir in reductions in emissions, with secondary actions including hazardous waste collection days and "e-cycling". The document may be found on the web at: http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/ApprovedFinalTMDL/TMDL_final_lochraven_Hg.asp

The nutrient and sediment TMDLs for Loch Raven Reservoir were approved by EPA in March 2007. As with the Prettyboy Reservoir, Total Phosphorus was found to be the limiting nutrient. The TMDL calls for a 50% reduction in Total Phosphorus and a 25% reduction in sediment. The sediment reduction is intended to expend the longevity of the reservoir by reducing the rate of infilling of the reservoir. The document can be found on the web at: http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/Pub_Notice/tmdl_PN_Gunpowder_P_Sed.asp#TMDL_Loch_Raven_Reservoir

The Loch Raven Reservoir Watershed Management Plan was completed in 1997. The plan has been submitted to Maryland Department of the Environment. Previous reports have discussed various aspects of the plan. The Goodwin Run-Hunt Valley-Loveton SWAP, discussed above will provide the level of detain necessary for meeting a diverse array of environmental goals.

Table 7-4 presents the status of the capital improvement projects in the Loch Raven Reservoir watershed.

Table 7-4: Loch Raven Reservoir Watershed – CIP Status

Capital Improvement Projects Through 2007 Loch Raven Reservoir Watershed								
Project	Facility Type	DA (LF)	Cost	Date	Removal Rate (lb./year)			Impervious Acres
					TN	TP	TSS	
Completed Projects								
Spring Branch	NWET	47	276,473	97	198.9	22.1	5,821	12.3
Spring Branch	SR	(10,000)	1,868,380	97	2,020.0	107.0	35,800	140.9
Long Quarter Branch	NWET	139	150,000	99	524.1	51.0	23,643	63.4
Long Quarter Branch	SR	(2,300)	564,581	99	464.6	24.6	23,643	69.7
Dulaney Valley Branch	SR	(1,700)	220,000	98	343.4	18.2	6,086	7.6
East Beaver Dam Run I	SR	(2,000)	372,000	00	404.0	21.4	7,160	12.4
Goodwin Run - Padonia Rd	SR	(700)	491,000	02	141.4	7.5	2,506	60.4
Hampton Branch	SR	(2,500)	630,000	04	505.0	26.8	8.950	19.8
Western Run@Ashland Ch	SR	(500)	365,675	04	101.0	5.4	1,790	2.9
Projects Under Design or Construction								
Spring Branch II	SR	(2,500)	850,000	08	505.0	26.8	8,950	35.6
Dulaney Gate Repairs			150,000	08				
Projects in the Capital Budget								
Gypsy Lane Trib.	SR		825,000	09				
East Beaver Dam Run II	SR		720,000	10/11				47.8
Loch Raven Retrofit	RET		150,000	12/13				
Loch Raven SR (Design)	SR		250,000	12/13				

Totals		186 (22,200)	7,883,109		5,207.4	310.8	115,408	472.8

Abbreviations
CNV: SWM Pond Conversion
NWET: New Wet Pond
SR: Stream Restoration
HAB: Habitat improvement
RET: Retrofit
NEXT: New Extended Detention Pond
SCR: StormCeptor
SE: Shoreline Enhancement
TBD: To Be Determined

To date seven stream restoration projects have been completed in the watershed and one more will be constructed in 2008. Several additional stream restoration projects are in the Capital budget for the future years. The completed stream restoration projects have restored 19,700 linear feet of stream channel. This is equivalent to approximately 0.3% of the stream miles in the Loch Raven Reservoir watershed. The additional stream restoration project to be constructed this year will result in the restoration of an additional 2,500 linear feet of degraded stream channel.

Two new stormwater management wet ponds have been installed in the Loch Raven Reservoir watershed to date. These two facilities provide water quality and peak flow attenuation for a total of 186 acres of urban land. The resulting pollutant load reductions are displayed in Table 7-3. An additional retrofit, yet to be identified, and three stream restoration projects are currently funded for in the capital budget.

To expand the County's overall restoration strategy DEPRM developed the *Watershed Association Restoration Planning and Implementation Grant* Program. This grant program was developed to address staffing needs of local Watershed Associations. The intent of the grant is to provide funding for staff time to volunteer groups to participate in County restoration planning, identification of restoration projects, implementation of restoration projects, identify Stream Watch participants, offer educational activities, and the ability to leverage additional funding. Annual funding is limited up to $30,000 with a minimum of 1000 hours of staff time to be expended on projects. Funding is provided for salaries, fringe, and overhead (limited to 10%). Funding is not provided for restoration materials, supplies, or the Executive Director's salary.

The Gunpowder Valley Conservancy (GVC) geographically includes the Loch Raven Reservoir, Lower Gunpowder, Little Gunpowder, Gunpowder River and Bird River watersheds within their organization. The GVC applied for and received their second grant under this program in September 2007. The organization intends to use the funds to expand their membership base, identify new volunteers, improve their web communication, organize tree planting and clean-up projects, engage citizens in Stream Watch, and conduct neighborhood outreach events. The GVC geographic range includes all of the Gunpowder Basin, therefore the restoration activities can occur anywhere within the basin.

7.3.4 Lower Gunpowder Falls Watershed

The Lower Gunpowder Falls watershed exhibits a diversity of land uses, with the portion below the mainstem of the Gunpowder River within the Perry Hall planned growth area, and the portion above the mainstem devoted mainly to agriculture and forest cover. The Lower Gunpowder Falls is listed by MDE as being impaired by heavy metals, nutrients, and as being biological impaired. In 2008, the draft *2008 Integrated Report of Surface Water Quality in Maryland* listed Lower

Gunpowder Falls watershed as biologically impaired according to the new biological listing criteria, but removed the individual impairment listing for 12-digit watersheds.

A Water Quality Assessment for heavy metals was conducted in 2003 and submitted to EPA for approval indicating that the waters were not impaired by heavy metals. The document can be found on the web at:
http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/ApprovedFinalTMDL/WQA_lowergunpowder_final_metals.asp

The draft *2008 Integrated Report of Surface Water Quality in Maryland* indicates that the Lower Gunpowder Falls is a high priority for development of a nutrient TMDL within the next two years. Maryland Department of the Environment is waiting on the final development of the Chesapeake Bay Model – Phase V prior to initiating the model for the Lower Gunpowder Falls TMDL development.

The Lower Gunpowder Falls Watershed Management Plan was completed in 1999. The plan has been submitted to MDE. Previous reports have discussed various aspects of the plan. The development of a SWAP within the Lower Gunpowder Falls is not anticipated to take place in the next several years. The timing of the development of the SWAPs for the Lower Gunpowder will depend on the development of TMDLs for the watershed. Table 7-5 presents the status of the capital improvement projects in the Lower Gunpowder watershed.

Table 7-5: Lower Gunpowder Falls Watershed – CIP Status

Capital Improvement Projects Through 2007 Lower Gunpowder River Watershed								
Project	Facility Type	DA (LF)	Cost	Date	Removal Rate (lb./year)			Impervious Acres
					TN	TP	TSS	
Completed Projects								
Minebank Run I	SR	(7,000)	1,189,684	00	1,414	74.9	25,060	222.9
Minebank Run II	SR	(10,000)	4,400,000	05	2,020	107.0	35,800	156.7
Minbank Run Trib @ Waller	SR	(482)	258,958	08	97	5.2	1,726	0.1
Projects Under Design or Construction								
Jennifer Branch	SR	(4,500)	3,000,000	09	909	48.2	16,110	54.2
Cromwell Bridge (DPW)	SR	(1,500)	2,500,000		303	16.1	5,370	
Proposed Projects								
Northwind Farms (design)	SR		250,000	10/11				
Lower Gunpowder (design)	SR		250,000	10/11				
Northwind Farms (const.)	SR		800,000	12/13				
Lower Gunpowder (const)	SR		400,000	12/13				
Totals		(23,000)	13,048,642		4,743	251.4	84,066	433.9

Abbreviations
CNV: SWM Pond Conversion
NWET: New Wet Pond
SR: Stream Restoration
HAB: Habitat improvement
RET: Retrofit
NEXT: New Extended Detention Pond
SCR: StormCeptor
SE: Shoreline Enhancement
TBD: To Be Determined

Three stream restoration projects, which encompass almost the entire Minebank Run watershed, have been completed to date for a total of 17,500 feet of restored stream channel. The amount shown in the table above does not include the construction cost of a bridge that crosses the stream and needed repairs. Two additional stream restoration projects are currently in the design phase. The capital budget also included funding for two future stream restoration projects.

7.3.5 Little Gunpowder Falls Watershed

The Little Gunpowder Falls watershed is located on the eastern side of Baltimore County. The mainstem of the Little Gunpowder Falls serves as the boundary between Baltimore County and Harford County. MDE has previously listed Little Gunpowder Falls as impaired by heavy metals, nutrients, and as being biologically impaired. A Water Quality Assessment for heavy metals was conducted in 2003 and submitted to EPA for approval indicating that the waters were not impaired by heavy metals. The document can be found on the web at:

http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/ApprovedFinalTMDL/WQA_littlegunpowder_final_metals.asp

The changes in the biological listing criteria in the draft *2008 Integrated Report of Surface Water Quality in Maryland* resulted in Little Gunpowder Falls being delisted for biological impairment.

Currently, no capital improvement projects are under design or construction in this watershed. The Watershed Management Plan was completed in March 2002. There is relatively little urban land in the Little Gunpowder Falls watershed and consequently this watershed has fewer potential projects. The projects that were identified through the watershed management plan, while needed, have a lower priority when considered on a County-wide basis. Table 7-6 presents the capital commitment to the Little Gunpowder Falls watershed through FY2012. The funding for a stream restoration project has been allotted for FY 2012.

Table 7-6: Little Gunpowder Falls Watershed – CIP Status

Capital Improvement Projects Through 2007 Little Gunpowder Falls Watershed								
Project	**Facility Type**	**DA**	**Cost**	**Date**	**Removal Rate (lb./year)**			**Impervious Acres**
					TN	**TP**	**TSS**	
Completed Projects								
None								
Projects Under Design or Construction								
None								
Proposed Projects								
Little Gunpowder (design)	SR		250,000	13				
Totals			250,000					

Abbreviations
CNV: SWM Pond Conversion
NWET: New Wet Pond
SR: Stream Restoration
HAB: Habitat improvement
RET: Retrofit
NEXT: New Extended Detention Pond
SCR: StormCeptor
SE: Shoreline Enhancement
TBD: To Be Determined

7.3.6 Bird River Watershed

The Bird River is listed as impaired for sediment and as being biologically impaired. A Water Quality Assessment for nutrients was conducted in 2005 and with EPA concurrence (May 9, 2005) was delisted as impaired by nutrients. The Water Quality Assessment can be found at:

http://www.mde.state.md.us/assets/document/Bird%20River%20WQA_final.pdf

The changes in the biological listing criteria in the draft *2008 Integrated Report of Surface Water Quality in Maryland* resulted in Bird River being designated as having insufficient data to determine biological impairment. Therefore, the watershed has been placed into category 3 with

regards to biological impairment listing until such time as there is sufficient data to make a determination.

The Bird River Watershed Management Plan was completed in 1995 and was the first watershed management plan completed by Baltimore County. Much of the County's capital improvement work completed to date has been done in the Bird River watershed. Table 7-7 presents project status through calendar year 2007. A total of eight stormwater management facilities have been created or converted to water quality management to date. These facilities manage a total of 492 acres of urban land for water quality and peak flow attenuation.

A total of 30,780 linear feet of stream restoration has either been completed or is in the design phase in the Bird River Watershed. This number does not include the Maryland State Highway Administration stream restoration project on the White Marsh Run mainstem between Route 95 and Route 7, nor the Allison Transmissions stream restoration project below Route 7. Funds for an additional stream restoration project have been provided in the capital budget. Three additional stream restoration projects are in the design phase.

Table 7-7: Bird River Watershed – CIP Status

Capital Improvement Projects Through 2007 Bird River Watershed								
Project	**Facility Type**	**DA** (LF)	**Cost**	**Date**	**Removal Rate (lb./year)**			**Impervious Acres**
					TN	**TP**	**TSS**	
Completed Projects								
Burnam Woods	CNV	36	11,687	95	176.2	20.9	4,583	11.0
Featherhill	CNV	85	18,013	95	356.7	42.6	9,477	18.6
Lawrence Hill	CNV	58	102,091	96	223.0	26.7	4,437	9.8
Perryvale	SR	(800)	120,000	99	161.6	8.6	2,864	3.4
Perryvale-ex.-detention	CNV	38	120,000	99	229.7	27.5	3,489	13.4
Franklin Square	NWET	97	935,416	99	105.0	10.1	1,663	11.5
White Marsh Mall	CNV	112	435,838	99	624.2	40.8	14,734	31.1
White Marsh Run – Main	SR	(4,000)	982,387	00	808.0	42.8	14,320	46.6
White Marsh Business	RET	40	235,597	99	185.8	15.4	14,038	32.2
S. Fork White Marsh	SR	(1,900)	391,803	98	383.8	20.3	6,802	21.1
Bird-Silver Meadow	SR	(400)	128,945	99	80.8	4.3	1,432	21.3
Bird-Woodcroft	SR	(2,000)	700,000	00	404.0	21.4	7,160	56.5
Evergreen SWM	CNV	26	40,828	02	131.7	15.4	2,247	9.0
N. Fork White Marsh Run	SR	(7,000)	1,239,140	04	1,414.0	74.9	25,060	37.8
East Br. Honeygo Run	SR	(4,000)	1,330,000	04	808.0	42.8	14,320	9.3
S. Fork@ Franklin Square	SR	(2,600)	600,000	04	525.2	27.8	9,308	87.1
Projects Under Design or Construction								
WMR@Wht Mrsh Rd-desg	SR	(5,280)	764,500	09	1,066.6	56.5	18,902	73.0
S. Fork WMR@ Kings Ct.	SR	(2,500)	1,020,000	09	505.0	26.8	8,950	21.1
Whitemarsh Run@ Orbitan	SR	(300)	325,000	09	60.6	3.1	1,074	
Proposed Projects								
N. Fork II (Design)	SR		300,000	11				
N. Fork II (Construction)	SR		850,000	13				
Totals		492 (30,780)	10,651,245		8,249.9	528.7	164,860	513.8

Abbreviations
CNV: SWM Pond Conversion
NWET: New Wet Pond
SR: Stream Restoration
HAB: Habitat improvement
RET: Retrofit
NEXT: New Extended Detention Pond
SCR: StormCeptor
SE: Shoreline Enhancement
TBD: To Be Determined

7.3.7 Gunpowder River Watershed

The Gunpowder River tidal portion is listed as impaired for nutrients. The changes in the biological listing criteria in the draft *2008 Integrated Report of Surface Water Quality in Maryland* resulted in Gunpowder River being designated as having insufficient data to determine biological impairment. Therefore, the watershed has been placed into category 3 with regards to biological impairment listing until such time as there is sufficient data to make a determination. A watershed management plan is not required for the Gunpowder River watershed for the NPDES – Municipal Stormwater Discharge Permit due to the limited urban development. This is a ten square mile watershed and only one capital project has been completed in the watershed. This project is listed in Table 7-8.

Table 7-8: Gunpowder River Watershed – CIP Status

Capital Improvement Projects Through 2007 Gunpowder River Watershed								
Project	Facility Type	DA	Cost	Date	Removal Rate (lb./year)			Impervious Acres
					TN	TP	TSS	
Completed Projects								
Carrollwood Park	RET	59	350,000	95	189	18.1	7,750	17.6
Projects Under Design or Construction								
None								
Proposed Projects								
None								
Totals		59	350,000		189	18.1	7,750.1	17.6

Abbreviations
CNV: SWM Pond Conversion
NWET: New Wet Pond
SR: Stream Restoration
HAB: Habitat improvement
RET: Retrofit
NEXT: New Extended Detention Pond
SCR: StormCeptor
SE: Shoreline Enhancement
TBD: To Be Determined

7.3.8 Middle River Watershed

The tidal portion of the Middle River watershed is listed as impaired for nutrients and sediment. The changes in the biological listing criteria in the draft *2008 Integrated Report of Surface Water Quality in Maryland* resulted in Middle River being designated as having insufficient data to determine biological impairment. Therefore, the watershed has been placed into category 3 with regards to biological impairment listing until such time as there is sufficient data to make a determination.

The Middle River Watershed Management Plan was submitted to Maryland Department of the Environment in 2001. Under DEPRM's Capital Improvement Program, dredging of many of the creeks within this estuary was completed in 2002. To fulfill the dredging permit requirements, a feasibility study was completed to identify potential retrofit sites. Capital projects in Middle River are displayed in Table 7-9.

Much of the capital improvement work that has been completed in the Middle River watershed consists of shoreline improvement projects. A total of five shoreline enhancements have been completed. Five retrofit projects have been completed and one is still under design. The revitalization efforts in the Essex community have provided opportunities for additional water quality enhancements. The Tall Trees project is a joint effort between the developer and the County.

Table 7-9: Middle River Watershed – CIP Status

Capital Improvement Projects Through 2007 Middle River Watershed								
Project	Facility Type	DA	Cost	Date	Removal Rate (lb./year)			Impervious Acres
					TN	TP	TSS	
Completed Projects								
Turkey Point	SE	na	127,539	97				
Sue Creek	STWET	22	93,274	97	110.1	13.0	2,656	6.9
Dark Head Park	SE	na	168,000	90				
Pottery Farm Park	SE	na	351,000	95				
Hawthorne Park	SE	na	64,000	95				
Dark Head Park II	SE	na	15,094	99				
Norman Creek	STWET	25	131,151	95	127.1	16.2	2,484	3.5
Tall Trees	SR	(1,000)	1,100,000	06	202.0	10.7	3,580	
Tall Trees	RET	135	combined	06	482.3	52.2		40.9
Frog Mortar	RET		82,000	08	340.0	41.1		18.3
Projects Under Design or Construction								
Galloway Creek	RET		150,000	09				
Proposed Projects								
None								
Totals		182 (1,000)	2,282,058		1261.4	133.2	8,720	69.6

Abbreviations
CNV: SWM Pond Conversion
NWET: New Wet Pond
SR: Stream Restoration
HAB: Habitat improvement
RET: Retrofit
NEXT: New Extended Detention Pond
SCR: StormCeptor
SE: Shoreline Enhancement
TBD: To Be Determined
STWET: Stormwater Wetland

7.4 Patapsco/Back River Watersheds

The Patapsco/Back River Basin watersheds include: Liberty Reservoir, Patapsco River, Gwynns Falls, Jones Falls, Back River and Baltimore Harbor. Five of the six watersheds require watershed management plans based on the amount of urban development within the watershed.

The calculation of pollutant load reductions due to stream restoration where based on the re-analysis of the Spring Branch data presented in the NPDES 2006 Annual Report, which resulted in the following pollutant load reduction estimates:

- Total Nitrogen – 0.202 pounds per linear foot of stream restoration
- Total Phosphorus – 0.0107 pounds per linear foot of stream restoration
- Total Suspended Solids – 3.58 pound per linear foot of stream restoration

Section 10.2 describes the calculation of pollutant loads for both watersheds and for the drainage area to stormwater management facilities. The pollutant load reductions for stormwater management facility retrofits and conversions uses the loads calculated in accordance with

Section 10.2 and the pollutant removal efficiencies based on facility type found in Section 1 – Table 1-8.

7.4.1 Liberty Reservoir Watershed

The Liberty Reservoir is listed as impaired for nutrients, metals, sediment, bacteria, with some streams listed as being impaired biologically. A TMDL for mercury in fish tissue was prepared and submitted to EPA and approved in 2004. The major source of mercury is from air deposition due to discharges from power plants and incinerators. As such, the major factor in reducing mercury contamination in Loch Raven Reservoir in reductions in emissions, with secondary actions including hazardous waste collection days and "e-cycling". The document may be found on the web at:

http://www.mde.state.md.us/assets/document/tmdl/liberty/Liberty_main_pn.pdf

A Water Quality Analysis for chromium and lead was performed and submitted to EPA. EPA concurred (November 10, 2003) that no impairment by chromium and lead is occurring. The document may be found on the web at:

http://www.mde.state.md.us/assets/document/Liberty%20Reservoir%20WQA_final(1).pdf

The changes in the biological listing criteria in the draft *2008 Integrated Report of Surface Water Quality in Maryland* resulted in the entire Liberty Reservoir watershed being listed as biologically impaired.

A watershed management plan is not required for the Liberty Reservoir watershed for the NPDES – Municipal Stormwater Discharge Permit due to the limited urban development. The Liberty Reservoir serves as a drinking water reservoir for portions of Carroll County, Howard County, Baltimore County, Anne Arundel County and Baltimore City. Much of the Baltimore County portion of the drainage area to Liberty Reservoir is under forest cover. While there are no planned capital improvement projects for this watershed, its importance as a water supply reservoir require that additional planning of preservation and reforestation activities be considered in the future.

7.4.2 Patapsco River Watershed

The Patapsco River watershed is listed as impaired for nutrients, sediment, metals, and as being biologically impaired. The changes in the biological listing criteria in the draft *2008 Integrated Report of Surface Water Quality in Maryland* resulted in the entire Patapsco River watershed being designated as biologically impaired.

The Patapsco River Watershed Management Plan was submitted to Maryland Department of the Environment in 2000. Table 7-10 provides a summary of the capital improvement projects in the Patapsco River watershed. One retrofit and five stream restoration projects have been completed in the Herbert Run and Bens Run subwatersheds. A retrofit project was also completed in conjunction with the County's Department of Public Works. An additional stream restoration project is in the design and construction phase. A total of 4,750 linear feet of stream channel has either been restored or is in design to be restored. Additional funding for projects is allocated in the capital budget through FY2012.

A Total Maximum Daily Load (TMDL) has been completed for nutrients, and was submitted to EPA on December 14, 2006 for consideration. The nutrient TMDL was approved by EPA in

December 2007. This TMDL covers all of the watersheds draining to Baltimore Harbor. The TMDL has estimated that a 15% reduction in urban non-point source load will be needed, along with upgrades to the Patapsco WWTP to meet water quality standards for tidal Baltimore Harbor. The document can be found on the web at:

http://www.mde.state.md.us/assets/document/harbor-main-051906_PN.pdf

A SWAP has been initiated in the lower urban portion of the Patapsco River watershed, with the initial meeting held April 4, 2005. One of the goals for this SWAP will be to reduce nitrogen and phosphorus urban non-point pollutant loadings by 15% through a combination of County actions and projects, and citizen and business actions. The SWAP is anticipated to be completed in the winter/early spring of 2007.

The County has developed a grant program entitled, Watershed Association Restoration Planning and Implementation Grant Program. This grant program was developed to address staffing needs of local Watershed Associations. The intent of the grant is to provide funding for staff time to volunteer groups to participate in County restoration planning, identification of restoration projects, implementation of restoration projects, identify Stream Watch participants, offer educational activities, and the ability to leverage additional funding. Annual funding is limited up to $30,000 with a minimum of 1000 hours of staff time to be expended on projects. Funding is provided for salaries, fringe, and overhead (limited to 10%). Funding is not provided for restoration materials, supplies, or the Executive Director's salary.

The Friends of Patapsco Valley and Heritage Greenway (FPVHG) applied for and received their third grant under this program in February of 2007. The organization intends to use the funds to expand their base of volunteers, increase their membership, organize stream clean ups, engage citizens in Stream Watch, and outreach to schools and institutions.

Table 7-10: Patapsco River Watershed – CIP Status

Capital Improvement Projects Through 2007 Patapsco River Watershed								
Project	**Facility Type**	**DA** (LF)	**Cost**	**Date**	**Removal Rate (lb./year)**			**Impervious Acres**
					TN	**TP**	**TSS**	
Completed Projects								
Bloomsbury (DPW)	RET	10		90	42.5	5.0		1.4
Herbert Run@ Selma Ave.	SR	(550)	227,000	00	111.1	5.9	1,969	38.5
Herbert Run @ Leeds Ave	SR	(300)	78,144	03	60.6	3.2	1,074	2.8
2203 Sulphur Spring Rd	SR	(200)	111,000	03	40.4	2.1	716	10.7
Halethorpe Streambank	SR	(100)	61,500	03	20.2	1.1	358	
Bens Run	SR	(2,000)	570,964	04	404.0	21.4	7,160	21.3
Bens Run	STWET	30	incl. above	04	296.6	27.1	3,150	41.4
Projects Under Design or Construction								
Herbert Run @ First Ave	SR	(1600)	400,000	04	323.2	17.1	5,728	22.6
Proposed Projects								
Patapsco	SR		300,000	12/13	323.2	17.1	5,728	22.6
Totals		40 (4,750)	1,748,608		1,298.6	82.9	20,155	138.7

Abbreviations	
CNV: SWM Pond Conversion	NEXT: New Extended Detention Pond
NWET: New Wet Pond	SCR: StormCeptor
SR: Stream Restoration	SE: Shoreline Enhancement
HAB: Habitat improvement	TBD: To Be Determined
RET: Retrofit	STWET: Stormwater Wetland
cd: Consent Decree requirement	

7.4.3 Gwynns Falls Watershed

The County has completed the Gwynns Falls watershed management plan as a joint effort with Baltimore City and using the services of a professional consultant. Approximately two-thirds of the watershed is located in Baltimore County. Owings Mills, one of the County's two designated growth areas, is highly urbanized and located within this watershed.

Table 7-11 displays the status of capital projects in the Gwynns Falls watershed. The Department is implementing several buffer enhancement projects in the Dead Run subwatershed. These consist mainly of streetscape plantings that are adjacent to Dead Run. Baltimore County is not claiming pollutant reduction benefits from these projects at this time. Baltimore County realizes that the pollutant reduction efforts for the Gwynns Falls watershed are lagging behind the other watersheds. Therefore, substantial capital dollars are allocated in future years in anticipation of completing the watershed management plan and catching up the Gwynns Falls Watershed with the County's other urbanized watersheds.

A TMDL for nutrients has been completed for the Patapsco Basin, including Gwynns Falls. The TMDL identifies a 15% reduction from urban non-point sources as necessary to meet water quality standards in tidal Baltimore Harbor. The nutrient TMDL was approved by EPA in December 2007. The document can be viewed on the web at the location given under the discussion of the Patapsco watershed in section 7.4.2 above.

A TMDL for bacteria has also been developed for Gwynns Falls requiring a reduction in bacteria loads in the range of 98%. The bacteria TMDL was approved by EPA in December 2007. This document can be viewed on the web at:
http://www.mde.state.md.us/assets/document/GwynnsFalls_TMDL_071206_PN.pdf#TMDL_Georges_Creek_bacteria

One hundred and eighty-five (185) acres of urban land have been address through enhanced stormwater management through conversion of existing stormwater management facilities or retrofits of uncontrolled urban discharge. A total of 2,235 feet of stream restoration has been completed. A complete assessment of potential projects is underway for the Scotts Level Branch. This subwatershed was identified in the watershed Management Plan and through staff discussions as one for DEPRM to identify and implement all feasible capital projects. Long term monitoring will be ongoing as well in an effort to quantify the water quality improvements. Over $7,000,000 have been allocated for restoration within the Gwynns Falls in fiscal years 2007 through 2012.

The County has developed a grant program entitled, Watershed Association Restoration Planning and Implementation Grant Program. This grant program was developed to address staffing needs of local Watershed Associations. The intent of the grant is to provide funding for staff time to volunteer groups to participate in County restoration planning, identification of restoration projects, implementation of restoration projects, identify Stream Watch participants, offer

educational activities, and the ability to leverage additional funding. Annual funding is limited up to $30,000 with a minimum of 1000 hours of staff time to be expended on projects. Funding is provided for salaries, fringe, and overhead (limited to 10%). Funding is not provided for restoration materials, supplies, or the Executive Director's salary.

The Gwynns Falls Watershed Association applied for and received their first grant under this program in December of 2007. The organization intends to use the funds to expand their base of volunteers, increase their membership, organize stream clean ups, engage citizens in Stream Watch, and outreach to schools and institutions.

Table 7-11: Gwynns Falls Watershed – CIP Status

Capital Improvement Projects Through 2007 Gwynns Falls Watershed								
Project	**Facility Type**	**DA** (LF)	**Cost**	**Date**	**Removal Rate (lb./year)**			**Impervious Acres**
					TN	**TP**	**TSS**	
Completed Projects								
Greenshire Court	SR	(135)	17,690	99	27.3	1.4	483	3.9
Dead Run @ Security/McD	BE	(250)	23, 690	02				
Rutherford Business Ctr.	CNV	56	134,000	03	180.2	17.3	13,188	22.9
Dead R@ HS Ftbridge/wall	SR	(200)	141,000	03	40.4	2.1	716	1.7
Woodlawn HS retrofit	RET/BE	8.9	206,000	03	33.1	5.2	1,399	3.8
Dead Run@ Whitehead Rd	SCR/BE	60	155,000	03				
DR@Woodlawn Dr (Fox)	SR	(450)	232,594	04	90.9	4.8	1,611	24.8
Dead R @ Dogwood Rd	BE	(1,200)	Na	04				
Chartley SR	SR	(2,000)	970,000	06	404.0	21.4	7,160	13.4
Projects Under Design or Construction								
Scotts Level, Feasibility	RET		150,000	07				
Proposed Projects								
I70 Interchange WQ	RET		1,100,000	08-12				
Scotts Level Retrofit	RET		300,000	08				
Scotts Level I (Design)	SR		500,000	08				
Scotts Level I (Con)	SR		1,250,000	10				
Western Hills Ret	RET		300,000	10				
West View Park Des-Con	SR		1,450,000	08-10				
Scotts Level II	SR		800,000	12				
Scotts Level Ret	RET		350,000	12				
Totals		124.9 (4,235)	8,056,284		775.9	52.2	24,557	70.5

Abbreviations
CNV: SWM Pond Conversion
NWET: New Wet Pond
SR: Stream Restoration
HAB: Habitat improvement
RET: Retrofit
cd: Consent Decree requirement
NEXT: New Extended Detention Pond
SCR: StormCeptor
SE: Shoreline Enhancement
TBD: To Be Determined
BE: Buffer Enhancement

7.4.4 Jones Falls Watershed

The Jones Falls Watershed Management Plan was submitted to Maryland Department of the Environment in 1997. Table 7-12 provides a summary of the capital improvement projects in the Jones Falls watershed either completed, in design or proposed.

Three outfalls with a combined acreage of 133 acres have completed retrofit projects to provide water quality improvement. A total of 7,050 linear feet of stream restoration has either been completed or is in the design phase. An additional two retrofits and two stream restoration projects have been allocated for in the future capital budget.

A TMDL for nutrients has been completed for the Patapsco Basin, including Jones Falls. The TMDL identifies a 15% reduction from urban non-point sources as necessary to meet water quality standards in tidal Baltimore Harbor. The nutrient TMDL was approved by EPA in December 2007. The document can be viewed on the web at the location given under the discussion of the Patapsco watershed in section 7.4.2 above.

A TMDL for bacteria has also been developed for Jones Falls and was submitted to EPA September 22, 2006. The bacteria TMDL for Jones Falls was approved in February 2008. This TMDL requires a reduction in bacteria loads in the range of ~95%. This document can be viewed on the web at:

http://www.mde.state.md.us/assets/document/Jones_Falls_TMDL_071706_PN.pdf

Water Quality Assessments were performed by MDE for zinc, copper, and lead. The analysis of zinc was performed first and received EPA concurrence on February 20, 2003. The document can be found at the first link listed below. EPA also concurred with the Water Quality Assessment for copper and lead on December 2, 2004 (second link). Both of these Water Quality Assessments found no impairment related to the heavy metals considered.

http://www.mde.state.md.us/assets/document/Jones%20Falls%20WQA_final(1).pdf

http://www.mde.state.md.us/assets/document/Jones%20Falls%20WQA_final(2).pdf

A SWAP for Roland Run and Towson Run is currently being developed. The initial meeting was held February 8, 2005. The SWAP will address the reductions of nitrogen and phosphorus loads necessary to meet water quality standards. It is anticipated to be completed in the summer of 2009.

Table 7-12: Jones Falls Watershed – CIP Status

Capital Improvement Projects Through 2007 Jones Falls Watershed								
Project	Facility Type	DA (LF)	Cost	Date	Removal Rate (lb./year)			Impervious Acres
					TN	TP	TSS	
Completed Projects								
Robin Hood Cr. minor outf	DET	17	307,359	98	50.0	5.7	185	2.6
Kenilworth Park #144	DET	83	Inc. above	98	302.3	28.6	14,031	39.9
Orchard Hills outfall #149	DET	33	Inc. above	98	336.1	37.0	1,362	20.8
Roland Run - Essex Rd.	SR	(400)	479,488	98	80.8	4.3	1,432	
Roland Run – Sem. Ave.	SR	(100)	Inc. above	98	20.2	1.1	358	
Towson Run – VFW Hall	SR	(600)	349,869	00	121.2	6.4	2,148	70.6
Roland Run – Jeffers Rd.	SR	(1,550)	451,083	02	313.1	16.6	5,585	66.0
Wood Valley	SR	(2,000)	1,077,510	04	404.0	21.4	7,160	24.9
Roland Run-Riderwd. Hills	SR	(2,400)	1,100,000	07	484.8	25.7	8,592	98.3
Projects Under Design or Construction								
Roland Run @Greenspring	SR	(3,500)	1,500,000	08	707.0	37.5	12,530	
Roland Run @Greenspring	RET		620,000	08				
Proposed Projects								
Towson Run @ Cloisters	RET		700,000	08				

Roland Run @ Kellog (D)	SR		200,000	08				
Roland Run @ Kellog (C)	SR		800,000	10				
Totals		133 (10,550)	7,585,309		2,819.5	184.3	53,383	323.1

Abbreviations
CNV: SWM Pond Conversion
NWET: New Wet Pond
SR: Stream Restoration
DET: Detention Pond
HAB: Habitat improvement
cd: Consent Decree requirement
NEXT: New Extended Detention Pond
SCR: StormCeptor
SE: Shoreline Enhancement
TBD: To Be Determined
BE: Buffer Enhancement

EPA Region III has awarded Baltimore County a Water Quality Cooperative Assistance Grant in the amount of $200,000 for the creation of two SWAPs. One of the SWAPs is located in the lower Jones Falls and will include the subwatersheds of Slaughterhouse Run, Moores Run, Western Run and the Jones Falls portion of Baltimore City. The SWAP for this planning area began in December 2007 and is anticipated to be completed in the summer of 2008.

To expand the County's overall restoration strategy DEPRM developed the *Watershed Association Restoration Planning and Implementation Grant* Program. This grant program was developed to address staffing needs of local Watershed Associations. The intent of the grant is to provide funding for staff time to volunteer groups to participate in County restoration planning, identification of restoration projects, implementation of restoration projects, identify Stream Watch participants, offer educational activities, and the ability to leverage additional funding. Annual funding is limited up to $30,000 with a minimum of 1000 hours of staff time to be expended on projects. Funding is provided for salaries, fringe, and overhead (limited to 10%). Funding is not provided for restoration materials, supplies, or the Executive Director's salary.

The Jones Falls Watershed Association (JFWA) applied for and received their second grant under this program in October of 2007. The organization intends to use the funds to expand their base of volunteers, increase their membership, organize buffer plantings and removal of invasive plants, engage citizens in Stream Watch, and outreach to schools and institutions.

7.4.5 Back River Watershed

The Back River Watershed Management Plan was submitted to Maryland Department of the Environment in 1997. Table 7-13 provides a summary of the capital improvement projects in the Back River watershed either completed, in design or proposed.

Seven storm water retrofit/conversion projects, addressing 598 acres of drainage area, have either been completed or are in the design stage. Money has been allocated for an additional retrofit in the Back River watershed. Eight stream restoration projects addressing 10,181 linear feet of degraded stream channel have either been completed or are in the design phase. Two additional projects, a stream restoration project and a shoreline enhancement project, have been budgeted in future fiscal years.

A TMDL for nutrients has been completed for the Back River watershed and approved by EPA June 29, 2005. The TMDL identifies a 15% reduction from urban non-point sources as necessary to meet water quality standards in tidal Back River, along with nutrient reductions from the Back River WWTP. This document can be viewed on the web at:

http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/ApprovedFinalTMDL/TMDL_final_backriver_eutro.asp

In addition to the nutrient TMDL, MDE has developed a TMDL for chlordane (EPA approval December 17, 1999) and a TMDL for bacteria approved by EPA December 4,2007. A Water Quality Assessment was performed for zinc (EPA concurrence December 23, 2004) indicating no impairment due to zinc. These documents can be viewed on the web at:

http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/ApprovedFinalTMDL/tmdl_backriver.asp

http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/Pub_Notice/TMDL_PN_herringrun_bacteria.asp

http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/ApprovedFinalTMDL/WQA_final_backriver_zinc.asp

EPA Region III has awarded Baltimore County a Water Quality Cooperative Assistance Grant in the amount of $200,000 for the creation of two SWAPs. One of the SWAPs will be located in the upper Back River and will include the subwatersheds of Herring Run, Moores Branch, Redhouse Run, and Stemmers Run. The SWAP for this planning area began in December 2007 and is anticipated to be completed in the summer of 2008.

To expand the County's overall restoration strategy DEPRM developed the *Watershed Association Restoration Planning and Implementation Grant* Program. This grant program was developed to address staffing needs of local Watershed Associations. The intent of the grant is to provide funding for staff time to volunteer groups to participate in County restoration planning, identification of restoration projects, implementation of restoration projects, identify Stream Watch participants, offer educational activities, and the ability to leverage additional funding. Annual funding is limited up to $30,000 with a minimum of 1000 hours of staff time to be expended on projects. Funding is provided for salaries, fringe, and overhead (limited to 10%). Funding is not provided for restoration materials, supplies, or the Executive Director's salary.

The Herring Run Watershed Association (HRWA) applied for and received their second grant under this program in May of 2007. The organization intends to use the funds to expand their base of volunteers, increase their membership, organize street tree planting projects, organize stream clean up events, engage citizens in Stream Watch, and outreach to schools.

Table 7-13: Back River Watershed – CIP Status

Capital Improvement Projects Through 2007 Back River Watershed								
Project	Facility Type	DA (LF)	Cost	Date	Removal Rate (lb./year)			Impervious Acres
					TN	TP	TSS	
Completed Projects								
Coxs Point I	SE		45,000					
Coxs Point II	SE		295,000					
Rocky Point I	SE		270,000					
Rocky Point II	SE		192,000					
Lynch Point Cove – SM	CNV	27	250,000	97	166.5	19.6	3,565	9.8
Stemmers Run@ Dbl Rock	SR	(1,881)	362,905	97	380.0	20.1	6,734	156.5
Stemmers Run	SCR	33	121,000	98				
Redhouse E.S. Retrofit	RET	34	136,794	98	275.5	34.0	4,041	12.0

Greenhill WQ Retrofit	SCR	12	35,273	98	52.3	6.0	1,781	4.1
Rocky Point @ Ballestone	SE	NA	389,480	98				
Redhouse Run Md-7	SCR	11	49,925	99	1.1	0.2	104	1.7
Rossville Industrial Park	CNV	155	184,210	99	737.7	83.2	33,619	59.9
Herring Run (Wiltondale)	SR	(1,400)	295,860	99	282.8	15.0	5,012	113.3
Herring Run (Goucher)	SR	(300)	158,538	00	60.6	3.2	1,074	1.8
OverleaTrib @ HS Prop	SR	(2,600)	529,260	01	525.2	27.8	9,308	20.7
Linover Park	SR	(1,000)	206,745	02	202.0	10.7	3,580	3.7
Rocky Pt. Habitat Creation	HAB	na	519,000	02				
Martin Blvd Interchange	NEXT	191	629,144	04	897.8	105.1	23,332	50.2
Linwood Avenue	SR	(500)	283,968	04	101.0	5.4	1,790	24.9
Glenwest	RET	135	458,000	04				
Glenwest	SR	(500)	Inc. above	04	101.0	5.4	1,790	
Herring Run @ Sussex Rd.	SRepair	na	96,572	07				
Redhouse Rn@ St. Pat Rd	SR	(2,000)	1,500,000	07	404.0	21.4	7,160	
Golden Tree Sec I	CNV				119.9	14.4		6.8
Golden Tree Sec III	CNV				80.6	9.8		4.0
Projects Under Design or Construction								
Essex Skypark	SE		650,000	08-11				
Proposed Projects								
Redhouse Run			800,000	10/11				
Totals		598 (10,181)	8,458,674		4,388	381.3	102,890	469.4

Abbreviations
CNV: SWM Pond Conversion
NWET: New Wet Pond
RET: Retrofit
SR: Stream Restoration
HAB: Habitat improvement
NEXT: New Extended Detention Pond
SCR: StormCeptor
TBD: To Be Determined
SE: Shoreline Enhancement

7.4.6 Baltimore Harbor Watershed

The Baltimore Harbor Watershed Management Plan was submitted to Maryland Department of the Environment in 2001. Table 7-14 presents the status of capital improvement projects through 2003.

Seven storm water retrofit/conversion projects have been completed to date along with twelve shoreline enhancement projects. The seven retrofit projects address 619 acres of urban development for water quality improvements. Twelve shoreline enhancement projects have been completed in the Baltimore Harbor watershed. The capital budget contains money for one additional retrofit project.

A TMDL for nutrients has been completed for the Patapsco Basin, including the Baltimore Harbor watershed. The nutrient TMDL was approved by EPA in December 2007. The TMDL identifies a 15% reduction from urban non-point sources as necessary to meet water quality standards in tidal Baltimore Harbor. The document can be viewed on the web at the location given under the discussion of the Patapsco watershed in section 7.4.2 above. In addition, a TMDL for chlordane (EPA approval March 23, 2001) has been developed. This document can be viewed on the web at:

http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/ApprovedFinalTMDL/tmdl_baltoharbor.asp

A number of Water Quality Assessments have been performed in Baltimore Harbor resulting in the delisting of Baltimore Harbor as being impaired by zinc, lead, and chromium (EPA concurrence January 18, 2005). These documents can be found on the web at:

http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/ApprovedFinalTMDL/WQA_final_harbor_Cr.asp

http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/ApprovedFinalTMDL/WQA_final_harbor_Zn_Pb.asp

Table 7-14: Baltimore Harbor Watershed – CIP Status

Capital Improvement Projects Through 2007 Baltimore Harbor Watershed								
Project	Facility Type	DA (ft.)	Cost	Date	Removal Rate (lb./year)			Impervious Acres
					TN	TP	TSS	
Completed Projects								
Concrete Homes	SE	na	65,000	90				
Watersedge Park	SE	na	92,000	90				
Merritt Point Park	SE	na	175,000	90				
Bear Creek I	SE	na	66,000	90				
West Inverness	SE	na	19,000	90				
Geise Ave.	RET				0.8	0.2		0.5
Chink Creek	RET	12.6		90	66.5	8.1		3.3
Hughes Ave	RET	17		90	9.2	2.2		5.0
Charlesmont	SE	na	47,000	93				
Sandy Plains Elem.	SE	na	83,000	98				
Tabasco Cove	STWET	135	128,209	96	577.4	55.2	40,851	70.7
Lynch Point Cove	NWET	27	247,660	97				
North Point Creek	NEXT	90	117,277	98	391.0	48.6	8,081	17.0
Schoolhouse @ Oakleigh	SCR	61.5	419,133	98	8.6	1.7	4,259	10.9
Schoolhouse Cove	SCR	61.5	419,133	98	20.6	4.4		21.8
Bear Creek II Shore	SE	(500)	45,445	99				
Bear Creek II SD Retrofit	NWET	12	93,026	99	54.7	6.1	1,672	4.7
Sandy Plains Elem.	SE		97,349	99				
Watersedge Park II	SE	(100)	21,062	99				
Lynch Cove Retrofit site-I	STWET	217	500,000 combined	03	1,224.0	142.9	3,565	84.9
Lynch Cove Retrofit site-II	STWET	109		03	584.8	64.7	3,565	52.9
West Inverness	SE		372,000	03				
Concrete Homes	SE	(200)	110,000	03				
Fleming Park	SE		310,000	07				
Projects Under Design or Construction								
None								
Proposed Projects								
Bear Creek Headwaters	RET	152	100,000	09				
Pleasure Island	SE		2,805,000	08-11				
Totals		648.6 (800)	6,332,294		2,937.5	334.1	61,993	271.7

Abbreviations
CNV: SWM Pond Conversion
NWET: New Wet Pond
SR: Stream Restoration
STWET: Stormwater Wetland
HAB: Habitat improvement
NEXT: New Extended Detention Pond
SCR: StormCeptor
SE: Shoreline Enhancement
TBD: To Be Determined

7.5 Pollution Reduction Tracking Database

The pollution reduction tracking database currently tracks reductions from capital construction projects. It includes elements that are shown in the pollutant reduction tables in this section. In addition, pollutant reduction attributable to certain types of restoration (stream channel restoration and buffer planting) must continue to be monitored and assessed. Spring Branch has provided the data for a preliminary estimate of pollutant load reduction per linear foot of restored stream channel. A grant project that DEPRM and the Water Environment Research Federation (WERF) have recently completed will provide information on pollutant reduction benefits of urban forested riparian buffers. The Chesapeake Bay Program has assigned a tentative pollutant removal efficiency of 25% for Total Nitrogen and 50% for Total Phosphorus and Total Suspended Solids. In addition to the pollutant removal efficiencies the Chesapeake Bay Program counts urban forest riparian buffers as a land use conversion. The County has not included these reduction efficiencies in the current report, but anticipates that credit for urban-forested riparian buffers will be applied in future reports. In addition, the urban loads will be adjusted by a reduction in urban land use due to forest riparian buffers that are now included in the urban land use categories, due to the way the land use is derived by Maryland Department of Planning. A data tracking spreadsheet that includes operational programs will be completed when reduction amounts are quantified.

7.6 Impervious Surface Calculation

The impervious surface acreage in Baltimore County was calculated by using a GIS planimetric building footprint data layer and a planimetric roadway data layer that was created from aerial photography flown from 1995-1997. The building data layer does not include sidewalks or driveways. The roads data layer includes parking lots. The data are presented by watershed in Table 7-15. A new planimetric data layer for both buildings and roadways based on 2005 aerial photography is currently being developed. The estimates of impervious cover will be updated in next years report.

Using this methodology a total impervious coverage of 34,000 acres was derived for Baltimore County. All of the watersheds in the Patapsco/Back River Basin have higher impervious percentages then the watersheds in the Upper Western Shore Basin. This is with the exception of the Liberty Reservoir watershed, which has a low impervious percentage because of its value as a source for drinking water. The Baltimore Harbor watershed had the highest percentage of impervious area. Roadways and parking lots account for 63.1 % of the impervious surface coverage in Baltimore County.

Table 7-15: Baltimore County Impervious Area by Watershed

Watershed	Drainage Area (acres)	Building Acres	Road Acres	Total Acres Impervious	% Impervious
Upper Western Shore Watersheds					
Deer Creek	7,131	39.6	118.3	157.9	2.21
Prettyboy Reservoir	25,545	125.9	318.4	444.3	1.74
Loch Raven Reservoir	139,554	1,983.2	4,159.3	6,142.5	4.40
Lower Gunpowder Falls	29,471	767.6	846.0	1,613.6	5.48
Little Gunpowder Falls	17,229	190.3	403.7	594.0	3.45
Bird River	16,463	698.5	873.6	1,572.2	9.55
Gunpowder River	6,065	120.1	112.4	232.5	3.83
Middle River	6,520	429.0	351.3	780.3	11.97

Upper Western Shore Totals	**247,978**	**4,354.2**	**7,183.0**	**11,537.3**	**4.65**
Patapsco/Back River Watersheds					
Liberty Reservoir	17,555	133.3	363.5	496.9	2.83
Patapsco River	33,186	1,465.9	2,606.4	4,072.3	12.27
Gwynns Falls	28,643	2,170.3	3,983.5	6,153.8	21.48
Jones Falls	25,945	1,306.8	2,215.1	3,521.9	13.58
Back River	23,248	1,958.9	3,299.5	5,258.4	22.62
Baltimore Harbor	11,453	1,154.4	1,806.7	2,961.1	25.86
Patapsco/Back River Totals	**140,030**	**8,189.6**	**14,274.7**	**22,464.4**	**16.04**
County-Wide Totals	**388,008**	**12,543.8**	**21,457.7**	**34,002**	**8.76**

To meet the current NPDES permit requirement Baltimore County must provide restoration for impervious land areas that are equal to or greater than 10% of the County's urban impervious cover. Roads that are owned by the Maryland State Highway Administration do not have to be addressed by Baltimore County. Therefore the roadways that are maintained by the Maryland State Highway Administration were identified and the acreage of impervious cover associated with those highways was removed from Baltimore County's requirement. The results are presented in Table 7-16. The roadways owned by the Maryland State Highway Administration account for 3,455 acres of impervious area in Baltimore County or 10.2% of the total impervious area.

Table 7-15 calculates that Baltimore County is required to manage 10% of 31,090 acres, which equals 3,100 acres of impervious cover each 5-year permit term. Baltimore County is required to manage 20% of the county impervious area by June 2010. This is currently accounted for through the construction of restoration projects. Watershed management plans list specific potential projects that address water quality restoration. The capital budget provides funds on a watershed basis for implementation of the projects found to be feasible. The specific projects completed and currently under design or construction are listed in Tables 7-3 through 7-14 by watershed. Unidentified projects for each watershed are also listed by type.

Table 7-16: Baltimore County and Maryland State Highway Impervious Acreage

Watershed	Impervious Acres in Baltimore Co.	Impervious Acres owned by SHA	Remaining Impervious Acres
Upper Western Shore Watersheds			
Deer Creek	157.9	26.8	131.1
Prettyboy Reservoir	444.3	25.4	418.9
Loch Raven Reservoir	6,142.5	630.8	5,511.7
Lower Gunpowder Falls	1,613.6	119.4	1,484.2
Little Gunpowder Falls	594.0	98.9	495.1
Bird River	1,572.2	276.7	1,848.9
Gunpowder River	232.5	8.4	224.1
Middle River	780.3	64.5	715.8
Upper Western Shore	**11,537.3**	**1250.9**	**10,829.8**
Patapsco/Back River Watersheds			
Liberty Reservoir	496.9	93.1	403.8
Patapsco River	4,072.3	473.9	3,598.4
Gwynns Falls	6,153.8	539.2	5,614.6
Jones Falls	3,521.9	403.7	3,118.2
Back River	5,258.4	526.9	4,731.5
Baltimore Harbor	2,961.1	167.4	2,793.7
Patapsco/Back River	**22,464.4**	**2204.2**	**20,260.2**

County-Wide Totals	**34,001.7**	**3,455.1**	**31,090.0**

The drainage areas for most of the completed projects and the associated impervious acreage have been delineated with the use of GIS. The drainage area for each CIP project that has been completed was delineated using topography or consultant information. An associated GIS data layer created was created of all the CIP project drainage areas. The area of impervious surfaces within each digitized drainage area was measured. The total of these impervious surfaces was categorized by watershed and is included in Table 7-17.

The impervious acreage addressed by completed capital improvement projects is listed in Table 7-17. Baltimore County through its Capital Improvement Program has addressed 2,781 acres of its impervious acreage required under the current NPDES permit. In addition, 2,533 acres of impervious cover has been address through installation of stormwater management that does not have potential for retrofits and is providing water quality benefits. This results in a total of 17.1% of the impervious area in the County addressed through water quality controls.

Table 7-17: Impervious Acreage Addressed by Completed Capital Projects and Advanced Treatment SWM Facilities

Watershed	Impervious Acres to be Addressed	CIP Projects Drainage Area	CIP Project Impervious Acres Addressed	SWM Advanced Treatment Impervious Acres Addressed	Total Impervious Area Addressed	Total Percent of Impervious Addressed
Upper Western Shore						
Deer Creek	131.1	0	0	0	0	0.0%
Prettyboy Reservoir	418.9	0	0	2.7	2.7	0.6%
Loch Raven Reservoir	5,511.7	2,341.9	472.8	531	1003.8	18.2%
Lower Gunpowder Falls	1,484.2	2,324.3	434.0	178	612	41.2%
Little Gunpowder Falls	495.1	0	0	22	22	4.4%
Bird River	1,848.9	2,193.2	513.8	305	818.8	44.3%
Gunpowder River	224.1	65.9	17.6	13	30.6	13.7%
Middle River	715.8	232.7	69.6	44	113.6	15.9%
Upper Western Shore Totals	**10,829.8**	**7,158.0**	**1,507.8**	**1,095.7**	**2,603.5**	**24%**
Patapsco/Back River						
Liberty Reservoir	496.9	0	0	3.1	3.1	0.6%
Patapsco River	3,598.4	486.2	138.7	171	309.7	8.6%
Gwynns Falls	5,614.6	113.9	70.5	530	600.5	10.7%
Jones Falls	3,118.2	1,013.1	323.1	234	557.1	17.9%
Back River	4,731.5	1,703.5	469.4	456	925.4	19.6%
Baltimore Harbor	2,793.7	696.2	271.8	43	314.8	11.3%
Patapsco/Back River Totals	**20,353.3**	**4,012.9**	**1,273.5**	**1,437.1**	**2,710.6**	**13.3%**
County-Wide Totals	**31,090.0**	**11,170.9**	**2,781.3**	**2,532.8**	**5,314.1**	**17.1%**

The SWAPs that are currently under development will provide the information necessary to determine the extent of the restoration options necessary to meet TMDL determined pollutant load reductions, and the Maryland Chesapeake Bay Tributary Strategies. At the same time these plans will satisfy the NPDES – MS4 permit to address impervious area. Table 7-18 presents the information of the impervious cover that will be addressed by these five plans.

Table 7-18: Impervious Cover Addressed by the Current SWAPs

Planning Area	Drainage Area (acres)	Acres Buildings	Acres Roads	Total Impervious Area	% County Imp. Area (total = 31,090)
Goodwin Run/Hunt Valley/ Loveton	9,126	633	1,190	1,823	5.9
Roland Run/Towson Run	7,463	623	1,045	1,668	5.4
Lower Patapsco	17,569	1,224	2,141	3,365	10.9
Prettyboy WRAS	25,545	126	318	444	1.4
Lower Jones Falls	5,241	357	548	1052	2.9
Upper Back River	7,463	1,599	2,619	4,218	13.6
Total	**72,407**	**4,562**	**7,861**	**12,570**	**40.1**

As can be seen from the Table 7-18, over thirty percent of the impervious area in the County will be addressed by these five plans. As projects are implemented through these plans or in other portions of the County, the impervious area addressed by those projects will be added to Table 7-17.

8.0 Permit

D. Discharge Characterization

Baltimore County and 10 other municipalities in Maryland have been conducting discharge characterization monitoring since the early 1990's. From this expansive monitoring, a statewide database has been developed that includes hundreds of storms across numerous land uses. Summaries of this dataset and other research performed nationally effectively characterize stormwater runoff in Maryland for NPDES municipal stormwater purposes. These data shall be used by Baltimore County for guidance to improve stormwater management programs and develop watershed restoration projects. Monitoring required under this permit is now designed to assess the effectiveness of stormwater management programs and watershed restoration projects developed by the County. Details about this monitoring can be found in PART III. H.

H. Assessment of Controls

Assessment of controls is critical for determining the effectiveness of the NPDES stormwater management program and progress toward improving water quality. Therefore, Baltimore County shall use chemical, biological, and physical monitoring to document work toward meeting the watershed restoration goals identified above. Additionally, the County shall continue physical stream monitoring in the Windlass Run to assess the implementation of the *2000 Maryland Stormwater Design Manual* or other innovative stormwater management technologies approved by MDE. Specific monitoring requirement are described below.

1. Watershed Restoration Assessment

   The County shall monitor the Scotts Level Branch, or, select and submit for MDE's approval a new watershed restoration project for monitoring. Ample time shall be provided so that pre-restoration monitoring, or characterization monitoring can take place. Priority will be given to new practices where little monitoring data exist or where the cumulative effects of watershed restoration activities can be assessed. An outfall and associated in-stream station, or other locations based on an approved study design shall be monitored. The minimum criteria for chemical, biological, physical monitoring are as follows:

   a. Chemical Monitoring

      i. Twelve (12) storm events shall be monitored per year at each monitoring location with at least three occurring per quarter. Quarters shall be based on the calendar year. If extended dry weather periods occur, baseflow samples shall be taken at least once per month at the monitoring stations if flow is observed;

      ii. Discrete samples of stormwater flow shall be collected at the monitoring stations using automated or manual sampling methods. Measurements of

pH and water temperature shall be taken;

iii. At least three (3) samples determined to be representative of each storm event shall be submitted to a laboratory for analysis according to methods listed under 40 CFR Part 136 and event mean concentrations (EMC) shall be calculated for:

Biochemcial Oxygen demand (BOD_5)	Total Lead
Total Kjeldahl Nitrogen (TKN)	Total Copper
Nitrate plus Nitrite	Total Zinc
Total Suspended Solids	Total Phosphorus
Total Petroleum Hydrocarbons (TPH)	Oil and Grease*
Fecal Coliform or E. coli	(*Optional).

iv. Continuous flow measurements shall be recorded at the in-stream monitoring station or other practical locations based on an approved study design. Data collected shall be used to estimate annual and seasonal pollutant loads and for the calibration of the watershed assessment models.

b. Biological Monitoring

i. Benthic macroinvertebrate samples shall be gathered each Spring between the outfall and in-stream stations or other practical locations based on an approved study design; and

ii. The County shall use the U.S. Environmental Protection Agenciy's (EPA) Rapid Bioassessment Protocols (RBP), Maryland Biological Stream Survey (MBSS), or other similar method approved by MDE.

c. Physical Monitoring

i. A geomorphologic stream assessment shall be conducted between the outfall and in-stream monitoring locations or in a reasonable area based on an approved study design. This assessment shall be include an annual comparison of permanently monumented stream channel cross-sections and the stream profile;

ii. A stream habitat assessment shall be conducted using techniques defined by the EPA's RBP, MBSS, or other similar method approved by MDE; and

iii. A hydrologic and/or hydraulic model shall be used (e.g., TR-20, HEC-2, HSPF, SWMM, etc.) to analyze the effects of rainfall discharge rates; stage; and if necessary, continuous flow on channel geometry.

d. Annual Data Submittal: The County shall describe in detail its monitoring activities for the previous year and include the following:

i. EMCs submitted on MDE's long-term monitoring database as specified in PART IV below;

Chemical, biological, and physical monitoring results and a combined analysis for the Scotts Level Branch or other approved monitoring

ii. locations; and

iii. Any requests and accompanying justifications for proposed modification to the monitoring program.

2. Stormwater Management Assessment

The County shall continue monitoring the Windlass Run for determining the effectiveness of the *2000 Maryland Stormwater Design Manual* for stream channel protection. Physical stream monitoring protocols shall include:

a. An annual stream profile and survey of permanently monumented cross-sections in the Windlass Run to evaluate channel stability in conjunction with the implementation of the *2000 Maryland Stormwater Design Manual*.

b. A comparison of the annual stream profile and survey of the permanently monumented cross-sections with baseline conditions for assessing areas of aggradation and degradation; and

c. A hydrologic and/or hydraulic model shall be used (e.g., TR-20, HEC-2, HEC-RAS, HSPF, SWMM, etc.) to analyze the effects of rainfall discharge rates; stage; and, if necessary, continuous flow on channel geometry.

8.1 Introduction

The third term of the Baltimore County – NPDES MS4 Permit that became effective June 15, 2005 resulted in a change in the long-term monitoring location. The long-term monitoring site was moved from Spring Branch in the Loch Raven watershed to Scotts Level Branch in Gwynns Falls watershed. This report will present the research design and initial monitoring data for Scotts Level Branch (8.2), and the data for Windlass Run (8.3).

8.2 Scotts Level Branch Long-Term Monitoring

The Baltimore County NPDES Municipal Stormwater Discharge Permit requires monitoring of restoration effectiveness. For the first two rounds of the 5-year permit, the Spring Branch subwatershed had been monitored to determine the effectiveness of the stream restoration in promoting stream stability, reduction in pollutant loads, and improvement in the benthic macroinvertebrate community. Using the experience gained in monitoring Spring Branch, a more effective monitoring program has been designed for the Scotts Level Branch subwatershed, as detailed below.

Scotts Level Branch is located in the Gwynns Falls watershed in the Patapsco/Back River Basin. The 303(d) lists these waters as being impaired by nutrients, suspended sediments, and fecal coliform bacteria. In addition, Scotts Level Branch is listed as impaired for biology. The TMDLs for nutrients and bacteria are in the process of completion. The TMDL for nutrients has identified a reduction of 15% nitrogen and phosphorus loads from urban non-point sources as needed to meet water quality standards. The TMDL for bacteria has identified a ~98% reduction for human and domestic pet sources.

While the Spring Branch study monitored the effectiveness of one large restoration project, the Scotts Level Branch monitoring is designed on the basis that a number of restoration projects will be implemented within the subwatershed over a period of time. The ability to detect effects of individual restoration projects will be dependent on the size of the restoration project in relation to the total subwatershed size. Therefore each restoration project will be monitored for project effectiveness, dependent on staff availability. The cumulative effects of restoration will be measured at the long-term in-stream monitoring site.

In order to assess restoration progress in the Scotts Level Branch subwatershed, a paired watershed, before-after design concept will be used. Two additional subwatersheds within Gwynns Falls, Powdermill Run and Upper Gwynns Falls (above Gwynnbrook Road) have been selected as the "paired" subwatersheds (Figure 8-1).

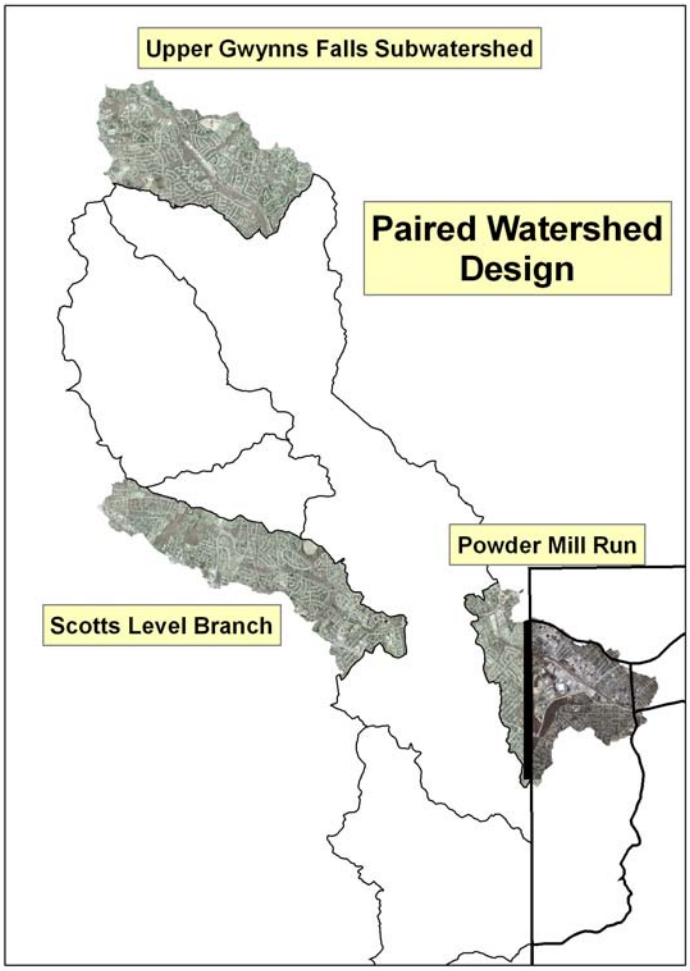


Figure 8-1: Subwatersheds to be used in the Paired Watershed Monitoring Design.

Table 8-1 presents a comparison between the three subwatersheds in relation to overall size, land use composition, percent impervious cover, and stream length. The third subwatershed (Upper Gwynns Falls) was added due to the fact that Baltimore City will be doing stream restoration work in the Powder Mill Run subwatershed. Restoration work will also be conducted in the Upper Gwynns Falls subwatershed in the future, with restoration work in Scotts Level Branch delayed for several years.

Table 8-1: Scotts Level Branch, Powder Mill Run, and Upper Gwynns Falls Information

Parameter	Scotts Level Branch	Powder Mill Run	Upper Gwynns Falls
Area (acres)	2,186	2,436	2,637
Land Use			
% Residential	91.1	63.4	74.9
% Commercial/Ind	6.0	32.5	6.3
% Forest	2.9	4.1	11.6
Impervious Cover (%)	23.7	33.8	21.4
Stream Miles	8.0	5.9	11.1

The monitoring will consist of flow monitoring, chemical monitoring, geomorphological monitoring, and biological monitoring as described below.

8.2.1 Monitoring Design

8.2.1.1 Flow Monitoring

Each of the three subwatersheds has had a gage installed and operated by the US Geological Survey (Table 8-2) with funding provided in total for the Powder Mill Run and Scotts Level Branch gages and in part for the Upper Gwynns Falls gage (Delight). USGS will provide the rating curves for the gages and annual data. A 36" outfall near the headwater of Scotts Level Branch will be monitored for discharge and chemistry. A weir was installed to permit continuous flow monitoring with a water level sensor installed and operated by Baltimore County. This outfall has a drainage area of 15.9 acres with ~35% impervious cover. The land use is ~88% medium residential and therefore representative of the major land use in each of the subwatersheds.

Table 8-2: USGS Gage Information

Gage Number	Location	Measurements			Real Time	Period of Record
		Stage	Discharge	Precipitation		
01589197	Upper Gwynns Falls	X	X	X	Yes	October, 1998 - Current
01589305	Powder Mill Run	X	X		Yes	November, 2005 – Current
01589290	Scotts Level Branch	X	X		Yes	November, 2005 – Current

The flow monitoring will be used in conjunction with the chemical monitoring (described below) to determine pollutant loads and in relation to the geomorphological monitoring. Over time the flow data will be assessed for any changes in relation to restoration work that is conducted in the subwatersheds.

8.2.1.2 Chemical Monitoring

The chemical monitoring will include both storm event and baseflow monitoring components. The standard list of chemicals detailed in the permit requirements will be analyzed. Figure 8-2 displays the location of the chemical monitoring sites in Scotts Level Branch by type.

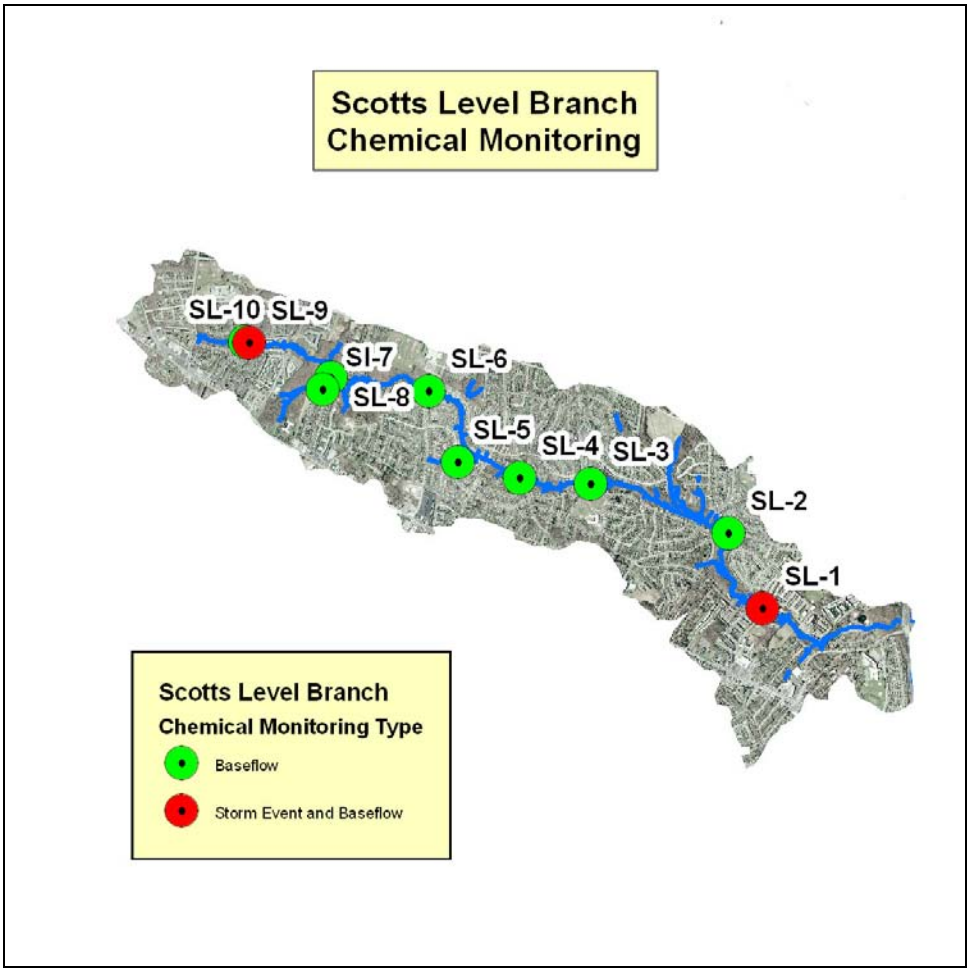


Figure 8-2: Scotts Level Branch Chemical Monitoring Locations

Storm Event Monitoring

Storm event monitoring will occur at each of the three USGS gages and at the outfall. The two Scotts Level Branch storm event monitoring sites (SL-1 in-stream, and SL-9 outfall) will be monitored for 12 storms each calendar year seeking to acquire samples for the entire hydrograph. At the other two USGS gages (Powder Mill Run and Upper Gwynns Falls) storm event grab samples will be collected to represent a range of stage discharges. The data from all four sites will be analyzed using regression analysis to determine the relationship between discharge and pollutant concentration. These relationships will then be used in conjunction with the flow data collected from the USGS operated gages and the water level sensor operated by DEPRM. The results and subsequent analysis following restoration will be used to determine annual loads and any load reductions due to restoration activities.

The pollutant load data collected from the Scotts Level Branch outfall will be used to estimate the wash load (the load derived from the land surface). While the pollutant load estimate derived from the Scotts Level Branch in-stream site will estimate the watershed load, which includes both the wash load and the load derived from stream bank erosion. The geomorphological analysis (see below) will attempt to determine the stream channel erosion component via changes

in the channel cross-section and analysis of the pollutant concentration of the stream bank and bed. Thus the wash load (derived from the outfall data) plus the stream erosion load (derived from the geomorphological data) should equal the watershed load (derived from the in-stream monitoring data). These data should provide an estimate of the relative proportions of pollutants derived from the land surface and the stream corridor. This will have important implications for restoration efforts in urban settings. If, as the literature suggests, a large component of the sediment and total phosphorus load is derived from the stream channel, then in order to meet sediment and phosphorus load reduction requirements for TMDLs and the Chesapeake Bay Program additional effort will need to be focused on stream restoration.

Baseflow Monitoring

Scotts Level Branch baseflow monitoring will occur at the outfall (SL-9), two tributary locations, and six mainstem locations for a total of 10 baseflow monitoring sites (Figure 8-2). Within Powder Mill Run baseflow monitoring will take place at the USGS gage and two up-stream sites that are representative of each major branch (one in the County and one in the City). Baseflow monitoring in Upper Gwynns Falls will occur only at the USGS gage site. The baseflow sites in Scotts Level Branch, Powder Mill Run, and Upper Gwynns Falls will be monitored quarterly during baseflow conditions (preceded by a minimum of 72 hours dry weather).

Analysis of baseflow pollutants is especially important in relation to nitrogen. Research work conducted by the County, indicates that ~50% of the nitrogen load occurs during dry weather conditions. The baseflow sampling will be used in conjunction with the storm event sampling to partition the annual discharge and pollutant load between baseflow (dry weather) conditions and storm event conditions.

8.2.1.3 Geomorphological Monitoring

The geomorphological monitoring is intended to provide an estimate of stream erosion and deposition rates, and an estimate of the pollutant load derived from stream channel erosion. In addition, it is intended over time to provide an estimate of the effects of restoration on stream stability on both a project basis and over the entire subwatershed.

In order to assure unbiased selection of cross-section locations, Scotts Level Branch and Powder Mill Run were divided into 30 equal length stream segments, 20 in Scotts Level Branch (Figure 8-3) and 10 in Powder Mill Run (Figures 8-4). Within each segment a point was randomly selected, using a GIS subroutine, for location of permanent cross sections. These cross sections will be monitored annually with the results overlaid to provide an assessment of the amount of channel change. Three longitudinal profile reaches will be selected in Scotts Level Branch for annual assessment.

Stream bank and bed core samples will be collected in the vicinity of the permanent cross sections for laboratory analysis of bulk density, particle size distribution, total nitrogen, and total phosphorus. These will be one-time sample collections, with 10% of the sites, randomly selected, for a second round of sample collection to provide an analysis of annual variability. Based on the annul and long term change, and the results of the core samples, the estimated annual sediment, total nitrogen, and total phosphorus loads will be calculated for comparison with the chemical monitoring results derived from the in-stream monitoring site.

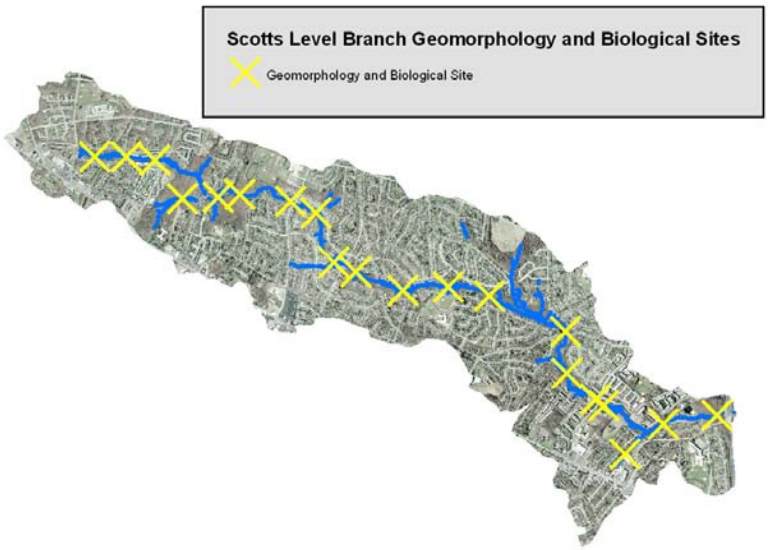


Figure 8-3: Scotts Level Branch Geomorphological and Biological Monitoring Site Locations

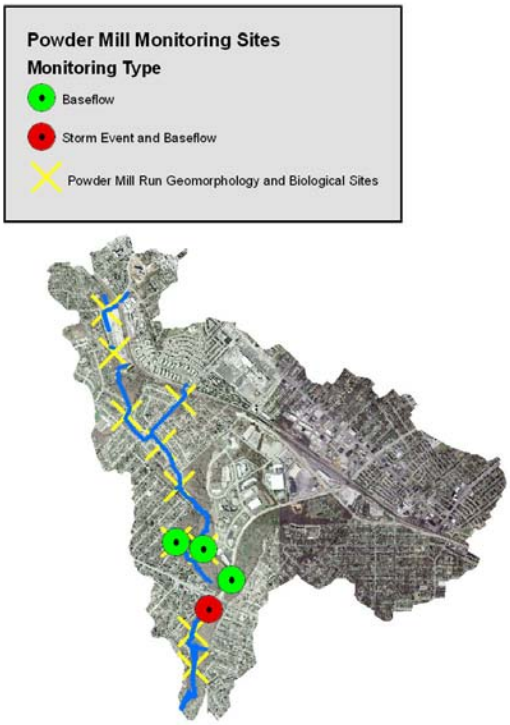


Figure 8-4: Powder Mill Run Geomorphological and Biological Monitoring Sites

8.2.1.4 Biological Monitoring

Benthic macroinvertebrate samples will be collected annually at every other randomly selected cross section monitoring site in the spring index period (March-April) (10 samples from Scotts Level Branch and 5 samples from Powder Mill Run) using Maryland Biological Stream Survey (MBSS) collection methods. Sample identification will be to the Genus taxonomic level or the lowest practical identification level. At the time of sample collection, a MBSS stream habitat assessment will be conducted. Fish assemblage monitoring will be conducted during the summer index period (June-September) at 5 sites in Scotts Level Branch and 3 Sites in Powder Mill Run on stream reaches associated with the randomly selected cross sections using MBSS methodologies.

The results of the biological monitoring will be compared with results from the cross sectional monitoring and the habitat analysis. In addition, the results will be compared between the two subwatersheds and to reference sites within Baltimore County. Inter-annual comparisons and changes in the biological community will be related to restoration progress within Scotts Level Branch.

8.3 Scotts Level Branch Long-Term Site Monitoring Results

8.3.1 Flow Monitoring

The U.S. Geological Survey under an agreement with Baltimore County installed a continuous gage on Scotts Level Branch where it crosses Rolling Road on September 29, 2005. This site is designated as SL-1. They also installed a continuous gage on Powder Mill Run below Liberty Road. In the fall of 2007, a weir with a continuous gage was installed at the outfall in Scotts Level Branch to provide a continuous discharge record. The data for Scotts Level Branch are analyzed in this report.

Precipitation Data: Hourly and daily precipitation data were acquired from the Department of Public Works stream gage located on Rolling Road. This is the same road SL-01 is located on, but not the at the exact site location. These data were recorded in conjunction with the Scotts Level Branch discharge data discussed below. For calendar year 2007 one hundred-fifteen days recorded measurable precipitation. The daily data were analyzed for precipitation amount (Table 8-3). As can be seen from Table 8-3, a little less than half of the days recorded less than a 0.1 inch of precipitation. Precipitation over one inch occurred on only 4% of the days, but accounted for 25.8% of the total amount of the precipitation in 2007. The maximum daily rainfall was 2.08 inches recorded on April 15, 2007. A total of 28.22 inches of precipitation, less than the long-term average (~42 inches), was recorded at the Department of Public Works rain gauge for 2007.

Table 8- 3: Precipitation Data Analysis for Calendar 2007

Precipitation Category	# of Days	% Days	Total Amount	% of accumulation
<.1	52	45 %	1.83	6.5 %
.1-.5	45	39 %	10.54	37.3 %
.5-1.0	13	11 %	8.57	30.4 %
1.0-1.5	3	3 %	3.67	13.0 %
1.5-2.0	1	1 %	1.53	5.42 %
2.0-2.5	1	1 %	2.08	7.4 %
2.5-3.0	0	0 %	0.00	0.0 %
Total	**115**		**28.22**	

Often storms span more than one day. The hourly precipitation data were used to delimit individual storms, by identifying the initiation of rain events greater than .05 inches, and the end of the storm event defined as greater than six hours with no rainfall recorded. A total of 35 distinct storms were identified. These storms were analyzed for amount of precipitation, intensity (inches/hour), and duration. The results of this analysis are presented in Table 8-4.

Table 8-4: 2007 Precipitation Amount, Intensity, and Duration by Category

Precipitation Category (Inches)	Accumulation Amount				Intensity (inches/hour)			Duration (hours)		
	# Storms	% Storms	Total Acc.	% Acc.	Intensity Category	# Storm	% storms	Duration Category	# storms	% storms
≤ .1	3	8.6	.25	1.5	≤ .1	17	48.6	≤1	5	14.3
.1 - .25	13	37.1	2.27	13.8	.1 - .25	13	37.1	1 – 3	13	37.1
.26 - .50	9	25.7	3.39	20.5	.26 - .50	4	11.4	3 – 6	10	28.6
.51 - .75	4	11.4	2.23	13.5	.51 - .75	1	2.9	6 – 9	1	2.9
.76 – 1.00	3	8.6	2.56	15.5	.76 – 1.00	0	0.0	9 – 12	1	2.9
1.01 – 1.50	1	2.9	1.23	7.5	1.01 – 1.50	0	0.0	12 – 15	2	5.7
1.51 – 2.00	1	2.9	1.94	11.8	1.51 – 2.00	0	0.0	15 – 18	1	2.9
2.01 – 3.00	1	2.9	2.63	15.9	2.01 – 3.00	0	0.0	18 – 21	1	2.9
3.01 – 4.00	0	0.0	0.00	0.0	3.01 – 4.00	0	0.0	21 – 24	0	0.0
> 4.00	0	0.0	0.00	0.0	> 4.00	0	0.0	>24	1	2.9
Total	**35**	**100**	**16.5**	**100**		**35**	**100**		**35**	**100**

Almost half (45.7%) of the storms were less than 0.25 inches in total amount of precipitation, but these storms accounted for only 15.3% of the total amount of rainfall. Only 8.7% of the storms were over one inch in total amount of rainfall and these storms accounted for about one-third (35.2%) of the total amount of precipitation in 2007. The largest storm for 2007 recorded 2.63 inches of precipitation over a 21-hour period. The highest intensity recorded at the DPW gauge in 2007 was 0.68 inches per hour. The majority of storms (85.7%) highest recorded hourly intensity was less than or equal to a quarter inch per hour. Likewise most storms (80.0%) were less than or equal to 6 hours in duration.

Flow Data: The Scotts Level Branch gage data includes 15-minute discharge readings from the period of October 1, 2005 to April 18, 2008. The entire record was analyzed for storm events. The data were visually scanned to determine the inception of each storm event. The termination of the event was based on three hours of discharge at the same rate. A total of 241 storm events for the period were identified, of which, 93 occurred in the calendar year 2007. Figure 8-5 displays the daily discharge and precipitation for calendar year 2007. The correlation coefficient was determined to be r = .81. The database was further coded to reflect the concurrence of storms as indicated by the increase in discharge and the precipitation from recorded at the DPW Rolling Road gauge. This resulted in 34 storms that had an overlap of both precipitation and storm discharge, and an increase in the correlation coefficient to r = .99, during 2007.

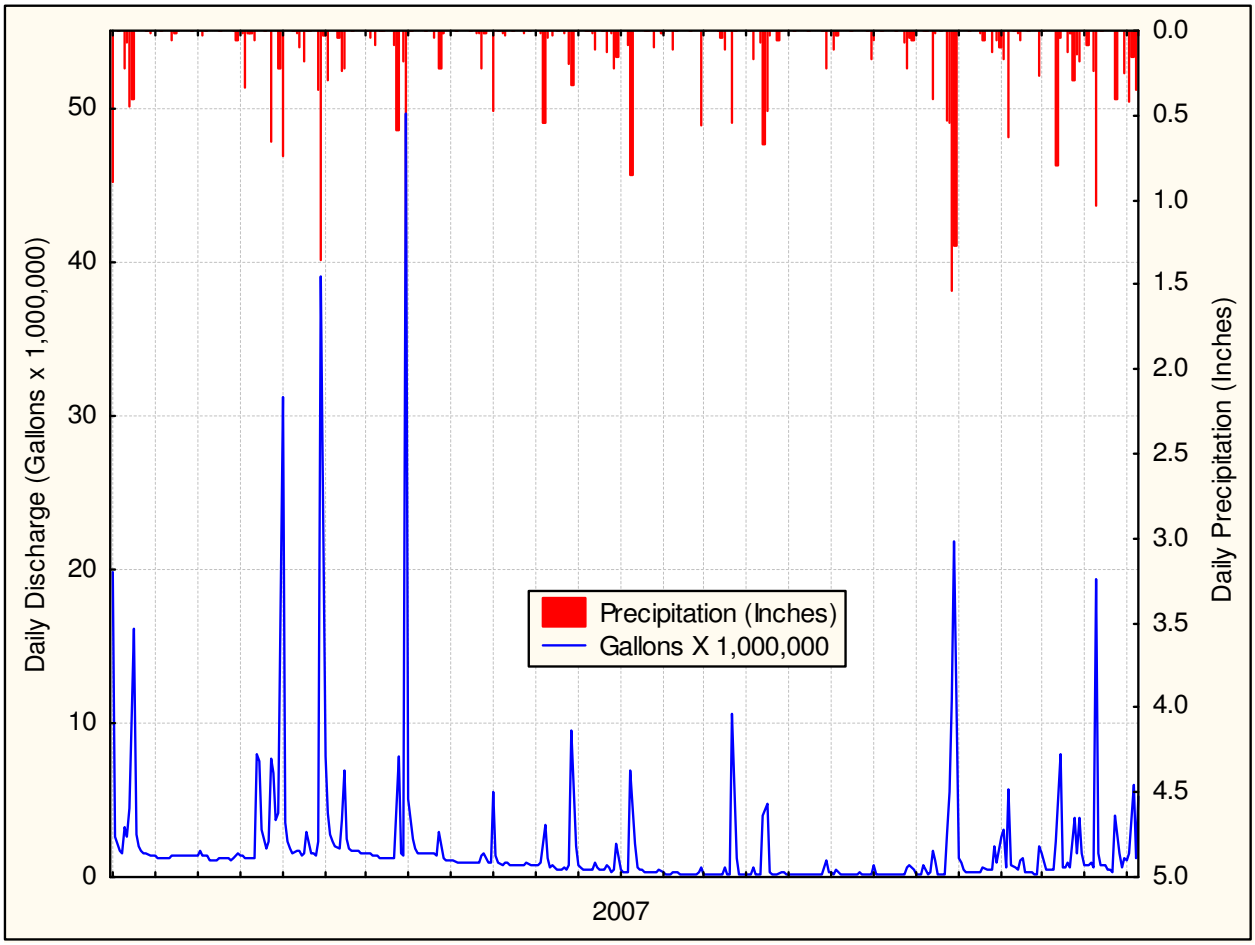


Figure 8-5: Calendar year 2007 Daily Precipitation and Discharge

Using this set of data for the 34 storms, the runoff coefficient was calculated for each storm. The average runoff coefficient was .222, with a maximum of .650 and a minimum of .014.

The 93 storm data set was further analyzed to determine the proportion of runoff to total precipitation, and the relative proportions of baseflow and storm event runoff. These data were analyzed by season for calendar year 2007. The results are presented in Table 8-5.

Table 8-5: Seasonal Precipitation and Runoff Characteristics

Parameter	Fall	Winter	Spring	Summer	Total
Precipitation Amount	9.32	8.20	5.82	4.88	28.22
Precipitation %	33.0 %	29.1 %	20.6 %	17.3 %	---
% of precipitation volume accounted for by Runoff	24.1 %	59.2 %	55.4 %	19.5%	40.0 %
% of precipitation volume accounted for by Evapotranspiration	75.9 %	40.8%	44.6%	80.5%	60.0 %
% of stream flow accounted for by Storm flow	74.0 %	66.1 %	50.4 %	65.3 %	63.1 %
% of stream flow accounted for by Baseflow %	26.0 %	33.9 %	49.6 %	34.7 %	36.9 %

For calendar year 2007 the precipitation was about evenly distributed. The fall and winter exhibited slightly higher precipitation than the spring and summer. Forty percent of the precipitation was accounted for by stream flow while the balance was assumed to be evapotranspiration. The evapotranspiration is the result of the evaporation of water, which is temperature dependant and the transpiration of water due to plants. Thus the expectation is that winter should exhibit the lowest evapotranspiration rates and summer the highest rate. The results for Scotts Level Branch bear this out with 40.8% and 80.5% evapotranspiration rates for winter and summer, respectively. As is characteristic of urban watersheds, Scotts Level Branch exhibits a shift in runoff from baseflow dominated to storm flow dominated. For the year, 63.1% of the flow was determined to be storm flow using the criteria described above, while only 36.9% was characterized as baseflow.

8.3.2 Chemical Monitoring

The data analysis for chemical monitoring includes three components, storm event monitoring (8.3.2.1), baseflow monitoring (8.3.2.2), and the calculation of pollutant loads (8.3.2.3)

8.3.2.1 Storm Event Monitoring Results

The chemical results from the storm event monitoring at the Scotts Level Branch in-stream monitoring site was analyzed in conjunction with the discharge data recorded by the DPW gage. Both the chemical and the discharge data were $\log_{10}$ transformed prior to regression analysis. The data for the regression equations was censored by removing any chemical data that was below the detection limit for any constituent. Regression equations were determined for Total Suspended Solids, TKN, Nitrate/Nitrite, Total Nitrogen, and Total Phosphorus, Total Copper, Total Lead, Total Zinc, Chloride and Sodium. The results are displayed in Table 8-6 and graphically in Figures 8-6 through 8-15.

Table 8-6: Regression Equations Relationship Between Discharge (CFS) and Pollutant Concentrations

Parameter	Regression Equation
Total Suspended Solids	0.9188+0.4866*(log cfs)
Total Kjeldahl Nitrogen	-0.3441+0.1705*(log cfs)
Nitrate/Nitrite	-0.1783-0.1406*(log cfs)
Total Nitrogen	0.0385+0.0465*(log cfs)
Total Phosphorus	-1.3318+0.2998*(log cfs)
Total Copper	-2.1878+0.2739*(log cfs)
Total Lead	-3.0562+0.33*(log cfs)
Total Zinc	-2.2933+0.4652*(log cfs)
Chloride	1.7826-0.0351*(log cfs)
Sodium	1.6156+0.1045*(log cfs)

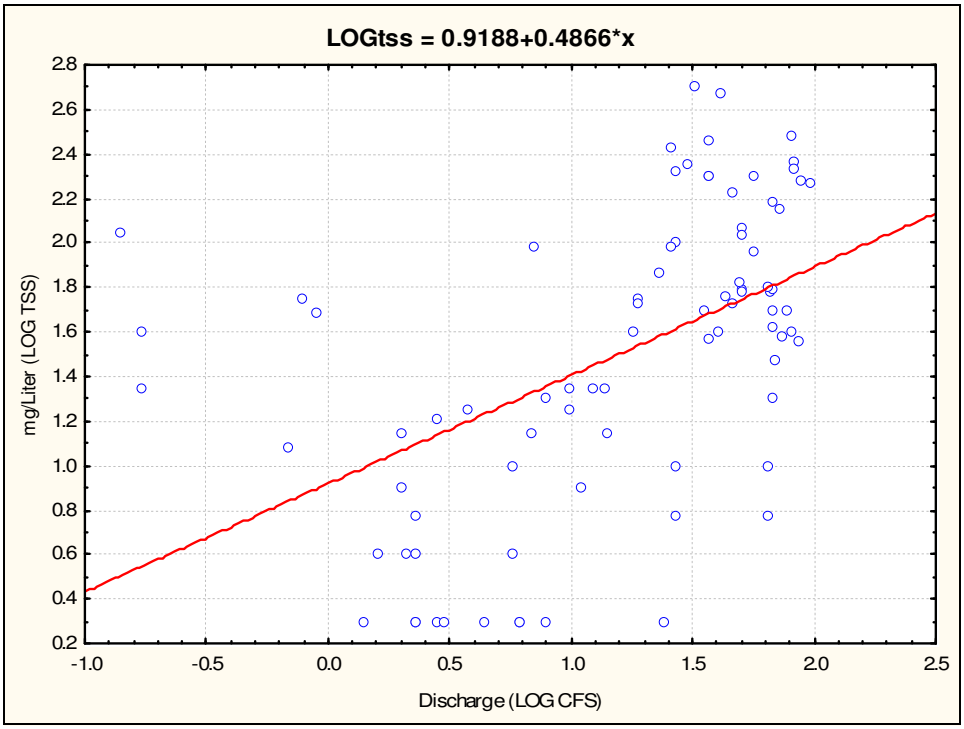


Figure 8-6: Total Suspended Solids (TSS) Data and Regressions for 2005-2008.

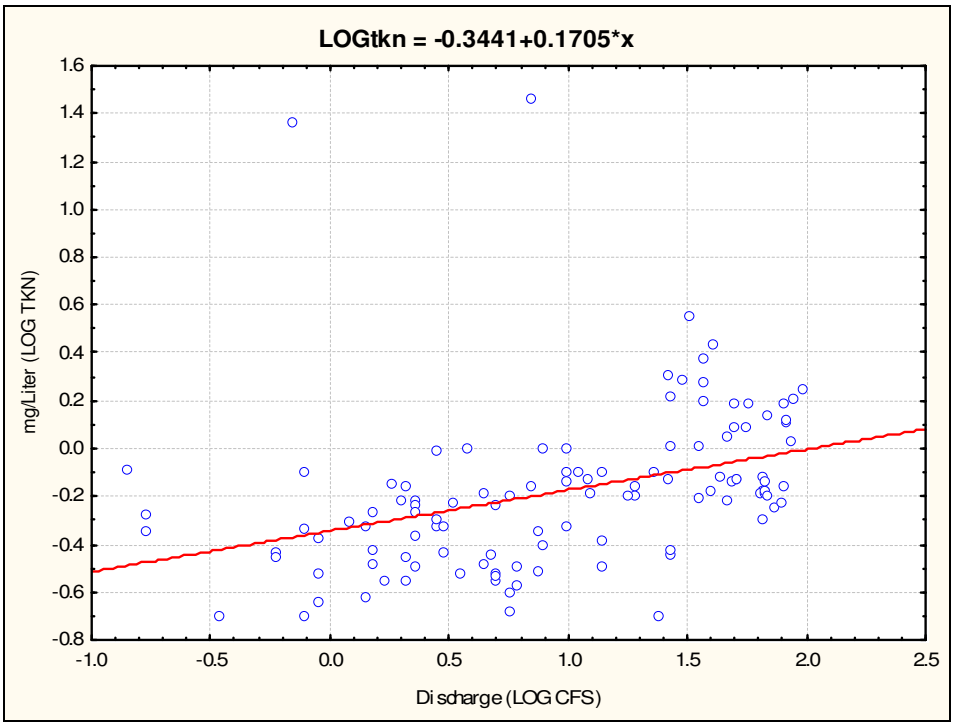


Figure 8-7: Total Kjeldahl Nitrogen (TKN) Data and Regressions for 2005-2008.

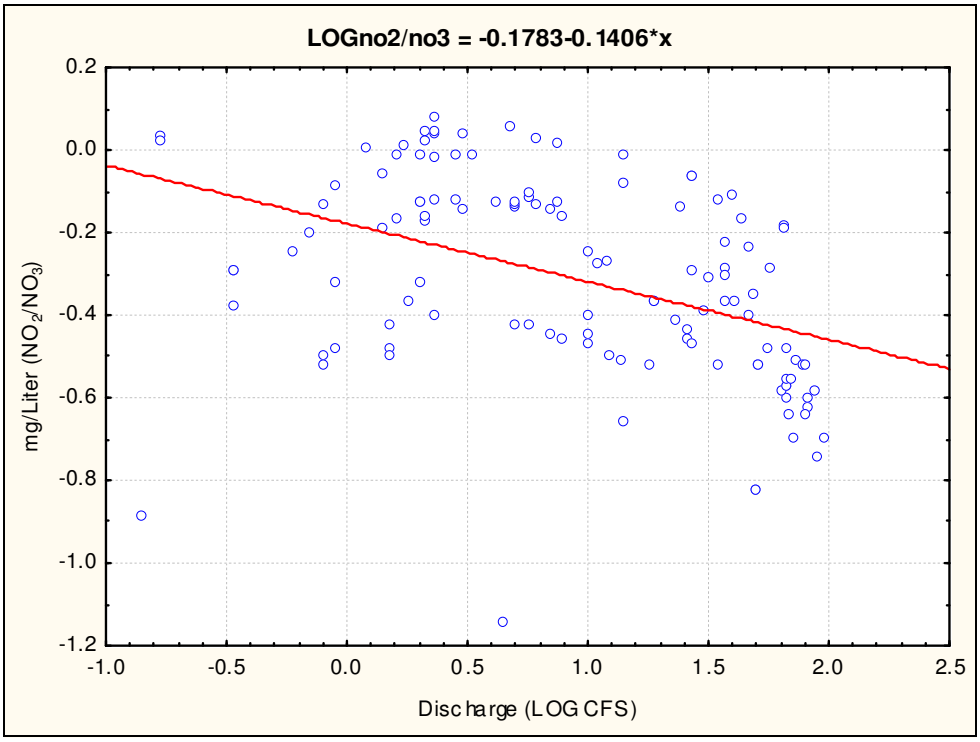


Figure 8-8: Nitrate/Nitrite (NO_2/NO_3) Data and Regressions for 2005-2008.

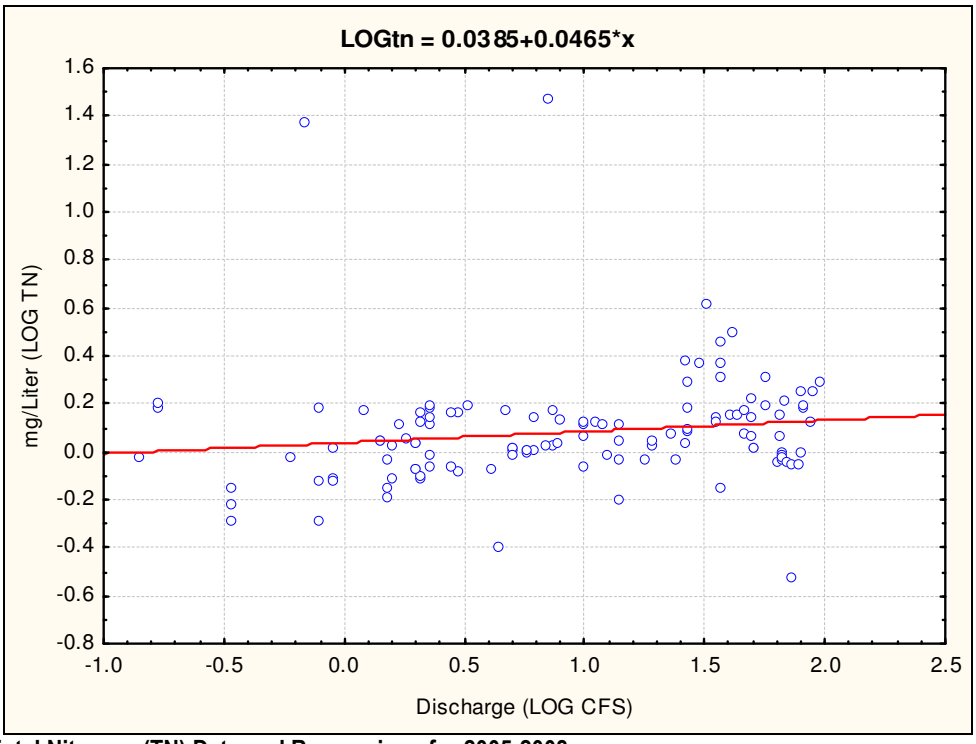


Figure 8-9: Total Nitrogen (TN) Data and Regressions for 2005-2008.

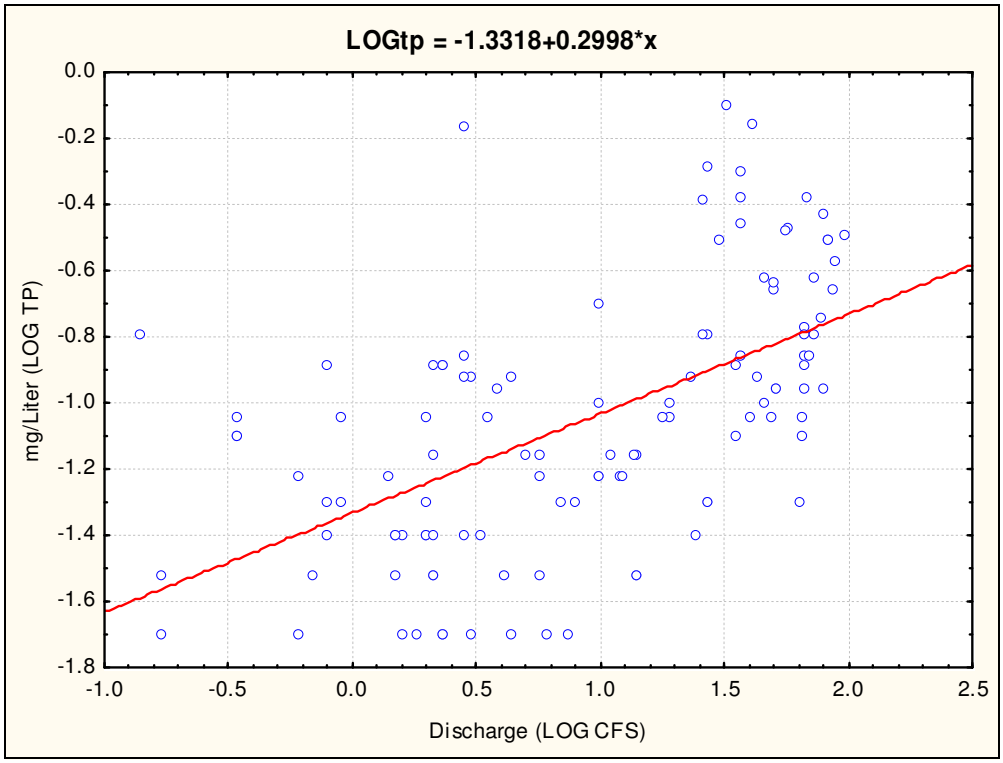


Figure 8-10: Total Phosphorus (TP) Data and Regressions for 2005-2008.

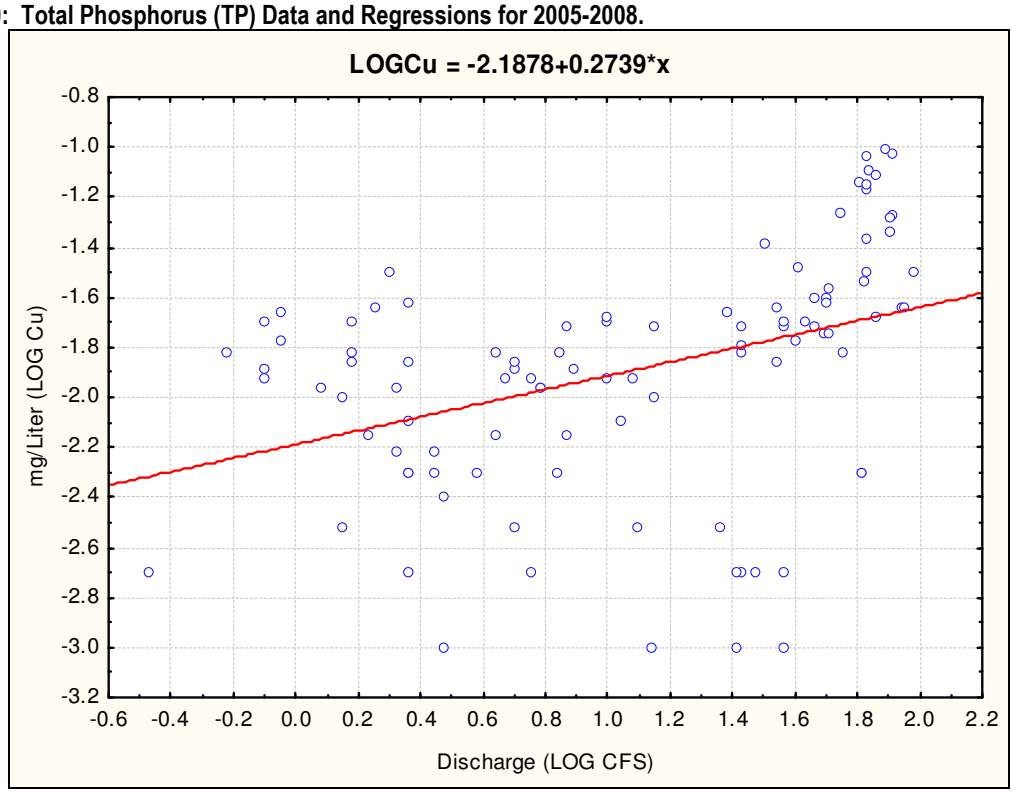


Figure 8-11: Total Copper (Cu) Data and Regressions for 2005-2008.

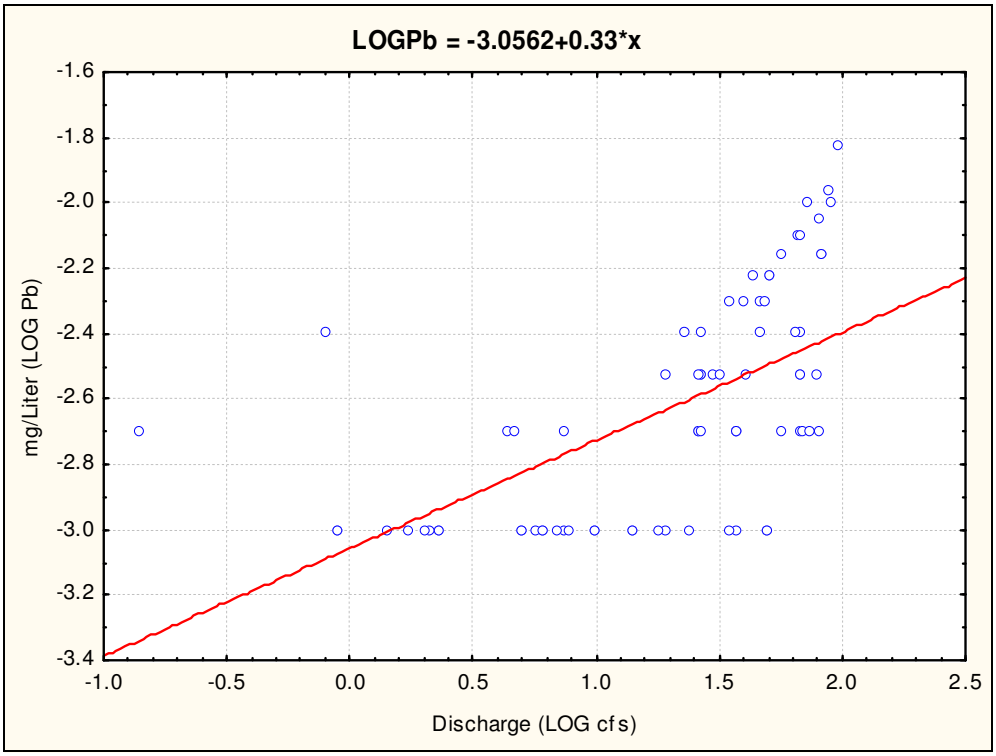


Figure 8-12: Total Lead (Pb) Data and Regressions for 2005-2008.

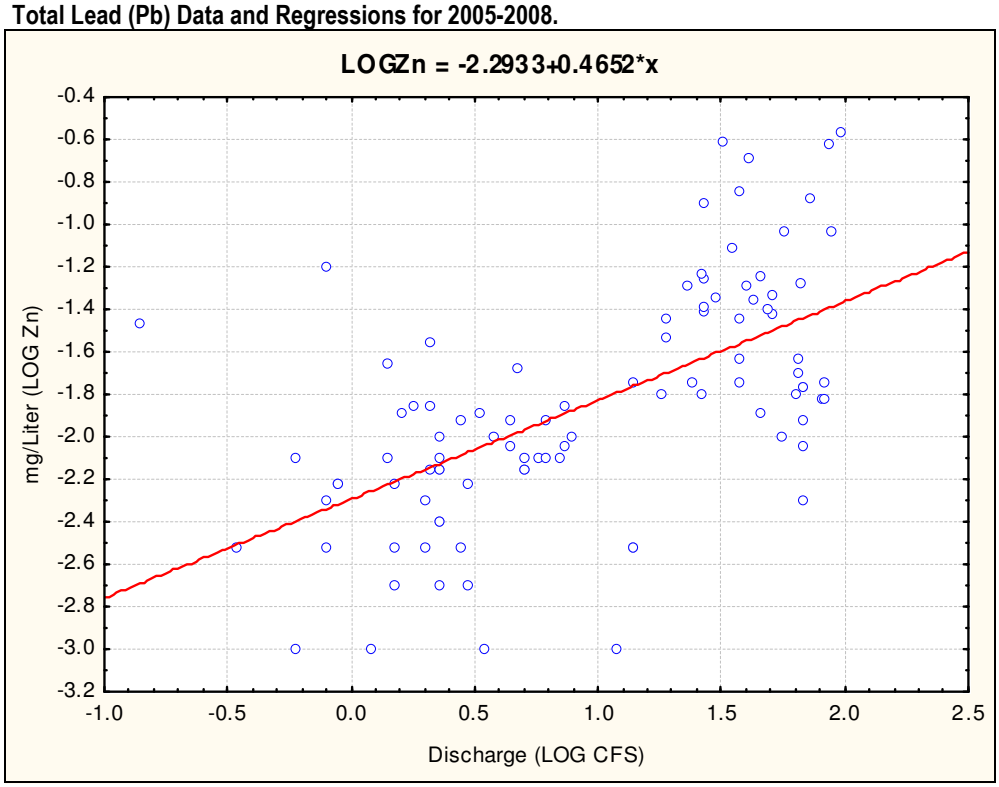


Figure 8-13: Total Zinc (Zn) Data and Regressions for 2005-2008.

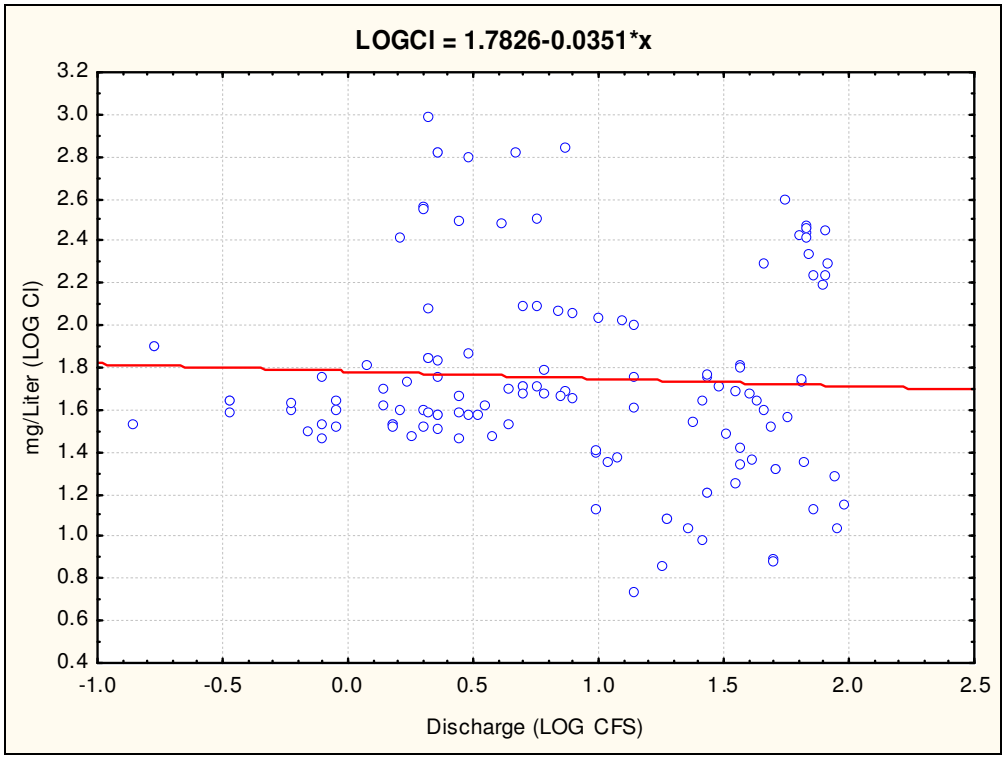


Figure 8-14: Chloride (Cl) Data and Regressions for 2005-2008.

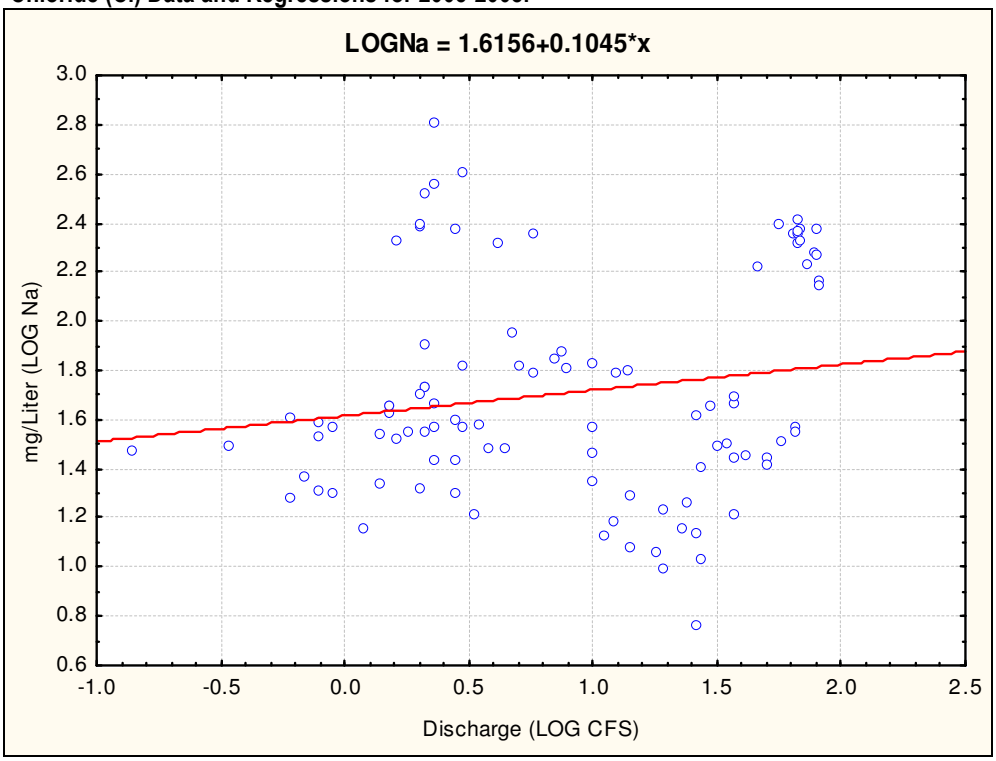


Figure 8-15: Sodium (Na) Data and Regressions for 2005-2008.

Total Suspended Solids, Total Phosphorus, Total Copper, Total Lead and Total Zinc exhibited strong positive relationships with discharge, while Nitrate/Nitrite Nitrogen displayed a strong negative relationship with discharge. The TKN, TN (TKN+Nitrate/Nitrite Nitrogen) and Sodium

relationship with discharge was relatively weak and positive, and the chloride was relatively weak and negative.

The regression equations were used to calculate the chemical concentrations for each 15-minute interval for recorded discharge. The log chemical concentrations were then back transformed. This permitted the calculation of the flow weighted Event Mean Concentrations for each of the 241 storms identified in the USGS gage data record. Figures 8-16a through 8-25b show the Event Mean Concentrations for Total Suspended Solids (TSS), Total Kjeldahl Nitrogen (TKN), Nitrate/Nitrite, Total Nitrogen (TN), and Total Phosphorus (TP), Total Copper, Total Lead, Total Zinc, Chloride, and Sodium.

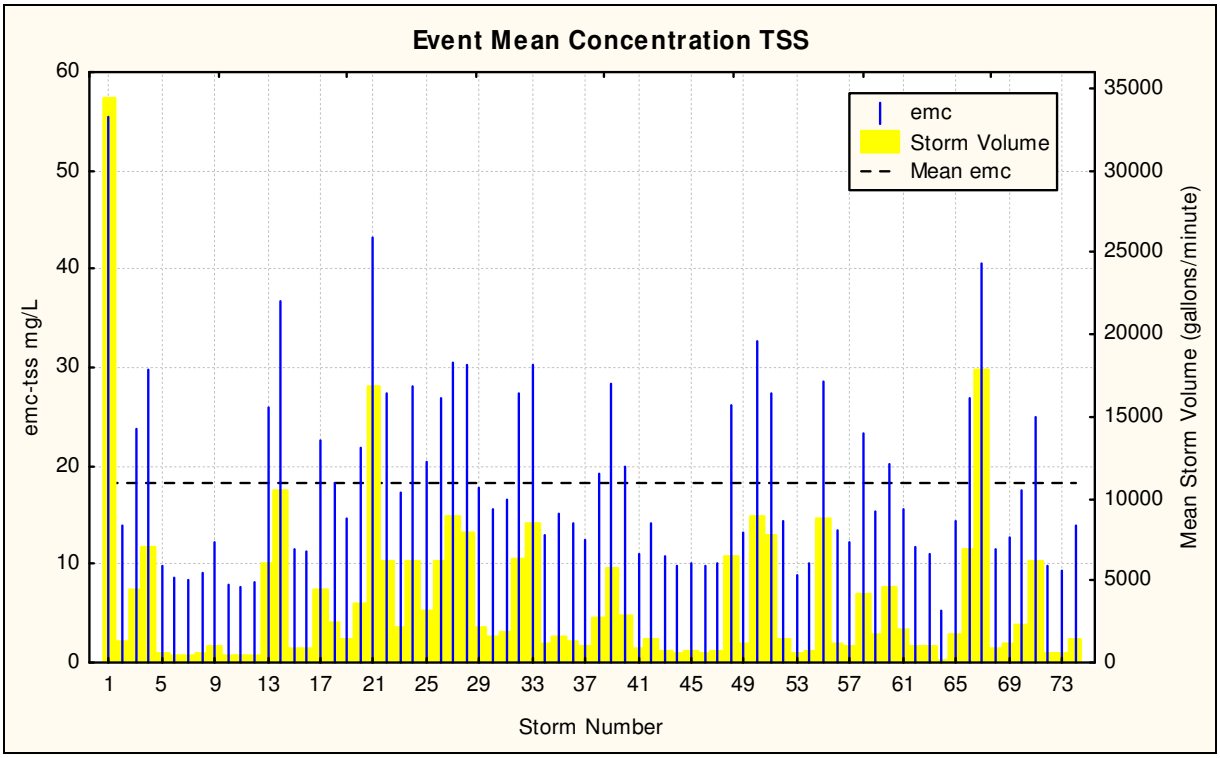


Figure 8-16a: Event Mean Concentration for Total Suspended Solids (TSS) 2005-2006

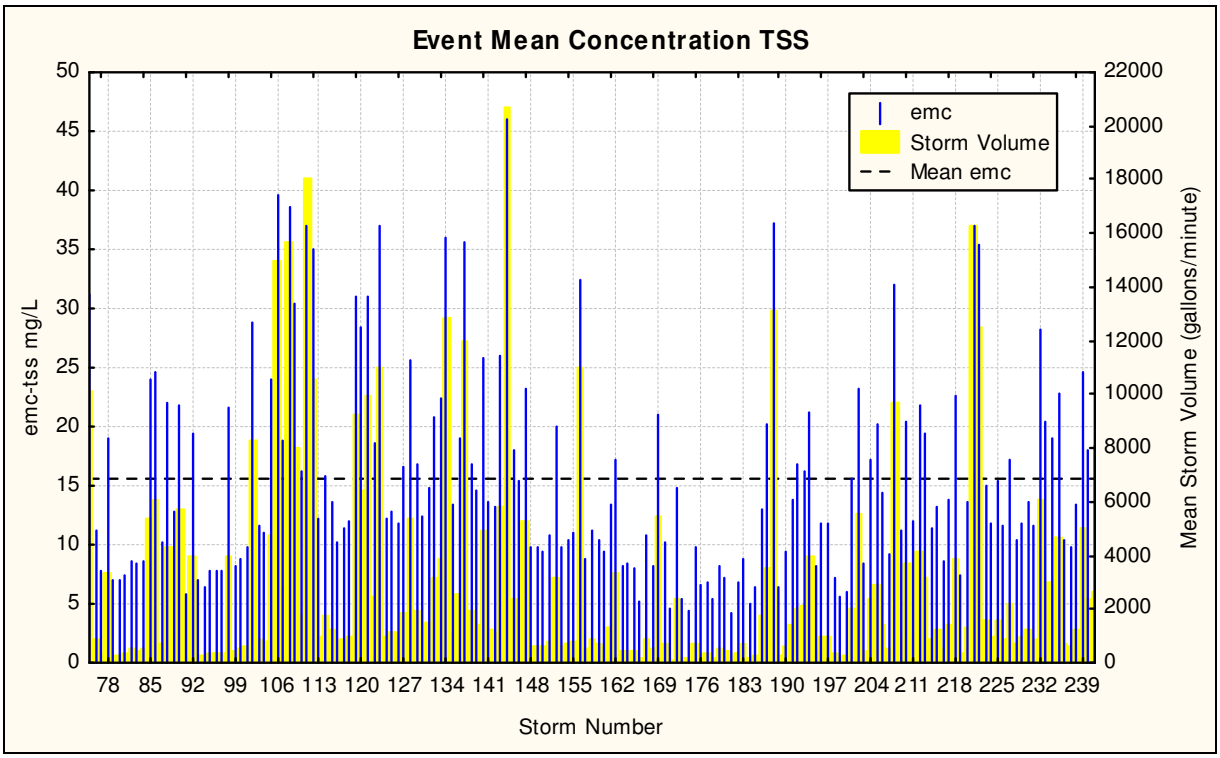


Figure 8-16b: Event Mean Concentration for Total Suspended Solids (TSS) 2007-2008

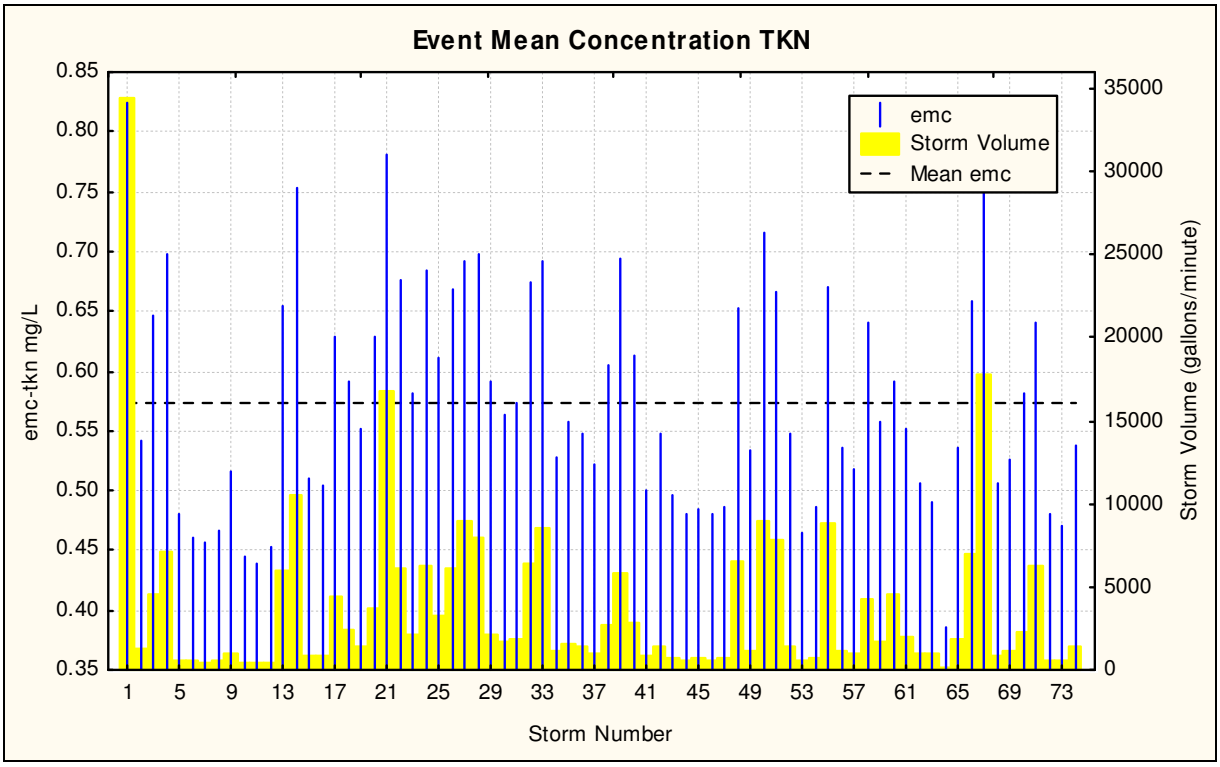


Figure 8-17a: Event Mean Concentration for Total Kjeldahl Nitrogen (TKN) 2005-2006

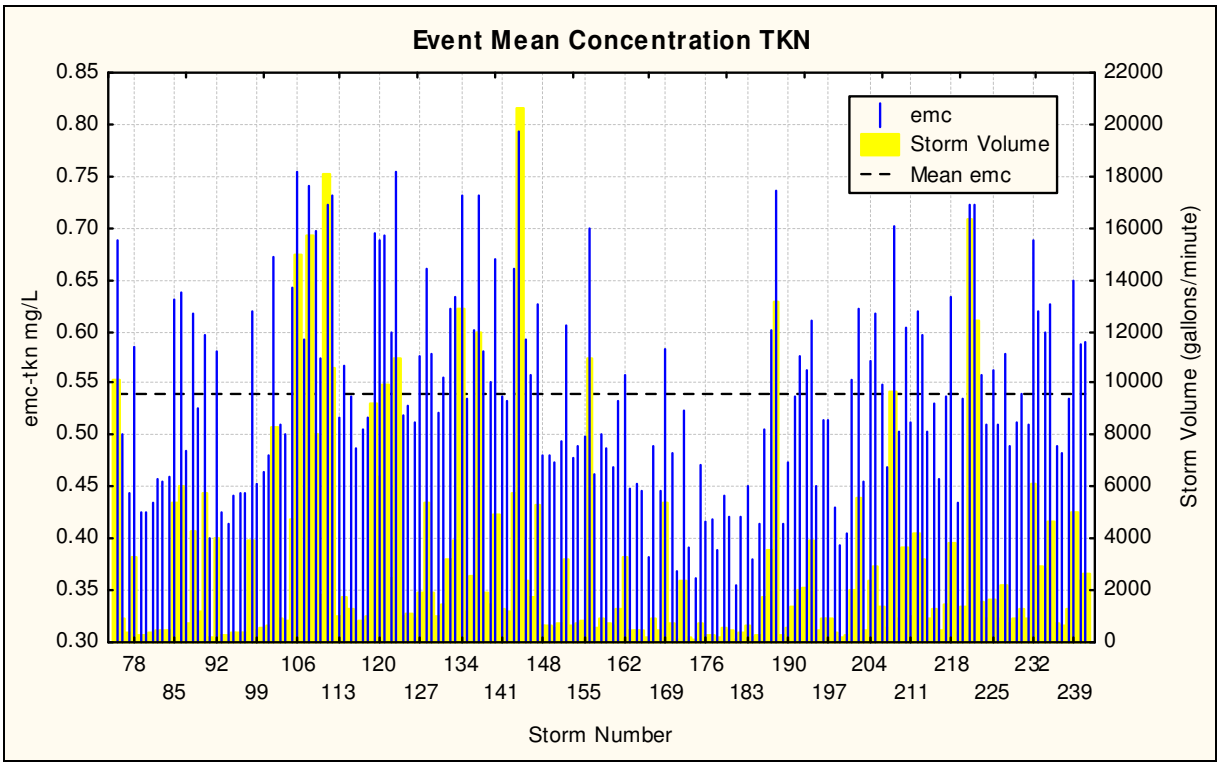


Figure 8-17b: Event Mean Concentration for Total Kjeldahl Nitrogen (TKN) 2007-2008

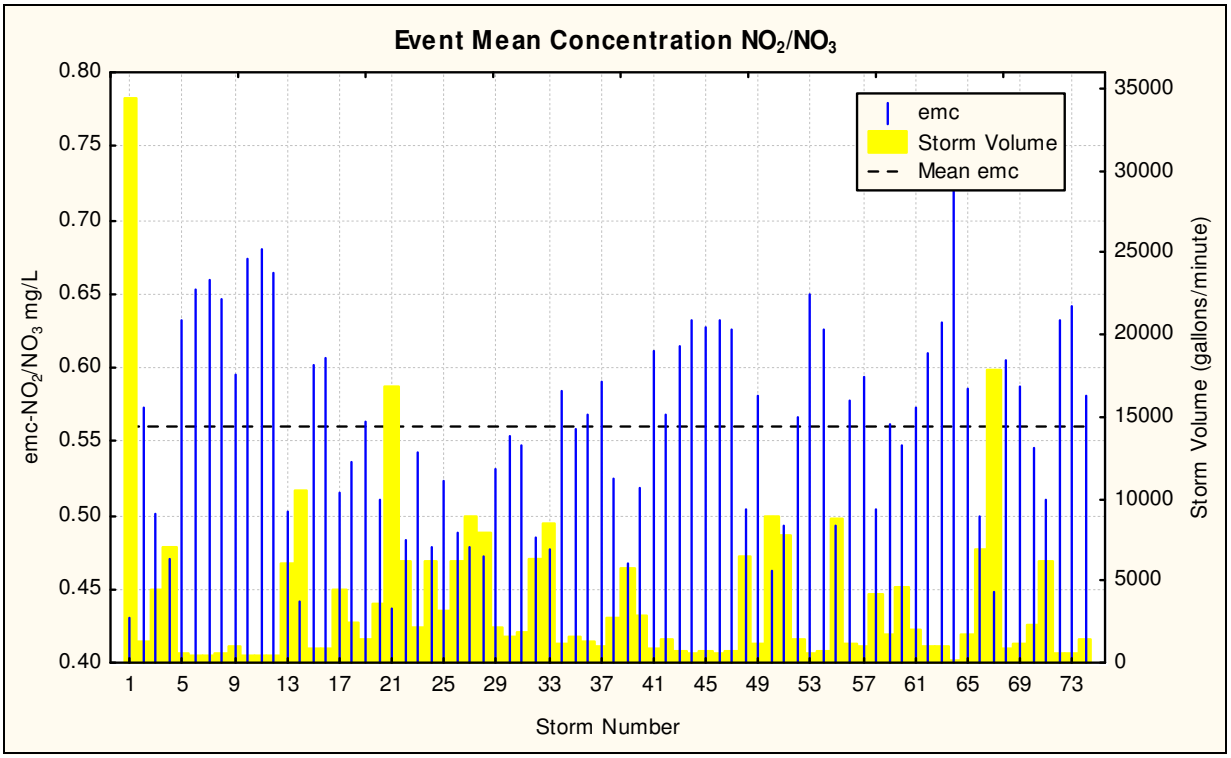


Figure 8-18a: Event Mean Concentration for Nitrate/Nitrite (NO_2/NO_3) 2005-2006

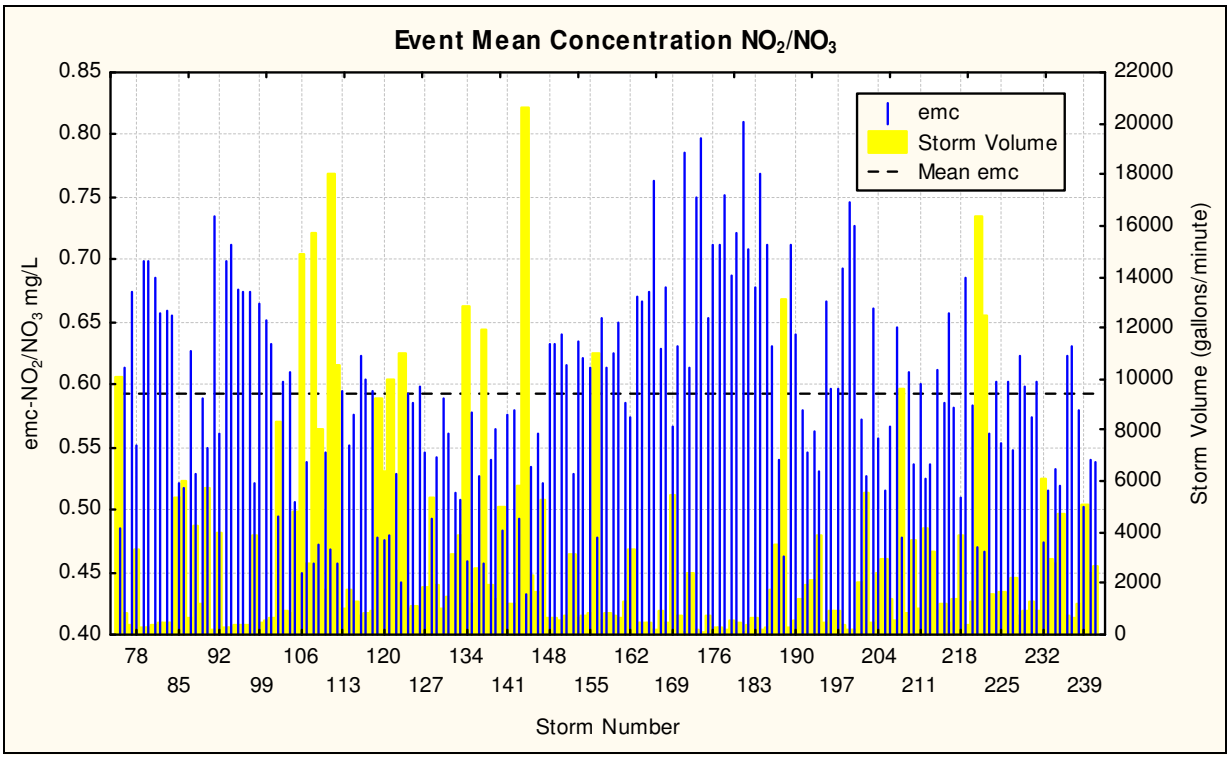


Figure 8-18b: Event Mean Concentration for Nitrate/Nitrite (NO_2/NO_3) 2007-2008

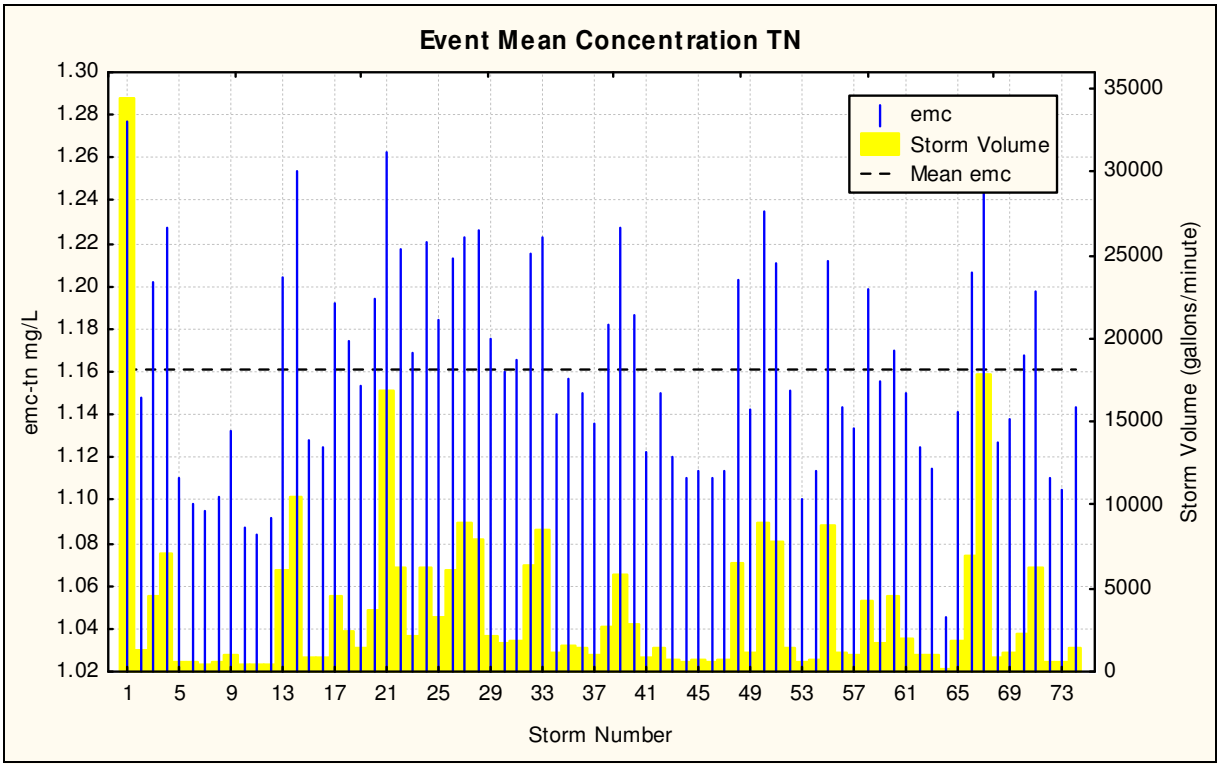


Figure 8-19a: Event Mean Concentration for Total Nitrogen (TN) 2005-2006

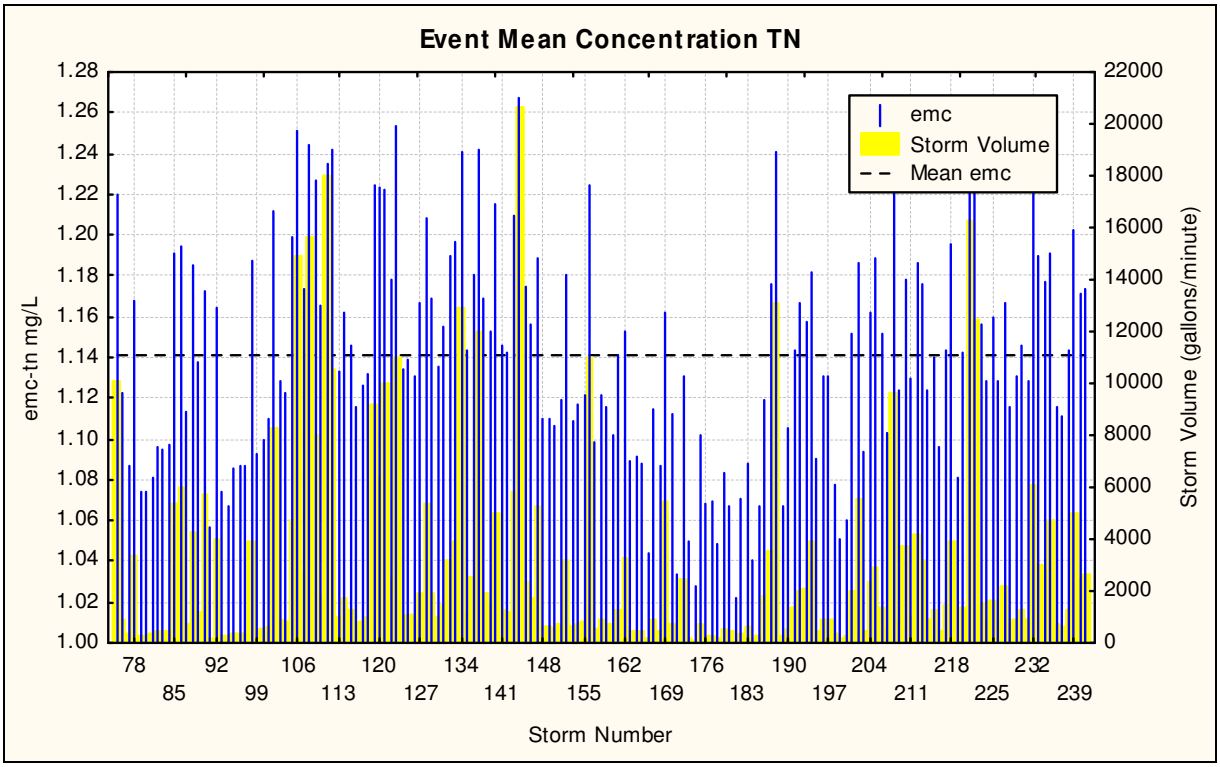


Figure 8-19b: Event Mean Concentration for Total Nitrogen (TN) 2007-2008

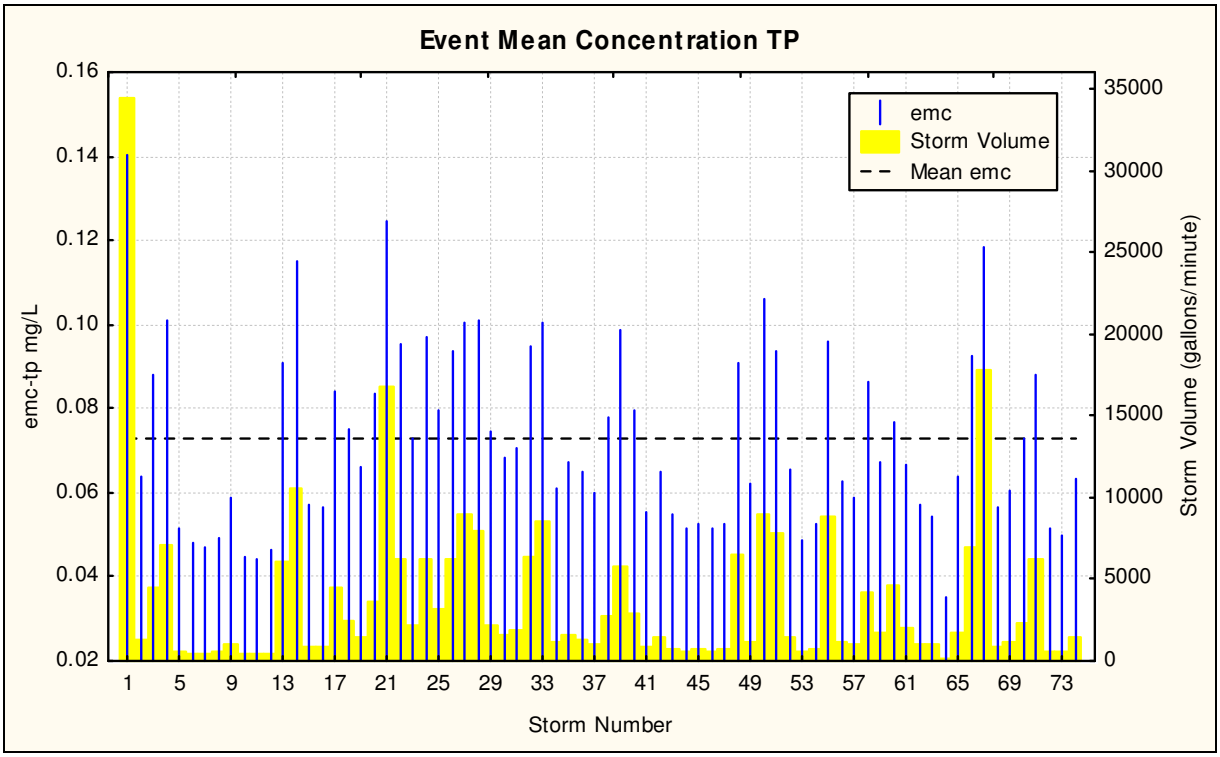


Figure 8-20a: Event Mean Concentration for Total Phosphorus (TP) 2005-2006

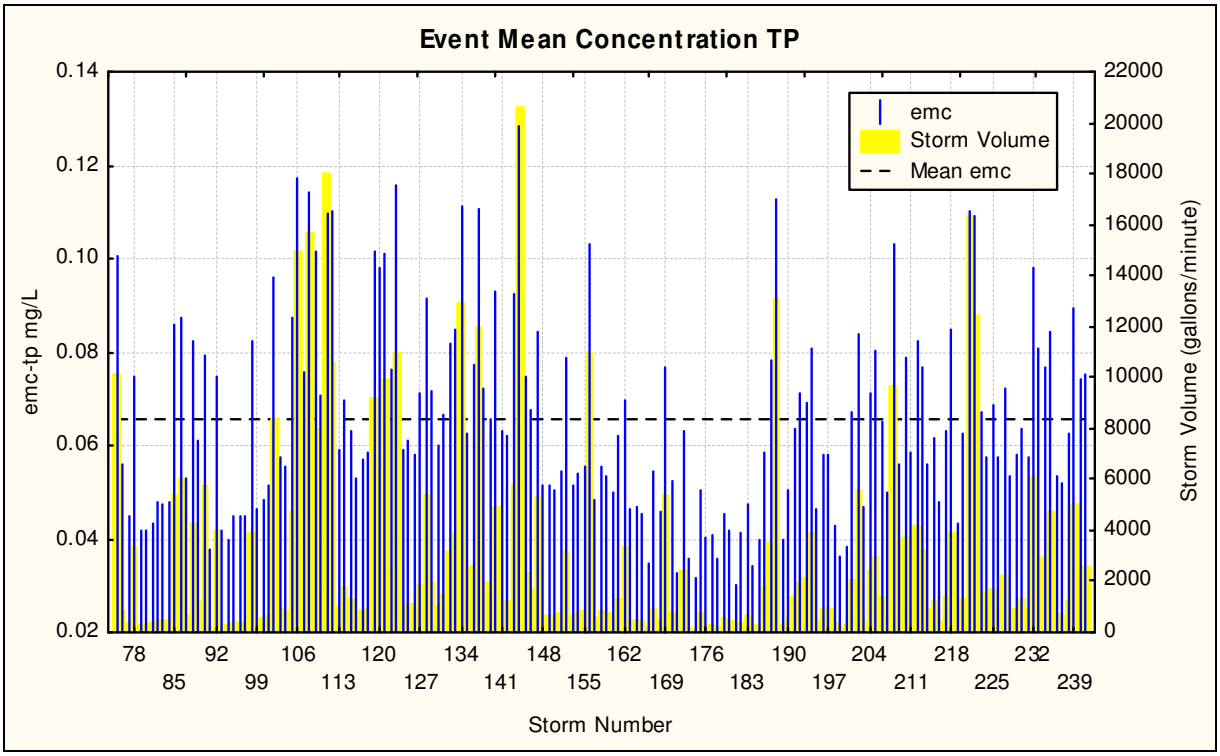


Figure 8-20b: Event Mean Concentration for Total Phosphorus (TP) 2007-2008

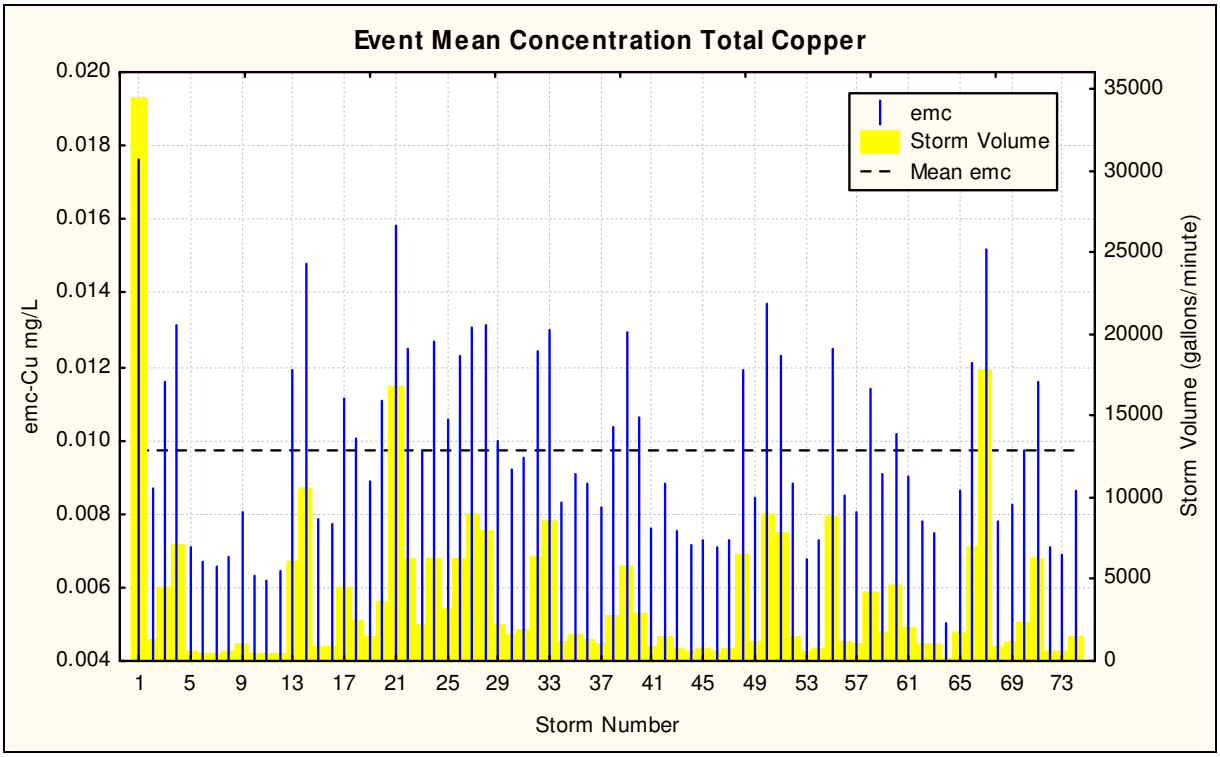


Figure 8-21a: Event Mean Concentration for Total Copper 2005-2006

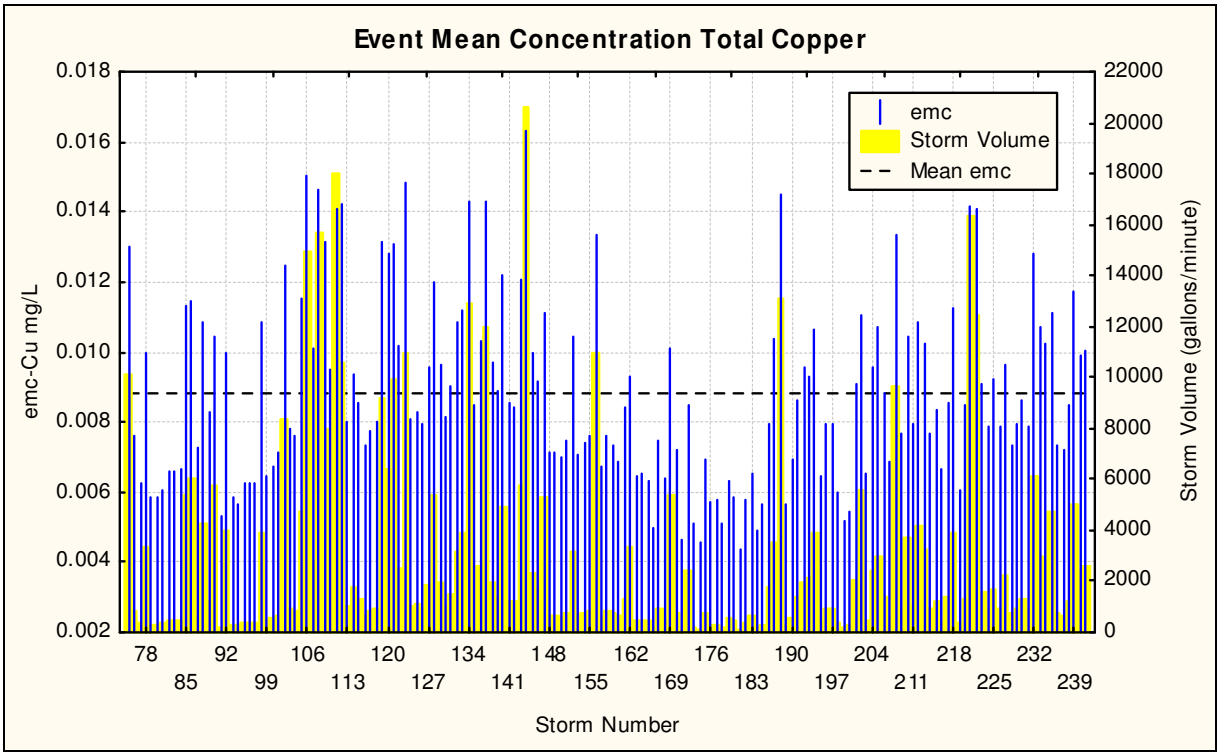


Figure 8-21b: Event Mean Concentration for Total Copper 2007-2008

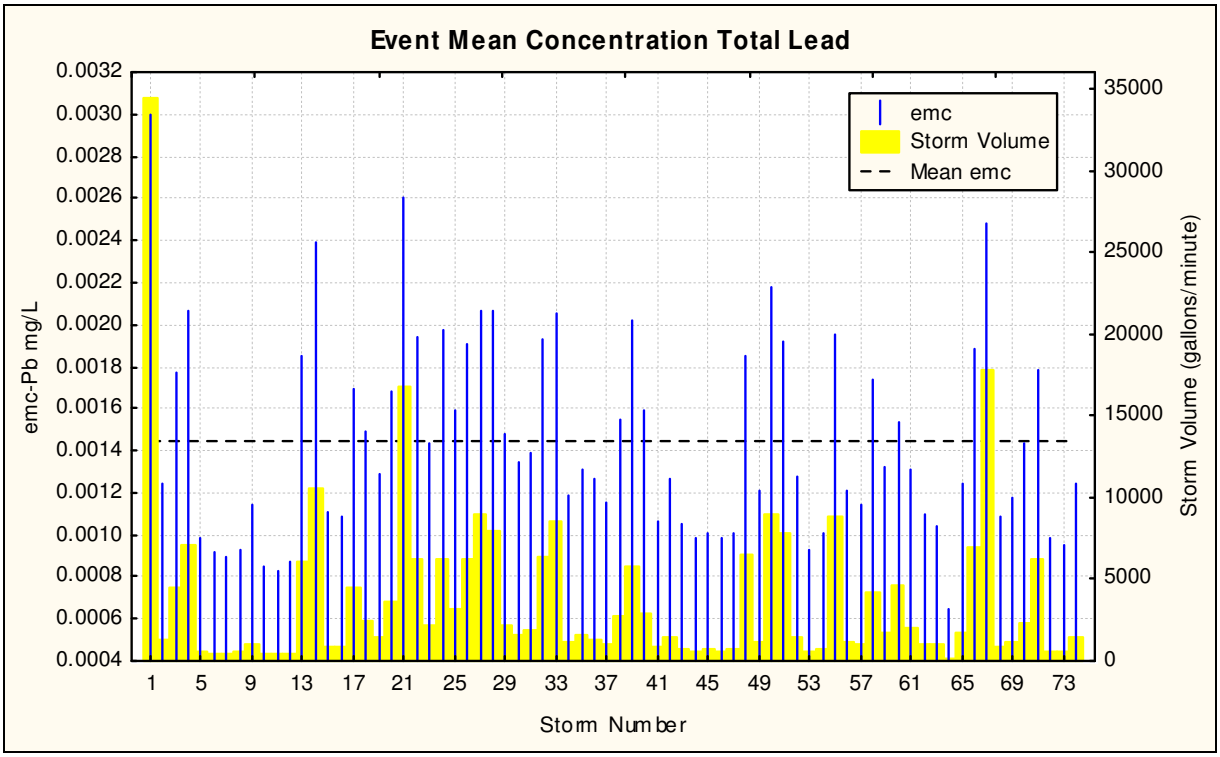


Figure 8-22a: Event Mean Concentration for Total Lead 2005-2006

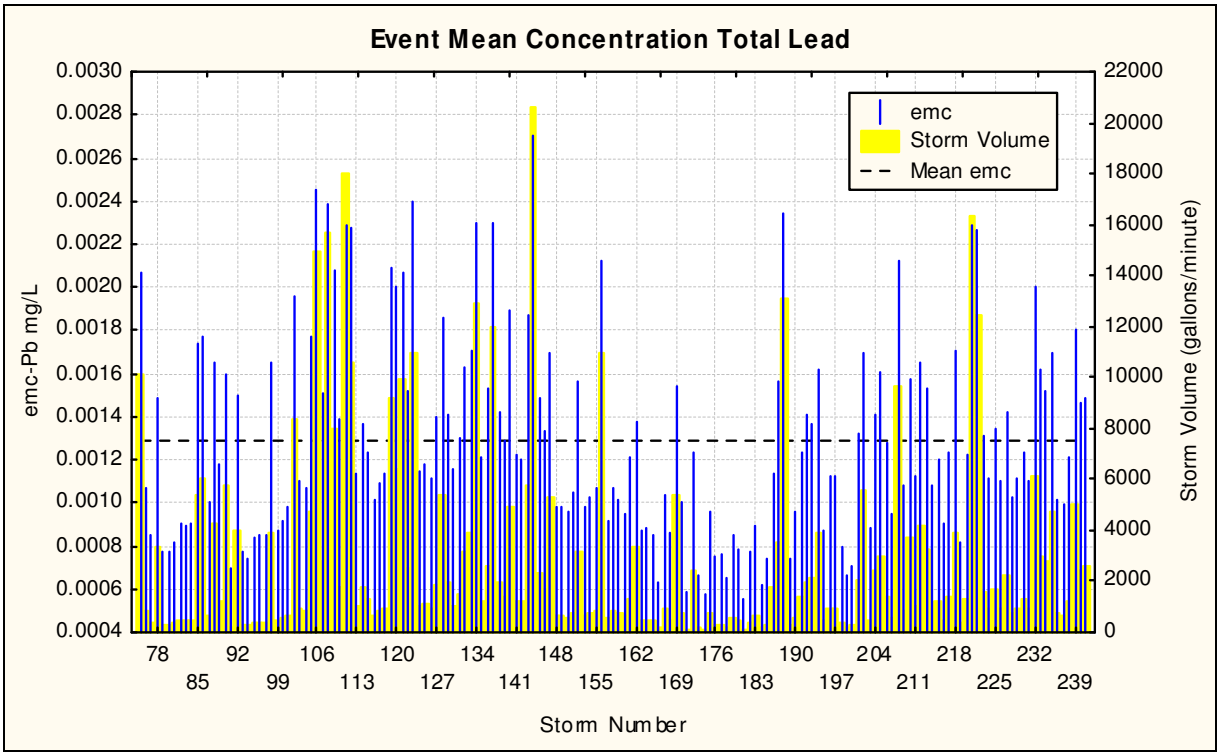


Figure 8-22b: Event Mean Concentration for Total Copper 2007-2008

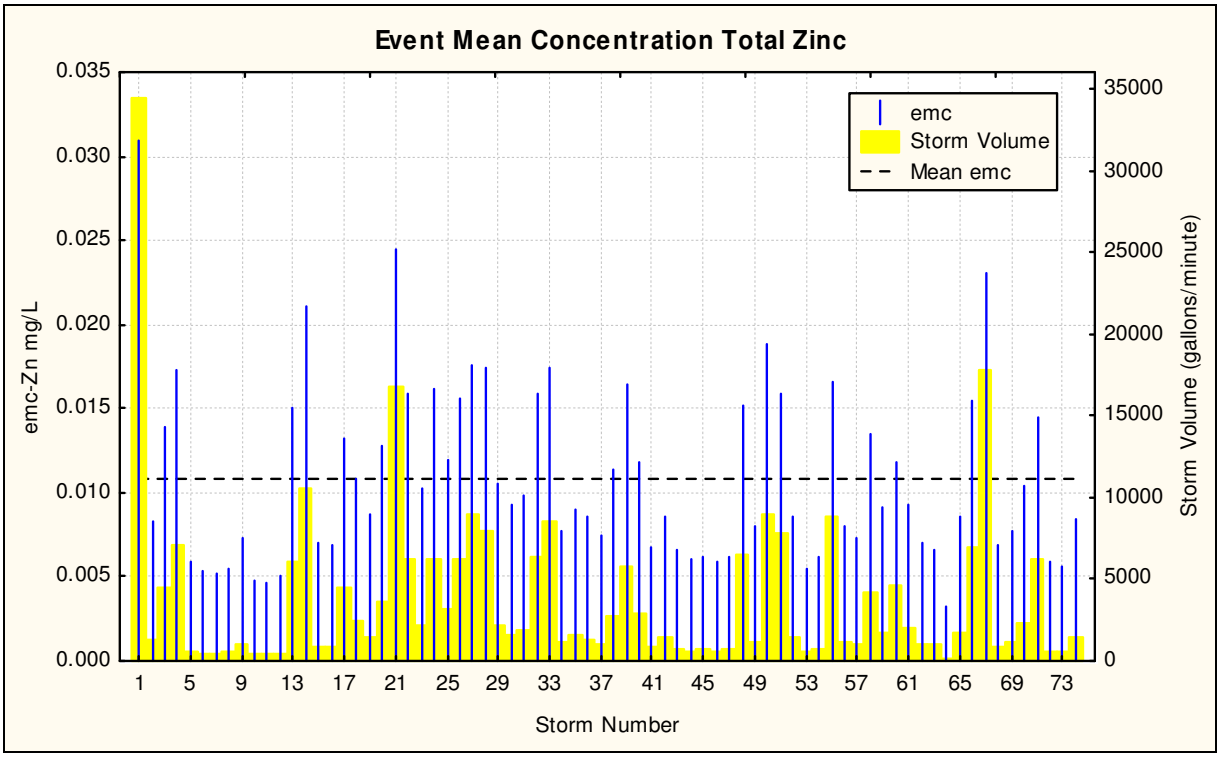


Figure 8-23a: Event Mean Concentration for Total Zinc 2005-2006

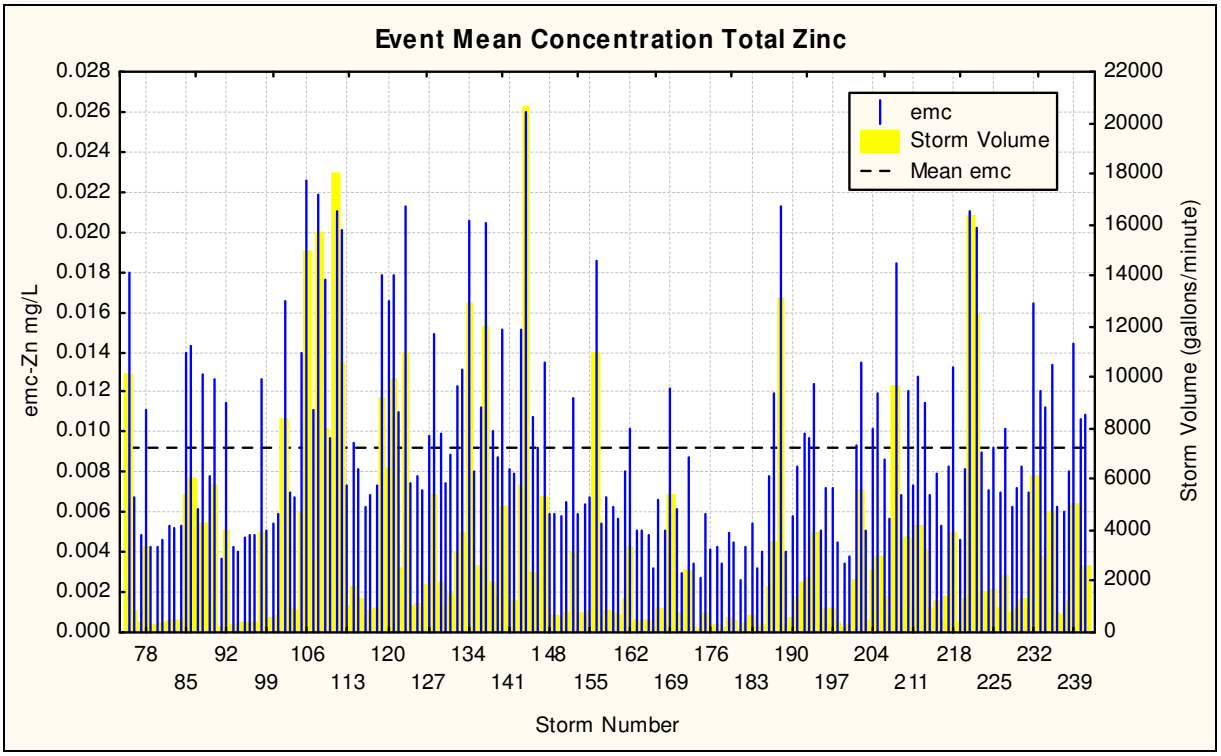


Figure 8-23b: Event Mean Concentration for Total Zinc 2007-2008

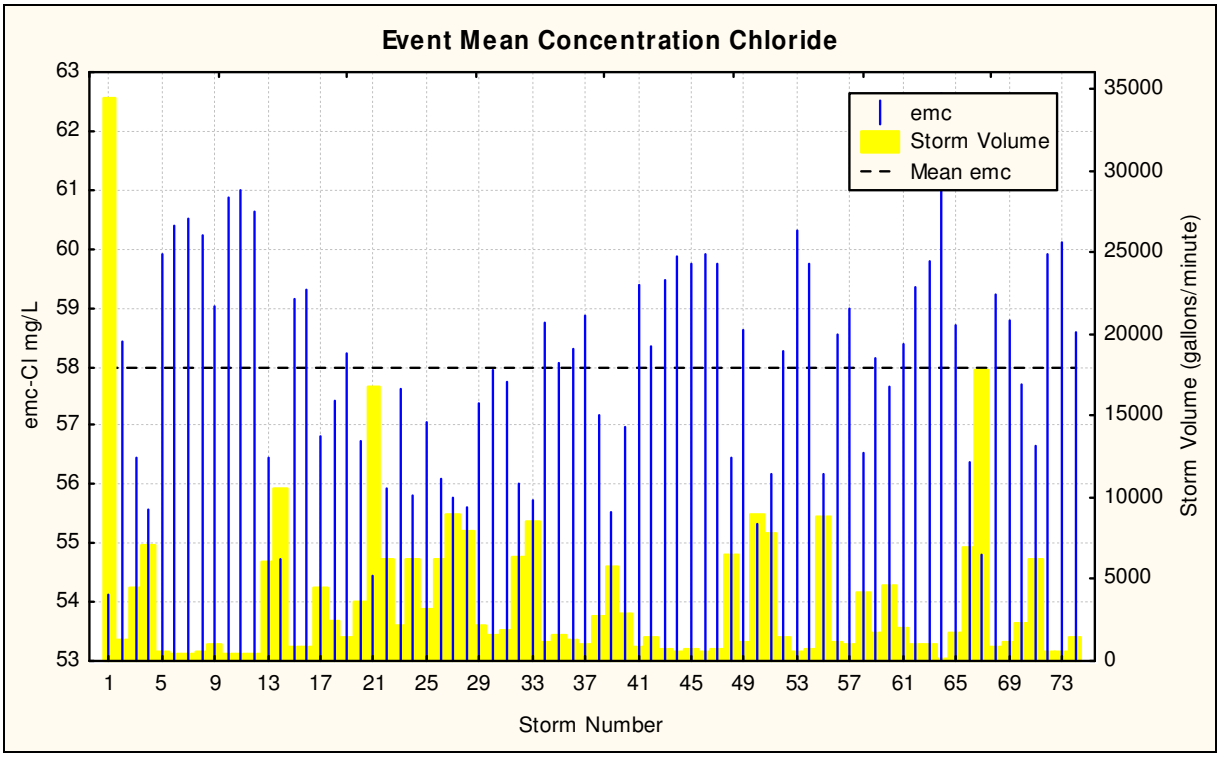


Figure 8-24a: Event Mean Concentration for Chloride 2005-2006

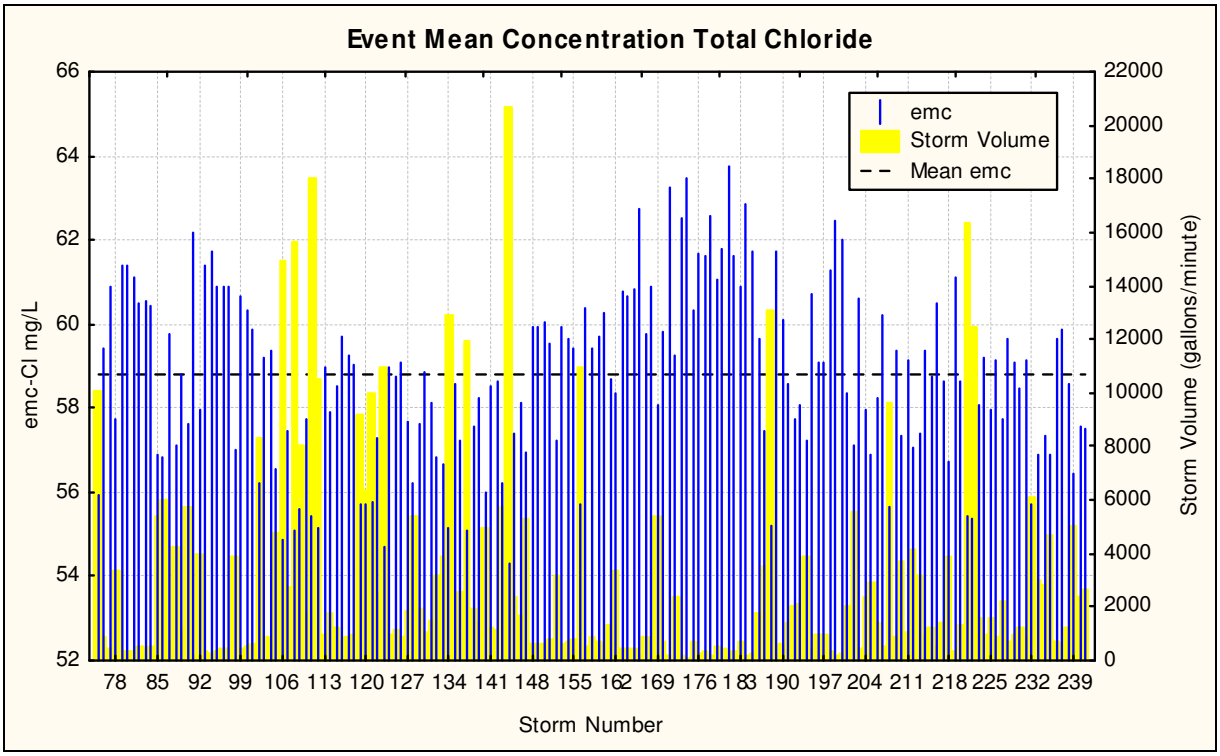


Figure 8-24b: Event Mean Concentration for Chloride 2007-2008

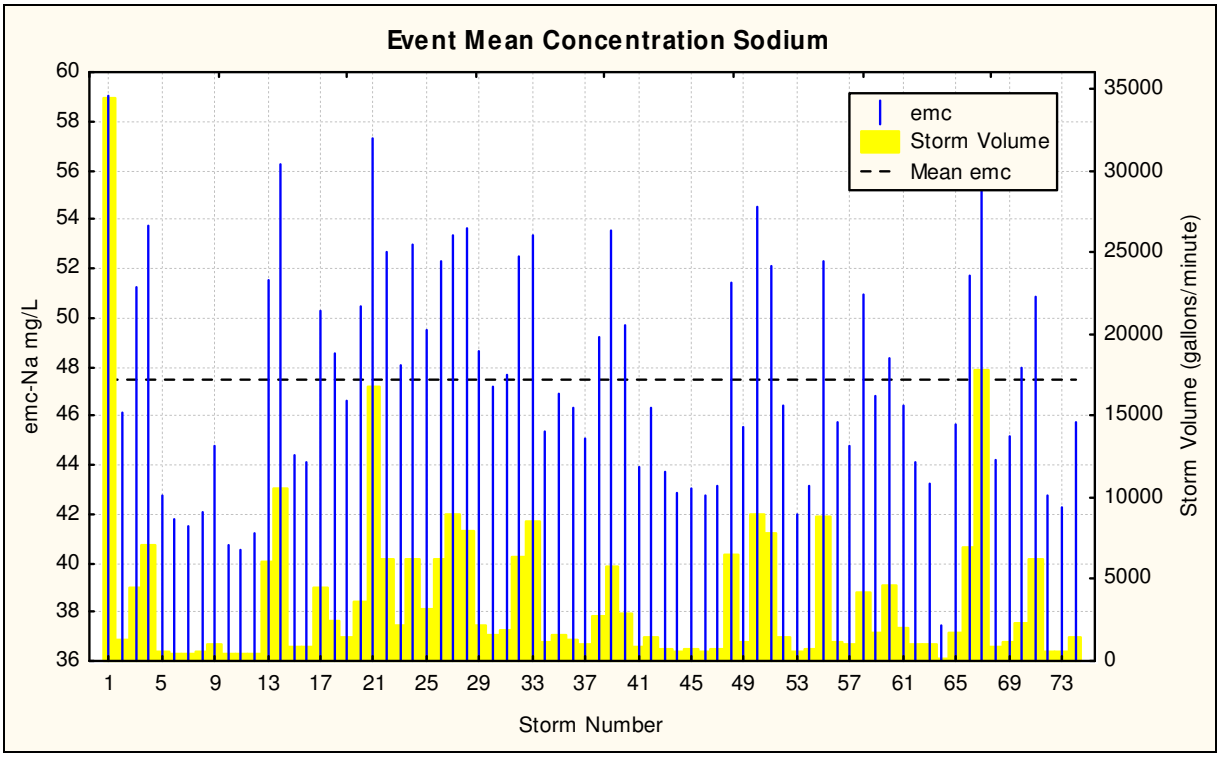


Figure 8-25a: Event Mean Concentration for Sodium 2005-2006

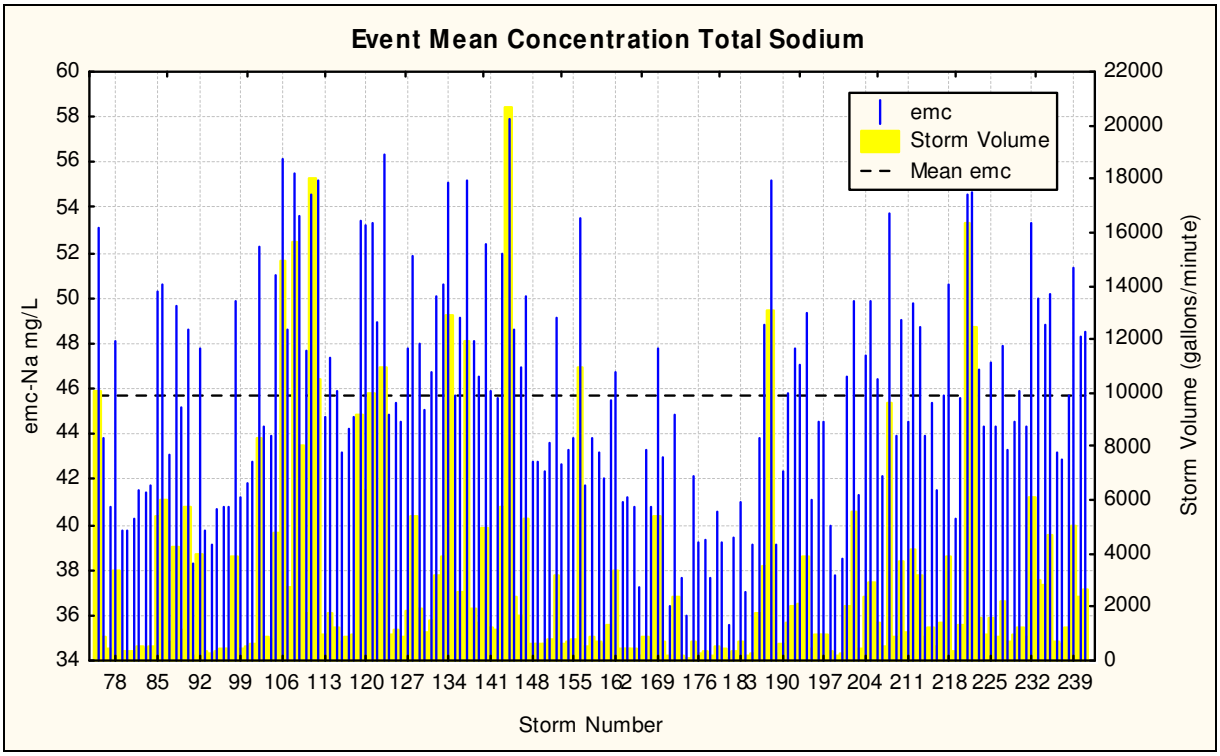


Figure 8-25b: Event Mean Concentration for Sodium 2007-2008

8.3.2.2 Baseflow Monitoring Results

Scotts Level Branch baseflow monitoring occurred at the outfall (SL-9), two tributary locations, and six mainstem locations for a total of 10 baseflow monitoring sites (Figure 8-2). Within Powder Mill Run baseflow monitoring will take place at the USGS gage and two up-stream sites that are representative of each major branch (one in the County and one in the City). Baseflow monitoring in Upper Gwynns Falls will occur only at the USGS gage site. The baseflow sites in Scotts Level Branch, Powder Mill Run, and Upper Gwynns Falls will be monitored quarterly during baseflow conditions (preceded by a minimum of 72 hours dry weather).

Analysis of baseflow pollutants is especially important in relation to nitrogen. Research conducted by the County indicates that ~50% of the nitrogen load occurs during dry weather conditions. The baseflow sampling will be used in conjunction with the storm event sampling to partition the annual discharge and pollutant load between baseflow (dry weather) conditions and storm event conditions.

Pollutant loads were examined for each of the baseflow sites. SL-09 was excluded because flow data was missing for most of the samples. Total Suspended solids were excluded from the baseflow analyses because limited conclusions can be drawn from this parameter during a baseflow sample. Many factors can affect the total suspended solids including small construction projects and car washing. These factors may only affect the stream for the limited time the sample is taken and can be misleading if extrapolated for a longer period of time. The results obtained were standardized to both daily pollutant load for drainage area and a daily load per acre and are shown in table 8-7.

Table 8-7: Daily Baseflow Pollutant Loads for Scott's Level Branch Sites

Site	Acres	TKN (mg/L)	TKN Daily Load (#s)	TKN Daily Load (#s per acre)	NO_2/NO_3 (mg/L)	NO_2/NO_3 Daily Load (#s)	NO_2/NO_3 Daily load (#s per acre)
SL-01	2,186	0.33	1.7265	0.0008	0.73	5.23	0.0024
SL-02	1,908	0.29	1.6082	0.0008	0.83	5.11	0.0027
SL-03	1,434	0.26	0.6109	0.0004	0.93	2.27	0.0016
SL-04	1,167	0.28	0.7817	0.0007	0.96	2.86	0.0025
SL-05 - Trib	202	1.22	0.4811	0.0024	2.48	1.20	0.0059
SL-06	742	0.45	0.6629	0.0009	1.01	1.44	0.0019
SL-07 - Trib	62	0.22	0.0182	0.0003	0.95	0.14	0.0023
SL-08	451	0.22	0.2379	0.0005	1.04	1.35	0.0030
SL-10	265	0.17	0.1785	0.0007	1.21	1.13	0.0043
Site	**Acres**	**TN (mg/L)**	**TN Daily Load (#s)**	**TN Daily Load (#s per acre)**	**TP (mg/L**	**TP Daily Load (#s)**	**TP Daily Load (#s per acre)**
SL-01	2,186	1.06	6.96	0.0032	0.051	0.22	0.00010
SL-02	1,908	1.12	6.72	0.0035	0.039	0.14	0.00007
SL-03	1,434	1.19	2.88	0.0020	0.031	0.06	0.00004
SL-04	1,167	1.23	3.64	0.0031	0.028	0.05	0.00004
SL-05 Trib.	202	3.70	1.68	0.0083	0.168	0.06	0.00030
SL-06	742	1.46	2.04	0.0027	0.041	0.05	0.00007
SL-07 Trib.	62	1.18	0.16	0.0026	0.016	0.00	0.00000
SL-08	451	1.26	1.46	0.0032	0.027	0.03	0.00007
SL-10	265	1.38	1.31	0.0049	0.040	0.03	0.00011

A number of observations are possible based on the information in Table 8-7. First, site SL-05, a tributary with a drainage area of 202 acres has disproportionately high concentrations of all nutrient parameters. These high concentrations are suspected to be from the stormwater management pond in which this tributary originates, no illicit discharges were found. Second, there is in general a decrease in nitrate/nitrite concentrations in a downstream direction (SL-10 → SL-1). The same pattern of decrease in a downstream direction is exhibited by total phosphorus and total nitrogen. This could be the result of nutrient uptake by biota in the stream as the water passes downstream.

8.3.2.3 Pollutant Load Calculations

Data from the USGS gage was recorded at 15-minute intervals from October 1, 2005 through April 18, 2008 resulting in ~89,300 individual discharge readings. The regression equations determined above from the storm event samples, relating pollutant concentration to discharge, were used to determine the pollutant concentration for each 15-minute interval. From this data the load was calculated for each 15-minute interval using the following formula:

$P_L = (P_C * .000008345) * (CFS * 448.8 * 15)$, where

P_L = Pollutant Load,
P_C = Pollutant Concentration,
.000008345 = Conversion factor to convert mg/L to pounds per gallon,
CFS = Cubic feet per second,
448.8 = Conversion factor to convert cubic feet per second to gallons per minute
15 = number of minutes in the interval.

The results obtained by the above formula were standardized to both an annual pollutant load for the drainage area and an annual pollutant load per acre. In addition, the data were analyzed for seasonal loads, storm event pollutant loads, and the percent of the load delivered during baseflow conditions (Table 8-8).

Table 8-8: Pollutant Load Characteristics for USGS gaged site (SL-01) Calendar Year 2007

Parameter	Pounds/ Year	Pound/Acre	% by Season	Storm Event lbs.	% Load as Storm Flow	Baseflow lbs.	% Load as Baseflow
TSS							
Fall	37,568	17.19	19.5%	34,675	92.3%	2,893	7.7%
Winter	87,490	40.02	45.5%	76,991	88.0%	10,499	12.0%
Spring	55,079	25.20	28.7%	45,880	83.3%	9,199	16.7%
Summer	12,068	5.52	6.3%	11,165	92.5%	903	7.5%
Total	**192,205**	**87.93**		**168,711**	**87.8%**	**23,494**	**12.2%**
TKN							
Fall	775	0.35	19.7%	639	82.5%	136	17.5%
Winter	1,724	0.79	44.4%	1,295	75.1%	429	24.9%
Spring	1,095	0.50	28.1%	693	63.3%	402	36.7%
Summer	286	0.13	7.3%	222	77.6%	64	22.4%
Total	**3,880**	**1.78**		**2,849**	**73.4%**	**1,031**	**26.6%**
NO_2/NO_3							
Fall	553	0.25	19.7%	363	65.6%	190	34.4%
Winter	1,147	0.52	40.9%	668	58.2%	479	41.8%
Spring	805	0.37	29.1%	324	40.2%	481	59.8%
Summer	268	0.12	9.4%	145	54.1%	123	45.9%
Total	**2,773**	**1.27**		**1,500**	**54.1%**	**1,273**	**45.9%**
TN							
Fall	1,358	0.62	19.9%	1,039	76.5%	319	23.5%
Winter	2,958	1.35	43.4%	2,031	68.7%	927	31.3%
Spring	1,936	0.89	28.6%	1,043	53.9%	893	46.1%
Summer	551	0.25	8.0%	379	68.8%	172	31.2%
Total	**6,804**	**3.11**		**4,492**	**66.0%**	**2,312**	**34.0%**
TP							
Fall	116	0.05	18.5%	101.2	87.2%	14.8	12.8%
Winter	262	0.12	44.4%	212.9	81.3%	49.1	18.7%
Spring	164	0.08	29.6%	119.1	72.6%	44.9	27.4%
Summer	40	0.02	7.4%	33.9	84.7%	6.1	15.3%
Total	**582**	**0.27**		**467.0**	**80.2%**	**115.0**	**19.8%**
Total Copper							
Fall	14.9	0.0068	19.8%	12.91	86.6%	2.0	13.4%
Winter	33.7	0.0154	44.9%	26.96	80.0%	6.7	20.0%
Spring	21.1	0.0097	28.3%	14.95	70.9%	6.2	29.1%
Summer	5.2	0.0024	7.0%	4.35	83.7%	0.9	16.3%
Total	**75.0**	**0.0343**		**59.17**	**78.9%**	**15.8**	**21.1%**
Total Lead							
Fall	2.4	0.0011	20.0%	2.12	88.3%	0.3	11.7%
Winter	5.5	0.0025	45.5%	4.49	81.6%	1.0	18.4%
Spring	3.4	0.0016	29.1%	2.54	74.7%	0.9	25.3%
Summer	0.8	0.0004	7.3%	0.70	87.5%	0.1	12.5%
Total	**12.1**	**0.0055**		**9.85**	**81.4%**	**2.3**	**18.6%**
Total Zinc							
Fall	21.5	0.0098	19.6%	19.71	91.7%	1.8	8.3%
Winter	49.8	0.0228	45.5%	43.48	87.3%	6.3	12.7%
Spring	31.3	0.0143	28.5%	25.73	82.2%	5.6	17.8%
Summer	6.9	0.0032	6.4%	6.37	92.3%	0.5	7.7%
Total	**109.5**	**0.0501**		**95.29**	**87.0%**	**14.2**	**13.0%**

Table 8-8 (cont.): Pollutant Load Characteristics for Calendar Year 2007

Parameter	Pounds/ Year	Pound/Acre	% by Season	Storm Event lbs.	% Load as Storm Flow	Baseflow lbs.	% Load as Baseflow
Sodium							
Fall	59,286	27.12	20.0%	47,064	79.4%	12,222	20.6%
Winter	130,460	59.68	44.0%	93,609	71.8%	36,851	28.2%
Spring	84,052	38.45	28.3%	49,000	58.3%	35,052	41.7%
Summer	22,944	10.50	7.7%	16,784	73.2%	6,160	26.8%
Total	**296,742**	**135.75**		**206,457**	**69.6%**	**90,285**	**30.4%**
Chloride							
Fall	62,491	28.59	19.9%	44,983	23.6%	17,508	14.3%
Winter	133,660	61.14	42.7%	85,729	45.0%	47,931	39.1%
Spring	89,919	41.13	28.7%	42,934	22.5%	46,985	38.3%
Summer	27,269	12.47	8.7%	17,043	8.9%	10,226	8.3%
Total	**313,339**	**143.34**		**190,688**		**122,650**	

There are distinct seasonal differences in the delivery of nutrient and total suspended solids pollutant loads, with summer being the season of reduced load delivery for all pollutants analyzed. Approximately 17% of the precipitation fell during the summer season, but only 19.5% of this precipitation was reflected in the stream flow (Table 8-5). This summer decrease in stream flow results in a decrease in the delivery of pollutants.

Baseflow accounts for a negligible amount of the pollutant load delivery for Total Suspended Solids (12.2%), Total Phosphorus (19.8%), Total Zinc (13.0%) and Total Lead (18.6%). The Nitrite/Nitrate load has about half of its load delivered during baseflow conditions. TKN (ammonia and organic nitrogen) has about one-quarter of its load delivered during baseflow conditions. Organic nitrogen will be mobilized within the stream channel and washed into the stream during storm events.

8.3.3 Geomorphological Monitoring

The geomorphological monitoring is intended to provide an estimate of stream erosion and deposition rates, and an estimate of the pollutant load derived from stream channel erosion. In addition, it is intended over time to provide an estimate of the effects of restoration on stream stability on both a project basis and over the entire subwatershed. In order to assure unbiased selection of cross section locations, Scotts Level Branch and Powder Mill Run were divided into 30 equal length stream segments, 20 in Scotts Level Branch (Figure 8-3) and 10 in Powder Mill Run (Figures 8-4). Within each segment a point was randomly selected, using a GIS subroutine, for location of permanent cross sections. These cross sections will be monitored annually with the results overlaid to provide an assessment of the amount of channel change. Note that we were not able to obtain permission from the landowner for 2 of the 20 cross sections; therefore only 18 of the randomly selected cross sections were done in 2005-2007. Two longitudinal profile reaches were selected in Scotts Level Branch for annual assessment.

Streambank Soil Sampling: Two sets of Stream bank and bed core samples were collected in the vicinity of the permanent cross sections for laboratory analysis of bulk density, particle size distribution, total nitrogen, and total phosphorus and other constituents. One of the two sets was taken in the vicinity of Scotts Level Cross Section # 13, and the other set was taken from Powder

Mill Cross Section # 2. Eventually, it is planned to sample each of the 30 cross sections of both streams. The samples will be one-time sample collections, with 10% of the sites, randomly selected, for a second round of sample collection to provide an analysis of annual variability. The data from each cross section will allow either positive or negative loading estimates to be made for the cross sections. These estimates, if extended to represent their respective stream segments may provide information helpful in understanding the sediment and chemical flux of the stream system. Based on the annual and long term change, and the results of the core samples, the estimated annual sediment, total nitrogen, and total phosphorus loads will be calculated for comparison with the chemical monitoring results derived from the in-stream monitoring site.

Scotts Level Branch Geomorphological Monitoring Results: Overlays of the 18 randomly selected cross sections show the changes that occurred between the 2006 and 2007 measurement dates. Figure 8-26 shows an overlay of CX #1. Table 8-9 presents the amount of aggradation (filling) or degradation (cutting) within the active channel, and Table 8-10 below (listed from upstream to downstream) summarizes Table 8-9. Data in Table 8-9 were annualized to standardize aggradation and degradation estimates. To supplement the cross sections, 2 longitudinal thalweg profiles (ranging from 200' – 400' in length) were measured in the vicinity of CX# 20 and CX# 8. The data files and plots can be viewed on the separate data CD accompanying this report. As can be seen from Table 8-10, all of the random cross sections remained relatively unchanged during 2006-2007 in terms of net change (cut or fill) except Cross Section # 13 and Cross Section # 1. Cross Section # 13 experienced a large cut along the right channel side. Cross Section # 1 experienced a large amount of deposition along both channel sides and within the stream channel. Cross Section # 1 is characterized by a steep gradient leading into it. The cross sectional area acts as a flatter depositional zone.

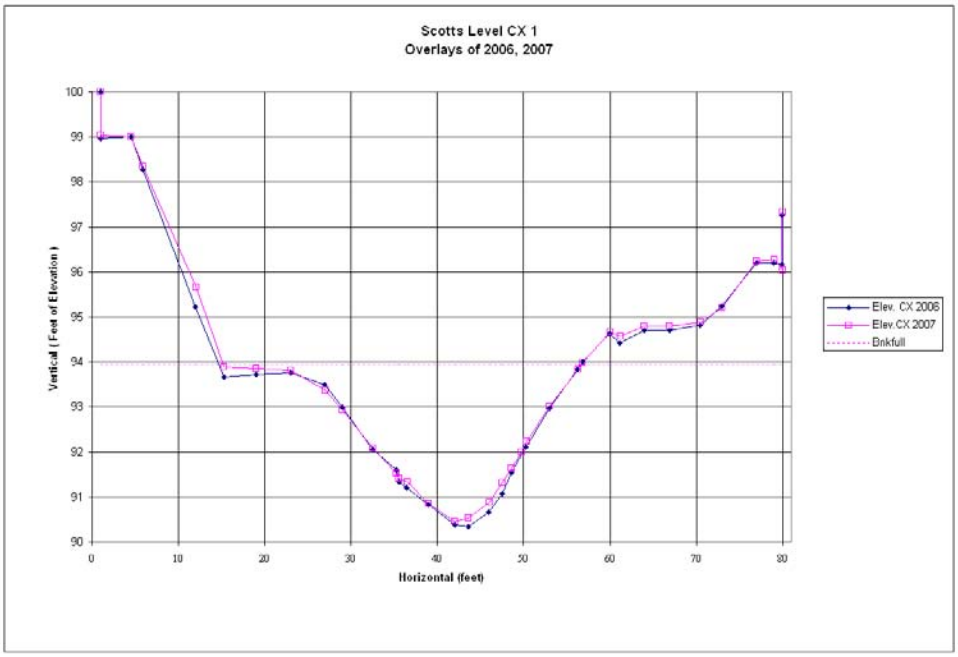


Figure 8-26: Scotts Level Branch Geomorphological Cross Section 1 Overlay showing net deposition especially on the channel sides between the 2006 and 2007 surveys.

Since most of the input hydrology to the Scotts Level is from impervious area, the sediment fluxes within the stream channel are most likely part of the process of the stream reworking its surrounding legacy flood plain sediments ultimately transporting them into the Gwynns Falls mainstem and beyond. The data now being collected should serve as an important baseline prior to monitoring the effects of future stream channel and stormwater management improvements in the watershed. The results of the initial cross-section measurements are found on the separate data CD accompanying this report.

Table 8-9: Scotts Level Branch Cross Sections - Cut and Fill Amounts

SL 20: Change (cu ft)	**Period: 2006 – 2007**	**Period: 2005 – 2006**	**SL 10: Change (cu ft)**	**Period: 2006 – 2007**	**Period: 2005 – 2006**
Total Cut	-3.1	-1.6	Total Cut	-1.5	-1.4
Total Fill	1.3	0.4	Total Fill	1.6	2.8
Total Change	4.4	2.0	Total Change	3.1	4.2
Net Change	-1.8	-1.2	Net Change	0.1	1.4
SL19: Change (cu ft)	**Period: 2006 – 2007**	**Period: 2005 – 2006**	**SL 9: Change (cu ft)**	**Period: 2007 – 2008**	**Period: 2005 – 2006**
Total Cut	-3.1	-1.3	Total Cut	-1.2	-1.2
Total Fill	1.4	4.2	Total Fill	1.4	0.9
Total Change	4.5	5.5	Total Change	2.6	2.1
Net Change	-1.7	2.9	Net Change	0.2	-0.3
SL 18: Change (cu ft)	**Period: 2006 – 2007**	**Period: 2005 – 2006**	**SL 8: Change (cu ft)**	**Period: 2007 – 2008**	**Period: 2005 – 2006**
Total Cut	-3.8	-1.7	Total Cut	-3.5	-1.1
Total Fill	0.0	3.1	Total Fill	0.6	2.7
Total Change	3.8	4.8	Total Change	4.1	3.8
Net Change	-3.8	1.4	Net Change	-2.9	1.6
SL 17: Change (cu ft)	**Period: 2006 – 2007**	**Period: 2005 – 2006**	**SL 7: Change (cu ft)**	**Period: 2006 – 2007**	**Period: 2005 – 2006**
Total Cut	-3.9	-2.3	Total Cut	-1.1	-4.4
Total Fill	7.0	0.4	Total Fill	1.6	0.4
Total Change	10.9	2.7	Total Change	2.7	4.8
Net Change	3.1	-1.9	Net Change	0.5	-4.0
SL 16: Change (cu ft)	**Period: 2006 – 2007**	**Period: 2005 – 2007**	**SL 6: Change (cu ft)**	**Period: 2006 – 2007**	**Period: 2005 – 2006**
Total Cut	-1.2	-1.8	Total Cut	-0.9	-2.5
Total Fill	0.8	0.8	Total Fill	3.7	0.2
Total Change	2.0	2.6	Total Change	4.6	2.7
Net Change	-0.4	1.0	Net Change	2.8	-2.3
SL 15: Change (cu ft)	**Period: 2006 – 2007**	**Period: 2005 – 2006**	**SL 5*: Change (cu ft)**	**Period: 2006 – 2007**	**Period: 2005 – 2006**
Total Cut	-0.5	-0.2	Total Cut	NA	NA
Total Fill	2.0	1.4	Total Fill	NA	NA
Total Change	2.5	1.6	Total Change	NA	NA
Net Change	1.5	1.2	Net Change	NA	NA
SL 14: Change (cu ft)	**Period: 2006 – 2007**	**Period: 2005 – 2006**	**SL 4*: Change (cu ft)**	**Period: 2006 – 2007**	**Period: 2005 – 2006**
Total Cut	-0.5	-5.8	Total Cut	NA	NA
Total Fill	4.6	3.9	Total Fill	NA	NA
Total Change	5.1	9.7	Total Change	NA	NA
Net Change	4.1	-1.9	Net Change	NA	NA

Table 8-9 (cont.): Scotts Level Branch Cross Sections - Cut and Fill Amounts

SL 13: Change (cu ft)	Period: 2006 – 2007	Period: 2005 – 2006	SL 3: Change (cu ft)	Period: 2006 – 2007	Period: 2005 – 2006
Total Cut	-9.0	-3.0	Total Cut	-0.1	0.0
Total Fill	3.2	-1.8	Total Fill	0.5	1.5
Total Change	12.2	4.8	Total Change	0.6	1.5
Net Change	-5.8	-1.2	Net Change	0.4	1.5
SL 12: Change (cu ft)	**Period: 2006 – 2007**	**Period: 2005 – 2006**	**SL 2: Change (cu ft)**	**Period: 2006 – 2007**	**Period: 2005 – 2006**
Total Cut	-7.3	-5.4	Total Cut	-1.3	-3.9
Total Fill	6.1	2.1	Total Fill	2.3	0.9
Total Change	13.4	7.5	Total Change	3.6	4.8
Net Change	-1.2	-3.3	Net Change	1.0	-3.0
SL 11: Change (cu ft)	**Period: 2006 – 2007**	**Period: 2005 – 2006**	**SL 1: Change (cu ft)**	**Period: 2006 – 2007**	**Period: 2005 – 2006**
Total Cut	-1.0	-0.6	Total Cut	-0.5	-0.8
Total Fill	0.6	1.8	Total Fill	6.2	14.2
Total Change	1.6	2.4	Total Change	6.7	15.0
Net Change	-0.4	1.2	Net Change	5.7	13.4

* Permission from private property owners for sampling SL 5 and SL 4 has not yet been obtained, therefore there are no results.

Table 8-10: Scotts Level Branch Stream Channel Changes Over Time

SL #	CX 2005-2006	CX 2006-2007	TW 2005-2006	TW 2006-2007
20	sd	sd	a	a
19	a	sd	NA	NA
18	sa	d	NA	NA
17 (Trib.)	d	a	NA	NA
16	sa	sd	NA	NA
15	sa	sa	NA	NA
14	d	a	NA	NA
13	sd	d	NA	NA
12	d	sd	NA	NA
11	sa	sd	NA	NA
10	sa	sa	NA	NA
9	sd	sa	NA	NA
8	sa	d	a	a
7	a	sa	NA	NA
6	d	a	NA	NA
5	NA	NA	NA	NA
4	NA	NA	NA	NA
3	sa	sa	NA	NA
2	d	sa	NA	NA
1	a	a	NA	NA

Symbols: a: aggradation, d: degradation, s: slight, m: moderate

The aggradation/degradation and stream bank soil chemistry data, when combined with water chemistry data, allows examination of pollutant loads for various components of the Scotts Level Branch watershed. The expectation is that instream water quality estimates are equal to the sum of stream bank and watershed wash-off estimates. Table 8-11 shows loads for Total Nitrogen,

Total Phosphorus, and Sediment from the instream and stream bank components of the Scotts Level Branch watershed for 2006 and 2007. Estimates of sediment loads were based on Total Suspended Solids for instream water quality and stream bank soil weights for geomorphology. Instream water quality data were taken from the 2007 NPDES Report. As expected, the pollutant load for Total Phosphorus was highest in stream bank soils, while the load for Total Nitrogen was highest for instream water quality. Soil particles bind phosphorus; therefore streams typically have elevated phosphorus concentrations only during stormflow. Groundwater contributes most of the nitrogen (as baseflow) in a watershed. Sediment loads were greatest in stream bank soils in both years. Missing from this discussion is the watershed wash-off estimate, which will be made using the Scotts Level Branch outfall. The United States Geological Survey is developing a flow-rating curve for the outfall. Pollutant loads for the outfall will be included in the 2009 NPDES report, after the rating curve is complete.

Table 8-11: Pollutant Load Estimates- Comparison between Water Quality Monitoring and Geomorphology for Scotts Level Branch, 2006 and 2007

	2006		2007	
Parameter	**Instream Water Quality Pollutant Load (lbs/yr)**	**Geomorphology Pollutant Load (lbs/yr)**	**Instream Water Quality Pollutant Load (lbs/yr)**	**Geomorphology Pollutant Load (lbs/yr)**
TN	9,194	3,634	6,804	3,201
TP	866	1,134	582	999
Sediment	312,285	1,608,633	192,205	1,416,805

Extending this analysis to the entire watershed (geomorphology station SL-1), which includes the portion below the gage, for stream bank soils shows loads of 3,237 lbs/yr and 1,943 lbs/yr for Total Nitrogen in 2006 and 2007, respectively. Total Phosphorus loads are zero for both years, and Sediment loads are 1 lbs/yr and 6 lbs/yr in 2006 and 2007, respectively. This is a result of the net deposition in the lower portion of the watershed. Examination of the contribution of NO_2/NO_3 and TKN to Total Nitrogen in the stream banks reveals that NO_2/NO_3 is only 0.2% of Total Nitrogen in both 2006 and 2007. This highlights the roles of baseflow as a contributor of NO_2/NO_3, and stream bank sediments as contributors of other forms of nitrogen, to overall nitrogen loads. This analysis has begun to show patterns of nutrient and sediment loading to Scotts Level Branch. Continued water quality and stream bank soil sampling, along with estimates of loads from the outfall, should provide more refined estimates of the relative contribution of each of these components to the pollutant loads within the watershed, as well as estimates of export from the watershed. These data will allow DEPRM to more accurately determine the contribution of the various flow components to overall pollutant load estimates, and will form the basis for more accurate determination of benefits from future stream restoration.

Powder Mill Run Monitoring Results: Overlays of the 10 randomly selected cross sections show the changes that occurred during the year between 2006 and 2007 measurement dates. Table 8-12 presents a quantification of these changes in terms of aggradation (filling) or degradation (cutting) within the active channel, and Table 8-13 below summarizes Table 8-12. The largest change (degradation) occurred at CX #2. As with Scotts Level CX #1, the stream channel at this location is flat, with a wide flood plain on the left bank. It would be expected to be more of a

depositional area. It is possible that one of the larger storms during 2007 removed a large amount of sediment. There was also a significant difference in the net change at CX #1, with a large amount of degradation during 2005-2006, and only slight aggradation during 2006-2007. This stream reach has a steep gradient immediately upstream of it, and would be expected to routinely lose sediment to degradation. Interestingly, precipitation for calendar year 2007 was only half that of 2006, and there were three times as many storms with greater than one inch of rainfall in 2006 than in 2007. Between 2005 and 2006, eight of the ten cross sections experienced aggradation. With significantly less rainfall in 2007, it is likely that the degradation was generally not great enough to wash away sediment accumulated the previous year, although some combination of localized conditions allowed for the large amount of sediment export at CX #2. The data files and plots can be viewed on the separate data CD accompanying this report.

Table 8-12: Powder Mill Run Cross Sections - Cut and Fill Amounts

PM 10: Change (cu ft)	Period: 2006 – 2007	Period: 2005 – 2006	PM 5: Change (cu ft)	Period: 2006 – 2007	Period: 2005 – 2006
Total Cut	-4.5	-0.6	Total Cut	-3.3	-4.1
Total Fill	0.7	3.8	Total Fill	0.9	3.6
Total Change	5.2	4.4	Total Change	4.2	7.7
Net Change	-3.8	3.2	Net Change	-2.4	-0.5
PM 9: Change (cu ft)	**Period: 2006 – 2007**	**Period: 2005 – 2006**	**PM 4: Change (cu ft)**	**Period: 2006 – 2007**	**Period: 2005 – 2006**
Total Cut	-0.9	-0.4	Total Cut	-3.6	-1.2
Total Fill	2.0	1.9	Total Fill	1.7	1.4
Total Change	2.9	2.3	Total Change	5.3	2.6
Net Change	1.1	1.5	Net Change	-1.9	0.2
PM 8: Change (cu ft)	**Period: 2006 – 2007**	**Period: 2005 – 2006**	**PM 3: Change (cu ft)**	**Period: 2006 – 2007**	**Period: 2005 – 2006**
Total Cut	-2.0	-0.5	Total Cut	-2.7	-0.7
Total Fill	1.9	1.8	Total Fill	0.5	3.8
Total Change	3.9	2.3	Total Change	3.1	4.5
Net Change	-0.1	1.3	Net Change	-2.2	3.2
PM 7: Change (cu ft)	**Period: 2006 – 2007**	**Period: 2005 – 2006**	**PM 2: Change (cu ft)**	**Period: 2006 – 2007**	**Period: 2005 – 2006**
Total Cut	-1.4	-0.6	Total Cut	-6.9	-2.2
Total Fill	1.4	3.1	Total Fill	1.3	2.3
Total Change	2.8	3.7	Total Change	8.2	4.5
Net Change	0.0	2.5	Net Change	-5.6	0.1
PM 6: Change (cu ft)	**Period: 2006 – 2007**	**Period: 2005 – 2006**	**PM 1: Change (cu ft)**	**Period: 2006 – 2007**	**Period: 2005 – 2006**
Total Cut	-3.1	-2.2	Total Cut	-4.2	-28.6
Total Fill	0.0	0.8	Total Fill	5.6	2.2
Total Change	3.1	3.0	Total Change	9.8	30.8
Net Change	-3.1	1.4	Net Change	1.4	-26.4

Table 8-13: Powder Mill Run, 2005-2006 and 2006-2007 Stream Channel Changes

PM #	CX 2006-2007	CX 2005-2006
10	d	a
9	sa	sa
8	sd	sa

Table 8-13 (cont.): Powdermill Run, 2005-2006 and 2006-2007 Stream Channel Changes

PM #	CX 2006-2007	CX 2005-2006
7	none	a
6	d	sd
5	d	sd
4	sd	sa
3	d	sa
2	d	sa
1	sa	d

Symbols: a: aggradation, d: degradation, s:slight, m:moderate

8.3.4 Biological Monitoring Results

Benthic macroinvertebrate and fish sampling were conducted as per MBSS protocols. Benthic macroinvertebrates were sampled between March 14th and April 25th. Macroinvertebrates were sampled at 13 randomly selected stations in 2007. Fish were sampled at eight stations in 2007, between August 9th and September 19th. Beginning with summer, 2007, the five stations sampled for fish on Scotts Level Branch, and three stations in Powder Mill Run, were selected as permanent biological monitoring stations for both benthos and fish. The slight change in methodology will allow for repeated sampling at fixed stations, which will provide the opportunity to monitor biological change due to stream restoration over time. The previous methodology was used to obtain unbiased estimates of the biological condition throughout each watershed. The biological data collected up to summer 2007 suggested achievement of that goal. The Benthic Index of Biotic Integrity (BIBI) and Fish Index of Biotic Integrity (FIBI) were calculated using metrics developed by MBSS for Piedmont streams. The BIBI and FIBI scoring criteria are: 1.00-1.99 (Very Poor), 2.00-2.99 (Poor), 3.00-3.99 (Fair), and 4.00-5.00 (Good). Stream physical habitat was assessed when macroinvertebrates and fish were collected. The protocol measured components of stream physical habitat, including fish habitat quality, macroinvertebrate habitat quality, stream depth and velocity diversity, riffle quality, pool quality, the percentage of sediment surrounding stream bottom substrates, and the percentage of shading in the stream reach. Each parameter was estimated on a scale of 0-20, except for sediment and shading, which were percentage estimates. The physical habitat assessments were standardized to a scale of 0-100 by adding the individual scores for instream habitat, epifaunal substrate, stream depth and velocity diversity, riffle quality, pool quality, percent shading, trash rating, and the difference of one hundred and percent sediment. This total was divided by 320 and multiplied by 100. Individual condition categories were Optimal (76-100), Sub-optimal (51-75), Marginal (26-50), and Poor (0-25).

The IBI scores are shown in Figure 8-27. All BIBIs were in the Very Poor condition category. The FIBI scores ranged from Very Poor to Fair. Physical habitat condition ranged from Poor to Optimal (Figure 8-28), but 8 of the 13 stations were in the Sub-optimal range.

The physical habitat scores suggest that water chemistry, rather than physical habitat, is more limiting to aquatic organisms. Only four stations had overall habitat scores less than Sub-optimal. There was no clear longitudinal pattern in BIBI or FIBI scores, except that the downstream-most station in each stream had the highest FIBI scores. Fish in both Scotts Level Branch and Powder Mill Run are better able than benthic macroinvertebrates to survive the acute and chronic water quality problems within both streams. The mobility of fish likely allows them

to better exploit good habitat and avoid such episodic events as high storm flows. Interestingly, a small number of smallmouth bass were collected at PM-1. Smallmouth bass are known to inhabit the Gwynns Falls, and it is possible that these fish may provide a source from which to establish a new population in Scotts Level Branch, once improvements in water quality from stream restoration are realized.

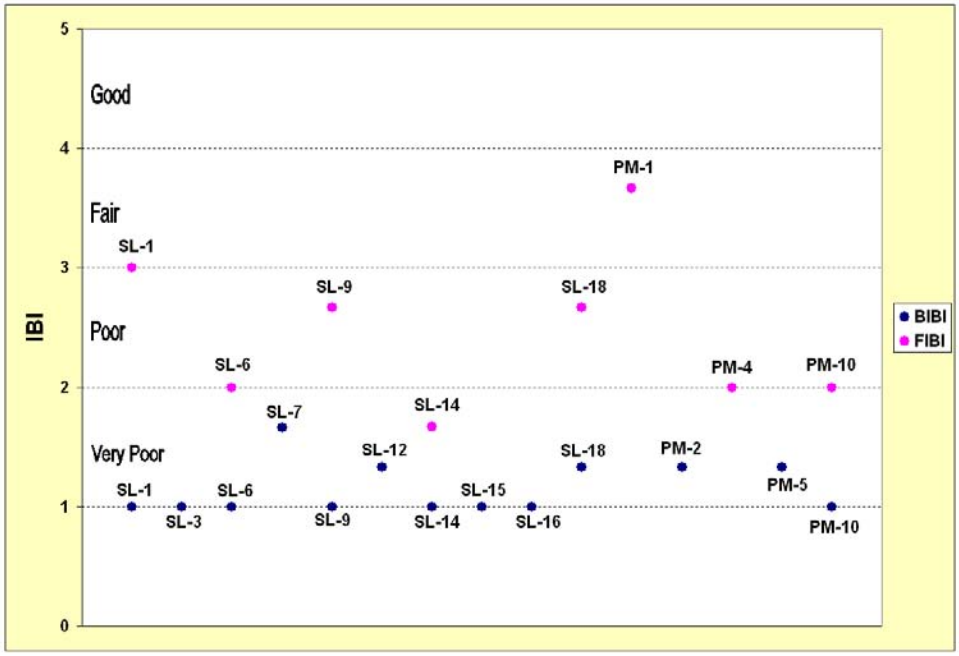


Figure 8-27: Scotts Level Branch and Powder Mill Run IBI Scores

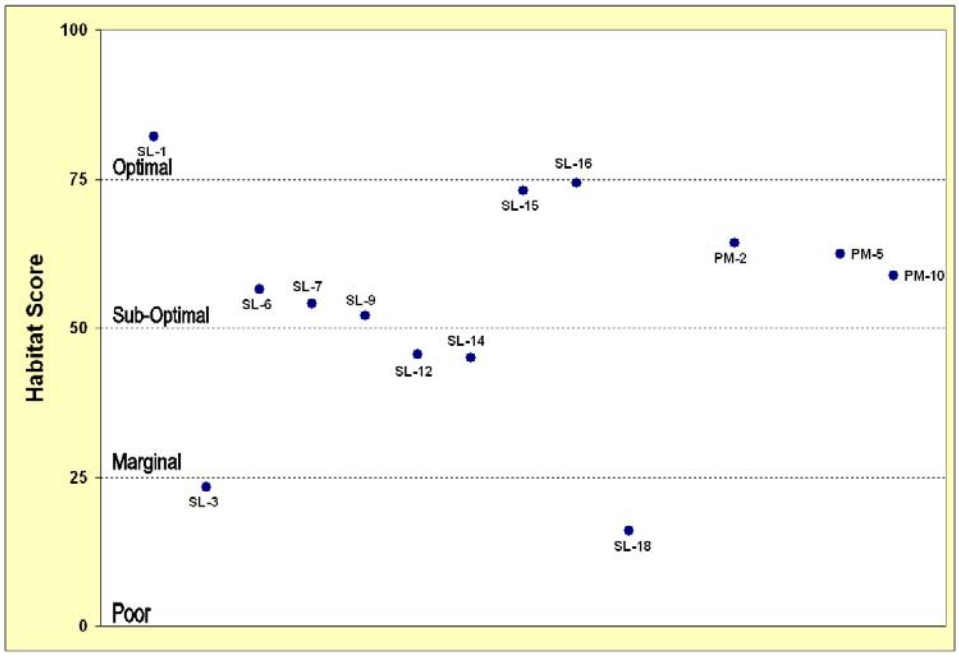


Figure 8-28: Scotts Level Branch and Powder Mill Run Habitat Scores

8.4 Windlass Run Monitoring – Stormwater Management Assessment

Baltimore County's National Pollutant Discharge Elimination System (NPDES) permit requires the monitoring of a subwatershed for geomorphological impacts resulting from development under the revised Stormwater Management Design Manual. In order to comply with this component of the permit, Baltimore County conducted a comprehensive review of the available land for development. An analysis using geographic information systems (GIS) was used for selection of the monitoring subwatershed. The characteristics for determination of the selected subwatershed were:

- 1) an area of open undeveloped land, and
- 2) an area with a zoning category that would lead to development.

Nearly all new development and redevelopment will be effected by the guidelines in the new stormwater design manual, but the denser developments are expected to show a more dramatic change to the stream system. Therefore the study area must have a zoning category of sufficient density to affect the stability of the stream system. The results of a countywide screening, followed by field verification led to the selection of Windlass Run as the monitoring subwatershed.

The Windlass Run subwatershed is 1,926 acres, and has the potential for a large amount of future development. The level of imperviousness in the subwatershed is currently about 3 % and is expected to increase to well over 20%. Much of the undeveloped land is zoned for manufacturing. The development in this subwatershed has not already occurred because the extension of MD route 43 has not yet been completed. This roadway will be the primary access to these properties and is needed for the intense level of development expected in this subwatershed. This level of high-density development would be expected to have a severe impact on the water quality and stability of Windlass Run. The protection provided by the new stormwater management regulations should be easily visible through monitoring of the stream conditions.

Windlass Run is a Coastal Plain stream system typified by a stable, low gradient, sinuous, unconfined, silt and sand channel within well-developed floodplains. Average Rosgen bankfull width and corresponding bankfull depths are 10 and 2 feet, respectively. The Windlass Run system is very stable, and there are no areas of moderate or severe streambank erosion. One year of stream gage data was recorded by U.S.G.S. in 1992 – 1993. Well-vegetated stream buffers surround the stream. The upper portion exhibits multiple channels, which are stable and meander through non-tidal wetlands. These conditions are reflective of those described in the Bird River watershed plan that was completed in 1995.

Monitoring in the Windlass Run watershed includes stream geomorphological monitoring, and biological monitoring. The Baltimore County NPDES Municipal Stormwater Discharge Permit only requires the stream stability geomorphological monitoring. In 2002, a water level sensor was installed on the mainstem at Bird River Road and downstream of the Route 43 road construction and the area of future major development. Baseflow and storm event, water chemistry data was collected at this site. Due to high flood levels and unstable channel

conditions the sensor was moved to within 100' above the "new" Route 43 crossing on Windlass Run in 2004 where stream conditions are more stable. A rating curve is still in development for the water level sensor

8.4.1 Stream Geomorphologic Monitoring

Six (6) sites in the Windlass Run subwatershed have been selected for monitoring and are shown in Figure 8-29 below. The site selection process took into consideration the location of future development and the extension of MD Route 43. Three sites are located along the mainstem: two above (WR3, WR5) and one below (WR2) the crossing of the proposed MD Route 43 extension. One site (WR4) is on a tributary (WR4) within the area of proposed industrial and high-density development, and down stream of Route 43. Another cross section (WR6) is located on a tributary within the area of proposed development. The last cross section (WR1) is a reference site on a tributary near the bottom of the subwatershed. This tributary is within an area zoned for agricultural uses and should not be affected by the other development activities in the watershed. Sites WR1 and WR6 are not down slope or downstream of any of the Route 43 construction.

The geomorphic monitoring consists of a channel cross-section measurement, a channel slope/ profile measurement, and a Wolman pebble count. Cross sections were selected on the reach between meander bends and where the conditions best represented confined flow. Rebar was placed above the banks of the stream for permanently marking the end points of the six selected cross sections. Profiles were also surveyed at all of the cross section reaches and include the cross sections. The procedures outlined by D. Rosgen (1996) were generally used for channel classification and stability assessment at each of the six permanent site locations. In spring 2002-2008, the six cross sections and profiles were surveyed. Note, however, that no profile was done at Cross Section #6 in 2002 and 2003 due to heavy vegetation. Pebble counts, sinuosity, and a Rosgen Level 3 assessment were also completed at each site. The monitoring will continue yearly.

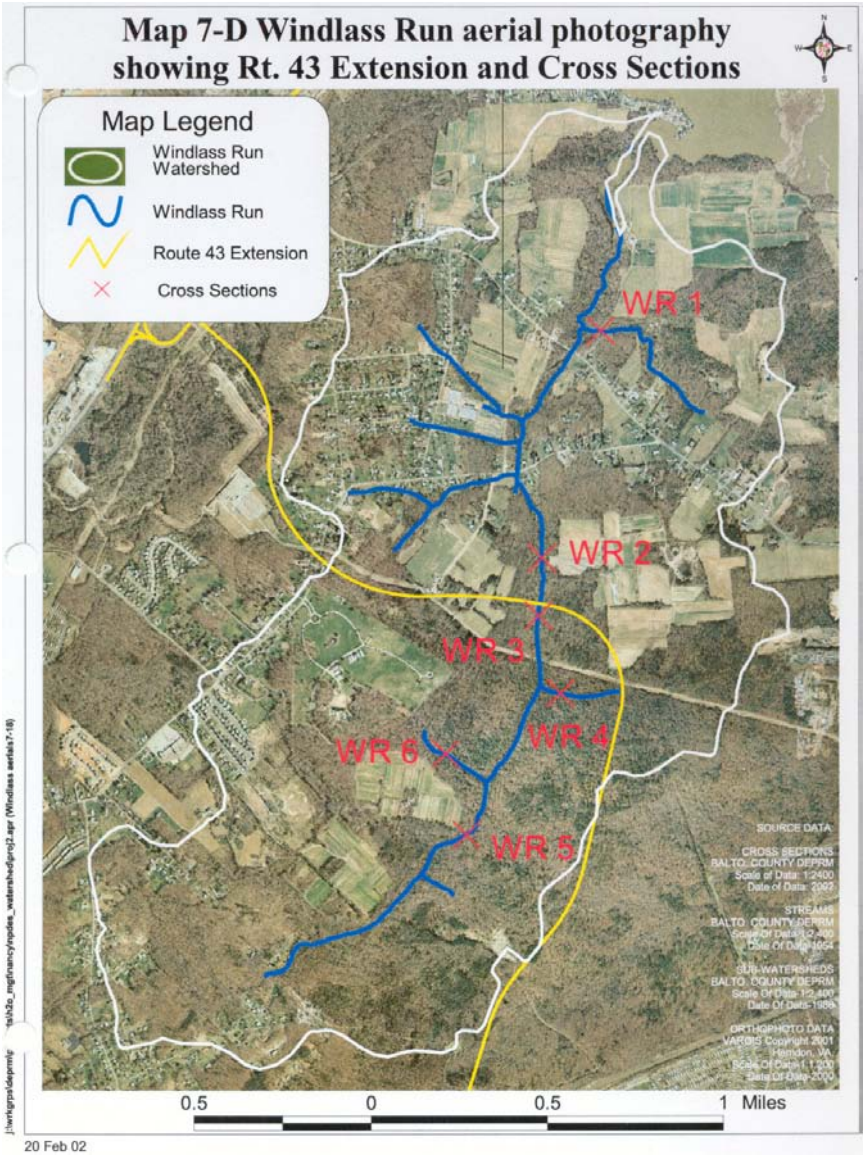


Figure 8-29: Windlass Run Aerial Photograph Showing Monitoring Station Locations.

Windlass Run Monitoring Results:

The cross sections between 2002 and 2008 were overlaid to reveal any morphological changes. The change in the reaches over the two study intervals can be summarized as follows:

Reach 1 (Reference reach on a tributary)

- A scour hole appeared at the cross section in 2003. No further change was observed during that time period.
- The profile deepened overall during both 2007-2008 and 2002-2008.
- The substrate fined slightly during 2007-2008, but coarsened overall between 2002-2008.
- This section shows that approximately 1.5 feet of localized incision (scour hole) occurred in 2003 in the channel bed, however no changes occurred in the banks, the overbank area or the rest of the thalweg profile. There was no apparent causal factor for the scour hole

right at the cross section, however tropical storm Isabel (Fall, 2003) is believed to be the precipitating event. Since 2002 the overall gradient over the longitudinal profile has flattened due to a 0.2 – 0.3 foot decrease in the upstream elevation of the thalweg profile. The only change in 2007 - 2008 was a slight deepening in the overall profile.

Reach 2 (On the mainstem below the Route 43 crossing)

- A slight fill was observed in the cross section's left bank during 2007-2008.
- The thalweg has been active in the profile since 2002 with both aggradation and degradation over time and the thalweg length. It incised overall in 2007 -2008.
- The substrate shows some fining during 2007-2008, but overall coarsening from 2002-2008.
- Note: 2004 was the last year that agricultural operations were underway in the vicinity of Reach 2. During 2004-2006, mass grading has supplanted the agricultural activity. In late 2007, development began in the reach.

Reach 3 (Just above Route 43 crossing)

- A slight channel enlargement occurred between 2002 – 2008, however little change except slight cutting was observed in the cross section during 2007 – 2008. The thalweg degraded overall prior to 2004, and held steady in 2005 – 2006 and 2006 – 2007. The wavelike cut and fill oscillations of about 0.6 ft amplitude within the profile continued in 2008.
- The pebble count indicated a slight coarsening overall, and fining from 2007-2008.

Reach 4 (On a tributary below Route 43)

- Very slight aggradation in 2007-2008 and 2002-2008.
- Degradation in the thalweg over 2002-2008 including slight incision during 2007-2008.
- Coarsening of the substrate during 2002-2008, including coarsening over the past year (2007-2008).

Reach 5 (On mainstem above Route 43)

- The stream channel had a 1-foot planiform shift to the left and a slight deepening (0.3 ft) between 2002 – 2008, with some of this occurring during 2004. It continued to be stable in 2007-2008.
- The profile degraded in the upper end with aggradation in the middle portion during 2002-2008. Slight overall degradation occurred during 2005 - 2008.
- Coarsening occurred in Reach 5 over 2002-2008, with slight fining in 2007-2008.

Reach 6 (On a tributary unaffected by Route 43)

- The cross section filled in by 0.7 ft during 2007-2008. This was responsible for overall aggradation between 2002 - 2008.
- The thalweg incised overall from 2004 – 2007, including some additional degradation during 2005 –2007,however the lower portion of the channel diverted to the left due to sediment accumulations impinging at the diversion point during 2006-2007. No data prior to 2004 was collected.

- A marked coarsening of channel material, with the occurrence of many particles in the 0.1 – 0.5 mm grain size, occurred by the Spring of 2005, but by Spring 2006 the substrate had returned back to its finer original state. A re-coarsening occurred by 2007, followed by fining in 2008. Overall, substrates have coarsened in 2002-2008.

The results discussed above are displayed in Figure 8-30 and Tables 8-14 and 8-15.

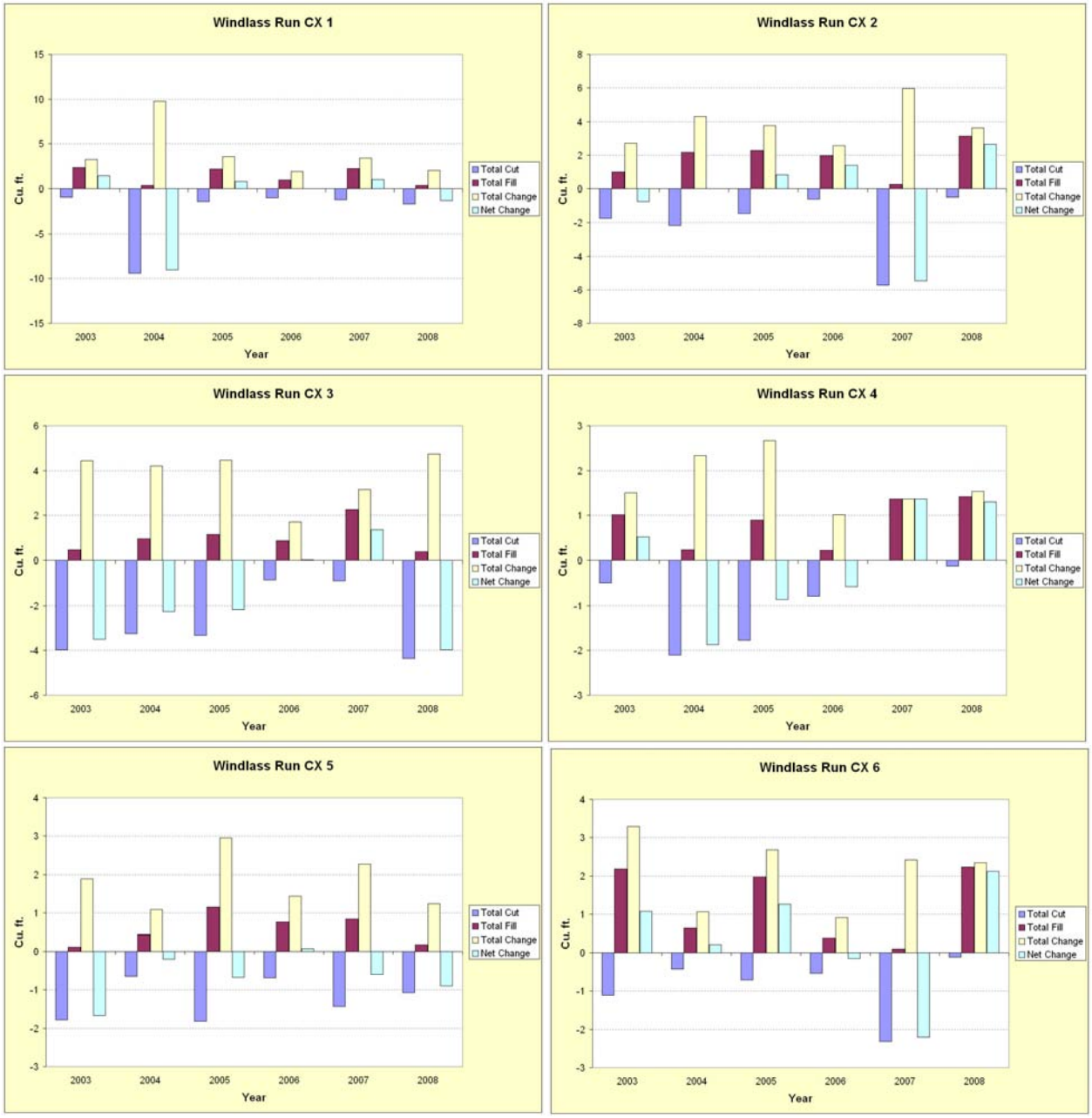


Figure 8-30: Summary of cross-sectional changes in Windlass Run during entire study period.

Table 8-14: Windlass Run Cross Sections - Cut and Fill Amounts

WR 1: Change (cu ft)	Period: 2007 – 2008	Period 2002 – 2008
Total Cut (negative value)	-2.1	-1.3
Total Fill	0.5	0.6
Total Change	2.6	1.9
Net Change	-1.6	-0.7
WR 2: Change (cu ft)	**Period: 2007 – 2008**	**Period 2002 – 2008**
Total Cut (negative value)	-0.7	0.0
Total Fill	4.4	1.4
Total Change	5.1	1.4
Net Change	3.7	1.4
WR 3: Change (cu ft)	**Period: 2007 – 2008**	**Period 2002 – 2008**
Total Cut (negative value)	-5.9	-1.2
Total Fill	0.5	0.1
Total Change	6.4	1.3
Net Change	-5.4	-1.1
WR 4: Change (cu ft)	**Period: 2007 – 2008**	**Period 2002 – 2008**
Total Cut (negative value)	-0.2	0.0
Total Fill	1.8	0.2
Total Change	2.0	0.2
Net Change	1.6	0.2
WR 5: Change (cu ft)	**Period: 2007 – 2008**	**Period 2002 – 2008**
Total Cut (negative value)	-1.5	-0.4
Total Fill	0.2	0.4
Total Change	1.8	0.8
Net Change	-1.3	0.0
WR 6: Change (cu ft)	**Period: 2007 – 2008**	**Period 2002 – 2008**
Total Cut (negative value)	-0.2	0.0
Total Fill	3.2	0.7
Total Change	3.4	0.7
Net Change	3.0	0.7

Table 8-15: Windlass Run Stream Channel Changes Over Time

WR #	Down slope Of Rt. 43	*CX 02-08*	*CX 07-08*	*TW 02-08*	*TW 07-08*	*Pebble 02-08*	*Pebble 07-08*
2	yes	*sa*	*a*	*a*	*d*	*sc*	*f*
3	yes	*sd*	*d*	*d*	*d*	*c*	*f*
4	yes	*sa*	*sa*	*d*	*d*	*c*	*sc*
5	no	*0*	*sd*	*d*	*a*	*c*	*sf*
1	no	*sd*	*sd*	*d*	*d*	*c*	*sf*
6	no	*sa*	*a*	*a*	*a*	*sc*	*f*

Symbols: a: aggradation, d: degradation, c: coarsening, fining, p: planiform change, s:slight, m:moderate

The Windlass Run stream channels are generally low gradient and well connected with their flood plains at bankfull flows. They also have good riparian vegetational coverage along their banks. The stream system is almost entirely within a well-forested setting providing good habitat, erosional resistance, and canopy coverage. Windlass Run presently appears to be in a near pristine condition except the tributary at CX 6 that is being impacted by sediment due to off

road RV usage that churns up a large amount of mud just upstream. Some visual evidence of increased hydrology was observed at CX4, however it could be due to rainfall patterns during the past year. Windlass Run emerged from a record rainfall year including tropical storm Isabel in 2003 with apparently little change in morphology or habitat quality. The major part of construction of the Highway 43 extension occurred in the watershed during 2004, however no significant change that could be attributed to this impact was noted. Cross sections #2, #3, and #4 are the locations that are downstream or down slope of this construction. Construction of several business parks and other industries began in 2007. The several years of completed pre-development monitoring may now be used as the baseline condition to detect any important changes due to development in the subwatershed.

8.4.2 Biological Monitoring

Benthic macroinvertebrate data is being used to approximate the degree of disturbance in the Windlass Run watershed. The changes in the benthic macroinvertebrate community between pre- and post-construction will help assess the effectiveness of the new stormwater regulations and document the impact of the extension of Route 43 and the subsequent development of the Windlass Run watershed.

Benthic macroinvertebrate sampling was conducted as per MBSS protocols. Benthic macroinvertebrates were sampled annually, during the spring index period (March 1st - April 30$^{th)}$, at WR-1, WR-2, WR-3, WR-4, and WR-5, as shown in Figure 8-10. WR-1 was not sampled in 2004 and 2006 because a beaver dam downstream of the station, on the Windlass Run mainstem, was causing backwater effects within the station reach. Data for WR-1 from 2005 are missing because the sorted sample had dried before it could be identified. A Benthic Index of Biotic Integrity (BIBI) was calculated using metrics developed by MBSS for Coastal Plain streams. The BIBI scoring criteria are: 1.00-1.99 (Very Poor), 2.00-2.99 (Poor), 3.00-3.99 (Fair), and 4.00-5.00 (Good). Stream physical habitat was assessed when macroinvertebrates were collected. Three different protocols were used for the habitat assessments. In 2002, the Save Our Streams protocol was followed. In 2003, a modified Environmental Protection Agency Rapid Bioassessment protocol was used. Since 2004, MBSS protocols have been followed. The protocols changed as DEPRM's biological assessment program developed and expanded. All protocols measured similar components of stream physical habitat, including fish habitat quality, macroinvertebrate habitat quality, stream depth and velocity diversity, riffle quality, pool quality, the percentage of sediment surrounding stream bottom substrates, and the percentage of shading in the stream reach. Each parameter is estimated on a scale of 0-20.
The BIBI scores are shown in Figure 8-31.

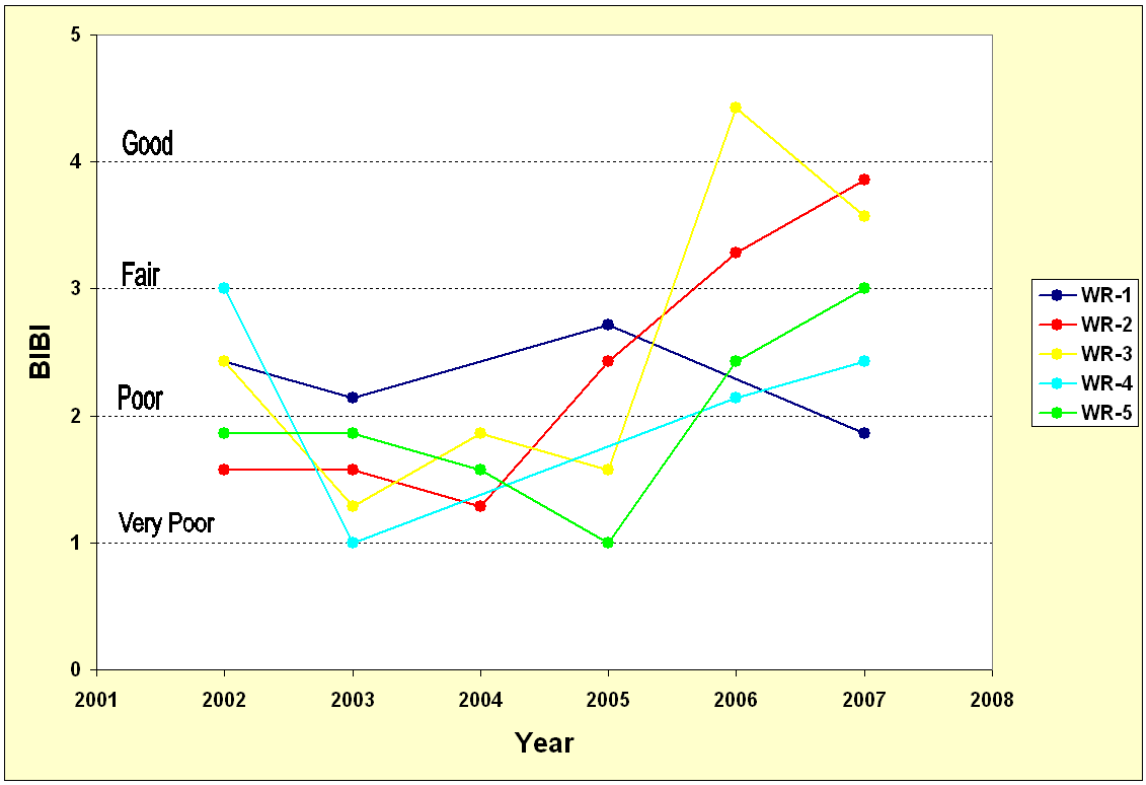


Figure 8-31: Windlass Run BIBI Scores

Biological condition scores in 2007 remained relatively consistent with scores from 2006, although WR-1 and WR-3 each decreased by one category. The remaining stations increased in condition within their respective categories. These new data suggest natural, year-to-year variation, rather than response to the construction of Route 43, as WR-2 (the station immediately downstream of Route 43) showed improvement, while WR-3 (upstream of Route 43) showed degradation. Physical habitat condition continued its slight, steady decrease in 2007 (Figure 8-32). Habitat scores for 2004-2007 were standardized using the method for Scotts Level Branch and Powder Mill Run (Section 8.3.4). Dividing the sum of Attachment Sites for Macroinvertebrates, Shelter for Fish, Channel Alteration, Sediment Deposition, Bank Vegetative Protection, Condition of Banks, and Riparian Vegetative Zone, by 140, and multiplying by 100 standardized habitat scores for 2002. Dividing the sum of Epifaunal Substrate, Pool Substrate, Pool Variability, Sediment Deposition, Channel Flow Status, Channel Alteration, Bank Stability, Vegetative Protection, and Riparian Vegetative Zone Width, by 200, and multiplying by 100 standardized habitat scores for 2003. The slightly decreasing physical habitat condition may reflect the farming land use, or it may be an artifact of the changes in assessment protocols. As with the geomorphological data, future sampling will determine whether any changes due to development occur in the Windlass Run watershed.

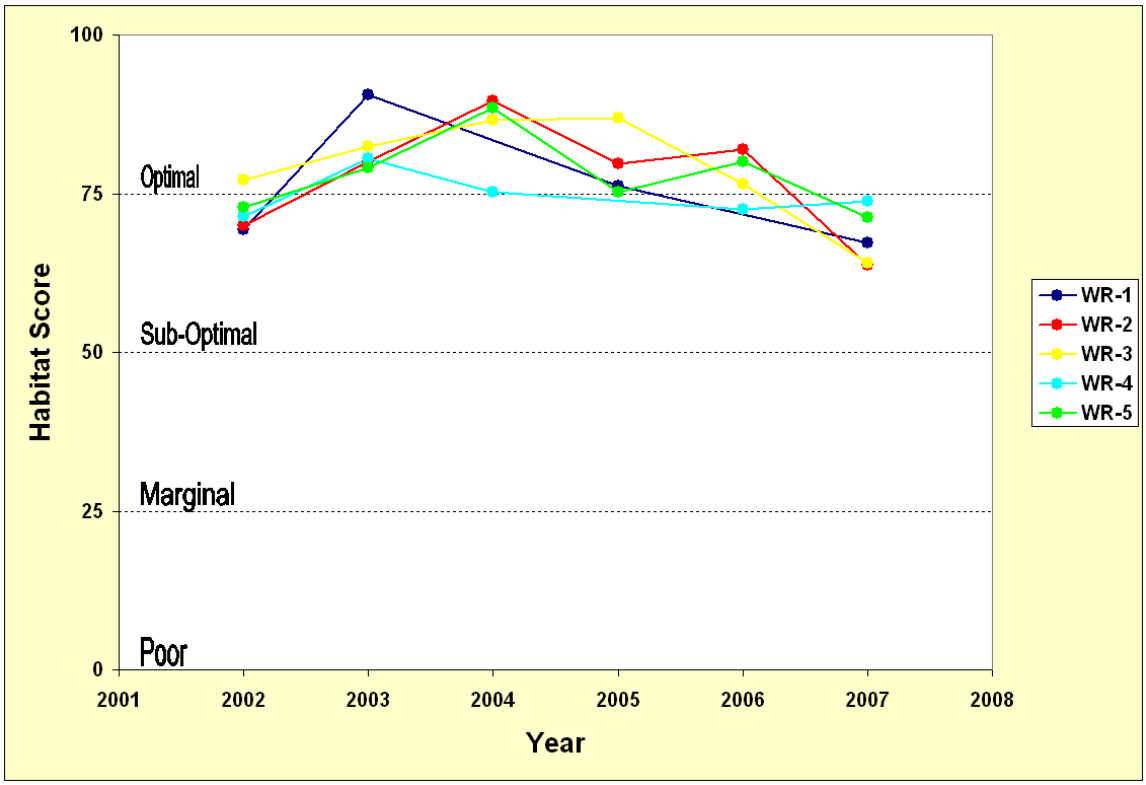


Figure 8-32: Windlass Run Physical Habitat Scores

9.0 Permit Requirements

F. Watershed Assessment and Planning

Baltimore County shall continue to update and revise watershed assessments that have been developed for its 10 urban watersheds (Baltimore Harbor, Bird River, Back River, Gwynns Falls, Jones Falls, Little Gunpowder, Loch Raven, Lower Gunpowder River, Middle River, and the Patapsco River). The overall goal is to ensure that each County watershed is thoroughly evaluated and has an action plan to maximize water quality improvements. Additionally, the County shall encourage the public to participate in the development and implementation of watershed restoration activities. At a minimum, the County shall:

1. Continue to perform and update detailed assessments in all of its urban watersheds. These watershed assessments shall include:
    a. Determining current water quality conditions;
    b. Identifying and ranking water quality problems;
    c. Identifying all structural and non-structural water quality improvements opportunities;
    d. Reporting the results of a visual watershed inspection;
    e. Specifying how the restoration efforts will be monitored; and
    f. Providing an estimated cost and a detailed implementation schedule for those improvement opportunities identified above.

H. Assessment of Controls

Assessment of controls is critical for determining the effectiveness of the NPDES stormwater management program and progress toward improving water quality. Therefore, Baltimore County shall use chemical, biological, and physical monitoring to document work toward meeting the watershed restoration goals identified above.

9.1 Introduction

In order to meet the permit requirements detailed in section F (1. a-e) and section H, Baltimore County has initiated chemical, biological, and geomorphological monitoring programs in addition to the specific monitoring required by the permit and detailed in Section 8. The chemical monitoring program (9.2) consists of two elements, stream baseflow monitoring and tidal water monitoring. A third element consisting of storm event monitoring at USGS gage sites has been sporadic and will not be included in this report. The stream geomorphological monitoring program (9.3) includes monitoring of stream restoration projects and conducting stream assessments in support of the Small Watershed Action Plan preparation. The biological monitoring program (9.4) has four elements including probabilistic monitoring, CIP monitoring, reference site monitoring, and submerged aquatic vegetation monitoring.

9.2 Chemical Monitoring Program

In order to determine the chemical condition of Baltimore County waters, two chemical monitoring programs have been implemented. The chemical monitoring program is intended to provide information on ambient chemical conditions and, over time, to assess trends in both chemical concentrations and chemical loads. The information will be used to better target restoration activities, to provide data for the calibration of pollutant load models, and to provide local data to assess the results of the Chesapeake Bay Program modeling efforts and TMDL modeling. The data will be used to assess water quality improvements that are the result of restoration efforts. It will also be used to determine progress in meeting the pollutant load reductions required by the Chesapeake Bay restoration efforts and as determined by the development of Total Maximum Daily Loads (TMDLs). These programs will partially fulfill the restoration effectiveness monitoring required under NPDES Permit section F.1 and H above.

The two current, chemically oriented programs, the Baseflow Monitoring Program and the Tidal Waters Monitoring Program are described in Sections 9.2.1 and 9.2.2, respectively.

9.2.1 Baseflow Monitoring

A baseflow monitoring program was initiated in 1999. The initial effort was targeted at watersheds that were undergoing or about to undergo the preparation of a Water Quality Management plan. The targeted watersheds included the Lower Gunpowder, the Little Gunpowder, the Middle River and the Baltimore Harbor watersheds. The limited data was used in the calibration of the SWMM pollutant load models that were included in the Water Quality Management plans. In the fall of 2000, the baseflow monitoring was shifted to the Back River, Jones Falls and Gwynns Falls watersheds. The shift was intended to address the lack of chemical monitoring information available for these watersheds. These watersheds were monitored until the spring of 2001. The data collected was presented in the NPDES – 2001 Annual Report. Staffing levels curtailed the continuance of the baseflow monitoring program until the spring of 2003.

The baseflow monitoring program, which resumed in 2003 was also redesigned. Baseflows are monitored in the Patapsco/Back River Basin in odd-numbered years, while the Gunpowder Basin/Deer Creek are monitored in the even-numbered years. In 2007, because of staff time constraints, we created Tier 1 and Tier 2 sites. The Tier 1 sites are our regular sampling sites. Tier 2 are sites that were removed from sampling, but will be picked back up if we have a Small Watershed Action Plan (SWAP) or other project in that area. There are 31 Tier 1 and 9 Tier 2 sites in the Patapsco Back River Basin. Four of the Tier 2 sites were sampled because of our SWAP in the Upper Back River and Lower Jones Falls. Tier 1 and Tier 2 sites have not yet incorporated into the Gunpowder Basin/Deer Creek. There are 63 sampling sites in the Gunpowder Basin/Deer Creek. The points were chosen to maximize the number of subwatersheds monitored. The monitoring points within the Patapsco/Back River Basin are displayed in Figure 9-1, while the Gunpowder Basin/Deer Creek monitoring points are displayed in Figure 9-2. Appendix 9-1, at the end of this section, displays the watersheds and subwatersheds associated with each monitoring point.

The target number of baseflow samples is eight samples per year at each site. The actual number sampled will vary depending on weather conditions, staffing and other duties. The standard set of monitored pollutants includes (TSS, TS, TKN, Nitrate/Nitrite, Total Phosphorus, Ortho-phosphorus, Cadmium, Copper, Lead, Zinc, BOD, COD, Chlorides, Sodium, Hardness,

Magnesium and Calcium) as well as temperature and pH determined in *situ*. Discharge measurements are taken during each sample collection. A minimum of three days of dry weather is required prior to monitoring any baseflow site.

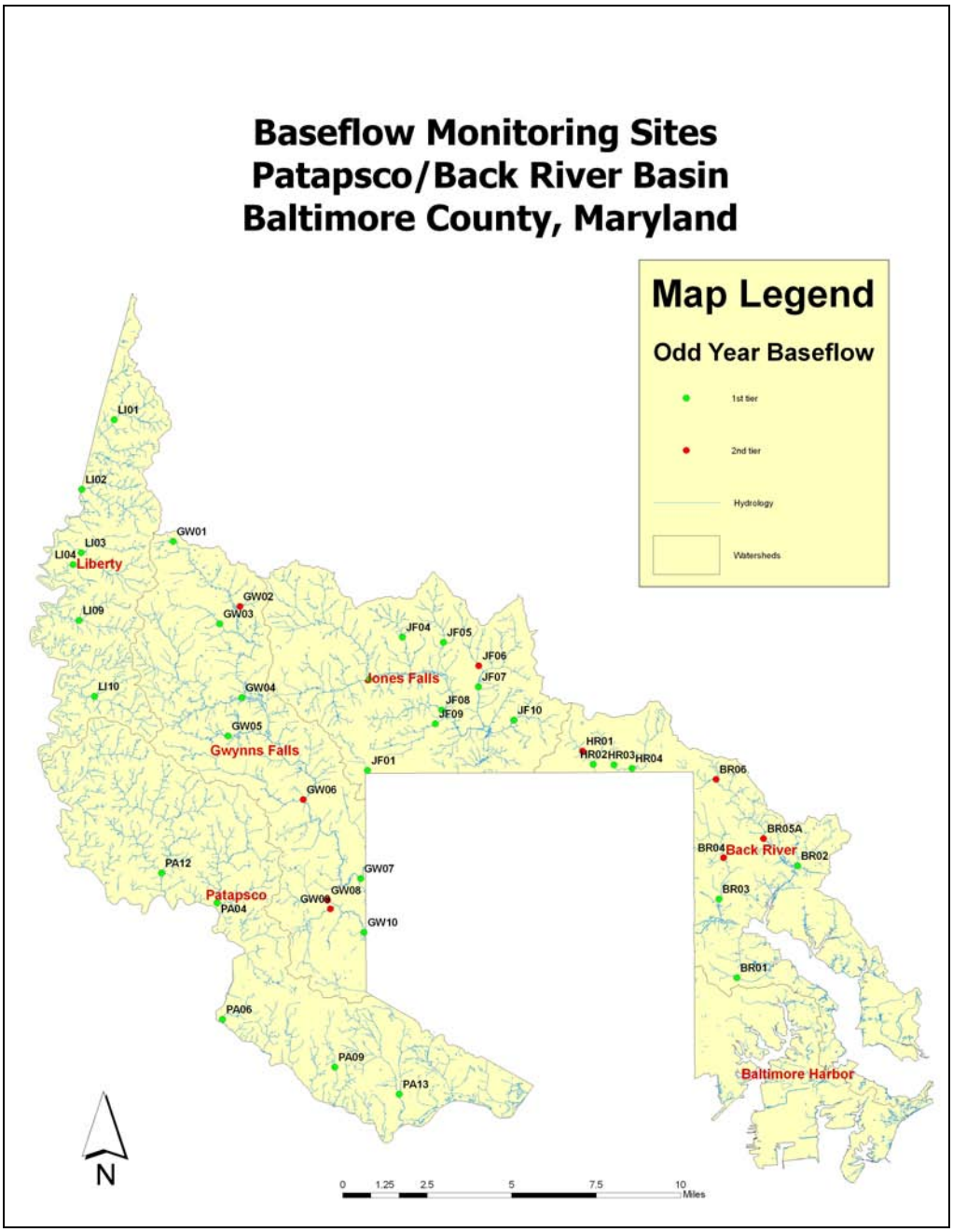


Figure 9-1: Patapsco/Back River Basin – Baseflow Monitoring Sites

The design will allow determination of ambient water quality for major portions of each watershed. The two-year sampling cycle will allow an analysis of baseflow water quality trends for the pollutant parameters analyzed.

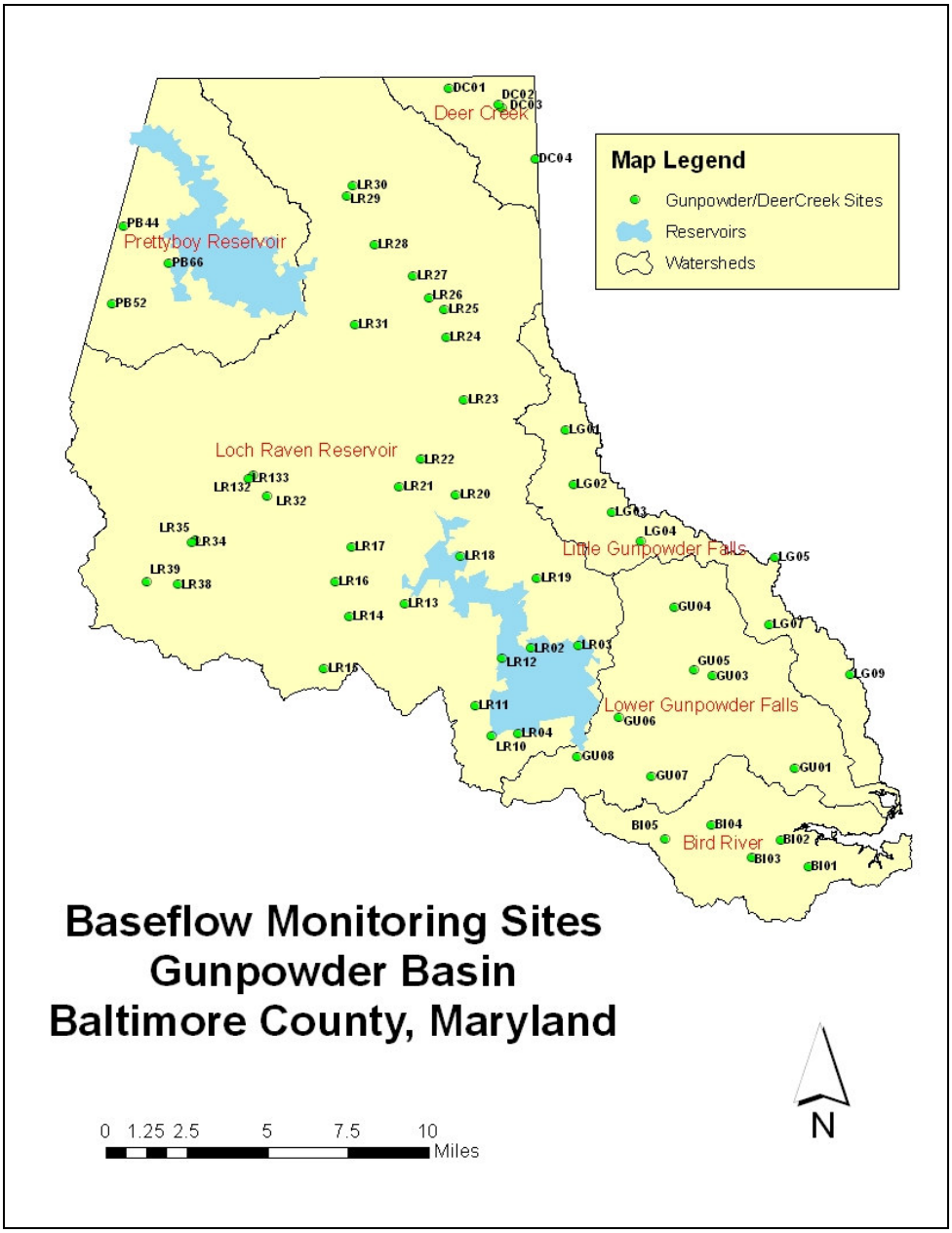


Figure 9-2: Gunpowder Basin/Deer Creek – Baseflow Monitoring Sites **PB26, PB28, PB33, PB43, and PB54 not shown on map. They were part of the Prettyboy Reservoir Watershed Restoration Strategy project and located outside the county.

A total of 148 baseflow samples were collected in the Patapsco/Back River Basin in 2007. The number of samples per site varied from one to three, with the majority of being done three times. In addition to the baseflow samples, 30 field blanks and 30 duplicate samples were collected; these are excluded from calculations and are only for quality control purposes. The mean, number of samples and the standard deviation for each site are presented at the end of this section in Appendix 9-2 for each parameter analyzed.

A frequency analysis was conducted on the metals data to determine exceedance of water quality criteria. All statistical analyses were conducted using Statistica (Ver. 6.1). Figure 9-3 displays the frequency distribution for both total copper and dissolved copper. Maryland Department of the Environment water quality criteria was used. The water quality criteria are based on dissolved metals and the toxicity is influenced by hardness. The total copper samples exceeded the chronic criteria for aquatic life for 100.0% and exceeded the acute criteria for 18.3% of the samples. For dissolved copper, 3.5% of the samples exceeded the chronic standard and .7% exceeded the acute criteria. The sample results for zinc indicated it did not exceed the water quality standards in baseflow samples. Cadmium exceeded the chronic standard (.00025 mg/L) once for total metals at a concentration of .016 mg/L and once for the dissolved metals at a concentration of .003 mg/L. Lead exceeded the chronic standard (.0025 mg/L) once for total metals at a concentration of .003 mg/L.

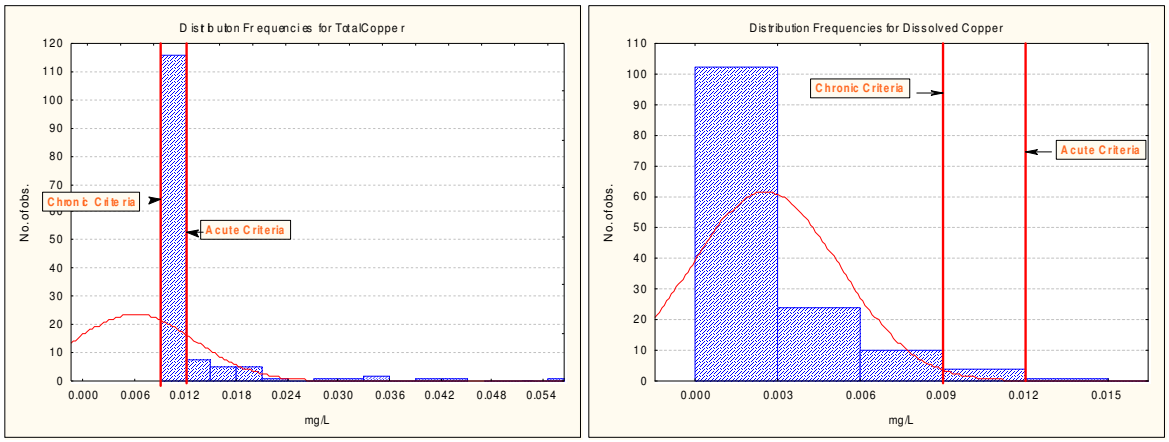


Figure 9-3: Frequency distributions by concentration for Total Copper and Dissolved Copper for the 2007 Patapsco/Back River Basin samples.

The baseflow data collected in 2007 were analyzed for differences in concentration for each pollutant between the six watersheds sampled. ANOVA and Duncan's Multiple Range tests were used to examine relationships among the watersheds. The results are displayed in Table 9-1. The results of the Duncan's Multiple Range Test are displayed with the watersheds having the highest concentrations to the left and progressing in order to the lowest concentrations on the right. The watersheds joined by the same line are not significantly different.

Table 9-1: Baseflow Pollutant ANOVA and Duncan's Multiple Range Test Results

Pollutant Parameter	df Effect	Df Error	F	P
pH	4	142	1.18	NS
TSS	4	142	0.77	NS
TS	4	143	8.12	<.001
TKN	4	133	.36	NS
Nitrate/Nitrite	4	136	5.05	<.001
TP	4	133	1.26	NS
OP	4	136	0.96	NS
Cadmium	4	137	0.43	NS
Dissolved Cadmium	4	137	0.43	NS
Total Copper	4	137	4.32	<.01
Dissolved Copper	4	137	4.33	<.01
Total Lead	4	137	1.38	NS
Dissolved Lead	4	137	0.77	NS

Pollutant Parameter	df Effect	Df Error	F	P
Zinc	4	137	1.01	NS
Dissolved Zinc	4	137	1.27	NS
BOD	4	143	1.27	NS
COD	4	143	2.54	<.05
Chloride	4	127	8.82	<.001
Hardness	4	133	15.45	<.001
Sodium	4	133	13.94	<.001
Magnesium	4	115	2.98	<.05
Calcium	4	115	16.35	<.001

Duncan's Multiple Range Test

TS	GW BR JF PA LI
Nitrate/Nitrite	LI JF GW BR PA
Total Copper	PA GW LI JF BR
Dissolved Copper	PA GW LI JF BR
Chemical Oxygen Demand (COD)	PA GW BR JF LI
Chloride	BR JF GW PA LI
Sodium	BR JF PA GW LI
Hardness	GW BR JF PA LI
Magnesium	JF GW BR PA LI
Calcium	BR GW JF PA LI

The concentrations of ten parameters were found to differ significantly between watersheds. No single watershed was dominant in highest concentrations; they were fairly spread out among the watersheds. The Patapsco River and Back River watersheds each had the highest concentrations for three parameters; the Patapsco River was the highest for Total and Dissolved Copper and COD and the Back River was highest for Chlorides, Sodium and Calcium. The Gwynns Falls was highest for TS and Hardness. Liberty Reservoir and Jones Falls were each highest for one parameter, NO_2/NO_3 and Magnesium, respectively. Unlike the highest concentrations for the ten parameters, Liberty Reservoir was lowest in concentrations most frequently. Liberty was lowest for seven parameters including TS, COD, Chlorides, Sodium, Hardness, Magnesium, and Calcium. Figure 9-4 displays the results of the Duncan's Multiple Range Test for COD, NO_2/NO_3, Dissolved Copper, and Chlorides. Figure 9-5 displays the results for Dissolved Copper, Nitrate/Nitrite, Chloride, and Total Phosphorus, as these are pollutants of major concern.

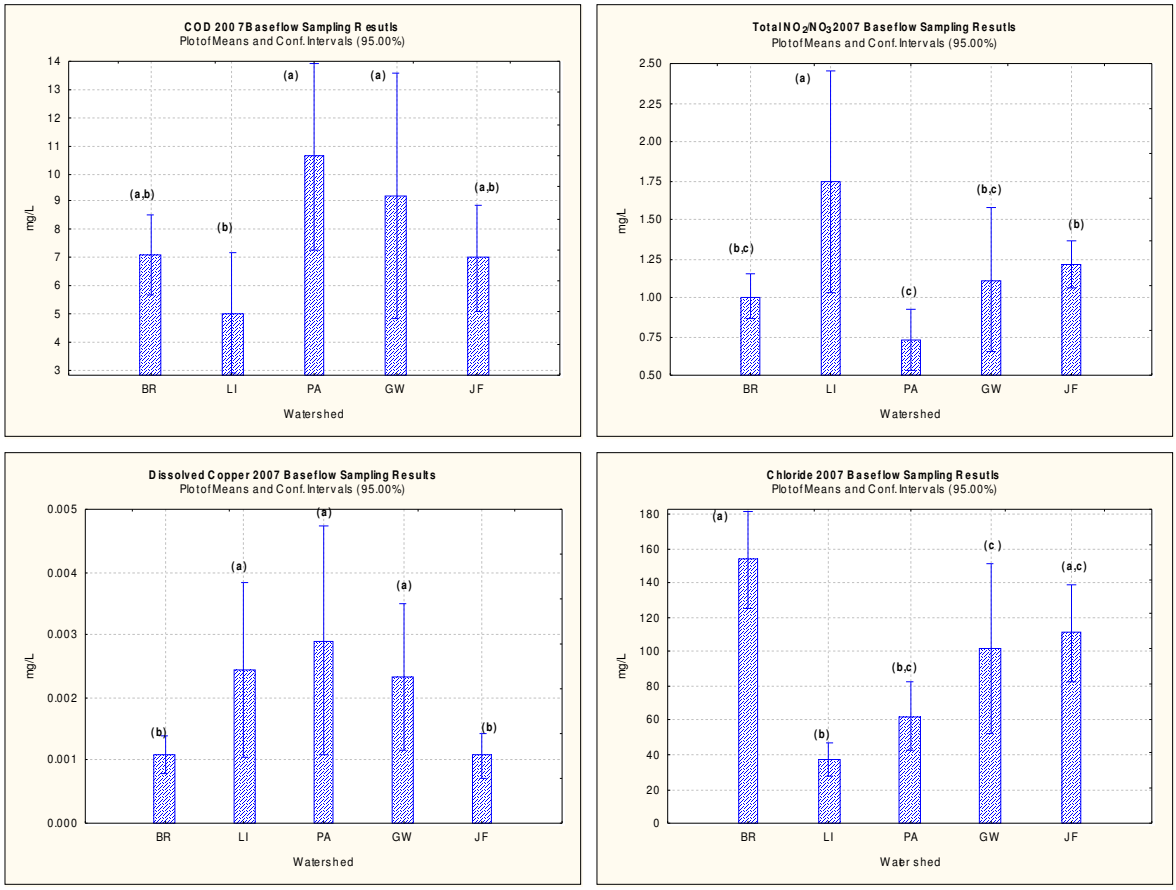
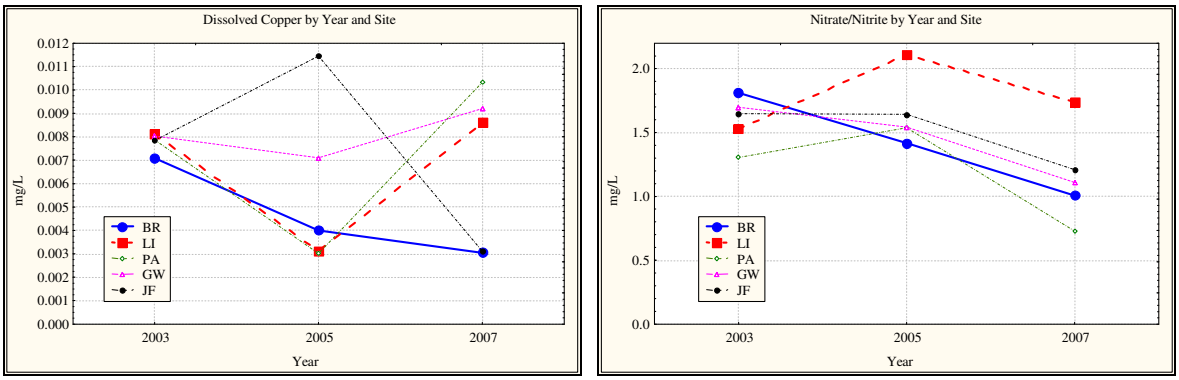


Figure 9-4: Duncan's Multiple Range Test results for COD, NO_2/NO_3, Dissolved Copper, and Chlorides.

Figure 9-5: Baseflow Dissolved Copper, Nitrate/Nitrite, Chloride, and Total Phosphorus for sampling years 2003, 2005, and 2007



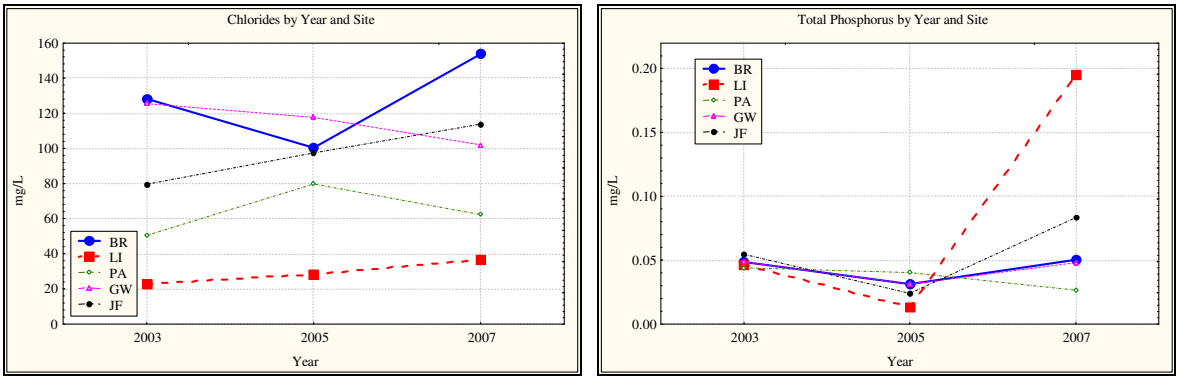


Figure 9-5: Baseflow Dissolved Copper, Nitrate/Nitrite, Chloride, and Total Phosphorus for sampling years 2003, 2005, and 2007 (continued).

Several interesting trends can be seen from the graphs in Figure 9-5.

For dissolved copper:

- Gwynns Fall, Liberty Reservoir, and Patapsco River all fell in 2005 and rose again 2007, while Back River continues its declining trend.
- Jones Falls rose in 2005, but fell dramatically in 2007 from .01 mg/L to .0003 mg/L.

For nitrate/nitrite:

- Patapsco River had the most dramatic change between 2005 and 2007, falling from 1.54 mg/L to 0.73 mg/L.
- Liberty Reservoir declined during this period as well.
- The Jones Falls, Gwynns Falls and Back River continue their declining trend.

For chlorides:

- The Jones Falls and Liberty Reservoir have been increasing since 2003.
- Back River had the most dramatic increase from 100.34 mg/L to 153.73 mg/L.
- Patapsco fell from 2005 to 2007 and Gwynns Falls continues its decline.

For total phosphorus:

- Jones Falls, Back River, and Gwynns Falls all fell from 2005 to 2007.
- Liberty Reservoir followed a similar trend, rising from .013 mg/L to .19 mg/L.

Two map displays showing the Nitrate/Nitrite and Total Phosphorus mean concentrations are shown in Figures 9-6 and 9-7 on the following two pages. As can be seen from Figure 9-6, the highest concentrations of Nitrate/Nitrite predominate in the agricultural portions of the County. These increased Nitrate/Nitrite concentrations may be the result of agricultural activities, septic system inputs, or a combination of both. Several of the urban areas, scattered in the various watersheds, show elevated Nitrate/Nitrite concentrations.

The distribution of Total Phosphorus concentrations conversely shows elevated to very high concentrations predominately in the urban areas, with several notable exceptions, including Liberty Reservoir, a rural Lower Gunpowder site, and one site in Deer Creek. The majority of

Total Phosphorus is delivered during storm events, associated with sediment. Thus the concentrations measured in baseflow sampling are much lower than during storm event sampling. The elevated concentrations in the urban areas are likely the result of increases in orthophosphate, which occurs in a dissolved form. The source is currently not known, but may be associated with sewage and various industrial processes. The elevated and very high concentrations in rural areas may be associated with animal operations where livestock have access to the stream.

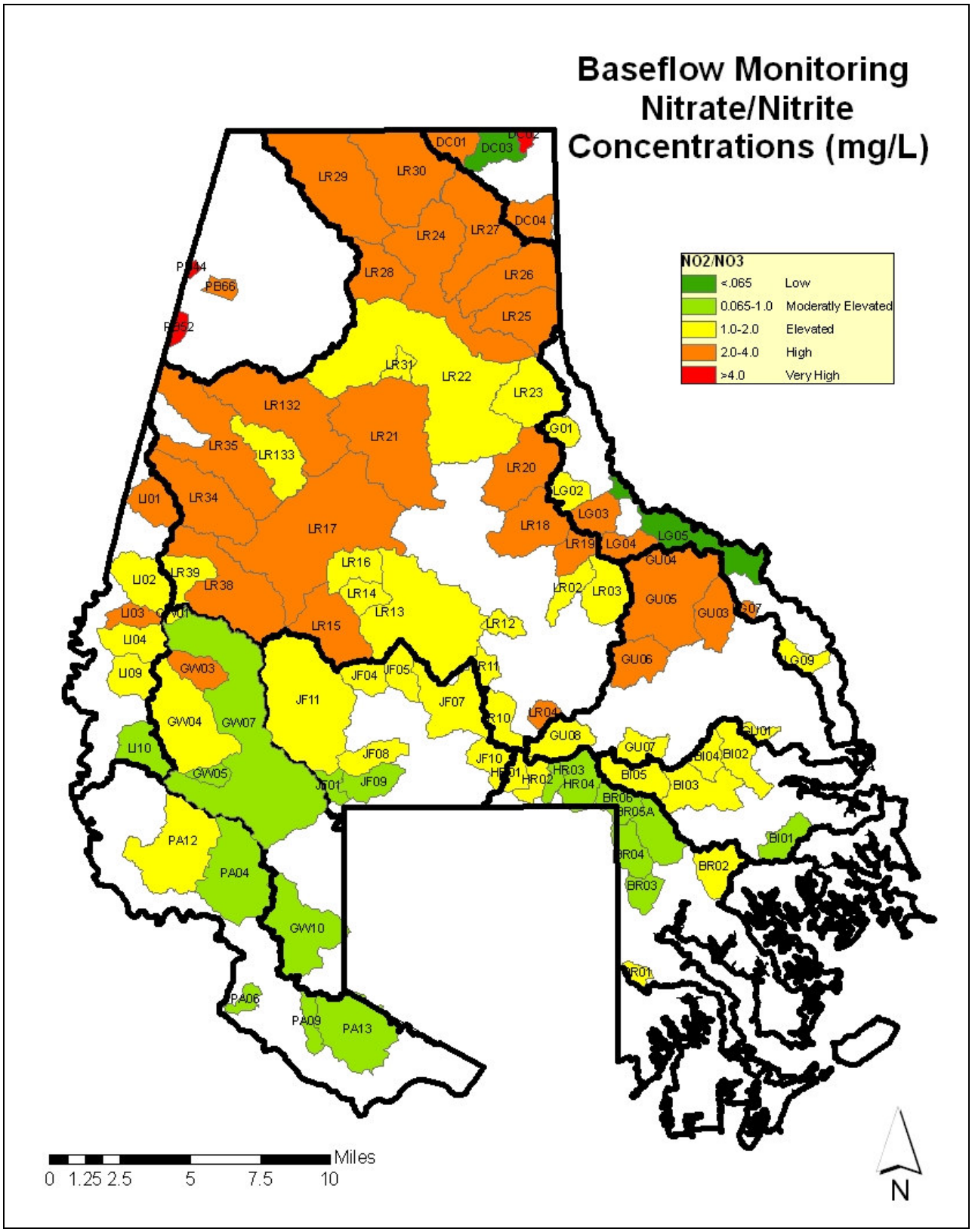


Figure 9-6: Baseflow Nitrate/Nitrite mean concentrations for monitoring years 2007 (Patapsco/Back River Basin) and 2006 (Gunpowder Basin). **PB26, PB28, PB33, PB43, and PB54 not shown on map. They were part of the Prettyboy Reservoir Watershed Restoration Strategy project and located outside the county.

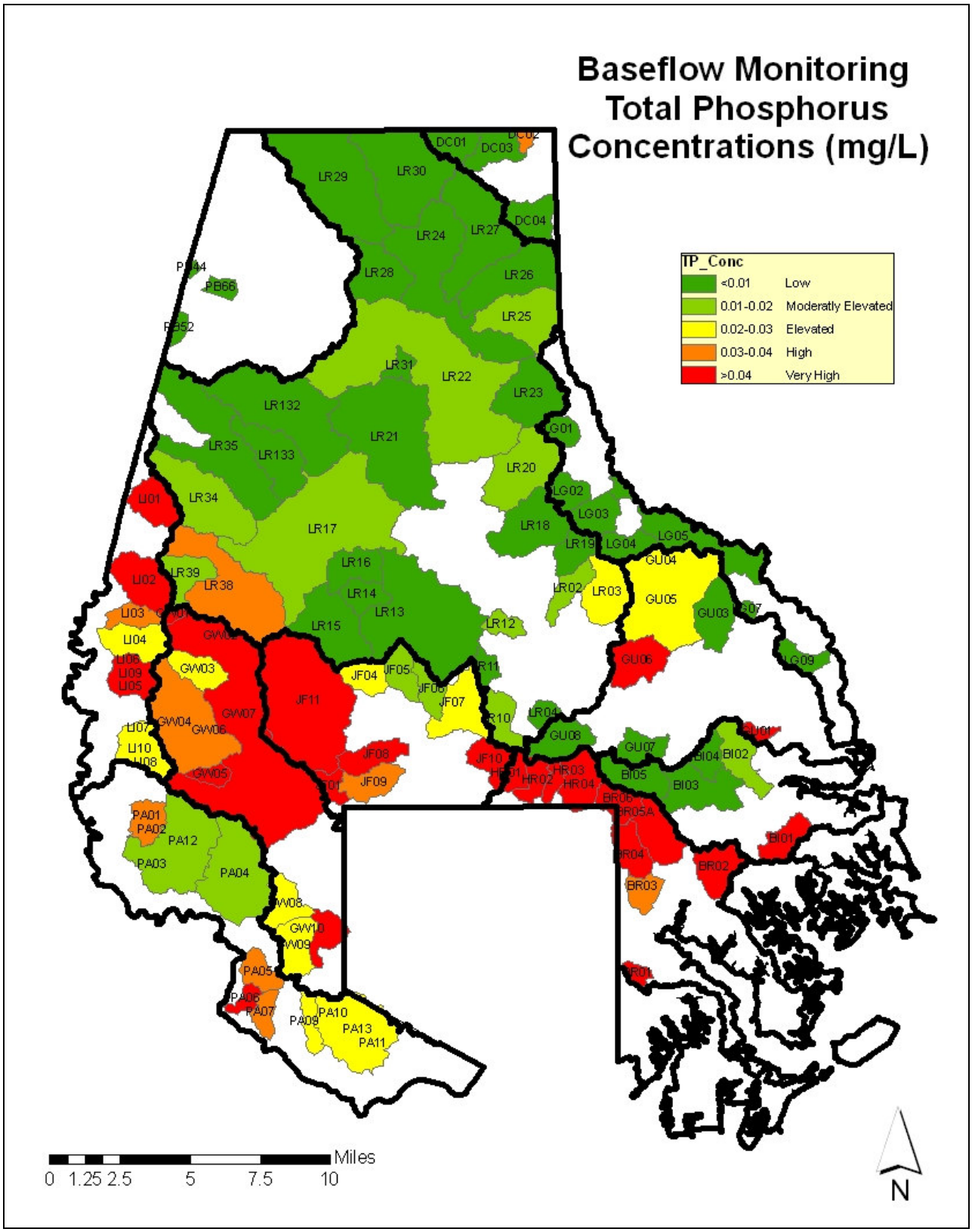


Figure 9-7: Baseflow Total Phosphorus mean concentrations for monitoring years 2007 (Patapsco/Back River Basin) and 2006 (Gunpowder Basin). **PB26, PB28, PB33, PB43, and PB54 not shown on map. They were part of the Prettyboy Reservoir Watershed Restoration Strategy project and located outside the county.

9.2.2 Tidal Waters Monitoring Program

Baltimore County has had a tidal recreational water-monitoring program since 1970. Early bacteriological sampling was conducted on a monthly basis between, Labor Day and Memorial Day, for fecal coliform. Since 2000, and the advent of the US EPA Beach Act, tidal water sampling has been conducted bi-weekly by boat for the indicator organism Enterococci. The sampling season has been extended to cover the period of April through November (weather permitting). Multiple bacteriological samples are taken in 10 zones representing areas of heavy recreational use with 4 single grab samples taken in less utilized areas. In addition, beach sampling also utilizing Enterococci is conducted at 3 permitted beach locations, on a basis alternate to recreational water sampling.

Individual sample results are recorded as well as the Geometric Mean of multiple sample zones. A value of 35 MPN (geomean) Enterococci is required to be utilized as a threshold for public safety and water contact only in association with a known or suspected sewage overflow. 35 MPN is otherwise used for comparison purposes to make general characterizations of open water.

Special sampling is also conducted to support environmental/public health evaluations after severe storm events or sanitary sewage overflows.

Starting in 2002, chemical sampling of surface waters was initiated at 7 locations designed to represent major county tidal basins. This sampling takes place during the recreational water-sampling run and has recently been expanded to ten locations. The codes for those locations as noted on the " Beach, Beach Area, And Recreational Water Sampling Locations" map and the tidal water basins they represent are found on Table 9-2.

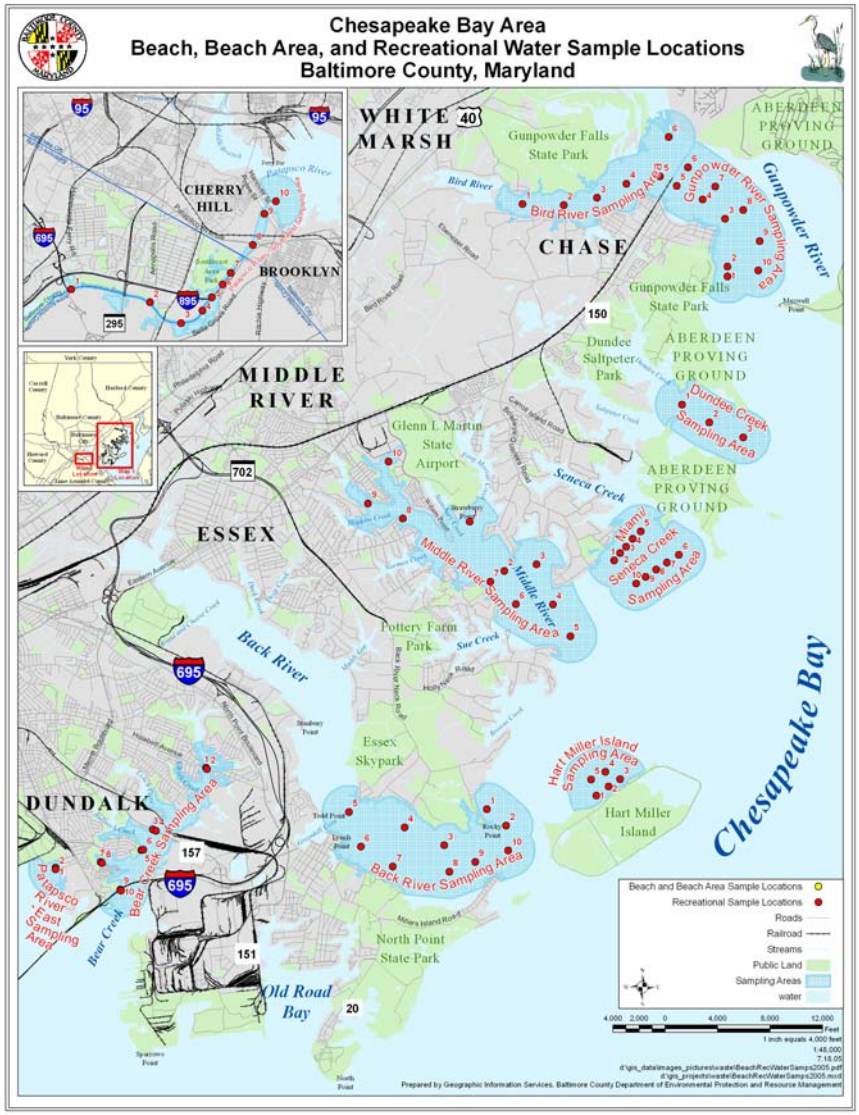


Figure 9-8: Tidal Waters Monitoring Site Locations.

Table 9-2: Site Codes and the Associated Tidal Water body

Code	Water Body
BC	Bear Creek
PR	Patapsco River - Outer
GR	Gunpowder River
MS	Miami Beach/Seneca Creek
MR	Middle River
BR	Back River
HM	Hart Miller Island
BD	Bird River
PS-F	Patapsco River – Fresh Water
PS-E	Patapsco River – Estuarine

All ten stations were monitored between fourteen and eighteen times during the time period of April 2007 through November 2007. The same standard set of pollutant parameters detailed in Section 9.1.1, were monitored in the tidal waters, excluding Magnesium, Calcium, pH and

temperature. The data are summarized by site in Appendix 9-3, which presents the means, number of samples and the standard deviation for each pollutant parameter presented.

An analysis of variance (ANOVA) was used for each pollutant to determine if there were significant differences between the ten sites. The results of the ANOVA are displayed in Table 9-3. Analyses were not run on Ortho-phosphorus, Cadmium, and Fluoride because there was no variance in the samples. If a significant difference was found a post hoc Duncan's Multiple Range Test was used to determine which sites were significantly different. The results of the Duncan's Multiple Range Test are presented at the end of Table 9-3. When interpreting the results of the Duncan's Multiple Range Test, the sites are arranged from highest concentration of the parameter to the lowest concentration. The same line joins the sites that are not significantly different.

Table 9-3: ANOVA and Duncan's Multiple Range Test Results

Pollutant Parameter	df Effect	Df Error	F	P
TSS	9	148	3.81	NS
TS	9	148	18.27	<.001
TKN	9	150	12.45	<.001
Nitrate/Nitrite	9	122	1.00	NS
TP	9	150	2.55	<.01
Total Copper	9	150	2.62	<.01
Dissolved Copper	9	150	2.60	<.01
Total Lead	9	150	4.20	<.001
Dissolved Lead	9	150	3.57	<.001
Total Zinc	9	150	1.69	NS
Dissolved Zinc	9	150	1.56	NS
BOD	9	151	7.07	<.001
COD	9	152	2.33	<.05
Chloride	9	141	15.18	<.001
Sulfate	9	140	15.65	<.001

Duncan's Multiple Range Test

Total Solids (TS)	PR BC PS-E HM MS MR BR GR BD PS-F
Total Kjeldahl Nitrogen (TKN)	BR PR PS-E BD BC PS-F MR GR HM MS
Total Phosphorus (TP)	BR BC PR BD PS-E HM GR MR MS PS-F
Total Copper	PR BC MR HM PS-E GR MS BD BR PS-F
Dissolved Copper	PR BC MS MR HM PS-E GR BR BD PS-F
Total Lead	PR BC P-SE MS MR BR HM PS-F BD GR
Dissolved Lead	PR BC MS HM GR MR BR PS-E PS-F BD
Biological Oxygen Demand (BOD)	PR BR BC PS-E BD HM PS-F MR MS GR
Chemical Oxygen Demand (COD)	PR BC BR MS HM PS-E BD MR GR PS-F
Chloride	PR BC PS-E HM MS BR MR GR BD PS-F
Sulfate	PR BC PS-E HM MS BR MR GR BD PS-F

Sampling results for 2007 indicated that eleven of the parameters (TS, TKN, TP, Total Copper, Dissolved Copper, Total Lead, Dissolved Lead, BOD, COD, Chloride, and Sulfate had mean concentrations that differed among sites.

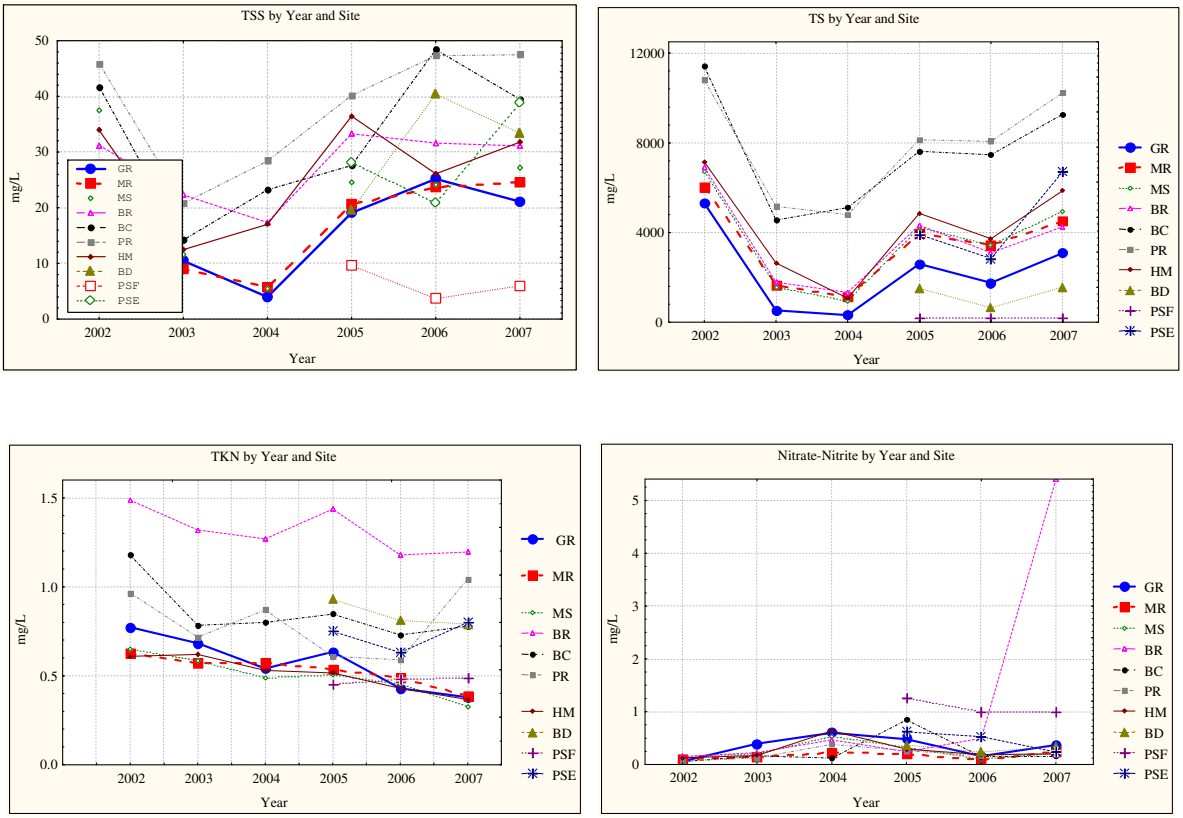
There were few changes in the relative ranking of the sites from highest to lowest between years for the eleven parameters that were found to have a significant difference among sites. Both the TS and chloride parameters for the Patapsco River (PR) and Bear Creek (BC) sites had the highest concentrations. This would indicate that these sites had the highest mean salinity. Back River (BR) along with the Patapsco River-Outer had significantly higher TKN concentrations than the other nine sites. This is probably due to the presence of the Waste Water Treatment Plant (WWTP) in both these areas. BD (Bird River) and BC (Bear Creek) also have relatively high TKN concentrations and were joined by PS-E (Patapsco River – Estuarine), the same as last year. This may also be related to the relatively poorer connection with open bay waters and the presence of algal populations, which would increase the organic nitrogen concentration. BR

(Back River) had the highest concentration and PS-F had the lowest concentration for Total Phosphorus mean concentrations, the same as last year. The presence of the Back River WWTP could account for the elevated concentrations of Total Phosphorus. The Patapsco River (PR) and Bear Creek (BC) sites had the highest and second highest mean concentrations of total and dissolved lead and total and dissolved copper. These sites have significant amounts of industrial activity in the watershed, which may account for the relatively higher metal concentrations.

Patapsco River (PR), Back River (BR), had the highest mean concentrations for biological oxygen demand. These two these sites also had the highest elevated TKN levels. This could indicate that the two sites had a greater algal population than the other sites. This would result in an increase in the biological oxygen demand. The Patapsco River (PR) and Back River (BR) also had the highest concentrations for COD and Sulfate.

A graphical comparison between years for site and select pollutants was conducted. Bird River (BD), PS-F (Patapsco River – Fresh), and PS-E (Patapsco River – Estuarine) have only three years of data. The results are presented in Figure 9-9.

Figure 9-9: Pollutant Between Year Variation by Site



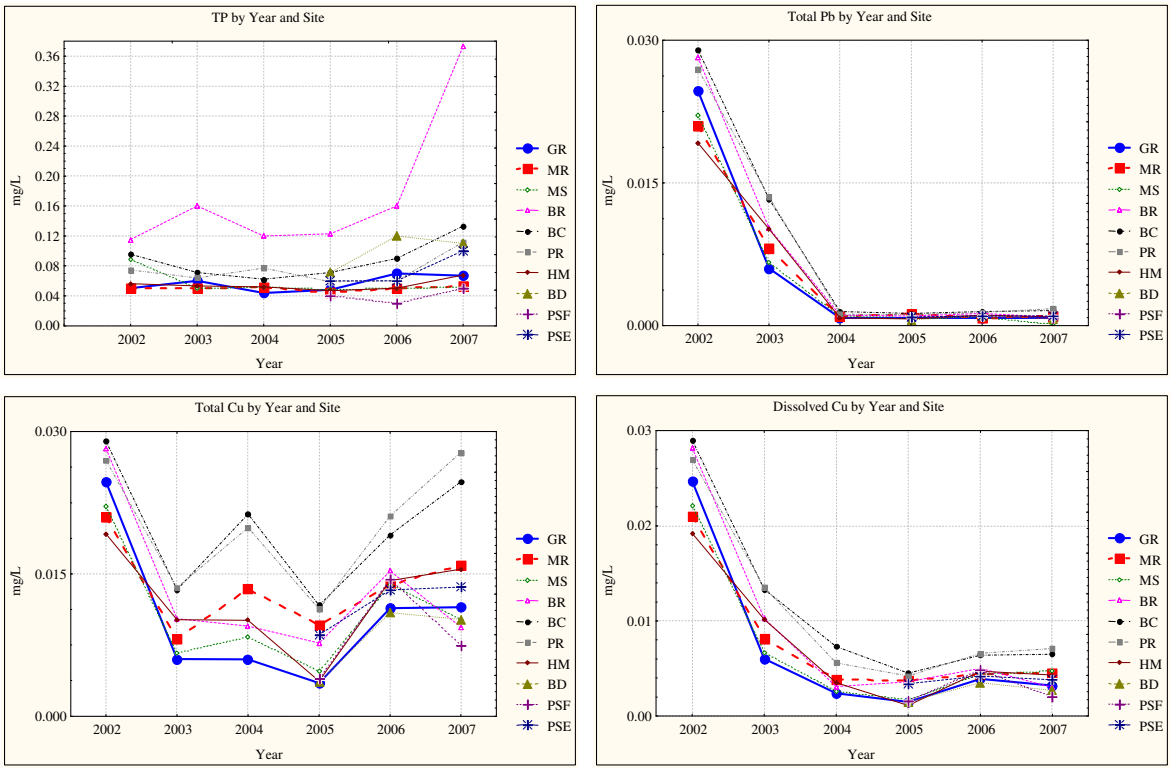


Figure 9-9: Pollutant Between Year Variation by Site (continued).

Several interesting trends can be seen from the graphs in Figure 9-9.

For Total Suspended Solids (TSS):

- All the sites are following the same trend except PSF (Patapsco River- Fresh), which has much lower levels than the other sites.
- A noted decrease in concentrations for all sites can be noted between 2002 and 2003.
- Since 2004, there has generally been an increasing trend.

For Total Solids (TS) and Total Copper:

- The TS reduction between 2002 and 2003 is undoubtedly related to the reduced salinity that resulted from the increased runoff.
- There was an increase in 2005 for all sites.
- From 2006 to 2007 there was again a moderate increase for all sites except PSF.
- Some sites had a slight increase in concentration and some with a slight decrease in 2004 relative to 2003.
- In 2005, all sites exhibited an increase in TSS concentrations while at the same time displaying a decrease in Total Copper concentrations.
- For 2007, both TSS and Total Copper increased, except for Total Copper levels in BR (Back River) and MS (Miami Beach/Seneca Creek).

For Dissolved Copper and Total Lead:

- They both continued to decrease in 2004 and 2005 for all sites.
- For 2007, Dissolved Copper decreased slightly in about half the sites including BD, GR, PSF, and BR while the remaining sites held steady.
- Total Lead held steady in 2006 and 2007.

For Nitrate/Nitrite:

- Concentrations increased in 2004 (with the exception of Bear Creek) relative to the 2003 and 2002 concentrations
- They decreased in 2005 (except for the HM site).
- Concentrations saw a large decrease in 2006, with the exception of Back River (BR), which increased by 48%.
- In 2007, there was a slight increase except in Back River (BR). In Back River (BR) there was a sample taken on May 15 that exhibited the extraordinarily high concentration of 67.24 mg/L. The mean without this outlier goes from 5.40 mg/L to 0.24 mg/L.
- PSF generally has higher concentrations than the other sites.

For Total Kjeldahl Nitrogen (TKN):

- Concentrations continue to decrease or stay about the same, except for PR (Patapsco River) and PSE (Patapsco River – Estuarine), which increased significantly in 2007.

For Total Phosphorus:

- Concentrations have varied little over the years.
- However, there was a slight increase in 2006, which continued in 2007.
- Total Phosphorus in Back River (BR) had one sample taken in August that was much higher (3.16 mg/L) than the other samples, and raised the mean concentration for that area. The mean without this outlier goes from 0.37 mg/L to 0.19 mg/L

9.3 Stream Geomorphological Monitoring

Baltimore County DEPRM performs post-project monitoring of its completed stream restoration projects in accordance with applicable federal and state waterway construction permit requirements. The field monitoring and reports are either done completely in-house or by consulting firms competent in this work. These monitoring activities also provide compliance with the NPDES permit requirement to monitor effectiveness of restoration projects.

9.3.1 Stream Restoration Project Monitoring

The U.S. Army Corps of Engineers authorization for stream restoration activity is generally required pursuant to Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act of 1899. Additionally, projects are normally eligible for authorization by the Maryland State Programmatic General Permit (MDSPGP) as published in the Special Public Notice 96-19 issued in June, 1996. For these projects, the conditions of the (MDSPGP) authorization normally require the development of a monitoring plan that will be used to identify and evaluate changes in the completed stream restoration project and to take remedial measures as necessary in coordination with the regulatory agencies. For each project, specific elements of

the monitoring plan are identified as determined by the regulatory agencies. See Exhibit 5-1 of the 2003 NPDES Report for an example of an authorization document/permit and monitoring criteria. Periodic field monitoring followed by a written report of findings and any proposed remedial measures are submitted to the Army Corps of Engineers, Maryland Section Northern and to the Maryland Department of the Environment (MDE) Non-Tidal Wetland and Waterways Division as called for in the monitoring plans. Monitoring is also utilized to determine if the capital project implementation meets the goals of the project. Further, the DEPRM believes that the post construction monitoring program provides valuable feed-back information that enables it to improve the effectiveness of its future project design and construction approaches.

The post construction monitoring plans require periodic collection of field data – usually annually for 2 to 5 years. Additional monitoring may be required after large storms. In most cases, monumented and surveyed channel cross-sections located at strategic points along the project are required. Occasionally, longitudinal profiles are required or elected to be done by DEPRM. Field data are collected using Standard Operating Procedures for pebble counts, cross sectional surveys, and longitudinal surveys. Data from the cross-sections and longitudinal surveys are entered into a computer program and plotted. For multi-year surveys these plots are overlayed (current over prior year(s)) to detect any changes in morphology that may have occurred between these periods. Bed material characterization via the Wolman pebble count procedure, inspection of the condition of any riparian plantings, visual inspection of the degree of channel erosion or deposition etc., and photographing the channel and banks at key locations are other components that may be included in the monitoring plan and report.

Table 9-4 summarizes the streams and stream restoration projects monitored and/or reported to the regulatory agencies in 2007. Copies of the completed reports submitted and listed in Table 9-4 are on file at the Maryland Department of the Environment (MDE) Non-Tidal Wetland and Waterways Division and at the DEPRM CIP Section where they are available for inspection.

Table 9-4: Summary of Capital Improvements Projects Monitoring Reports Submitted for 2007

Project	Submitted	Responsible Personnel
Hampton Branch Stream Restoration	2007	In-House WMM
Minebank Run II Stream Restoration	2007	GPI
North Fork Stream Restoration	2006	KCI
Stemmers Run at Glenwest Stream Restoration	2007	In-House WMM
White Marsh Run Wetland	2007	Sub KCI
Woodvalley Stream Restoration	2007	In-House WMM

9.3.2 Stream Stability Assessments

DEPRM is utilizing consulting assistance through a multi-year on-call contract to perform planning level stream stability assessments on various streams in Baltimore County. These assessments entail field teams who “cruise”, by walking, assigned stream reaches collecting morphological, riparian, habitat quality, and other data useful in making evaluative assessments of stream condition and evidence of change. Other information will be collected related to infrastructure conflicts, pollution sources, fish blockages, etc. The stream assessments will be in support of the Small Watershed Action Plan (SWAP) process, TMDL’s, and for comparison of baseline conditions and stream management/restoration needs, and for consideration of potential stream restoration projects. Four stream stability assessments have been completed to date: *Hunt Valley Stream Stability Assessment, Prettyboy Reservoir Stream Stability Assessment (Compass Run and Frog Hollow Subwatersheds), Lower Jones Falls Stream Stability Assessment, and*

Upper Back River Stream Stability Assessment. An electronic copy of these reports was submitted with the NPDES 2006 Annual Report. Electronic copies of the Lower Jones Falls and Upper Back River reports are included with this report. These assessments have identified potential restoration projects by category, including:

- Stream restoration/stabilization,
- Buffer enhancement,
- Bank plantings,
- Utility conflict resolution,
- Habitat enhancement,
- Trash cleanup,
- Yard waste cleanup, and
- Invasive species removal.

9.3.3 Geomorphological Monitoring Summary

In summarizing the results of the in-house monitoring completed through 2006 and mid year 2007, it can be stated that the stream restoration projects have been successful in achieving the goals of self-maintaining channel stability, reduction of bed and bank erosion, protection of private and public infrastructure, and habitat improvement. Improvements in aesthetics and public safety aspects have been additional benefits. Most of the problems observed have been localized and minor in scale such as shifting of rock elements in grade control structures, bank scouring at the downstream end of bank protection structures, depositional bar build-up in the vicinity of grade control structures, and channel erosion at intra project segments that were not restored or modified during the overall project. The information gained from the monitoring has enabled DEPRM to improve its stream restoration approaches such as increasing the size of the rock elements in grade control structures subject to high tractive forces, and more closely relating the height of bank protection structures to bank full elevation. The challenges of effective stream improvement in an urban setting are formidable. Through the knowledge and experience gained with its design, construction, and monitoring efforts, DEPRM continues to build upon a successful stream restoration program.

9.4 Biological Monitoring

In addition to the biological monitoring required at Scotts Level Branch under Baltimore County's NPDES permit, the County has four additional biological monitoring programs. These programs use the biological community to assess the ecological health of the streams within the County (Probabilistic Monitoring Program, Section 9.4.1), assess the effectiveness of stream restoration projects (CIP Monitoring Program, Section 9.4.2), provide data on the best streams in Baltimore County to serve as bench marks for other stream assessments (Reference Site Monitoring Program, Section 9.4.3), and assess Submerged Aquatic Vegetation (Submerged Aquatic Vegetation (SAV) Monitoring Program, Section 9.4.4). The first three programs use assessments based on the benthic macroinvertebrate community and, in some cases, the fish assemblage. It is widely accepted that the biological community of streams is sensitive to anthropogenic perturbations. By monitoring the biological community, the County can assess the amount of change due to anthropogenic activities and the benefit of stream restoration to stream organisms. The SAV Monitoring Program provides an assessment of the coverage of SAV and progress made in meeting the new water quality standards for water clarity and SAV coverage in Baltimore County tidal waters.

9.4.1 Probabilistic Monitoring

The County adopted Maryland Biological Stream Survey (MBSS) methodologies in 2003, which has allowed for direct comparisons with State generated data. This has expanded upon the available data for assessing County waters. Probabilistic monitoring (randomly selected monitoring sites) has allowed statistically valid statements regarding the state of the waters. Using the targeted site monitoring design, as was conducted previously by Save Our Streams (SOS), did not allow for statistical analysis or direct data comparability with the State.

The County has contracted a consultant to perform the probabilistic monitoring. Each year a different basin is sampled, with the Patapsco/Back River Basin monitored in odd years and the Gunpowder River Basin and Deer Creek watersheds monitored in the even years. One hundred sites are selected at random for each year's sampling effort. The contractor samples these 100 sites during the spring index period, March 1 to April 30, for macroinvertebrates using the MBSS protocols. These samples are sub-sampled to 100 organisms and identified to Genus or the lowest possible taxonomic level. A Benthic Index of Biotic Integrity (BIBI) is calculated. The BIBI describes the biological condition of the streams in the County. In 2006, a subset of previously sampled random sites was selected to serve as sentinel sites. The sites were located towards the base of major subwatersheds. Eighteen sentinel sites were selected in the Patapsco/Back River basin, and 13 sentinel sites were selected in the Gunpowder/Deer Creek basin. The sentinel sites will be used to monitor biological condition over a range of watershed and stream conditions.

The current BIBI uses six metrics. These six metrics, what they measure and the expected response to stressors are displayed in Table 9-5.

Table 9-5: BIBI Metrics

BIBI Metric	Metric Measure	Expected Response
Number of Taxa	Species Richness	Decrease
Number of EPT	Species Richness	Decrease
Number of Ephemeroptera	Species Richness	Decrease
Percent Intolerant to Urban	Tolerance/Intolerance	Decrease
Percent Chironomidae	Taxonomic Composition	Increase
Percent Clingers	Habit	Decrease

The results for each site from the 2007 probabilistic monitoring are displayed in Appendix 9-4 at the end of this section. The sites are grouped by subwatershed and 12-digit watershed, along with their respective BIBI and condition rating. The sites are assigned condition ratings based on the BIBI scores, with 1.00 – 1.99 being "Very Poor," 2.00 – 2.99 being "Poor," 3.00 – 3.99 being "Fair," and 4.00 – 5.00 being "Good." Figure 9-10 displays the site condition by color code for each of the 192 sites sampled in 2004 and 2005. Figure 9-11 displays the same information for sites sampled in 2006 and 2007, respectively.

Table 9-6 shows the results, by watershed, as the percentage of sites within each BIBI range. The Patapsco/Back River Basin data show an improvement in biological condition. Sites within the Good and Fair categories increased from 15% in 2003 to 44% in 2007. This may be the result of natural stress from the drought of 2002 and record wet year of 2003, with a subsequent recovery in 2005. Continued low, but stable flows between 2005 and 2007 may have allowed for better recruitment and subsequent expansions in density and diversity of benthic macroinvertebrate populations. Liberty Reservoir had all 20 sampled sites in the Fair and Good

categories in 2007. As in 2005, Jones Falls had the next highest percentage of sites in the Fair and Good categories (46%).

The 2004 and 2006 sampling results for the Gunpowder Basin/Deer Creek watersheds indicated a decrease in water quality. In 2004, 79% of sites were in the Fair and Good categories, while in 2006 only 66% of sites rated Fair and Good. The biological condition of streams in the Gunpowder River/Deer Creek watersheds continues to be better than in Patapsco/Back River. Gunpowder River/Deer Creek streams had higher percentages of sites rated Fair and Good, and Patapsco/Back River had higher percentages of streams rated Very Poor and Poor. This is likely a reflection of higher population density and greater development pressure in Patapsco/Back River. However, over the entire county for the 5-year sampling period, the percentages of streams rated Fair and Good (47%) is roughly equal to percentage rated Very Poor and Poor (53%).

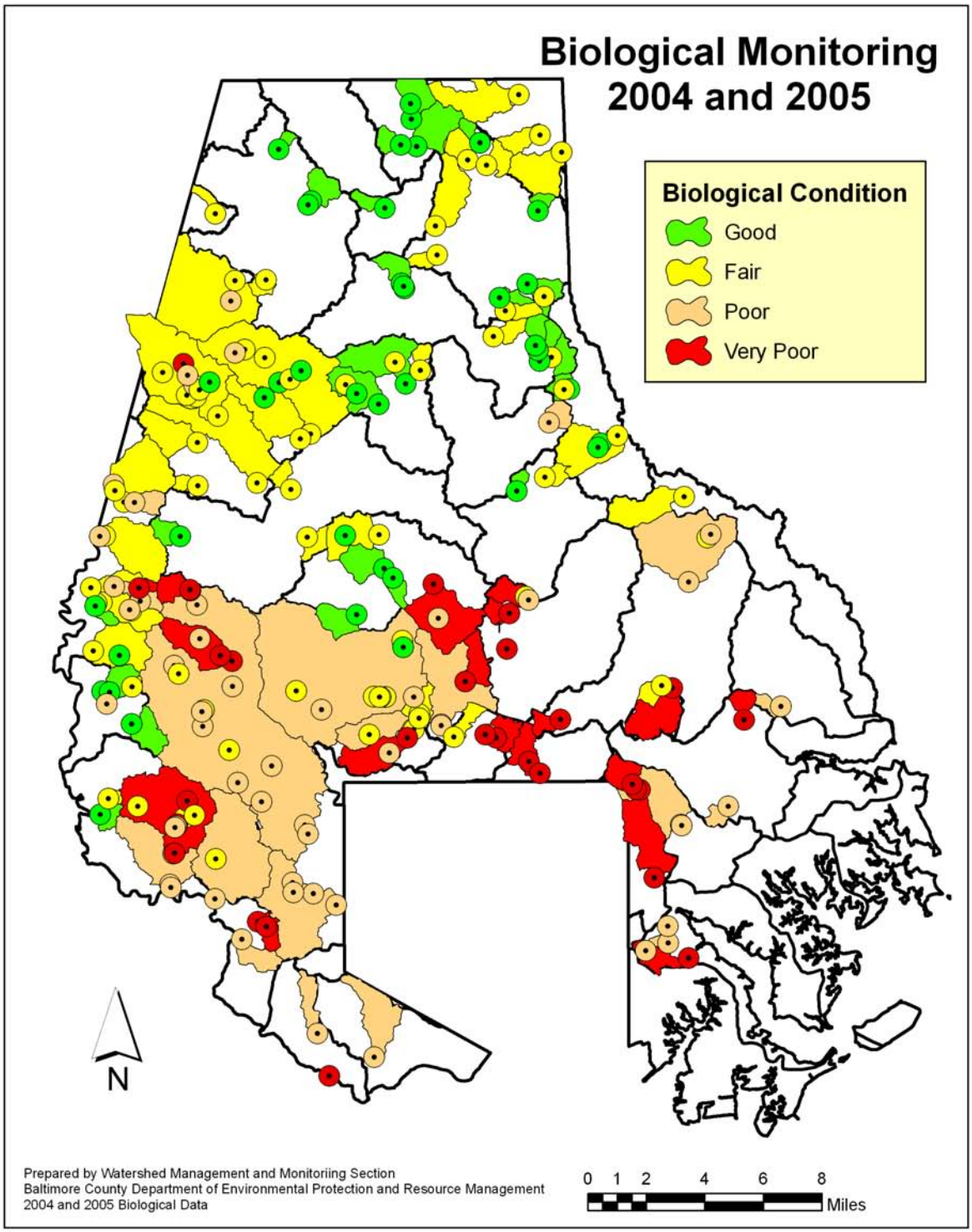


Figure 9-10: Probabilistic Biological Monitoring results for 2004 and 2005.

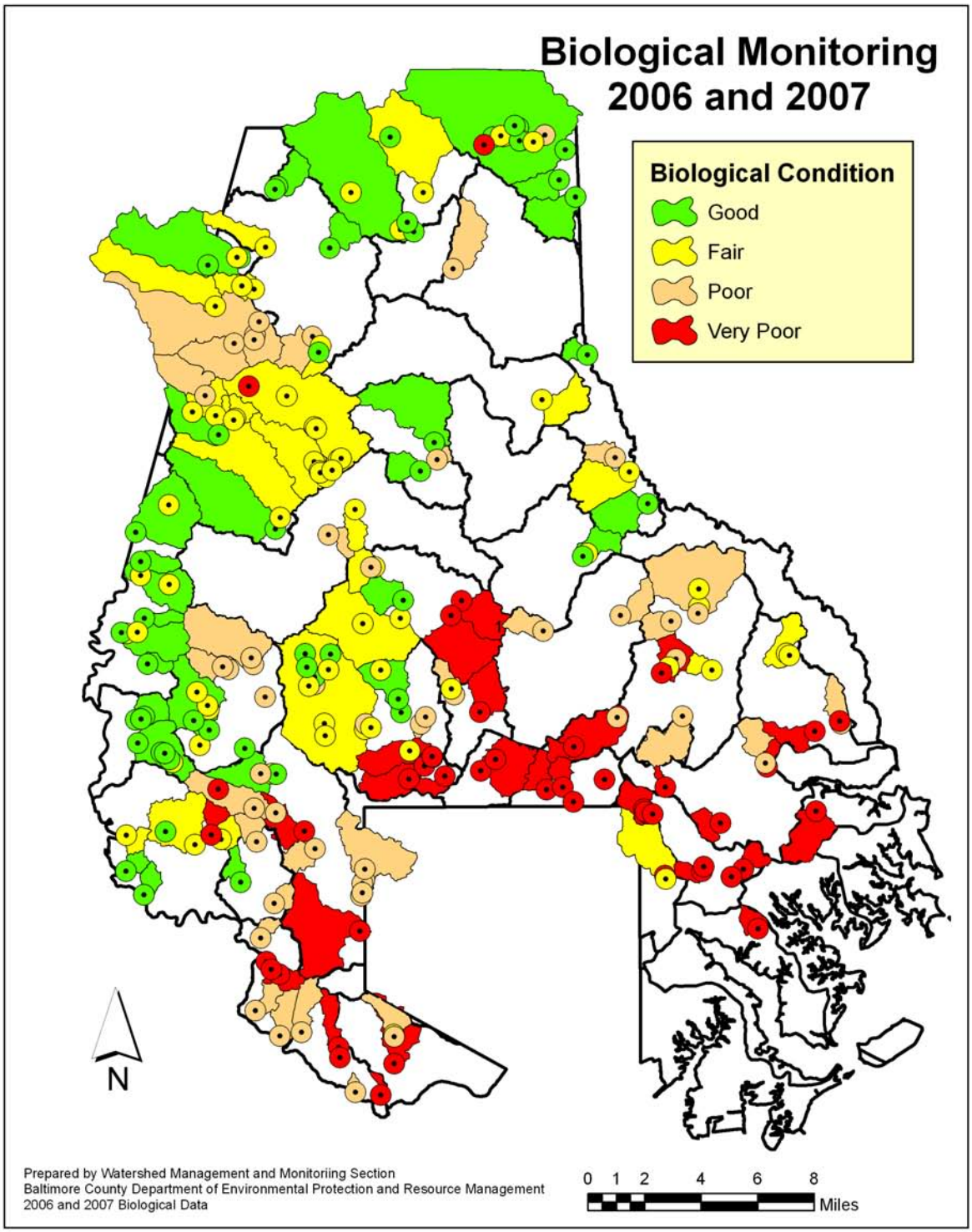
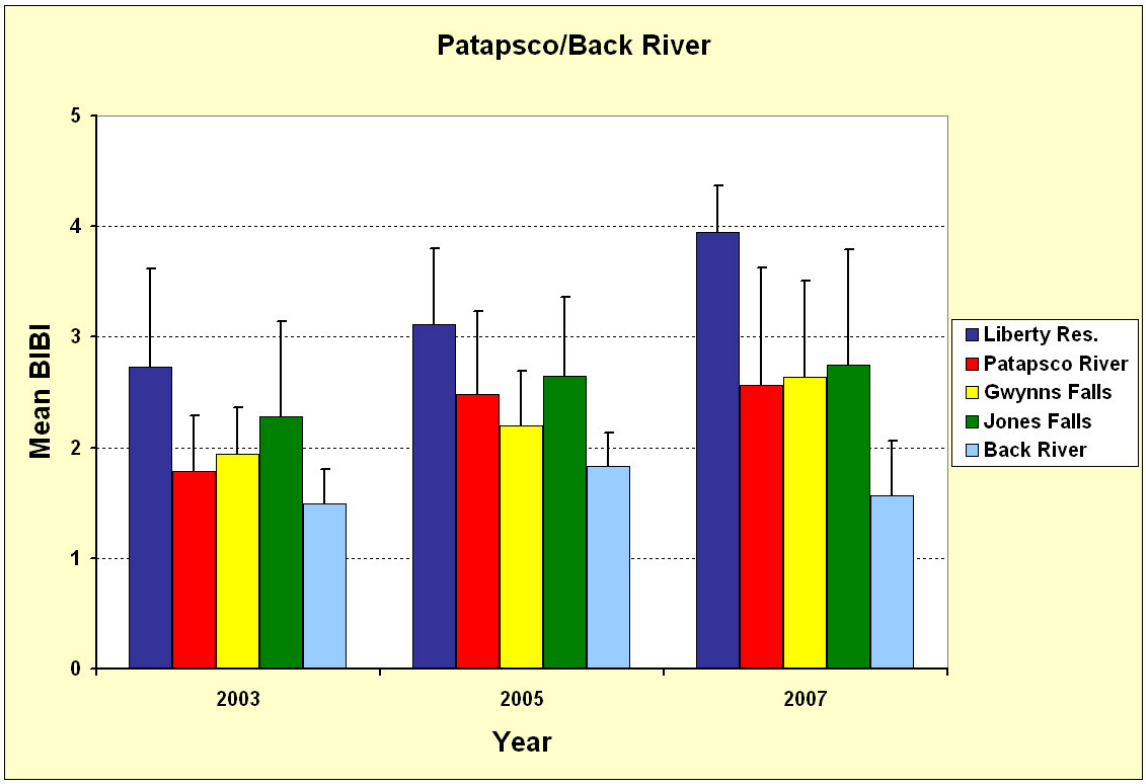


Figure 9-11: Probabilistic Biological Monitoring results for 2006 and 2007.

Table 9-6: BIBI Score Distribution by Watershed (% by Category)

Watershed	N	1.00-1.99 Very Poor	2.00-2.99 Poor	3.00-3.99 Fair	4.00-5.00 Good
Patapsco/Back River Basin – Sampled in 2003					
Liberty Reservoir	10	10	50	30	10
Patapsco River	13	54	46	0	0
Gwynns Falls	30	43	53	3	0
Jones Falls	32	38	31	25	6
Back River	15	87	13	0	0
Total	**100**	**46**	**39**	**12**	**3**
Gunpowder River Basin/Deer Creek – Sampled in 2004					
Deer Creek	3	0	33	67	0
Prettyboy Reservoir	7	0	14	43	43
Loch Raven Res.	67	6	9	43	42
Lower Gunpowder	7	29	43	29	0
Little Gunpowder	6	0	0	50	50
Bird River	2	50	50	0	0
Total	**92**	**8**	**13**	**42**	**37**
Patapsco/Back River Basin – Sampled in 2005					
Liberty Reservoir	22	5	32	41	23
Patapsco River	21	29	43	24	4
Gwynns Falls	22	18	68	14	0
Jones Falls	23	17	30	48	4
Back River	12	58	42	0	0
Total	**100**	**22**	**43**	**28**	**7**
Gunpowder River Basin/Deer Creek – Sampled in 2006					
Deer Creek	13	8	8	31	53
Prettyboy Reservoir	17	0	30	35	35
Loch Raven Res.	44	7	16	57	20
Lower Gunpowder	17	30	35	35	0
Little Gunpowder	4	0	25	25	50
Bird River	5	80	20	0	0
Total	**100**	**13**	**21**	**42**	**24**
Patapsco/Back River Basin – Sampled in 2007					
Liberty Reservoir	20	0	0	30	70
Patapsco River	24	33	33	17	17
Gwynns Falls	26	12	54	19	15
Jones Falls	28	29	25	25	21
Back River	19	84	11	5	0
Total	**117**	**30**	**26**	**20**	**24**
County Total	**509**	**24**	**29**	**28**	**19**

Figure 9-12 shows the means and standard deviations of the BIBI scores for each watershed. The mean scores for the 2003 sampling year indicate that all Patapsco/Back River watersheds were in the Poor to Very Poor categories. In 2005 and 2007, Liberty Reservoir watershed improved to a mean rating of Fair. Two watersheds (Patapsco River and Gwynns Falls) improved from Very Poor to Poor between 2003 and 2005, and maintained that rating in 2007. As explained above, this may be a result of the extended drought in 2001-2002, followed by the extremely wet year in 2003. The 2005 and later results may be a recovery from these naturally stressful conditions. Watersheds in the Gunpowder River and Deer Creek basins were stable. The Deer Creek, Prettyboy Reservoir, Loch Raven Reservoir, and Little Gunpowder watersheds had Fair mean BIBI scores in both 2004 and 2006. The Lower Gunpowder and Bird River had Poor and Very Poor mean BIBI scores, respectively.



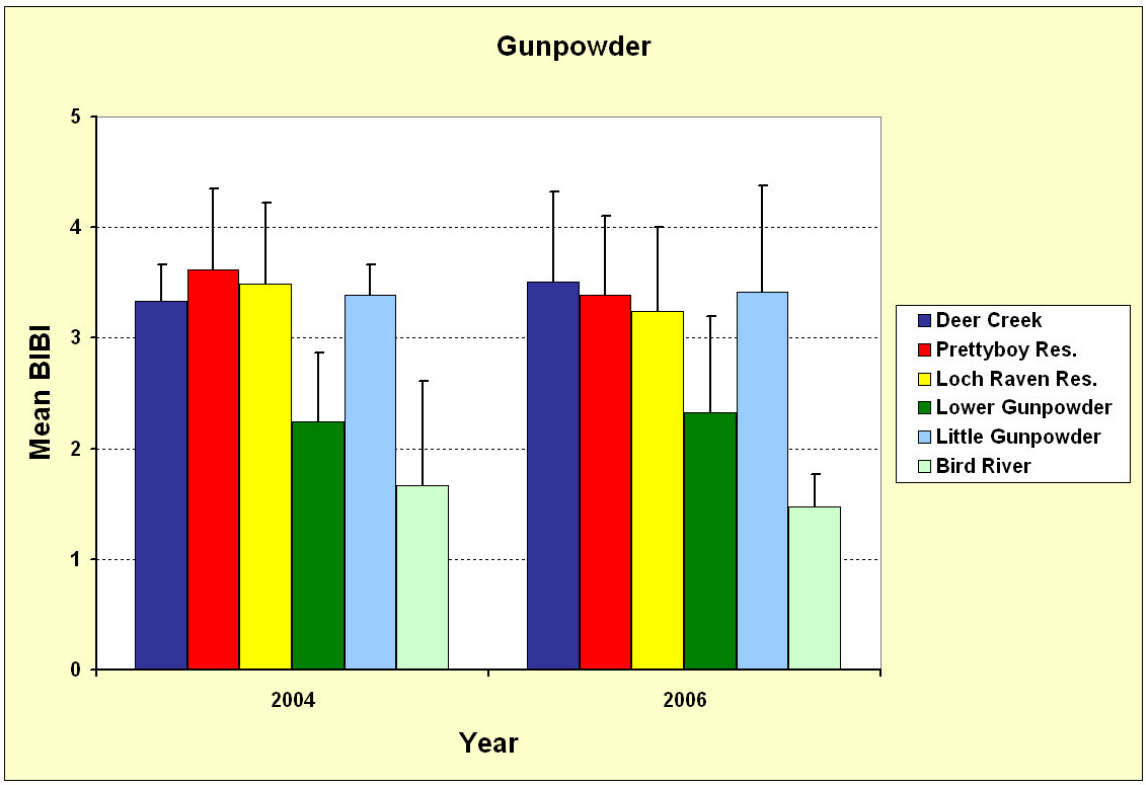


Figure 9-12: Means and Standard Deviations of BIBI Scores by Watershed

The methodology developed by Maryland Department of the Environment and Maryland Department of Natural Resources to determine biological impairment of fresh water streams was used to determine the watershed condition for all five sampling years. The methodology is detailed in Appendix G at the following web site:
http://www.mde.state.md.us/assets/document/2006DRAFTList_Appendices(1).pdf

This methodology is applied to watersheds that have a minimum of 10 sampling locations. Less than 10 sampling locations in a watershed are indicated as having insufficient data to make a determination. The determination is based on the mean BIBI and the 90% confidence intervals. The results of the analysis are presented in Table 9-7. A new listing methodology for biology is currently under review, and, if approved, will list the percentage of stream miles impaired by watershed. Baltimore County will apply the new method when it is approved.

Table 9-7: Watershed Biological Condition

Watershed	BIBI Mean	N	CL_{Lower}	CL_{Upper}	Condition
2003 Sampling Year					
Liberty	2.73	10	2.22	3.25	Inconclusive
Patapsco River	1.79	13	1.55	2.04	Impaired
Gwynns Falls	1.94	30	1.81	2.07	Impaired
Jones Falls	2.28	32	2.02	2.54	Impaired
Back River	1.49	15	1.35	1.63	Impaired
2004 Sampling Year					
Deer Creek	3.33	3	2.77	3.90	Insufficient Data
Prettyboy	3.62	7	3.08	4.16	Insufficient Data
Loch Raven	3.49	67	3.34	3.64	Meets Criteria
Lower Gunpowder	2.24	7	1.78	2.70	Insufficient Data
Little Gunpowder	3.89	6	3.66	4.11	Insufficient Data
Bird River	1.67	2	-2.54	5.88	Insufficient Data
2005 Sampling Year					
Liberty	3.11	22	2.85	3.36	Inconclusive
Patapsco River	2.48	21	2.20	2.76	Impaired
Gwynns Falls	2.20	22	2.02	2.37	Impaired
Jones Falls	2.65	23	2.40	2.91	Impaired
Back River	1.83	12	1.68	1.99	Impaired
2006 Sampling Year					
Deer Creek	3.51	13	3.11	3.91	Meets Criteria
Prettyboy	3.39	17	3.09	3.69	Meets Criteria
Loch Raven	3.24	44	3.05	3.43	Meets Criteria
Lower Gunpowder	2.33	17	1.34	3.32	Inconclusive
Little Gunpowder	3.42	4	1.84	5.00	Insufficient Data
Bird River	1.47	5	0.98	1.96	Insufficient Data
2007 Sampling Year					
Liberty	3.95	20	3.79	4.11	Meets Criteria
Patapsco River	2.56	24	2.20	2.92	Impaired
Gwynns Falls	2.64	26	2.36	2.92	Impaired
Jones Falls	2.75	28	2.43	3.07	Inconclusive
Back River	1.58	19	1.39	1.76	Impaired

Three watersheds (Patapsco River, Gwynns Falls, and Back River) are impaired, as they have consistently failed to meet biological criteria. The Liberty Reservoir watershed met criteria in 2007. Loch Raven Reservoir watershed met the criteria in both 2004 and 2006. Deer Creek and Prettyboy watersheds met the criteria in 2006. The balance of the watersheds had either insufficient data to make a determination or the data were inconclusive. Three watersheds are

not assessed using the Biological Probabilistic Monitoring Program (Baltimore Harbor, Middle River, and Gunpowder River) due to the limited miles of free flowing streams in the watersheds.

There are 18 sentinel sites in the Patapsco/Back River drainage and 13 sentinel sites in the Gunpowder River/Deer Creek drainage. Sentinel sites were sampled 2003, 2004, 2006, and 2007. Table 9-8 shows the sentinel site locations and biological condition by year. As with the probabilistic monitoring, the biological condition of sentinel sites in the Gunpowder River/Deer Creek drainage was generally better than the biological condition of sentinel sites in the Patapsco/Back River drainage. The Gunpowder River/Deer Creek had 31% and 23% of sites rated Good in 2004 and 2006, respectively, whereas the Patapsco/Back River had only 6% and 17% of sites rated Good in 2003 and 2007, respectively. A more dramatic difference existed between the two drainages when comparing the percentage of sites rated Poor or Very Poor. The Patapsco/Back River had 83% and 67% of sites rated Poor or Very Poor in 2003 and 2007, respectively. The Gunpowder River/Deer Creek had 31% and 46% of sites rated Poor or Very Poor in 2004 and 2006, respectively. Not surprisingly, sites rated Poor or Very Poor were located in urbanized and agricultural areas. Good sites were in less populated, more forested subwatersheds. Four of the 13 Gunpowder River/Deer Creek sites (31%) decreased in biological condition between 2004 and 2006, while three sites (23%) increased. Five of the 18 Patapsco/Back River sites (28%) increased in biological condition between 2003 and 2007, while two sites (11%) decreased. As shown in Table 9-9, no benthic macroinvertebrates were found in the sample at site 1203022 in 2007. A site was considered to have changed in biological condition if the BIBI score differed by at least one condition category. Condition changes within categories were not considered significant change.

Table 9-8: Sentinel Site Locations and Biological Condition for 2003, 2004, 2006, and 2007. "NS" indicates that a site was not sampled in a given year, while "NA" indicates that no benthic macroinvertebrates were found at site 1203022 in 2007.

Station	Subwatershed	Benthic Index of Biotic Integrity Scores			
		2003	2004	2006	2007
503010	Norris Run	3.67	NS	NS	3.33
503017	Locust Run	4.00	NS	NS	4.33
603058	East Branch Herbert Run	1.33	NS	NS	1.86
703003	Gwynns Falls	2.00	NS	NS	2.33
703017	Horsehead Branch	2.67	NS	NS	2.67
703033	Gwynns Falls	1.67	NS	NS	2.00
703040	Red Run	2.67	NS	NS	4.00
703067	Scotts Level Branch	1.33	NS	NS	1.33
703075	Dead Run	2.00	NS	NS	1.67
803008	Dipping Pond Run	3.33	NS	NS	4.33
803025	Slaughterhouse Branch	2.33	NS	NS	3.00
803031	Moores Branch	1.00	NS	NS	1.67
803060	Deep Run-Jones Falls	1.33	NS	NS	2.00
1203002	Herring Run-B	1.67	NS	NS	1.00
1203017	Stemmers Run	2.00	NS	NS	1.86
1203020	Brians Run	2.00	NS	NS	1.57
1203021	Brians Run	1.33	NS	NS	1.57
1203022	Herring Run-B	1.67	NS	NS	NA
204014	Prettyboy Direct 3	NS	4.00	4.00	NS

Station	Subwatershed	Benthic Index of Biotic Integrity Scores			
		2003	2004	2005	2006
204033	Georges Run	NS	3.00	2.33	NS
304021	Fourth Mine Branch	NS	3.67	2.67	NS
304084	Piney Run	NS	3.67	3.67	NS
304121	Blackrock Run	NS	4.00	3.67	NS
304197	Baisman Run	NS	4.33	4.00	NS
304208	Goodwin Run	NS	1.33	1.67	NS
304214	Merrymans Branch	NS	2.33	2.33	NS
404001	Little Deer Creek	NS	3.33	3.33	NS
404006	Plumtree Branch	NS	3.67	4.00	NS
904008	Parker Branch	NS	4.00	3.67	NS
1004002	Jennifer Branch	NS	1.67	2.33	NS
1004029	Long Green Creek	NS	1.67	2.00	NS

9.4.2 Capital Improvement Projects Monitoring

Baltimore County monitors benthic macroinvertebrate and fish assemblages in conjunction with several capital improvement stream restoration projects. Monitoring is performed in the stream segments where the restoration will take place or has taken place. The segments are monitored pre- and post-construction to document any change in the biological community. As with the Probabilistic Monitoring Program, MBSS methods are followed. Stream physical habitat data are also collected during macroinvertebrate and fish surveys. Habitat assessments are based on visual ratings of instream and riparian zone characteristics that are important to stream biological communities. The Minebank Run and Woodvalley projects are currently being monitored under the Capital Improvement Projects Monitoring Program. Their ADC map locations are displayed in Table 9-9.

Table 9-9: Stream Restoration Biological Monitoring Site Locations

Station	Stream and Location	ADC Map, Grid
Minebank Run II Stream Restoration		
MNBK-1	Minebank Run upstream of Gunpowder River	28 C2
MNBK-2	Minebank Run upstream of USGS gage	28 B3
MNBK-3	Minebank Run downstream of bridge @ park	28 A4
MNBK-4	Minebank Run upstream of bridge @ park	28 A4
MNBK-5	Minebank Run behind Loch Raven High School	27 K5
MNBK-6	Minebank Run upstream of Cowpens Road	27 J5
MNBK-7	Minebank Run upstream of Glen Eagles Court	27 H6
MNBK-8	Minebank Run upstream of MNBK-7	27 H6
MNBK-9	Minebank Run downstream of Cromwell ES	27 G6
JB-1	Jennifer Branch upstream of Gunpowder River	28 J2
JB-2	Jennifer Branch near archery range	28 J3
Woodvalley Stream Restoration		
WDVL-1	Unnamed Trib to Jones Falls at Michelle Way	25 F7
WDVL-2	Unnamed Trib to Jones Falls at Gardenview Way	25 G6
WDVL-3	Unnamed Trib to Jones Falls at Evan Way	25 F6

The staff of the Watershed Management and Monitoring Section of DEPRM has conducted yearly biological assessments of the Minebank Run stream restoration project since April, 2004,

at eleven sampling stations (Figure 9-13). The stream restoration was completed in 2002 (Phase I) on the reach where MNBK-6, MNBK-7, MNBK-8, and MNBK-9 are located. The stream restoration was completed in 2005 (Phase II) where MNBK-2, MNBK-3, MNBK-4, and MNBK-5 are located. Stations MNBK-1, JB-1, and JB-2 are controls. As of 2007, DEPRM has collected four years of post-restoration data at the Phase I stations, and two years of pre-restoration and two years of post-restoration data at the Phase II stations.

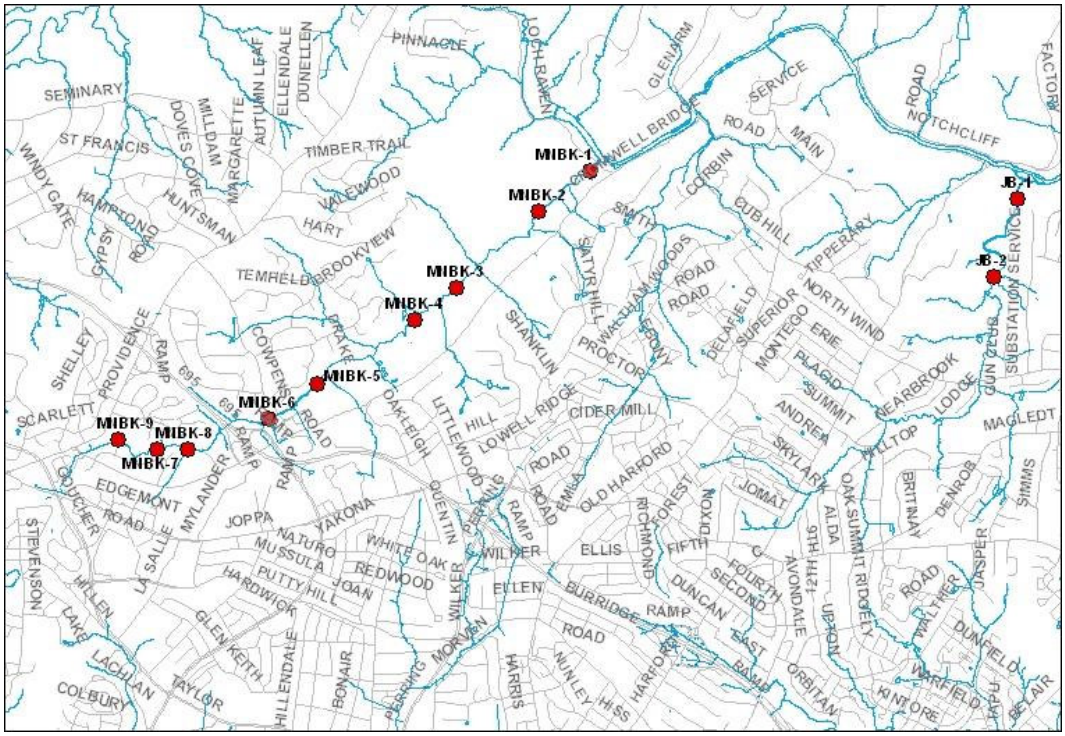


Figure 9-13: Minebank Run biological monitoring stations.

All eleven stations were sampled yearly for macroinvertebrates. Fish surveys were completed for a sub-set of the stations: MNBK-1, MNBK-2, MNBK-7, and JB-1 in 2004; MNBK-1, MNBK-7, and JB-1 in 2005; MNBK-1, MNBK-2, MNBK-4, MNBK-7, and JB-1 in 2006 and 2007. Stream physical habitat was assessed, and habitat scores derived, as detailed in Section 8.3.4.

Means and standard deviations of BIBI, FIBI, riparian buffer width, and habitat scores are presented in Table 9-10. The BIBI scores were Very Poor at control and Phase I and Phase II restored stations (Table 9-10), except for Phase II stations in 2005, which was Poor. Control stations had the highest FIBI scores, which, after 2004, were consistently in Fair Condition. Control stations always had wider riparian buffers and higher habitat scores. Phase I had wider riparian buffers than Phase II stations, which would be expected, because Phase I stations were restored three years earlier than Phase II stations. Habitat scores between Phase I, and Phase II stations were essentially similar, although Phase I stations had slightly better scores than Phase II stations. Overall means for biology and habitat reflect these conclusions (Table 9-10). Comparisons of pre- and post-restoration BIBI and FIBI scores at Phase II stations show little difference in biological condition before and after restoration. The mean BIBI was 1.58 before restoration and 1.00 after restoration. The FIBI at the one Phase II fish station was 2.00 in 2004, and averaged 2.08 between 2006 and 2007.

Table 9-10: Minebank Run Phase I vs. Phase II, Comparison of Biological and Habitat Condition *

Treatment	Year	BIBI	FIBI	Buffer Width (m)	Habitat Score
Phase I	2004	1.00 (0.00)	1.67	29 (17)	54 (8)
Phase II	2004	1.17 (0.19)	2.00	16 (14)	50 (14)
Control	2004	1.33 (0.00)	2.83	43 (12)	72 (10)
Phase I	2005	1.17 (0.24)	2.67	33 (18)	50 (6)
Phase II	2005	2.00 (0.88)	**	22 (16)	47 (7)
Control	2005	1.44 (0.51)	3.50	50 (0)	63 (10)
Phase I	2006	1.00 (0.00)	2.67	19 (11)	46 (8)
Phase II	2006	1.00 (0.00)	2.50	15 (15)	48 (7)
Control	2006	1.00 (0.00)	3.50	43 (12)	64 (16)
Phase I	2007	1.00 (0.00)	2.67	28 (13)	46 (15)
Phase II	2007	1.00 (0.00)	1.67	24 (13)	40 (4)
Control	2007	1.00 (0.00)	3.84	43 (12)	61 (10)
Phase I	Overall	1.03 (0.09)	2.42 (0.50)	27 (16)	49 (9)
Phase II	Overall	1.24 (0.53)	2.07 (0.72)	20 (13)	46 (9)
Control	Overall	1.19 (0.30)	3.42 (0.71)	45 (9)	65 (11)

* Numbers in parentheses for BIBI, FIBI, Buffer Width, and Habitat Score represent one standard deviation of the mean. Standard deviations for FIBI are presented only for overall means, as there is only one station in Phase II and two stations in Phase I.

** The one fish station in Phase II was not sampled in 2005.

It is likely that high storm flows continue to impair development of the benthic community, while fish, being more mobile, are better able to react and adapt to periodic storm flows. In contrast to previous years, no brown trout were collected at any of the stations in 2007. As shown in Table 9-10, collection of multiple years of pre- and post-restoration data has allowed DEPRM to get some idea of the amount of variability present in recovering biological communities.

The Woodvalley stream restoration project was completed in 2005. Pre-restoration data were collected in 2004 and 2005. Two stations, WDVL-1, unnamed tributary to Jones Falls at Michelle Way (within the restored reach), and WDVL-2, unnamed tributary to Jones Falls at Gardenview Way (control reach), were sampled for benthos and fish in 2004. A third station, WDVL-3, unnamed tributary to Jones Falls at Evan Way and Park Heights Avenue, was added as a control in 2005, because no fish were collected at WDVL-2 in 2004, and its upstream watershed area is less than 300 acres. Post-restoration data were collected beginning in 2006. See Figure 9-14 for station locations. Due to time and staffing constraints, WDVL-2 was not sampled in 2005.

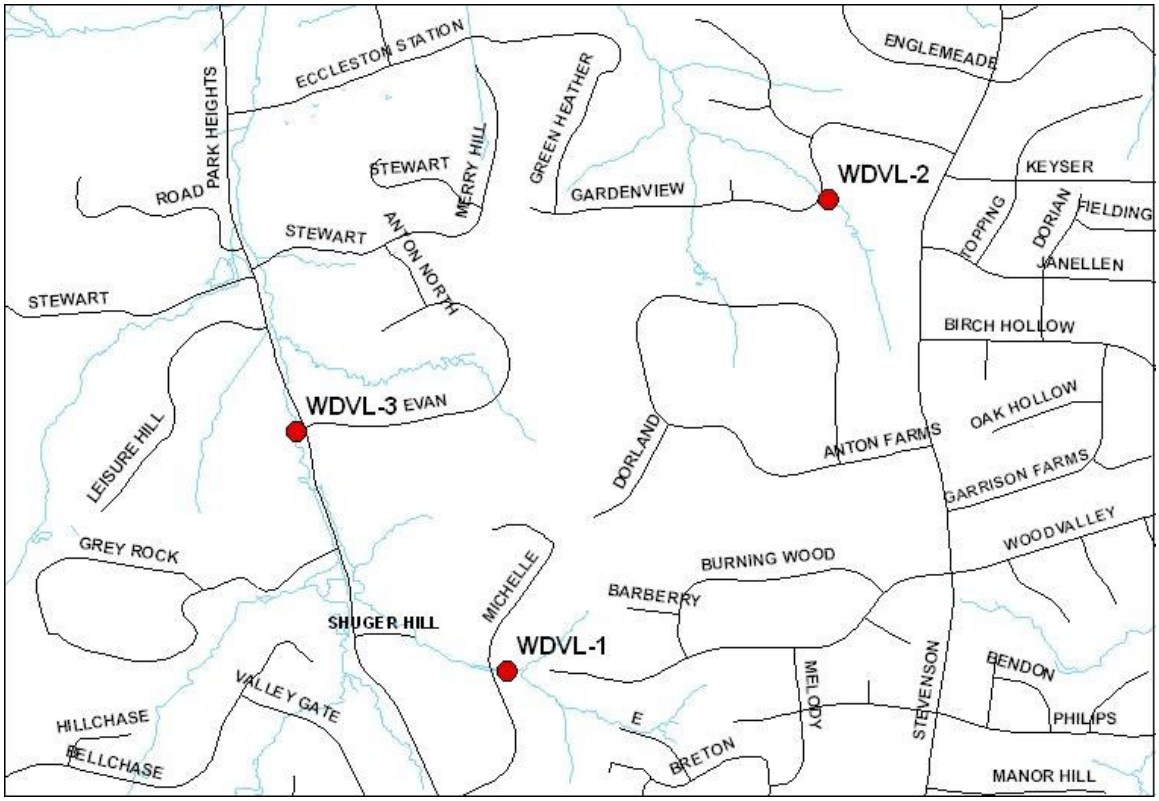


Figure 9-14: Woodvalley biological monitoring station locations.

The BIBI and FIBI (Table 9-11) scores rated Very Poor, except for the pre-restoration FIBI at WDVL-1, which rated Poor. No apparent difference exists between pre- and post-restoration biological and habitat condition. The decrease in buffer width at WDVL-1 is an artifact of assessments being done by different personnel. The pre-restoration buffer was interpreted as the amount of pre-existing lawn, while the post-restoration buffer was measured as the actual buffer planted for the stream restoration. As more data are collected, the width of the planted buffer will be analyzed as a function of time, which will be a more accurate measure of the progress of the restoration project. At present, the planted riparian buffer has not had time to mature and achieve its full function. However, observations made during the geomorphological survey conducted in October 2007, suggest that the buffer is becoming established. Although no trout were collected from within either study reach, one wild brown trout was collected, from just downstream of WDVL-3, while the electrofishing probes were being tested prior to sampling. The continued presence of brown trout within the control reach (documented in previous NPDES reports) suggests the potential of the stream restoration reach to provide habitat for wild salmonids.

Table 9-11: Woodvalley, Comparison of Pre- and Post-restoration Biological and Habitat Condition *

Station	Treatment	BIBI	FIBI	Buffer Width (m)	Habitat Score
WDVL-1	Pre-restoration	1.17	2.33	36	51
WDVL-1	Post-restoration	1.33	1.67	16	46
WDVL-2	Pre-restoration	1.17	**	22	60
WDVL-2	Post-restoration	1.33	**	28	59
WDVL-3	Pre-restoration	1.00	1.67	24	61
WDVL-3	Post-restoration	1.00	1.50	28	61

* No measure of variation around the mean is presented, as means are calculated from only two values.

** Fish sampling discontinued after 2004 due to absence of fish at site and watershed area < 300 acres.

9.4.3 Reference Site Monitoring

Baltimore County has been monitoring eight (8) reference sites since spring of 2001. GIS was used to identify watersheds within the County that contained greater than 50% forested land use and less than 20% urban land use. An initial suite of twenty-one (21) sites was reduced to eight (8) sites for future monitoring based on land use, chemical, and stream physical habitat benchmarks. The ADC map site locations, along with the stream name are displayed in Table 9-12.

Table 9-12: Reference Site Locations

Station	Stream Name and Location	ADC Map, Grid
REF-001	Baisman Run upstream of Ivy Hill Road	18 C5
REF-004	Poplar Run upstream of Gunpowder Road	1 H11
REF-009	Springhouse Run upstream of Gunpowder Rd	1 H8
REF-012	Panther Branch upstream of Gunpowder Falls	7 H8
REF-013	Mingo Branch upstream of Gunpowder Falls	7 C7
REF-015	Charles Run upstream of Gerting Road	8 F11
REF-017	Sunnyking Run near Sunnyking Drive	24 A3
REF-019	Fourth Mine Branch upstream of Stablers Church Road	3 H12

The eight sites are sampled annually for benthic macroinvertebrates in the spring index period using MBSS sampling protocols. The samples are sorted and identified in the laboratory to genus or the lowest practical taxonomic level. The metrics in Table 9-5 are used to calculate BIBIs. Benthic macroinvertebrates were collected in 2001, 2003, and 2005-2007. Fish were sampled in 2003 and 2007, during the summer index period (June 1-September 30). Fish sampling is done only periodically to reduce stress to the naturally reproducing trout populations inhabiting these streams. In 2003, only three sites were sampled for fish. In 2007, all sites except REF-004 and REF-009 were sampled for fish. REF-004 had been electrofished in 2006 by the Maryland Department of Natural Resources Fisheries Service. REF-009 is no longer sampled due to loss of landowner permission. Alternate locations on the same stream are currently being evaluated for inclusion as a reference site beginning in 2008.

Data from 2001-2007 are presented here. Water chemistry data were collected in 2000-2001. Stream physical habitat data were collected in 2001-2003 following Maryland Save Our Streams protocols, and in 2005-2007 using MBSS protocols. Benthic community condition is the primary means by which the reference sites are evaluated as benchmarks for other streams in the

county. Fish community condition is an ancillary measure. Fish data will be included in future reports in years when the fish community is sampled.

Land Use

Land use within the reference site watersheds is predominantly forest (Figure 9-15). Agriculture is also a significant activity within the reference site watersheds.

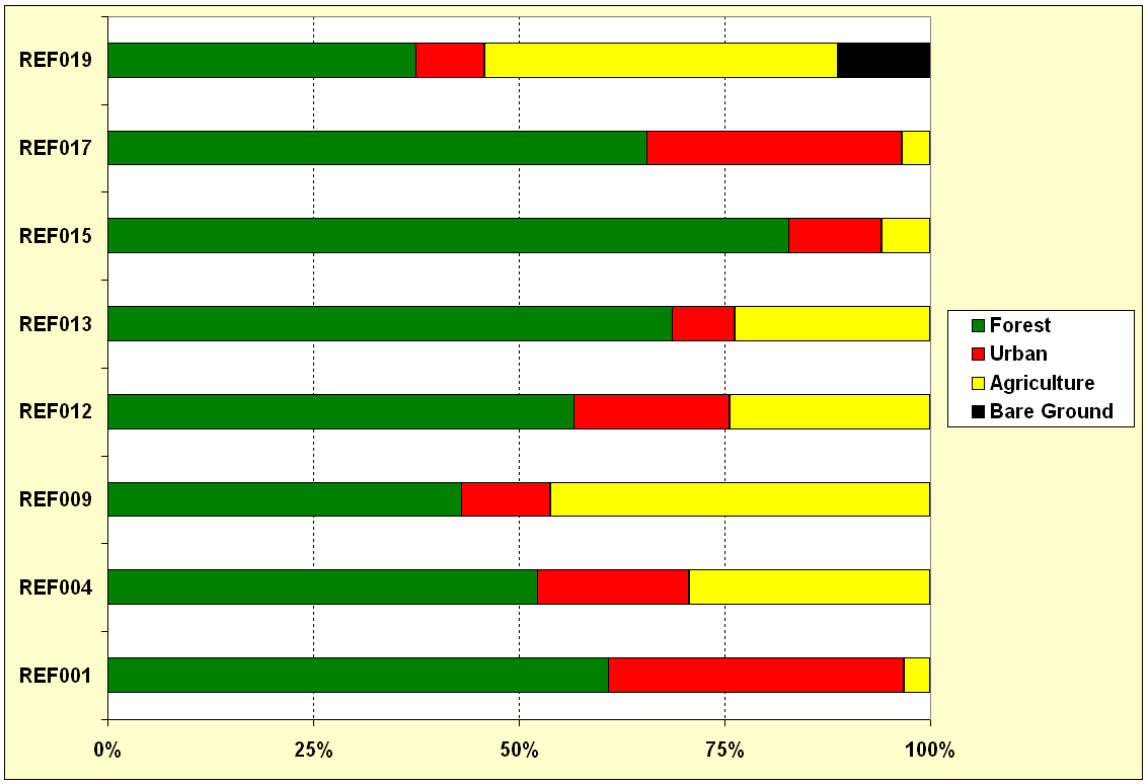


Figure 9-15: Reference site land use.

Water Chemistry

Water chemistry parameters are presented in Table 9-13. Data are shown for key parameters, which were used to evaluate whether potential sites represented reference conditions.

Table 9-13: Reference Site Water Chemistry

Station	Date	DO	pH	TS	NO_2/NO_3	SO_4	CL
REF-001	10/26/00	9.76	7.21	80	1.32	2.58	19.97
REF-004	10/05/00	9.38	7.36	58	1.90	NA	10.48
REF-009	10/12/00	10.19	6.99	62	3.40	2.02	6.16
REF-012	10/19/00	10.57	7.52	188	2.69	4.42	64.16
REF-013	10/19/00	10.11	7.44	265	1.39	5.91	110.86
REF-015	10/19/00	9.59	7.41	26	<0.06	3.91	3.37

Station	Date	DO	pH	TS	NO_2/NO_3	SO_4	CL
REF-017	10/26/00	9.01	7.55	121	1.56	4.73	14.48
REF-019	11/16/00	12.53	7.17	120	2.88	5.06	41.10
REF-001	10/18/01	10.11	6.93	<1	0.78	1.54	19.65
REF-004	10/18/01	11.72	7.07	25	0.98	2.75	10.87
REF-009	10/18/01	10.50	6.74	27	1.92	2.13	6.17
REF-012	10/18/01	10.19	7.06	155	1.76	3.34	58.17
REF-013	10/18/01	9.79	7.07	119	0.97	4.51	109.24
REF-015	10/18/01	9.70	7.13	1	<0.06	3.28	3.72
REF-017	10/18/01	10.69	6.81	86	1.61	1.24	19.59
REF-019	10/18/01	10.36	6.88	58	1.56	2.41	43.21

The most notable exceptions to "reference" water chemistry occurred at REF-012, REF-013, and REF-019 for chloride. The elimination threshold for chloride was 26.5 mg/l. Although all three sites were higher than the threshold on both sampling dates, they were retained in the reference site suite because previous sampling had shown good benthic biology. The high chloride is likely from impervious drainage in the headwaters from York Road (REF-012) and Interstate-83 (REF-013 and REF-019).

Stream Physical Habitat

Stream physical habitat was assessed following Maryland Save Our Streams protocols in 2001-2003 and MBSS Summer Index Period protocols in 2005-2007. The protocols are visual estimates of key instream, stream bank, and riparian zone parameters. Staff members that were trained to make accurate estimates of the parameters made the assessments. To account for the change in protocol, "habitat scores" were derived by converting the sum of key parameters to a percentage of the total possible sum. Table 9-14 shows the habitat parameters from each protocol that were included in the habitat scores. Note that summer index period habitat assessments were made during the spring index period because

Table 9-14: Habitat parameters for derived habitat scores at reference sites

Protocol	Parameter	Definition
Save Our Streams	Attachment Sites for Macroinvertebrates	Quality of benthic macroinvertebrate habitat
	Embeddedness	Extent to which substrates surrounded by fine sediment
	Shelter for Fish	Quality of fish habitat
	Channel Alteration	Degree to which channel has been artificially altered
	Sediment Deposition	Amount of deposition of fine sediment
	Stream Velocity and Depth Combinations	Representation of fast, slow, deep, and shallow areas
	Channel Flow Status	Amount of water within channel
	Bank Vegetative Protection	Degree to which stream banks vegetated
	Condition of Banks	Degree of stream bank stability

Protocol	Parameter	Definition
	Riparian Vegetative Zone	Width of riparian zone
MBSS	Instream Habitat	Quality of fish habitat
	Epifaunal Substrate	Quality of benthic macroinvertebrate habitat
	Velocity Depth Diversity	Representation of fast, slow, deep, and shallow areas
	Pool/Glide/Eddy Quality	Extent of pool habitat
	Riffle/Run Quality	Extent of riffle habitat
	Embeddedness	Percent of riffle substrates surrounded by fine sediment
	Shading	Percent of wetted area shaded by vegetation
	Trash Rating	Amount of trash present in reach

electrofishing is not conducted every year at the reference sites. These data were deemed useful, however, because they would still indicate the general quality of stream habitat available for biota.

Benthic Macroinvertebrates

Benthic IBI values have been fair to good over the entire monitoring period (Figure 9-16), with several exceptions. Sites REF-013, REF-017, and REF-019 have been

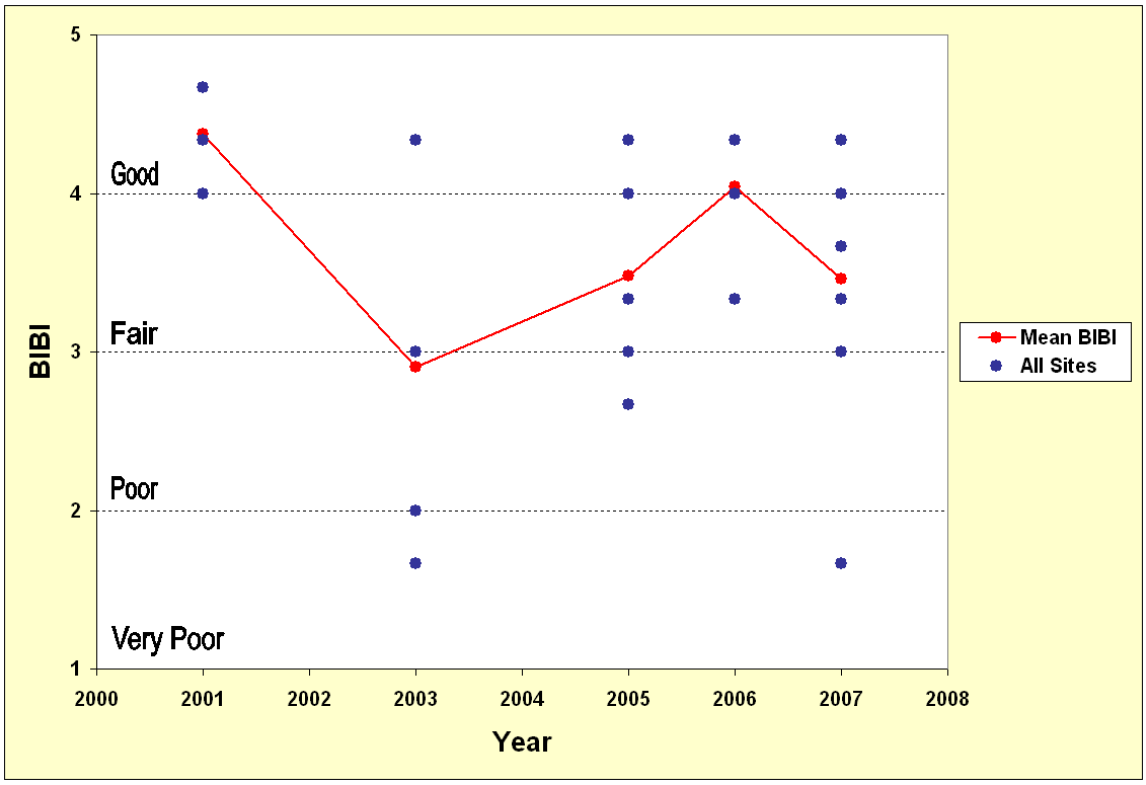


Figure 9-16: Reference site BIBIs by year. The mean BIBI for all sites is represented by the red line.

variable, as REF-013 and REF-019 have each rated poor for one year. Habitat quality has increased since 2003 (Figure 9-17). Sites with the lowest habitat scores also had the

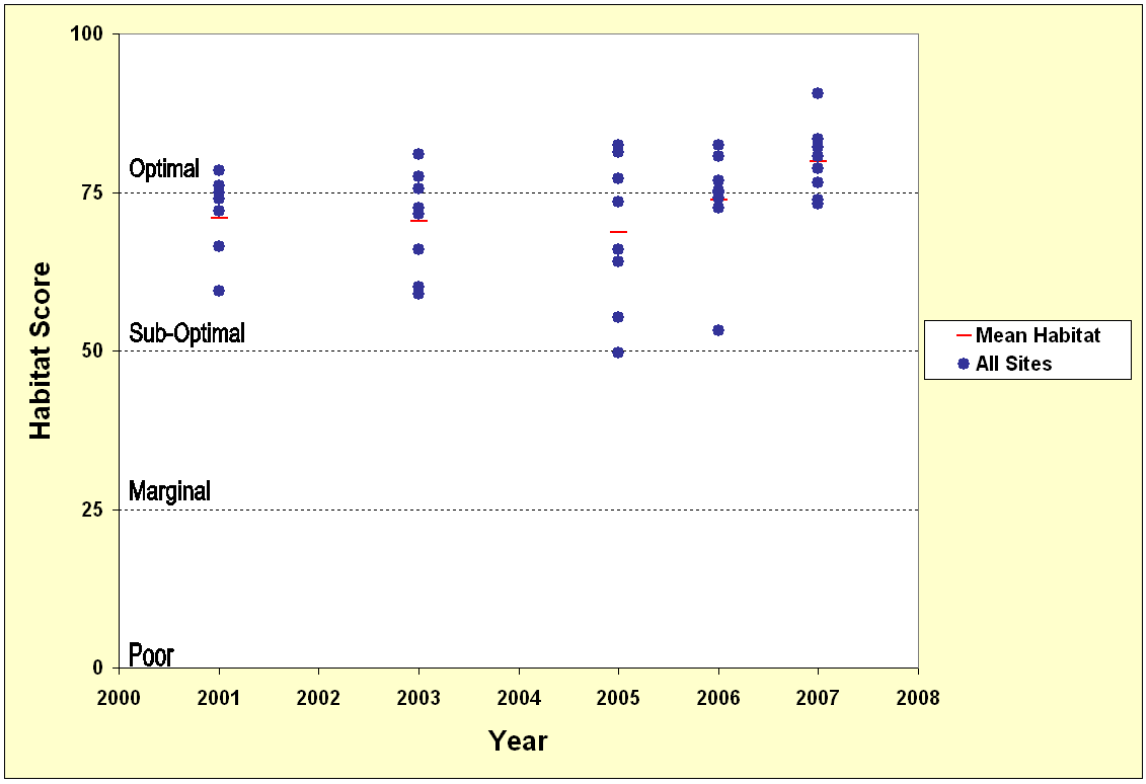


Figure 9-17: Reference site stream habitat by year. Mean habitat score is represented by the red line.

lowest BIBIs (REF-013, REF-017, and REF-019). The patterns in the benthic data were likely due in part to patterns in precipitation and hydrology. Precipitation was below normal from 2000-2002, and there were several large storms during winter 2003; lower BIBI scores in 2003 reflect the accumulated stress of these extremes in hydrologic regime. Drought may cause mortality of benthic macroinvertebrates, but many benthic macroinvertebrates migrate to the saturated habitat beneath the stream bed (the hyporheic zone) until hydrologic conditions return to normal. This, in addition to aerial dispersal during mating flights, is responsible for the persistence and stability of benthic macroinvertebrate populations during periods of fluctuating climactic conditions. Precipitation increased in 2003, and although no data were collected for 2004, BIBI values increased and remained relatively stable between 2005-2007, suggesting a response to changing precipitation amounts. The increase in habitat quality during 2005-2007 suggests that higher precipitation provided more of the living space needed by macroinvertebrates. The influence of land use on benthic communities has been well documented. At present, the current land use data that are needed to examine whether any land use change has occurred, and what effects, if any, such change has had on the benthic communities of the reference sites, is unavailable.

Fish

Fish IBI values were generally poor (Table 9-15). This is typical of small, forested headwater streams. Headwater streams typically support a few species of fish, which have narrow environmental requirements. Both brook and brown trout have been collected at most of the

sites during the monitoring period (Table 9-15). Trout are only found in cold-water streams with minimal anthropogenic influences.

Table 9-15: Fish IBIs and Trout Presence for Reference Sites in 2003 and 2007

Station	Year	FIBI	Condition	Trout Present
REF-013	2003	3.67	Fair	Yes
REF-015	2003	2.00	Poor	Yes
REF-019	2003	1.33	Very Poor	No
REF-001	2007	1.67	Very Poor	Yes
REF-012	2007	4.00	Good	Yes
REF-013	2007	4.33	Good	Yes
REF-015	2007	2.67	Poor	Yes
REF-017	2007	2.67	Poor	No
REF-019	2007	2.33	Poor	Yes

The reference sites appear to be performing their intended function, that is, providing a benchmark with which to compare stream biological condition in other, anthropogenically-affected streams. Benthic macroinvertebrate communities of the reference sites seem to be responding to physical and climactic influences in predictable ways, and should prove useful in assessing human-induced changes to other Baltimore County streams.

9.4.4 Submerged Aquatic Vegetation Monitoring Program

Baltimore County has conducted Submerged Aquatic Vegetation monitoring since 1989 on certain waterways. With the advent of water quality standards for submerged aquatic vegetation, reporting on the monitoring results will commence this year. During the last Water Quality Standards Triennial Review Maryland Department of the Environment adopted standards for tidal water submerged aquatic vegetation and water clarity, among other standards also adopted. The standards are based on water quality segments that are derived from the Chesapeake Bay Program model. There are a total of seven segments in Baltimore County tidal waters. Three of the segments (MIDOH, GUNOH1, and BACOH) are entirely within Baltimore County tidal waters. Four other segments have tidal waters that extend to other jurisdictions. Two of these segments (CB2OH and CB#MH) are Chesapeake Bay mainstem segments and extend to the eastern shore of Maryland. The Chesapeake Bay Program draft document *Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll a for the Chesapeake Bay and Its Tidal Tributaries 2006 Addendum* provides guidance on assessing the attainment of the SAV acreage criteria. The document states "the shallow-water bay grass designated use is considered in attainment if there are sufficient acres of SAV observed within the segment or there are enough acres of shallow-water habitat meeting the applicable water clarity criteria to support restoration of the desired acres of SAV for that segment." The recommended procedure is to use the **single best year SAV acreage** based on the most recent three-year period of available data. The criteria may also be met by attaining water clarity acres for the most recent three-year period of available data. Water clarity data is currently not collected in Baltimore County, so only the SAV acreage will be used.

Baltimore County monitors SAV distributions in the spring and summer of each year in accordance with the US Fish and Wildlife methodologies. There are currently 29 waterways in the County that are monitored. In order to assess the total acres of yearly coverage for the creeks surveyed, the data for the spring and summer were analyzed for overlap in SAV distribution between the two seasons. The total SAV coverage for each year is calculated by the following formula:

Total SAV_{acres} = (Spring SAV_{acres} – $Overlap_{acres}$) + ($Summer_{acres}$ SAV – $Overlap_{acres}$) + $Overlap_{acres}$

To estimate the progress in meeting the SAV goal for each tidal segment the Total SAV_{acres} are divided by the SAV goal for that segment. Since only three of the seven segments are totally within Baltimore County jurisdiction and therefore can be assessed for SAV criteria attainment. The other four segments provide a conservative estimate of the SAV criteria attainment.

Table 9-16 presents the SAV water quality standard for each segment and the results of the last three years of SAV monitoring. The yellow highlighted water quality segments lie entirely within Baltimore County. The red highlighted cells are the highest percent attainment for each water quality segment based on the last three years of data.

Table 9-16: SAV Standards and Baltimore County SAV Monitoring Results (2005-2007)

Water Quality Segment	SAV Goal (Acres)	2005		2006		2007	
		Acres	% of Goal	Acres	% of Goal		
MIDOH	879	432	49.1	234	26.7	240.7	27.3
GUNOH1	1,860	**	**	**	**	**	**
GUNOH2	572	13	9.2	84	14.7	194.36	33.9
BACOH	0	13	100	5	100	6.31	100
PATMH	389	53	13.5	5	1.3	8.95	2.30
CB2OH	705	202	28.6	152	21.6	133.8	19
CB3MH	1,370	10	0.7	55	4.0	44.31	3.23
Total SAV Acres				**301**		**381.42**	

* Acres of SAV area surveyed
** No monitoring conducted by Baltimore County in this segment.

The Middle River segment (MIDOH) has consistently the highest acreage of SAV coverage each year. In 2004 Middle River attained 54.9% of the SAV criteria. Since that time period there has been a decrease in the SAV coverage, with 2005 having the highest coverage at 49.1%. Only the last three years are considered in assessing the attainment of the SAV coverage. Back River has no SAV criteria, and generally has the least amount of SAV coverage. The Gunpowder segment (GUNOH1) is not monitored by Baltimore County. Of all the County's waterways surveyed, Middle River has the largest area of monitoring and Back River has the least amount of area monitored.

Appendix 9-1: Baseflow Monitoring Sites by Watershed

Site ID	Subwatershed	Site ID	Subwatershed
Liberty Reservoir – 6 Sites			
LI-01	Cliffs Branch	LI-09	Timber Run
LI-02	Glen Falls Run	LI-10	Locust Run
LI-03	Keysers Run		
LI-04	Norris Run		
Patapsco River – 5 Sites			
PA-04	Ben's Run	PA-12	Brice Run
PA-06	Cooper Branch	PA-13	West Branch
PA-09	Soapstone Branch		
Gwynns Falls – 6 Sites			
GW-01	Gwynns Falls – Glyndon	GW-05	Horsehead Branch
GW-03	Holly Branch	GW-07	Gwynn's Falls Trib.
GW-04	Red Run	GW-10	Dead Run – Mainstem
Jones Falls – 8 Sites			
JF-01	Western Run	JF-08	Shaughterhouse Run
JF-04	Dipping Pond Run	JF-09	Moores Run
JF-05	Deep Run	JF-10	Towson Run
JF-07	Roland Run	JF-11	Jones Falls
Back River – 10 Sites			
HR-01	West Branch – Herring Run	BR-02	Brians Run
HR-02	West Branch – Herring Run	BR-03	Redhouse Run
HR-03	East Branch – Herring Run	BR-04	Redhouse Run
HR-04	East Branch – Herring Run	BR-05A	Stemmers Run
BR-01	Bread and Cheese Creek	BR-06	Stemmers Run
Deer Creek – 4 Sites			
DC-01	Harris Mill	DC-03	Deer Creek – mainstem
DC-02	Ebaughs Creek	DC-04	Plumtree Branch
Prettyboy Reservoir – 8 Sites			
PB-26	Gunpowder Falls South Branch	PB-44	Graves Run
PB-28	Gunpowder Falls South Branch	PB-52	Murphy's Run
PB-33	Gunpowder Falls- Unnamed Trib.	PB-54	Georges Run
PB-43	Indian Run	PB-66	Compass Run
Loch Raven Reservoir – 32 Sites			
LR-02	Fitzhugh Run	LR-23	Charles Run
LR-03	Dulaney Valley Branch	LR-24	Little Falls
LR-04	Loch Raven Res. Unnamed Trib.	LR-25	First Mine Branch
LR-10 (LQ3)	Long Quarter Branch	LR-26	Second Mine Branch
LR-11 (SB-3)	Spring Branch	LR-27	Third Mine Branch
LR-12	Merryman Branch	LR-28	Owl Branch
LR-13 (BR1)	Beaver Dam Run – York Road	LR-29	Little Falls
LR-14	Baisman Run	LR-30	Beetree Run
LR-15	Beaver Dam Run – Rises Court	LR-31	Mingo Branch
LR-16	Oregon Branch	LR-32	Black Rock Run – Western Run
LR-17 (WR1)	Western Run	LR-34	McGill Run
LR-18	Green Branch	LR-35	Piney Run
LR-19 (OR1)	Overshot Run	LR-38	Delaware Run
LR-20	Carroll Branch	LR-39	Slade Run

LR-21	Piney Creek	LR-132	Black Rock Rn. (LR-32 Relocated)
LR-22 (GF1)	Gunpowder Falls - Glencoe	LR-133	Indian Run (LR-33 Relocated)
Lower Gunpowder Falls – 7 Sites			
GU-01	Bean Run	GU-06	Cowen Run
GU-03	Haystack Branch	GU-07	Jennifer Branch
GU-04	Long Green Creek – Hydes Rd.	GU-08	Minebank Run
GU-05	Long Green Creek – Hartley Mill		
Little Gunpowder Falls – 7 Sites			
LG-01	Nelson Branch	LG-05	Little Gunpowder Falls
LG-02	Parker Branch	LG-07	Little Gunpowder Falls
LG-03	Sawmill Branch	LG-09	Frannklinville Channel.
LG-04	Little Gunpowder Falls		
Bird River – 5 Sites			
BI-01	Windlass Run	BI-04	North Fork
BI-02	Honeygo Run	BI-05	Whitemarsh Run – Mainstem
BI-03	Whitemarsh Run - Headwaters		

Appendix 9-2: Baseflow Water Quality Data by Site

Site	Pollutant Parameter					
	pH			TSS		
	Mean	N	Std.Dev	Mean	N	Std.Dev
Liberty Reservoir						
LI-01	7.36	3	0.49	1.67	3	2.02
LI-02	7.25	3	0.43	0.50	3	0.00
LI-03	7.07	3	0.36	0.50	3	0.00
LI-04	6.94	3	0.48	0.50	2	0.00
LI-09	6.98	3	0.42	3.00	3	4.33
LI-10	7.74	3	0.21	1.00	3	0.87
Patapsco River						
PA-04	8.43	4	0.37	4.13	4	2.59
PA-06	8.14	4	0.38	2.38	4	3.75
PA-09	8.07	3	0.06	0.88	4	0.75
PA-12	8.04	4	0.30	1.88	4	2.75
PA-13	8.28	4	0.65	3.38	4	5.75
Gwynns Falls						
GW-01	7.14	4	0.65	5.75	4	9.53
GW-03	7.15	3	0.34	1.00	3	0.87
GW-04	7.46	3	0.49	18.17	3	22.87
GW-05	7.38	3	0.51	0.50	3	0.00
GW-07	7.80	3	0.23	2.33	3	3.18
GW-10	7.79	3	0.07	0.50	3	0.00
Site	Pollutant Parameter					
	pH			TSS		
	Mean	N	Std.Dev	Mean	N	Std.Dev
Jones Falls						
JF-01	7.38	7	0.73	1.50	7	1.71
JF-04	7.30	3	0.32	21.67	3	36.66
JF-05	7.48	3	0.31	1.67	3	2.02
JF-07	8.17	3	0.18	3.67	3	5.48
JF-08	7.49	7	0.80	4.00	7	7.18
JF-09	7.76	7	0.88	0.50	7	0.00
JF-10	7.78	3	0.12	2.33	3	3.18
JF-11	8.13	3	0.31	3.67	3	5.48
Back River						
HR-01	8.01	6	0.63	0.50	6	0.00
HR-02	7.50	6	0.58	2.58	6	3.71
HR-03	7.27	6	0.54	4.33	6	6.07
HR-04	7.59	6	0.36	6.58	6	9.64
BR-01	7.98	1	0.00	10.00	1	0.00
BR-02	7.45	6	0.34	0.50	6	0.00
BR-03	7.79	6	0.33	1.08	6	1.43
BR-04	8.00	6	0.6	1.08	6	1.43
BR-05A	7.70	6	0.39	3.17	6	2.84
BR-06	7.64	6	0.37	0.75	6	0.61
Site	Pollutant Parameter					
	TS			TKN		
	Mean	N	Std.Dev	Mean	N	Std.Dev

Liberty Reservoir						
LI-01	165.33	3	53.15	0.15	3	0.09
LI-02	159.33	3	15.53	0.15	3	0.08
LI-03	119.33	3	36.46	0.10	3	0.00
LI-04	162.67	3	77.00	0.10	3	0.00
LI-09	82.67	3	50.77	0.18	3	0.14
LI-10	138.67	3	35.23	0.10	3	0.00
Patapsco River						
PA-04	212.50	4	49.70	0.22	4	0.17
PA-06	228.50	4	36.38	0.21	4	0.15
PA-09	268.50	4	48.07	0.20	4	0.12
PA-12	140.00	4	30.94	0.30	4	0.24
PA-13	510.00	4	52.59	0.33	4	0.32
Gwynns Falls						
GW-01	728.50	4	446.97	0.16	3	0.10
GW-03	314.67	3	19.73	0.10	2	0.00
GW-04	224.67	3	82.08	0.10	2	0.00
GW-05	181.33	3	19.01	0.18	2	0.11
GW-07	324.67	3	69.58	0.27	3	0.04
GW-10	565.33	3	209.06	0.47	3	0.19
Site	**Pollutant Parameter**					
	TS			**TKN**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
Jones Falls						
JF-01	323.43	7	94.10	0.80	6	1.40
JF-04	173.33	3	66.40	0.10	3	0.00
JF-05	155.33	3	37.75	0.10	3	0.00
JF-07	454.00	3	275.16	0.18	3	0.07
JF-08	405.43	7	94.50	0.10	6	0.00
JF-09	320.86	7	42.12	0.10	6	0.00
JF-10	564.00	3	253.62	0.21	3	0.11
JF-11	176.67	3	25.79	0.11	3	0.01
Back River						
HR-01	263.67	6	67.82	0.14	6	0.07
HR-02	375.67	6	83.94	0.14	6	0.06
HR-03	384.42	6	206.07	0.15	6	0.13
HR-04	429.33	6	262.63	0.31	6	0.22
BR-01	430.00	1	0.00	0.25	1	0.00
BR-02	374.67	6	96.69	0.30	5	0.22
BR-03	298.33	6	101.38	0.24	5	0.13
BR-04	291.33	6	83.59	0.98	5	1.66
BR-05A	487.33	6	101.68	0.18	6	0.09
BR-06	314.33	6	57.83	0.20	6	0.09
Site	**Pollutant Parameter**					
	NO_2-NO_3			**TP**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
Liberty Reservoir						
LI-01	3.93	3	1.93	0.05	3	0.03
LI-02	1.47	3	0.90	0.98	3	1.62
LI-03	2.02	3	0.92	0.03	3	0.04
LI-04	1.52	3	0.72	0.03	3	0.02
LI-09	1.07	3	0.64	0.05	3	0.03
LI-10	0.43	3	0.40	0.03	3	0.03

Patapsco River						
PA-04	0.41	4	0.13	0.02	4	0.01
PA-06	0.50	4	0.24	0.05	4	0.03
PA-09	0.54	4	0.08	0.02	4	0.02
PA-12	1.48	4	0.18	0.02	4	0.01
PA-13	0.71	4	0.16	0.03	4	0.02
Gwynns Falls						
GW-01	1.74	4	0.70	0.06	3	0.03
GW-03	2.36	3	1.32	0.03	2	0.01
GW-04	1.04	3	0.71	0.04	2	0.00
GW-05	0.42	3	0.03	0.05	2	0.01
GW-07	0.54	3	0.05	0.04	3	0.02
GW-10	0.36	3	0.10	0.06	3	0.02
Site	**Pollutant Parameter**					
	NO_2-NO_3			**TP**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
Jones Falls						
JF-01	0.76	6	0.35	0.28	6	0.53
JF-04	1.72	3	0.11	0.03	3	0.02
JF-05	1.39	3	0.33	0.02	3	0.01
JF-07	1.2	3	0.16	0.03	3	0.02
JF-08	1.52	6	0.12	0.05	6	0.02
JF-09	0.76	6	0.16	0.04	6	0.02
JF-10	1.70	3	0.21	0.07	3	0.06
JF-11	1.26	3	0.11	0.05	3	0.03
Back River						
HR-01	1.57	5	0.24	0.05	6	0.02
HR-02	1.31	5	0.10	0.04	6	0.02
HR-03	0.98	5	0.28	0.05	6	0.02
HR-04	0.71	5	0.28	0.06	6	0.02
BR-01	1.75	1	0.00	0.09	1	0.00
BR-02	1.79	6	0.39	0.04	5	0.03
BR-03	0.86	6	0.22	0.04	5	0.02
BR-04	0.92	6	0.34	0.06	5	0.06
BR-05A	0.36	6	0.19	0.07	6	0.08
BR-06	0.54	6	0.31	0.04	6	0.02
Site	**Pollutant Parameter**					
	Cd			**Cd-dissolved**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
Liberty Reservoir						
LI-01	0.0005	3	0.0000	0.0005	3	0.0000
LI-02	0.0005	3	0.0000	0.0005	3	0.0000
LI-03	0.0005	3	0.0000	0.0005	3	0.0000
LI-04	0.0005	3	0.0000	0.0005	3	0.0000
LI-09	0.0005	3	0.0000	0.0005	3	0.0000
LI-10	0.0005	3	0.0000	0.0005	3	0.0000
Patapsco River						
PA-04	0.0005	4	0.0000	0.0005	4	0.0000
PA-06	0.0005	4	0.0000	0.0005	4	0.0000
PA-09	0.0005	4	0.0000	0.0005	4	0.0000
PA-12	0.0005	4	0.0000	0.0005	4	0.0000
PA-13	0.0005	4	0.0000	0.0005	4	0.0000

Gwynns Falls						
GW-01	0.0005	4	0.0000	0.0005	4	0.0000
GW-03	0.0005	3	0.0000	0.0005	3	0.0000
GW-04	0.0005	3	0.0000	0.0005	3	0.0000
GW-05	0.0005	3	0.0000	0.0005	3	0.0000
GW-07	0.0005	3	0.0000	0.0005	3	0.0000
GW-10	0.0005	3	0.0000	0.0005	3	0.0000
Site	**Pollutant Parameter**					
	Cd			**Cd-dissolved**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
Jones Falls						
JF-01	0.0005	6	0.0000	0.0005	6	0.0000
JF-04	0.0005	3	0.0000	0.0005	3	0.0000
JF-05	0.0005	3	0.0000	0.0005	3	0.0000
JF-07	0.0005	3	0.0000	0.0005	3	0.0000
JF-08	0.0005	6	0.0000	0.0005	6	0.0000
JF-09	0.0005	6	0.0000	0.0005	6	0.0000
JF-10	0.0005	3	0.0000	0.0005	3	0.0000
JF-11	0.0005	3	0.0000	0.0005	3	0.0000
Back River						
HR-01	0.0005	6	0.0000	0.0005	6	0.0000
HR-02	0.0005	6	0.0000	0.0005	6	0.0000
HR-03	0.0031	6	0.0063	0.00092	6	0.001
HR-04	0.0005	6	0.0000	0.0005	6	0.0000
BR-01	0.0005	1	0.0000	0.0005	1	0.0000
BR-02	0.0005	5	0.0000	0.0005	5	0.0000
BR-03	0.0005	5	0.0000	0.0005	5	0.0000
BR-04	0.0005	5	0.0000	0.0005	5	0.0000
BR-05A	0.0005	6	0.0000	0.0005	6	0.0000
BR-06	0.0005	6	0.0000	0.0005	6	0.0000
Site	**Pollutant Parameter**					
	Cu			**Cu-dissolved**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
Liberty Reservoir						
LI-01	0.0167	3	0.0176	0.0030	3	0.0043
LI-02	0.0095	3	0.0143	0.0023	3	0.0032
LI-03	0.0113	3	0.0188	0.0023	3	0.0032
LI-04	0.0057	3	0.0089	0.0023	3	0.0032
LI-09	0.0060	3	0.0095	0.0023	3	0.0032
LI-10	0.0087	3	0.0081	0.0023	3	0.0023
Patapsco River						
PA-04	0.0049	4	0.0055	0.0014	4	0.0011
PA-06	0.0104	4	0.0158	0.0029	4	0.0041
PA-09	0.0114	4	0.0191	0.0028	4	0.0042
PA-12	0.0081	4	0.0078	0.0044	4	0.0058
PA-13	0.0169	4	0.0281	0.0031	4	0.0046
Gwynns Falls						
GW-01	0.0046	4	0.0046	0.0011	4	0.0006
GW-03	0.0032	3	0.0024	0.0008	3	0.0003
GW-04	0.0040	3	0.0061	0.0010	3	0.0009
GW-05	0.0077	3	0.0051	0.0025	3	0.0023
GW-07	0.0120	3	0.0082	0.0033	3	0.0025
GW-10	0.0253	3	0.0200	0.0057	3	0.0035

Site	Pollutant Parameter					
	Cu			Cu-dissolved		
	Mean	N	Std.Dev	Mean	N	Std.Dev
Jones Falls						
JF-01	0.0027	6	0.0051	0.0010	6	0.0010
JF-04	0.0037	3	0.0055	0.0010	3	0.0009
JF-05	0.0037	3	0.0038	0.0013	3	0.0006
JF-07	0.0020	3	0.0026	0.0007	3	0.0003
JF-08	0.0047	6	0.0067	0.0015	6	0.0018
JF-09	0.0023	6	0.0043	0.0010	6	0.0010
JF-10	0.0042	3	0.0038	0.0012	3	0.0008
JF-11	0.0010	3	0.0009	0.0007	3	0.0003
Back River						
HR-01	0.0030	6	0.0059	0.0010	6	0.0010
HR-02	0.0030	6	0.0054	0.0010	6	0.0010
HR-03	0.0027	6	0.0046	0.0010	6	0.0010
HR-04	0.0045	6	0.0062	0.0009	6	0.0010
BR-01	0.0005	1	0.0000	0.0005	1	0.0000
BR-02	0.0023	5	0.0038	0.0008	5	0.0007
BR-03	0.0023	5	0.0038	0.0011	5	0.0011
BR-04	0.0048	5	0.0085	0.0018	5	0.0024
BR-05A	0.0027	6	0.0039	0.0008	6	0.0006
BR-06	0.0027	6	0.0039	0.0012	6	0.0011
Site	Pollutant Parameter					
	Pb			Pb-dissolved		
	Mean	N	Std.Dev	Mean	N	Std.Dev
Liberty Reservoir						
LI-01	0.0010	3	0.0009	0.0007	3	0.0007
LI-02	0.0010	3	0.0009	0.0007	3	0.0007
LI-03	0.0010	3	0.0009	0.0005	3	0.0005
LI-04	0.0010	3	0.0009	0.0007	3	0.0007
LI-09	0.0007	3	0.0003	0.0007	3	0.0007
LI-10	0.0008	3	0.0003	0.0005	3	0.0005
Patapsco River						
PA-04	0.0006	4	0.0003	0.0005	4	0.0005
PA-06	0.0009	4	0.0008	0.0006	4	0.0006
PA-09	0.0009	4	0.0008	0.0006	4	0.0006
PA-12	0.0006	4	0.0003	0.0005	4	0.0005
PA-13	0.0011	4	0.0013	0.0006	4	0.0006
Gwynns Falls						
GW-01	0.0006	4	0.0003	0.0005	4	0.0005
GW-03	0.0008	3	0.0003	0.0005	3	0.0005
GW-04	0.0012	3	0.0008	0.0007	3	0.0007
GW-05	0.0008	3	0.0003	0.0005	3	0.0005
GW-07	0.0007	3	0.0003	0.0005	3	0.0005
GW-10	0.0010	3	0.0009	0.0007	4	0.0007
Site	Pollutant Parameter					
	Pb			Pb-dissolved		
	Mean	N	Std.Dev	Mean	N	Std.Dev
Jones Falls						
JF-01	0.0006	6	0.0002	0.0005	6	0.0005
JF-04	0.0007	3	0.0003	0.0005	3	0.0005
JF-05	0.0007	3	0.0003	0.0005	3	0.0005

JF-07	0.0005	3	0.0000	0.0005	3	0.0005
JF-08	0.0008	6	0.0006	0.0006	6	0.0006
JF-09	0.0006	6	0.0002	0.0006	6	0.0006
JF-10	0.0005	3	0.0000	0.0005	3	0.0005
JF-11	0.0005	3	0.0000	0.0005	3	0.0005
Back River						
HR-01	0.0007	6	0.0003	0.0006	6	0.0006
HR-02	0.0008	6	0.0006	0.0006	6	0.0006
HR-03	0.0007	6	0.0003	0.0006	6	0.0006
HR-04	0.0008	6	0.0006	0.0006	6	0.0006
BR-01	0.0010	1	0.0000	0.0005	1	0.0000
BR-02	0.0006	5	0.0002	0.0005	5	0.0005
BR-03	0.0009	5	0.0007	0.0006	5	0.0006
BR-04	0.0008	5	0.0003	0.0005	5	0.0005
BR-05A	0.0008	6	0.0006	0.0006	6	0.0006
BR-06	0.0006	6	0.0002	0.0005	6	0.0005
Site	**Pollutant Parameter**					
	Zn			**Zn-dissolved**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
Liberty Reservoir						
LI-01	0.0090	3	0.0147	0.0027	3	0.0038
LI-02	0.0137	3	0.0228	0.0030	3	0.0043
LI-03	0.0070	3	0.0113	0.0023	3	0.0032
LI-04	0.0097	3	0.0159	0.0033	3	0.0049
LI-09	0.0050	3	0.0078	0.0013	3	0.0014
LI-10	0.0120	3	0.0079	0.0023	3	0.0015
Patapsco River						
PA-04	0.0091	4	0.0094	0.0026	4	0.0017
PA-06	0.0203	4	0.0180	0.0054	4	0.0044
PA-09	0.0061	4	0.0062	0.0016	4	0.0011
PA-12	0.0066	4	0.0081	0.0024	4	0.0031
PA-13	0.0105	4	0.0064	0.0028	4	0.0022
Gwynns Falls						
GW-01	0.0131	4	0.0146	0.0044	4	0.0043
GW-03	0.0142	3	0.0119	0.0052	3	0.0043
GW-04	0.0135	3	0.0113	0.0038	3	0.0038
GW-05	0.0125	3	0.0110	0.0038	3	0.0038
GW-07	0.0040	3	0.0061	0.0010	3	0.0009
GW-10	0.0063	3	0.0101	0.0030	3	0.0043
Site	**Pollutant Parameter**					
	Zn			**Zn-dissolved**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
Jones Falls						
JF-01	0.0066	6	0.0082	0.0019	6	0.0018
JF-04	0.0040	3	0.0061	0.0013	3	0.0014
JF-05	0.0150	3	0.0140	0.0032	3	0.0024
JF-07	0.0045	3	0.0065	0.0012	3	0.0008
JF-08	0.0083	6	0.0087	0.0023	6	0.0024
JF-09	0.0061	6	0.0063	0.0019	6	0.0016
JF-10	0.0045	3	0.0057	0.0015	3	0.0013
JF-11	0.0007	3	0.0003	0.0005	3	0.0000
Back River						
HR-01	0.0056	6	0.0077	0.0014	6	0.0012

HR-02	0.0113	6	0.0140	0.0021	6	0.0023
HR-03	0.0093	6	0.0081	0.0018	6	0.0015
HR-04	0.0080	6	0.0117	0.0060	6	0.0024
BR-01	0.0200	1	0.0000	0.0041	1	0.0000
BR-02	0.0135	5	0.0099	0.0038	5	0.0034
BR-03	0.0170	5	0.0244	0.0029	5	0.0046
BR-04	0.0117	5	0.0202	0.0057	5	0.0041
BR-05A	0.0183	6	0.0226	0.0029	6	0.0061
BR-06	0.0108	6	0.01818	0.0060	6	0.0041
Site	**Pollutant Parameter**					
	BOD			**COD**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
Liberty Reservoir						
LI-01	1.00	3	0.00	6.00	3	6.06
LI-02	1.00	3	0.00	5.00	3	4.33
LI-03	1.00	3	0.00	4.67	3	3.75
LI-04	1.00	3	0.00	2.50	3	0.00
LI-09	1.00	3	0.00	6.33	3	6.64
LI-10	1.00	3	0.00	5.67	3	5.48
Patapsco River						
PA-04	1.00	4	0.00	9.88	4	5.92
PA-06	1.00	4	0.00	10.38	4	6.02
PA-09	1.00	4	0.00	9.00	4	7.78
PA-12	2.00	4	2.00	10.38	4	5.68
PA-13	1.00	4	0.00	13.38	4	11.88
Gwynns Falls						
GW-01	1.75	4	1.50	8.13	4	11.25
GW-03	0.67	3	0.58	4.33	3	3.18
GW-04	1.00	3	0.00	6.67	3	7.22
GW-05	1.00	3	0.00	4.33	3	3.18
GW-07	1.00	3	0.00	8.50	3	6.26
GW-10	1.00	3	0.00	23.67	3	5.69
Site	**Pollutant Parameter**					
	BOD			**COD**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
Jones Falls						
JF-01	1.86	7	1.86	12.64	7	7.06
JF-04	1.00	3	0.00	6.83	3	4.25
JF-05	1.00	3	0.00	5.67	3	5.48
JF-07	1.00	3	0.00	8.17	3	5.01
JF-08	2.14	7	1.86	5.29	7	4.94
JF-09	1.57	7	0.98	4.36	7	3.92
JF-10	1.00	3	0.00	7.83	3	4.86
JF-11	1.00	3	0.00	3.33	3	1.44
Back River						
HR-01	1.67	6	1.03	6.92	6	6.03
HR-02	2.17	6	2.86	9.08	6	7.47
HR-03	1.83	6	1.33	5.33	6	3.13
HR-04	3.83	6	3.31	10.83	6	6.85
BR-01	1.00	1	0.00	9.00	1	0.00
BR-02	1.17	6	0.41	8.67	6	6.43
BR-03	1.00	6	0.00	5.00	6	3.92
BR-04	1.00	6	0.00	7.00	6	3.99

BR-05A	1.00	6	0.00	5.92	6	3.87
BR-06	1.00	6	0.00	4.83	6	3.74
Site	**Pollutant Parameter**					
	Cl			**Na**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
Liberty Reservoir						
LI-01	39.11	3	10.22	22.83	3	13.28
LI-02	45.58	3	19.99	24.82	3	14.15
LI-03	38.80	3	11.64	20.52	3	11.28
LI-04	60.63	3	15.41	23.30	3	13.18
LI-09	17.25	3	9.25	21.18	2	10.01
LI-10	19.62	3	11.68	13.87	3	4.78
Patapsco River						
PA-04	42.92	4	6.86	58.54	4	34.50
PA-06	53.12	4	14.13	58.35	4	26.56
PA-09	75.55	4	10.83	56.04	4	25.45
PA-12	27.89	4	2.43	39.21	4	35.16
PA-13	161.56	2	2.59	93.93	4	36.83
Gwynns Falls						
GW-01	193.08	3	201.35	74.02	3	37.81
GW-03	87.60	3	8.24	49.75	2	12.80
GW-04	73.66	3	0.71	46.38	2	16.51
GW-05	15.46	3	1.90	22.78	3	6.57
GW-07	91.66	3	24.57	45.75	3	9.61
GW-10	174.04	2	90.91	83.77	3	10.47
Site	**Pollutant Parameter**					
	Cl			**Na**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
Jones Falls						
JF-01	142.42	6	46.05	84.94	6	19.14
JF-04	37.98	2	2.57	56.32	3	16.61
JF-05	59.85	2	24.30	45.65	3	8.88
JF-07	94.95	2	15.34	52.71	3	24.06
JF-08	156.30	6	34.55	87.55	6	15.97
JF-09	76.14	6	8.78	43.93	6	7.66
JF-10	201.44	2	242.91	109.86	3	104.92
JF-11	36.48	2	2.16	39.51	3	26.98
Back River						
HR-01	92.08	5	25.33	58.23	6	24.04
HR-02	119.09	5	29.78	70.64	6	23.04
HR-03	176.47	5	60.38	87.75	6	42.38
HR-04	216.28	5	202.23	117.14	6	81.72
BR-01	108.78	1	0.00	119.80	1	0.00
BR-02	187.26	6	100.43	120.56	5	40.64
BR-03	110.99	6	51.86	89.06	5	41.08
BR-04	102.11	6	44.43	77.85	5	34.52
BR-05A	265.72	6	128.25	160.28	6	31.16
BR-06	119.21	6	48.38	91.00	6	35.79
Site	**Pollutant Parameter**					
	Hardness			**Mg**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
Liberty Reservoir						
LI-01	66.44	3	33.51	5.92	3	3.85

LI-02	61.87	3	31.39	5.53	3	3.71
LI-03	56.18	3	13.63	5.07	3	2.39
LI-04	69.98	3	20.18	5.85	3	3.26
LI-09	31.47	2	8.89	4.77	2	2.45
LI-10	79.18	3	56.99	11.50	3	12.80
Patapsco River						
PA-04	163.98	4	60.31	17.74	4	10.07
PA-06	145.63	4	51.72	12.48	4	6.42
PA-09	184.40	4	57.03	14.76	4	7.88
PA-12	97.06	4	23.96	7.55	4	3.56
PA-13	260.53	4	111.32	21.13	4	12.03
Gwynns Falls						
GW-01	427.80	3	281.33	36.22	3	21.34
GW-03	139.91	2	49.30	14.80	2	3.89
GW-04	144.60	2	53.83	16.23	2	5.06
GW-05	154.10	3	35.27	11.90	3	1.88
GW-07	262.66	3	91.32	24.30	3	10.13
GW-10	399.87	3	125.20	40.55	3	15.14
Site	**Pollutant Parameter**					
	Hardness			**Mg**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
Jones Falls						
JF-01	160.46	6	83.91	12.19	5	2.79
JF-04	101.80	3	76.46	21.39	3	16.97
JF-05	129.17	3	114.84	31.45	3	28.92
JF-07	201.31	3	149.04	137.79	3	198.69
JF-08	219.78	6	54.65	15.61	5	1.65
JF-09	305.14	6	66.49	22.55	5	2.43
JF-10	185.60	3	102.07	120.91	3	178.64
JF-11	151.68	3	109.36	63.69	3	81.40
Back River						
HR-01	204.73	6	41.69	15.38	4	0.86
HR-02	243.62	6	12.48	17.64	4	1.24
HR-03	274.81	6	60.39	23.51	4	1.90
HR-04	217.93	6	57.09	15.48	4	2.48
BR-01	266.45	1	0.00	20.50	1	0.00
BR-02	232.19	5	41.89	15.13	4	1.20
BR-03	200.86	5	31.38	13.14	4	3.08
BR-04	206.84	5	25.21	13.24	4	2.09
BR-05A	265.12	6	29.08	17.99	4	2.43
BR-06	239.13	6	43.08	19.61	4	3.48
Site	**Pollutant Parameter**					
	Ca					
	Mean	**N**	**Std.Dev**			
Liberty Reservoir						
LI-01	16.85	3	7.50			
LI-02	15.64	3	6.67			
LI-03	14.13	3	1.77			
LI-04	18.38	3	2.75			
LI-09	4.74	2	0.47			
LI-10	12.74	3	5.67			
Patapsco River						
PA-04	36.42	4	9.35			

PA-06	37.75	4	11.67			
PA-09	49.51	4	11.60			
PA-12	26.41	4	4.93			
PA-13	69.50	4	28.31			
Gwynns Falls						
GW-01	111.60	3	77.80			
GW-03	31.63	2	13.33			
GW-04	31.18	2	13.19			
GW-05	42.08	3	11.07			
GW-07	65.17	3	21.34			
GW-10	93.27	3	25.18			
Site	**Pollutant Parameter**					
	Ca					
	Mean	**N**	**Std.Dev**			
Jones Falls						
JF-01	49.81	5	25.46			
JF-04	26.57	3	21.88			
JF-05	36.05	3	31.16			
JF-07	60.18	3	26.78			
JF-08	63.35	5	21.73			
JF-09	86.25	5	25.86			
JF-10	53.80	3	25.24			
JF-11	43.30	3	25.80			
Back River						
HR-01	63.80	4	6.77			
HR-02	71.20	4	2.51			
HR-04	65.16	4	12.16			
HR-03	82.34	4	1.13			
BR-01	72.90	1	0.00			
BR-02	62.15	4	10.52			
BR-03	58.00	4	9.66			
BR-04	58.60	4	8.23			
BR-05A	73.51	4	9.64			
BR-06	68.16	4	14.02			

Appendix 9-3: Tidal Waters Chemical Monitoring Results

Site	TSS			TS		
	Mean	N	Std.Dev	Mean	N	Std.Dev
BC	39.5	15.0	23.8	9273.3	15	3390.3
PR	47.5	15.0	28.6	10238.9	15	3964.0
BD	34.3	16.0	22.4	1725.3	16	1856.0
BR	31.1	16.0	17.6	4246.6	16	2644.7
GR	21.1	16.0	14.9	3084.1	16	2598.4
MR	24.5	16.0	19.8	4513.9	16	3383.4
MS	27.3	16.0	21.5	4950.8	16	3592.1
PSE	39.9	17.0	41.4	6881.1	17	2494.3
PSF	6.3	17.0	13.4	187.4	17	63.9
HM	31.8	14.0	20.9	5861.7	14	3402.1
Site	**TKN**			**NO_2-NO_3**		
	Mean	N	Std.Dev	Mean	N	Std.Dev
BC	0.7788	16	0.3168	0.1546	13	0.2485
PR	1.0438	16	0.6876	0.2046	13	0.2834
BD	0.7838	16	0.2260	0.3831	13	0.5302
BR	1.1963	16	0.3768	5.3969	13	18.5830
GR	0.3794	16	0.1976	0.3700	13	0.4615
MR	0.3863	16	0.1812	0.2369	13	0.3049
MS	0.3269	16	0.1375	0.2146	13	0.2986
PSE	0.8112	17	0.4277	0.1947	15	0.2276
PSF	0.5047	17	0.3764	0.9680	15	0.5319
HM	0.3657	14	0.1420	0.2018	11	0.3333
Site	**TP**			**OP**		
	Mean	N	Std.Dev	Mean	N	Std.Dev
BC	0.1331	16	0.0767	0.05	13	0.00
PR	0.1119	16	0.0856	0.05	13	0.00
BD	0.1094	16	0.0448	0.05	13	0.00
BR	0.3731	16	0.7491	0.05	13	0.00
GR	0.0669	16	0.0316	0.05	13	0.00
MR	0.0531	16	0.0145	0.05	13	0.00
MS	0.0513	16	0.0200	0.05	13	0.00
PSE	0.1035	17	0.0637	0.05	15	0.00
PSF	0.0500	17	0.0392	0.05	15	0.00
HM	0.0679	14	0.0181	0.05	11	0.00
Site	**Cd**			**Cd-dissolved**		
	Mean	N	Std.Dev	Mean	N	Std.Dev
BC	0.0005	16	0.0000	0.0005	16	0.0000
PR	0.0005	16	0.0000	0.0005	16	0.0000
BD	0.0005	16	0.0000	0.0005	16	0.0000
BR	0.0005	16	0.0000	0.0005	16	0.0000
GR	0.0005	16	0.0000	0.0005	16	0.0000
MR	0.0005	16	0.0000	0.0005	16	0.0000
MS	0.0005	16	0.0000	0.0005	16	0.0000
PSE	0.0005	17	0.0000	0.0005	17	0.0000
PSF	0.0005	17	0.0000	0.0005	17	0.0000
HM	0.0005	14	0.0000	0.0005	14	0.0000

Site	Cu			Cu-dissolved		
	Mean	N	Std.Dev	Mean	N	Std.Dev
BC	0.0247	16	0.0128	0.0065	16	0.0032
PR	0.0278	16	0.0157	0.0071	16	0.0037
BD	0.0095	16	0.0164	0.0025	16	0.0028
BR	0.0094	16	0.0104	0.0030	16	0.0030
GR	0.0115	16	0.0187	0.0032	16	0.0033
MR	0.0159	16	0.0282	0.0045	16	0.0057
MS	0.0102	16	0.0105	0.0047	16	0.0067
PSE	0.0143	17	0.0144	0.0040	17	0.0037
PSF	0.0078	17	0.0139	0.0021	17	0.0029
HM	0.0155	14	0.0194	0.0043	14	0.0041
Site	**Pb**			**Pb-dissolved**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
BC	0.0016	16	0.0008	0.0008	16	0.0004
PR	0.0018	16	0.0010	0.0009	16	0.0004
BD	0.0008	16	0.0005	0.0005	16	0.0001
BR	0.0009	16	0.0007	0.0006	16	0.0002
GR	0.0008	16	0.0005	0.0006	16	0.0002
MR	0.0010	16	0.0006	0.0006	16	0.0002
MS	0.0010	16	0.0008	0.0007	16	0.0002
PSE	0.0010	17	0.0008	0.0006	17	0.0002
PSF	0.0008	17	0.0006	0.0006	17	0.0002
HM	0.0009	14	0.0006	0.0006	14	0.0002
Site	**Zn**			**Zn-dissolved**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
BC	0.0187	16	0.0185	0.0048	16	0.0040
PR	0.0161	16	0.0171	0.0041	16	0.0039
BD	0.0077	16	0.0090	0.0023	16	0.0024
BR	0.0127	16	0.0153	0.0033	16	0.0036
GR	0.0064	16	0.0059	0.0020	16	0.0017
MR	0.0095	16	0.0103	0.0030	16	0.0027
MS	0.0087	16	0.0084	0.0026	16	0.0024
PSE	0.0133	17	0.0133	0.0036	17	0.0032
PSF	0.0089	17	0.0130	0.0026	17	0.0033
HM	0.0067	14	0.0100	0.0017	14	0.0021
Site	**BOD**			**COD**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
BC	3.9	16	1.5	27.2	16	12.1
PR	5.3	16	6.0	43.2	16	63.3
BD	3.0	16	1.0	16.8	16	18.3
BR	4.6	16	2.2	23.1	16	18.9
GR	1.1	16	0.3	13.8	16	14.4
MR	1.2	16	0.4	13.8	16	7.5
MS	1.1	16	0.3	21.6	16	19.5
PSE	3.4	17	3.0	17.8	18	13.8
PSF	1.4	18	1.0	11.2	18	8.6
HM	1.7	14	1.4	20.3	14	16.0
Site	**CL**			**Fl**		
	Mean	**N**	**Std.Dev**	**Mean**	**N**	**Std.Dev**
BC	4820.9	15	2063.7	0.25	15	0.00
PR	5585.3	15	2588.0	0.25	15	0.00

BD	852.3	15	1000.3	0.25	15	0.00
BR	2356.1	15	1502.6	0.25	15	0.00
GR	1665.3	15	1560.9	0.25	15	0.00
MR	2079.9	15	1888.5	0.25	15	0.00
MS	2655.2	15	2161.7	0.25	15	0.00
PSE	4217.0	16	1697.4	0.25	17	0.00
PSF	46.1	17	11.3	0.25	17	0.00
HM	3242.7	13	2029.8	0.25	13	0.00
Site	**SO_4**					
	Mean	**N**	**Std.Dev**			
BC	702.35	14	294.86			
PR	790.24	15	332.30			
BD	128.93	15	146.63			
BR	353.13	15	208.26			
GR	248.02	15	222.00			
MR	353.10	15	269.14			
MS	397.48	15	299.25			
PSE	596.93	16	225.39			
PSF	17.93	17	4.53			
HM	485.65	13	276.84			

Appendix 9-4: Results of 2007 Probabilistic Monitoring

Station ID	Subwatershed	DNR 12 Digit Subsheds	Benthic Index of Biotic Integrity Score	Rating
Liberty Reservoir				
503010	Norris Run	048	3.33	Fair
503017	Locust Run	046	4.33	Good
507009	Norris Run	048	3.67	Fair
507016	Locust Run	046	4.33	Good
507018	Glen Falls Run	048	4.00	Good
507019	Norris Run	048	4.33	Good
507020	Liberty Reservoir-F	046	4.33	Good
507025	Cliffs Branch	048	3.00	Fair
507027	Locust Run	046	3.33	Fair
507028	Locust Run	046	4.00	Good
507032	Glen Falls Run	048	3.33	Fair
507033	Cliffs Branch	048	4.00	Good
507038	Timber Run	048	4.00	Good
507041	Keyser Run	048	4.00	Good
507047	Glen Falls Run	048	3.67	Fair
507050	Glen Falls Run	048	4.33	Good
507052	Locust Run	046	4.33	Good
507054	Liberty Reservoir-F	046	4.00	Good
507055	Liberty Reservoir-F	046	4.33	Good
507058	Locust Run	046	4.33	Good
Patapsco River				
603058	Herbert Run (E. Br)	012	1.86	Very Poor
607003	Patapsco River-A	017	2.67	Poor
607006	Herbert Run (E. Br)	012	3.29	Fair
607011	Bull Branch	016	1.67	Very Poor
607017	Mardella Run	019	4.00	Good
607021	Brice Run	019	3.67	Fair
607022	Mardella Run	019	3.00	Fair
607027	Miller Branch	017	1.33	Very Poor
607029	Brice Run	019	1.67	Very Poor
607031	Ben's Run	018	2.33	Poor
607032	Cedar Branch	017	2.33	Poor
607036	Patapsco River-E	019	4.33	Good
607041	Herbert Run (E. Br)	012	2.43	Poor
607043	Cooper Branch	017	2.00	Poor
607047	Dogwood Run	018	2.33	Poor
607062	Ben's Run	018	4.67	Good
607064	Patapsco River (N.Br)	019	3.67	Fair

607069	Patapsco River-A	016	1.86	Very Poor
607074	Bull Branch	016	1.33	Very Poor
607076	Patapsco River-E	019	4.33	Good
607091	Patapsco River-A	016	2.33	Poor
607110	Patapsco River-A	016	2.00	Poor
607111	Miller Branch	017	1.33	Very Poor
607112	Miller Branch	017	1.00	Very Poor
Gwynns Falls				
703003	Gwynns Falls-B	045	2.33	Poor
703017	Horsehead Branch	044	2.67	Poor
703033	Gwynns Falls-B	045	2.00	Poor
703040	Red Run	045	4.00	Good
703067	Scotts Level	044	1.33	Very Poor
703075	Dead Run	044	1.67	Very Poor
707002	Powder Mill Run	044	2.00	Poor
707005	Scotts Level	044	2.00	Poor
707011	Powder Mill Run	044	2.33	Poor
707012	Red Run	045	3.33	Fair
707014	Scotts Level	044	1.67	Very Poor
707019	Powder Mill Run	044	2.00	Poor
707030	Gwynns Falls-B	045	2.33	Poor
707034	Horsehead Branch	044	3.00	Fair
707036	Gwynns Falls-B	045	2.00	Poor
707038	Red Run	045	4.00	Good
707039	Red Run	045	3.67	Fair
707044	Red Run	045	3.33	Fair
707048	Powder Mill Run	044	2.00	Poor
707057	Gwynns Falls-B	045	2.67	Poor
707061	Red Run	045	4.33	Good
707069	Gwynns Falls-B	044	2.00	Poor
707070	Powder Mill Run	044	2.00	Poor
707071	Horsehead Branch	044	4.00	Good
707072	Red Run	045	3.67	Fair
707077	Scotts Level	044	2.33	Poor
Jones Falls				
803008	Dipping Pond Run	036	4.33	Good
803025	Slaughterhouse Branch	036	3.00	Fair
803031	Moores Branch	036	1.67	Very Poor
803060	Deep Run-Jones Falls	036	2.00	Poor
807001	Jones Falls	036	3.00	Fair
807002	Roland Run	037	2.00	Poor
807009	Jones Falls (North Branch)	036	2.67	Poor
807012	Jones Falls	036	2.67	Poor
807014	Moores Branch	036	1.33	Very Poor

807017	Jones Falls	036	1.67	Very Poor
807019	Dipping Pond Run	036	3.33	Fair
807021	Jones Falls (North Branch)	036	4.00	Good
807027	Jones Falls (North Branch)	036	4.00	Good
807029	Towson Run	034	1.33	Very Poor
807030	Towson Run	034	1.33	Very Poor
807031	Jones Falls (North Branch)	036	2.33	Poor
807042	Roland Run	037	2.00	Poor
807043	Dipping Pond Run	036	4.00	Good
807045	Roland Run	037	1.67	Very Poor
807051	Jones Falls	036	3.67	Fair
807054	Jones Falls	036	3.33	Fair
807057	Jones Falls (North Branch)	036	4.67	Good
807060	Jones Falls (North Branch)	036	4.00	Good
807064	Jones Falls (North Branch)	036	3.33	Fair
807065	Jones Falls	036	1.67	Very Poor
807066	Slaughterhouse Branch	036	1.67	Very Poor
807068	Jones Falls (North Branch)	036	2.67	Poor
807071	Jones Falls	036	3.67	Fair
Back River				
1203002	Herring Run-B	042	1.00	Very Poor
1203017	Brians Run	039	1.86	Very Poor
1203020	Stemmers Run	039	1.57	Very Poor
1203021	Brians Run	039	1.57	Very Poor
1203022	Herring Run-B	042	NA	NA
1207003	Stemmers Run	039	1.67	Very Poor
1207007	Herring Run-B	042	1.33	Very Poor
1207011	Herring Run-B	042	1.00	Very Poor
1207013	Stemmers Run	039	1.33	Very Poor
1207014	Stemmers Run	039	1.33	Very Poor
1207018	Stemmers Run	039	1.00	Very Poor
1207023	Herring Run-B	042	1.33	Very Poor
1207025	Brians Run	039	1.29	Very Poor
1207026	Redhouse Run	040	1.67	Very Poor
1207028	Deep Creek	038	1.57	Very Poor
1207035	Redhouse Run	040	3.00	Fair
1207036	Stemmers Run	039	1.33	Very Poor
1207038	Herring Run-B	042	2.00	Poor
1207042	Back River-E	038	2.33	Poor
1207043	Redhouse Run	040	1.67	Very Poor

10.0 Permit Requirements

Part IV. Program Review and Annual Progress Reporting

A. Annual Reporting

1. Annual progress reports, required under 40 CFR 122.42(c), will facilitate the long-term assessment of Baltimore County's NPDES stormwater program. The County shall submit annual reports on or before June 15th of each year that include:

   e. The identification of water quality improvements or degradation

10.1 Introduction

The following analysis provides a recalculation of watershed pollutant loads for nitrogen and phosphorus based on guidance from Maryland Department of the Environment on pollutant loading analysis for the Water Resources Element (10.2). It also presents a summary of the pollutant load reductions (water quality improvements) that have resulted from implementation of the management programs required under this permit. It includes reductions due to implementation of stormwater Best Management Practices (Section 1), reductions due to street sweeping and storm drain cleaning programs (Section 3), and reductions due to capital restoration projects (Section 7). Further reductions resulting from illicit connection removals (Section 5) and education activities (Section 4) are discussed under the appropriate section. Actual pollutant load reductions due to illicit connection removals and education activities have not been determined.

With the completion of a number of Total Maximum Daily Load analyses for impaired waters, target load reductions for nutrient, sediment, and bacteria have been determined for a number of watersheds. In addition, additional Water Quality Analyses and proposed modification of the biological listing criteria have resulted in changes to the impairment listings (2008 Integrated Report). Table 10-1 summarizes the reductions required for urban stormwater where they have been determined, on a percentage basis.

Table 10-1: Status of TMDLs and TMDL Reduction Requirements for Urban Stormwater

Watershed	Total Phosphorus	Total Nitrogen	Sediment	Bacteria	Biological	Other (Metals, Toxics)
Deer Creek	NA	NA	NA	NA	Not Comp.	NA
Prettyboy	54% (15% Urban)	NA	NA	Not Comp.	NA	Complete
Loch Raven	50% (15% Urban)	NA	25%	NA	Not Comp.	Complete
Lower Gunpowder	Not Comp.	Not Comp.	NA	NA	Not Comp.	NA
Little Gunpowder	NA	NA	NA	NA	NA	NA
Bird River	NA	NA	Not Comp.	NA	Not Comp.	NA
Gunpowder River	Not Comp.	Not Comp.	Not Comp.	NA	Not Comp.	Not Comp.
Middle River	Not Comp.	Not Comp.	Not Comp.	NA	NA	Not Comp.

Liberty Res.	Not Comp.	Not Comp.	Not Comp.	Not Comp.	Not Comp.	Complete
Patapsco	15%	15%	Not Comp.	NA	Not Comp.	Not Comp.
Gwynns Falls	15%	15%	Not Comp.	67.2-93.2%	Not Comp.	NA
Jones Falls	15%	15%	Not Comp.	92.4-95.3%	Not Comp.	Not Comp.
Back River	15%	15%	Not Comp.	95%	Not Comp.	Complete
Baltimore Harbor	15%	15%	Not Comp.	Not Comp.	Not Comp.	Complete

Additional TMDLs have been completed for chlordane (Back River and Lake Roland), and for mercury in fish tissue (Prettyboy Reservoir, Loch Raven Reservoir, and Liberty Reservoir). However, these TMDLs have limited options to address inputs from storm water discharge due to the nature of the source of pollution (chlordane – historic, mercury – air deposition). A number of listings for impairment have been removed due to Water Quality Assessments that have indicated that the level of particular pollutants is below the existing standards. The most recent Water Quality Assessments have indicated that Jones Falls is not impaired for zinc, and the Patapsco in not impaired for lead or zinc. A summary of the current status of all TMDLs and Water Quality Assessments can be found on the Maryland Department of the Environment web site; http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/Sumittals/index.asp.

The Maryland Tributary Strategies for meeting the Chesapeake Bay Program goals has identified a 24% reduction in nitrogen and a 42% reduction of phosphorus from urban non-point sources. This provides an additional reduction target for nutrients that in some cases exceeds the reductions determined by the TMDL analysis. The differences are due to the target water body being local tidal waters or reservoirs versus the entire Chesapeake Bay. Thus it may be possible to meet local tidal water quality standards, but need additional nutrient reductions to permit the Chesapeake Bay to meet its water quality standards. In the case of the reservoirs the TMDLs are for phosphorus only due to the fact that fresh water is usually phosphorus limited. The models indicate that reductions in nitrogen would result in limited improvement in reservoir water quality.

10.2 Pollutant Load Calculations

Revised pollutant load calculations were made for nitrogen and phosphorus to provide consistency with the Water Resources Element requirements to estimate pollutant loads from development and potential changes in the pollutant loads from future development. Maryland Department of the Environment (MDE) provided guidance for the calculation of the pollutant loads in the form of a spreadsheet with per acre pollutant loading for nitrogen and phosphorus based on the Chesapeake Bay Program – Watershed Model – Phase 4.3. Using the Maryland Department of Planning (MDP) land use designation MDE determined the per acre pollutant load based on basins. Within Baltimore County three basins were identified; Susquehanna above the fall line, Western Shore above the fall line, and Western Shore below the fall line. The delineation of the basins allow Baltimore County to determine the per acre pollutant loading for each of the fourteen 8-digit watersheds within the County. The urban acre loadings are based on acres of impervious cover and acres of pervious cover within the urban land use designations. Table 10-2 provides the per-acre loading by land use and basin for nitrogen and phosphorus.

10-2: Land Use Nutrient Loading Rates (Pounds/Acre)

Land Use	Susquehanna		Western Shore Above Fall Line		Western Shore Below Fall Line	
	Nitrogen	Phosphorus	Nitrogen	Phosphorus	Nitrogen	Phosphorus
Pervious Urban	10.86	0.66	8.29	1.04	11.55	1.58
Impervious Urban	8.21	0.50	7.30	0.45	7.74	0.48
Cropland	12.23	0.85	16.55	0.72	13.54	0.69
Pasture and Orchards	8.42	0.44	7.35	0.73	5.64	0.66
Feeding Operations	15.62	1.60	24.87	1.18	19.68	0.99
Row Crops	12.23	0.85	16.55	0.72	13.54	0.69
Forest	2.36	0.03	1.41	0.02	1.29	0.02
Water	10.61	0.57	10.05	0.57	10.00	0.57
Bare Ground	8.42	0.44	7.35	0.73	5.64	0.66

In order to determine the acres of impervious cover associated with urban land use, the MDP 2002 land use GIS layer was overlain with the planimetric buildings and roadways developed from the 1996-1997 aerials for each watershed. A new planimetric layer is currently in development using 2005 aerial photography. Next years report will provide a revised estimate of urban loads based on the more recent impervious cover. Since the impervious urban cover has a lower per-acre pollutant loading this will result in lower pollutant loads than in the current analysis.

The estimated pollutant loads by watershed are present in Table 10-3 for nitrogen and Table 10-4 for phosphorus. Each watershed load is broken down into the urban load, the agricultural load, and the forest load with the percentages of each.

Table 10-3: Watershed Nitrogen Loads (%)

Watershed	Urban Load	Agricultural Load	Forest Load	Total Load
Deer Creek	7,426 (12.5)	46,022 (77.7)	5,775 (9.8)	59,224
Prettyboy	20,905 (10.4)	148,515 (73.9)	31,556 (15.7)	201,018
Loch Raven	276,641 (24.6)	752,835 (66.9)	94,178 (8.4)	1,125,209
Lower Gunpowder Falls	87,771 (38.8)	122,473 (54.2)	14,591 (6.5)	225,935
Little Gunpowder Falls	33,005 (25.3)	93,897 (71.9)	3,673 (2.8)	130,685
Bird River	87,336.6 (70.8)	26,851 (21.8)	7,826 (6.3)	123,298
Gunpowder River	20,078 (68.8)	3,530 (12.1)	5,569 (19.1)	29,168
Middle River	43,200 (85.3)	3,763 (7.4)	3,145 (6.2)	50,672
Upper Western Shore	**576,364 (29.6)**	**1,197,877 (61.6)**	**166,313 (8.5)**	**1,945,208**
Liberty	28,244 (22.5)	73,006 (58.3)	24,035 (19.2)	125,285
Patapsco River	126,921 (62.6)	54,237 (26.7)	19,564 (9.6)	202,879
Gwynns Falls	172,891 (86.7)	17,644 (8.9)	7,991 (114.9	199,371
Jones Falls	144,532 (74.2)	42,132 (21.6)	7,694 (3.9)	194,898
Back River	177,285 (92.2)	6,801 (3.5)	7,803 (4.1)	192,301
Baltimore Harbor	95,437 (91.7)	4,655 (4.5)	3,935 (3.8)	104,044
Patapsco/Back River	**745,310 (73.2)**	**198,496 (19.5)**	**71,023 (7.0)**	**1,018,777**
County Load	***1,321,673 (44.6)***	***1,396,373 (47.1)***	***71,027 (8.0)***	***2,963,985***

Table 10-4: Watershed Phosphorus Loads (%)

Watershed	Urban Load	Agricultural Load	Forest Load	Total Load
Deer Creek	451 (12.5)	3,064 (85.3)	76 (2.1)	3,591
Prettyboy	2,546 (23.4)	7,259 (66.6)	1,089 (10.0)	10,898
Loch Raven	32,653 (45.2)	37,200 (51.5)	2,229 (3.1)	72,236
Lower Gunpowder Falls	10,176 (59.8)	6,489 (38.1)	251 (1.5)	17,026
Little Gunpowder Falls	3,970 (42.7)	5,259 (56.6)	52 (0.6)	9,292
Bird River	10,692 (86.6)	1,371 (11.1)	134 (1.1)	12,347
Gunpowder River	2,583 (89.6)	179 (6.2)	120 (4.2)	2,883
Middle River	5,185 (93.8)	197 (3.6)	80 (1.5)	5,528
Upper Western Shore	**68,256 (51.0)**	**61,019 (45.6)**	**4,032 (3.0)**	**133,801**
Liberty	3,402 (44.1)	3,429 (44.5)	874 (11.3	7,705
Patapsco River	14,245 (80.1)	3,013 (16.9)	312 (1.8)	17,784
Gwynns Falls	19,045 (94.5)	905 (4.5)	115 (0.6)	20,147
Jones Falls	16,632 (88.0)	2,075 (11.0)	130 (0.7)	18,891
Back River	21,264 (97.5)	349 (1.6)	156 (0.7)	21,818
Baltimore Harbor	11,363 (96.8)	237 (2.0)	137 (1.2)	11,739
Patapsco/Back River	**85,952 (87.6)**	**10,008 (10.2)**	**1,724 (1.8)**	**98,083**
County Load	***154,207 (66.5)***	***71,027 (30.6)***	***5,756 (2.5)***	***231,885***

The same type of analysis was used to determine the loading rates to stormwater management facilities (Section 1) and for stormwater management retrofits and conversions (Section 7)

10.3 Summary of Pollutant Reduction Programs

Four components of the County's overall effort to reduce pollutant loads are summarized in Tables 10-5 and 10-6, which address the Upper Western Shore and the Patapsco/Back River drainages respectively. The components are the Stormwater Management Program, the Vac-Con Program, the Street Sweeping Program, and the Capital Improvement Program. The urban loads for each watershed are presented in each table, along with the progress to date in reducing the pollutant loads for TSS, phosphorus and nitrogen. If a TMDL has been developed, the pollutant load reduction expressed as a percentage is shown. In the nutrient TMDLs developed to date, the expectation for the urban non-point source load reduction is 15%. In the case of Prettyboy and Loch Raven Reservoirs, this is less than the over all load reduction need to meet water quality standards in the receiving waters. The Maryland Tributary Strategies urban pollutant load reduction for nitrogen and phosphorus are 24% and 42%, respectively.

Table 10-5: Pollutant Removal (Pounds) by Upper Western Shore Watersheds Attributed to BMP's

Upper Western Shore			
Deer Creek			
	TSS	**TP**	**TN**
Stormwater Management	0	0	0
Inlet Cleaning	1,026	0.7	2
Street Sweeping	0	0	0
Restoration Projects	0	0	0
Totals	1,026	0.7	2
Urban Watershed Load	**92,636**	**451.4**	**7,426**
% Urban Load Removed	**1.1**	**0.2**	**0.0**

Table 10-5: Pollutant Removal (Pounds) by Upper Western Shore Watersheds Attributed to BMP's (continued)

Prettyboy Reservoir			
	TSS	**TP**	**TN**
Stormwater Management	2,010	12.4	77
Inlet Cleaning	0	0	0
Street Sweeping	0	0	0
Restoration Projects	0	0	0
Totals	2,010	12.4	77
Urban Watershed Load	**310,937**	**2,545.7**	**20,905**
TMDL % Reduction	NA	54% (15% Urban)	NA
% Urban Load Removed	**0.6**	**0.5**	**0.4**
Loch Raven Reservoir			
	TSS	**TP**	**TN**
Stormwater Management	260,660	1,009.3	6,410
Inlet Cleaning	6,885	4.8	13
Street Sweeping	354,200	250.8	647
Restoration Projects	115,408	310.8	5,207
Totals	737,153	1,575.7	12,277
Urban Watershed Load	**4,889,041**	**32,652.7**	**276,461**
TMDL % Reduction	25%	50% (15% Urban)	NA
% Urban Load Removed	**15.1**	**4.8**	**4.4**
Lower Gunpowder River			
	TSS	**TP**	**TN**
Stormwater Management	123,751	461.3	3,429
Inlet Cleaning	563	0.4	1
Street Sweeping	157,600	139.6	360
Restoration Projects	84,066	251.4	4,743
Totals	365,980	852.7	8,533
Urban Watershed Load	**1,627,658**	**10,176.6**	**87,771**
% Urban Load Removed	**22.5**	**8.4**	**9.7**
Little Gunpowder River			
	TSS	**TP**	**TN**
Stormwater Management	14,557	116.7	858
Inlet Cleaning	0	0	0
Street Sweeping	43,200	30.6	79
Restoration Projects	0	0	0
Totals	57,757	147.3	937
Urban Watershed Load	**499,533**	**3,969.8**	**33,005**
% Urban Load Removed	**11.6**	**3.7**	**2.8**
Bird River			
	TSS	**TP**	**TN**
Stormwater Management	167,984	671.7	4,520
Inlet Cleaning	7,183	5.0	13
Street Sweeping	181,200	128.7	332
Restoration Projects	164,860	528.7	8,250
Totals	521,227	1,334.1	13,115
Urban Watershed Load	**1,693,727**	**10,691.9**	**87,336.6**
% Urban Load Removed	**30.8**	**12.5**	**15.0**

Table 10-5: Pollutant Removal (Pounds) by Upper Western Shore Watersheds Attributed to BMP's (continued)

Gunpowder River			
	TSS	**TP**	**TN**
Stormwater Management	7,823	25.6	209
Inlet Cleaning	3,178	2.2	6
Street Sweeping	18,400	13.0	34
Restoration Projects	7,750	18.1	189
Totals	37,151	58.9	438
Urban Watershed Load	**303,755**	**2,582.9**	**20,078**
% Urban Load Removed	**12.2**	**2.3**	**2.2**
Middle River			
	TSS	**TP**	**TN**
Stormwater Management	32,058	98.3	708
Inlet Cleaning	22,276	15.6	40
Street Sweeping	67,800	48.0	124
Restoration Projects	8,720	133.2	1,261
Totals	130,854	295.1	2,133
Urban Watershed Load	**928,671**	**5,184.7**	**43,200**
% Urban Load Removed	**14.1**	**5.7**	**4.9**

Table 10-6: Pollutant Removal (Pounds) by Patapsco/Back River Watersheds Attributed to BMP's

Patapsco / Back River			
Liberty Reservoir			
	TSS	**TP**	**TN**
Stormwater Management	13,523	31.9	216
Inlet Cleaning	0	0.0	0
Street Sweeping	67,800	13.0	34
Restoration Projects	0	0	0
Totals	81,323	44.9	250
Urban Watershed Load	**468,447**	**3,401.8**	**28,244**
% Urban Load Removed	**17.4**	**1.3**	**0.9**
Patapsco River			
	TSS	**TP**	**TN**
Stormwater Management	122,704	492.7	3,056
Inlet Cleaning	20,588	14.5	37
Street Sweeping	425,500	300.9	776
Restoration Projects	20,155	82.9	1,299
Totals	588,947	891.0	5,168
Urban Watershed Load	**2,763,909**	**14,245.4**	**126,921**
TMDL % Reduction	NA	15%	15%
% Urban Load Removed	**21.3**	**6.3**	**4.1**
Gwynns Falls			
	TSS	**TP**	**TN**
Stormwater Management	368,146	1,332.0	7,984
Inlet Cleaning	40,581	28.5	74
Street Sweeping	800,800	567.0	1,462
Restoration Projects	24,557	52.2	776
Totals	1,234,084	1,979.7	10,296
Urban Watershed Load	**4,041,432**	**19,045.2**	**172,891**
TMDL % Reduction	NA	15%	15%
% Urban Load Removed	**30.5**	**10.4**	**6.0**

Table 10-6: Pollutant Removal (Pounds) by Patapsco/Back River Watersheds Attributed to BMP's (continued)

Jones Falls			
	TSS	**TP**	**TN**
Stormwater Management	116,008	812.5	5,341
Inlet Cleaning	12,479	8.5	23
Street Sweeping	169,400	119.9	309
Restoration Projects	53,383	184.3	2,820
Totals	351,270	1,125.2	8,493
Urban Watershed Load	**2,629,397**	**16,632.3**	**144,532**
TMDL % Reduction	NA	15%	15%
% Urban Load Removed	**13.4**	**6.8**	**5.9**
Back River			
	TSS	**TP**	**TN**
Stormwater Management	181,304	716.2	4,916
Inlet Cleaning	25,090	17.6	46
Street Sweeping	569,800	403.5	1,041
Restoration Projects	102,890	381.3	4,388
Totals	879,084	1,518.6	10,391
Urban Watershed Load	**3,388,146**	**21,264.2**	**177,285**
TMDL % Reduction	NA	15%	15%
% Urban Load Removed	**32.5**	**7.1**	**5.9**
Baltimore Harbor			
	TSS	**TP**	**TN**
Stormwater Management	17,845	62.9	420
Inlet Cleaning	61,202	43.0	111
Street Sweeping	234,000	165.7	427
Restoration Projects	61,993	334.1	2,938
Totals	375,040	605.7	3,896
Urban Watershed Load	**2,393,557**	**11,362.7**	**95,437**
TMDL % Reduction	NA	15%	15%
% Urban Load Removed	**16.5**	**5.3**	**4.1**

10.4 Progress in Meeting TMDLs and Maryland Tributary Strategies

This section discusses the progress made to date in meeting both TMDLs (10.4.1) and the Maryland Tributary Strategies (10.4.2)

10.4.1 TMDL Progress

Baltimore County has not yet developed a mechanism for estimating bacteria loads, nor efficiencies of the various urban best management practices in reducing bacteria loads. Table 10-7 presents the progress in meeting TMDLs for nutrients.

Table 10-7: Progress in Meeting Nutrient TMDLs Where Developed

Watershed	Phosphorus		Nitrogen	
	Target	**Progress**	**Target**	**Progress**
Prettyboy	15% (54%)	0.5%	NA	NA
Loch Raven	15% (50%)	4.8%	NA	NA
Patapsco	15%	6.3%	15%	4.1%
Gwynns Falls	15%	10.4%	15%	6.0%
Jones Falls	15%	6.8%	15%	5.9%
Back River	15%	7.1%	15%	5.9%
Baltimore Harbor	15%	5.3%	15%	4.1%

As can be seen from Table 10-7 the target reductions for phosphorus and nitrogen have not been met. In the cases of Prettyboy and Loch Raven Reservoir watersheds, the target phosphorus reduction is much higher (shown in parentheses), however, the reduction scenario developed by Maryland Department of the Environment indicates a 15% reduction of phosphorus from urban lands.

10.4.2 Maryland Tributary Strategies

Based on modeling by the federal EPA – Chesapeake Bay Program, nutrient and sediment pollutant load reductions needed for the Chesapeake Bay to attain water quality standards have been determined. These load reductions have been allocated to the various states within the Chesapeake Bay drainage area. Maryland has developed Tributary Strategies for the 10 basins within the state. Baltimore County lies within two of the tributary basins, the Upper Western Shore and the Patapsco/Back River basins. The Tributary Strategies identify the actions needed to achieve tidal Chesapeake Bay water quality standards. Actions to address urban non-point source reductions are expected to achieve a 24% reduction in nitrogen and a 42% reduction in phosphorus from urban lands.

At this point in time, Baltimore County is not tracking all of the strategies for which credit pollution reduction credit can be awarded. While Baltimore County has an aggressive reforestation program, for purposes of this report we have not been tracking the location and acreage of planting and the nutrient reduction attributable to the BMP. In future reports we will start tracking these activities. We are uncertain on how to obtain credit for the educational activities that fall under the designation of urban and mixed nutrient management.

The strategies developed apply to all of the jurisdictions within a Tributary Strategy basin, and have not been partitioned by jurisdiction. Table 10-8 presents the urban strategy for the Upper Western Shore, while Table 10-9 presents the urban strategy for the Patapsco/Back River. The strategy column in both tables represents the target for all jurisdictions within the Tributary Strategy basin, while the progress column only represents Baltimore County progress in meeting the urban strategy.

Stormwater Management: The stormwater management strategy represents the acreage of land that flows to a stormwater management facility (see Section 1), and includes only those facilities that have been built. It also includes the construction of new stormwater management facilities through the capital program (see Section 7), but not the conversion of existing facilities.

Erosion and Sediment Control: The acreage of disturbance for calendar year 2007 only is included (see Section 2). This represents the acreage under sediment control. Missing the target for this measure does not represent a failing, but reflects the pattern of development through time. Under the current economic conditions development is down. A better measure for this BMP would be 100% of the acreage under development is under sediment control.

Stream Restoration: The stream restoration strategy represents the target linear feet of urban stream restoration. The information for this measure comes from the individual watershed restoration tables in Section 7.

10-8: Upper Western Shore Urban Tributary Strategy

Urban BMP Type	Units	Strategy	Progress
Stormwater Management	Acres	56,784	11,498
Erosion and Sediment Control	Acres/Yr	5,576	325.9
Nutrient Management, Urban	Acres	67,206	NT
Nutrient Management, Mixed	Acres	86,984	NT
Buffers Forested, Urban	Acres	93	NT
Tree Planting, Mixed Open	Acres	433	NT
Tree Planting, Urban Pervious	Acres	597	NT
Stream Restoration, Urban	Linear feet	87,368	77,462

NT = Not Tracked

10-9: Patapsco/Back River Urban Tributary Strategy

Urban BMP Type	Units	Strategy	Progress
Stormwater Management	Acres	99,252	15,691
Erosion and Sediment Control	Acres/Yr	11,063	372.1
Nutrient Management, Urban	Acres	112,861	NT
Nutrient Management, Mixed	Acres	28,171	NT
Buffers Forested, Urban	Acres	160	NT
Tree Planting, Mixed Open	Acres	691	NT
Tree Planting, Urban Pervious	Acres	205	NT
Stream Restoration, Urban	Linear feet	82,421	59,716

NT = Not Tracked

In order to assess the progress in meeting the Maryland Tributary Strategy nutrient load reduction, the individual watershed load reductions from Tables 10-5 and 10-6 were summed, along with the individual watershed urban non-point nutrient loads. The overall percentage reduction for nitrogen and phosphorus due to urban BMPs for each tributary basin was calculated. The results are presented in Table 10-10.

10-10: Tributary Strategy Urban Non-point Nutrient Load Reduction Progress

	Upper Western Shore		Patapsco/Back River	
	Nitrogen	Phosphorus	Nitrogen	Phosphorus
Urban Load (#s)	576,364	68,256	745,310	85,952
Urban BMP Load Reduction (#s)	37,512	3,510	38,494	6,165
Urban BMP Load Reduction (%)	6.5 %	5.1 %	5.2 %	7.2 %
Trib Strategy – Target Reduction (%)	24 %	42 %	24 %	42 %

10.5 Summary

Nutrient pollutant load reduction from urban sources is progressing through the use of a variety of urban best management practices. As of this time, we have not achieved the target percentage reductions for either the TMDLs developed to date, nor the Tributary Strategies. However, there are several practices that we are not currently tracking, that when tracked, will increase our progress substantially. With the next report the extensive reforestation that is currently taking place through a variety of programs will be included. Baltimore County will also work towards establishing a mechanism to account for urban nutrient management progress through our education programs.

11.0 Permit Requirements

A. Permit Administration

Baltimore County shall designate an individual to act as a liaison with the Maryland Department of the Environment (MDE) and provide the coordinator's name, title, address, phone number, and email address. Additionally, the County shall submit to MDE an organizational chart detailing personnel and groups responsible for major National Pollutant Discharge Elimination System (NPDES) program tasks with each annual report.

B. Legal Authority

Adequate legal authority shall be maintained in accordance with the NPDES regulation 40 CFR 122.26(d)(2)(i) throughout the term of this permit. In the event that any provisions of its legal authority are found to be invalid, the County shall make the necessary changes to maintain adequate legal authority.

I. Program Funding

1. Annually, a fiscal analysis of the capital, operation, and maintenance expenditures necessary to comply with all conditions of this permit shall be submitted as required in Part IV below.
2. Adequate program funding to comply with all conditions of this permit shall be maintained.

11.1 Permit Administration

The designated individual to act as a liaison with Maryland Department of the Environment is:

Steve Stewart
Chief, Watershed Management and Monitoring Section
Baltimore County Department of Environmental Protection and Resource Management
401 Bosley Avenue, Suite 416
Towson, MD 21204
410-887-4488 x240
sstewart@baltimorecountymd.gov

The major NPDES program tasks are listed in Table 11-1, along with the Baltimore County Departments and associated bureaus or sections responsible for implementation. The County has designated an NPDES Management Committee, composed of representatives from agencies involved in NPDES activities, that meets on a periodic basis for updates and coordination. The main focus of the NPDES Management Committee over the last year has been County property management.

Table 11-1: Major NPDES Program Tasks and Responsible Baltimore County Agencies

NPDES Program Task	Department - Section
Program Administration	DEPRM – Watershed Management and Monitoring
Legal Authority	DEPRM - Administration Baltimore County – Law Office
Source Identification	DEPRM – Watershed Management and Monitoring DEPRM – Policy, Research, Education, and Communication OIT – Geographic Information Systems
Stormwater Management – Review	DEPRM – Stormwater Engineering
Stormwater Management – Inspections	DEPRM – Stormwater Engineering DEPRM – Capital Program and Operations
Erosion and Sediment Control	DEPRM – Inspection and Enforcement
Illicit Discharge Detection and Elimination	DEPRM – Watershed Management and Monitoring DEPRM – Environmental Health
County Property Management	DPW – Highways Bureau DPW – Utilities Bureau Department of Recreation and Parks Community College of Baltimore County Dept. of Education
Road Maintenance	DPW – Highways Bureau – Street Sweeping DPW – Utilities Bureau – Storm Drain Cleaning DEPRM – Watershed Management and Monitoring – Data Management
Public Education	DEPRM – All Sections DEPRM – Policy, Research, Education, and Communication – Major Component
Watershed Assessment and Planning	DEPRM – Watershed Management and Monitoring
Watershed Restoration	DEPRM – Capital Program and Operations
Assessment of Controls	DEPRM – Watershed Management and Monitoring
Program Funding	DEPRM – Finance and Administration
Total Maximum Daily Loads	DEPRM – Watershed Management and Monitoring
Annual Report	DEPRM – Watershed Management and Monitoring DEPRM – Policy, Research, Education, and Communication
Reapplication for NPDES Permit	DEPRM – Watershed Management and Monitoring

DEPRM = Department of Environmental Protection and Resource Management
DPW = Department of Public Works
OIT = Office of Information Technology

The organizational chart submitted as part of the budget request for fiscal year 2009 for the Baltimore County Department of Environmental Protection and Resource Management is displayed in Exhibit 11-1. Exhibit 11-2 is DEPRM's departmental organization effective April 25, 2008. The FY2009 budget includes four additional staff positions for the Department of Environmental Protection and Resource Management, two for the Environmental Health programs and two for the Stormwater Engineering Section. These two engineering positions may have a benefit to the implementation of the County's NPDES program.

11.2 Legal Authority

The County continues to maintain adequate legal authority.

11.3 Fiscal Analysis

Table 11-2 displays the operation costs for FY2007 and the projected salary expenses through FY 2013. Table 11-3 summarizes the annual fiscal year Capital Program costs through 2011. Both the operating budget and the capital budget are developed annually by the Baltimore County Executive and submitted to the Baltimore County Council for approval. The level of commitment for operating and capital funding is fixed for the approved budgets. The projected budgets may change due to budgetary constraints.

Table 11-2: NPDES Operating Budget

FY 2007 Actual	FY 2008 Budgeted	FY 2009 Projected	FY 2010 Projected	FY 2011 Projected	FY 2012 Projected	FY 2013 Projected
6,724,012	7,273,886	7,579,014	7,806,384	8,040,576	8,281,793	8,530,247

Table 11-3: Capital Program

FY 2007 Actual	FY 2008 Budgeted	FY 2009 Projected	FY 20010 Projected	FY 2011 Projected	FY 2012 Projected	FY 2013 Projected
18,000,000	18,361,000	0	14,523,000	0	9,386,000	0

The Capital Program is on a two-year funding cycle; therefore, the second year of the funding cycle indicates a zero dollar amount. Not all of the Capital Program funds are directly related to the NPDES permit. While dredging and shore erosion control projects are not directly related to the permit because they do not address stormwater, they are indirectly related because they address pollutant load reduction. The dredging projects require retrofitting the watershed draining to the dredged water body to reduce sediment loads. The retrofits typically take the form of various types of stormwater management facilities that reduce pollutants. The shore erosion control projects reduce pollutant loads of sediment and other pollutants associated with sediment to tidal waters.

Tables 11-4 through 11-6 displays the anticipated Capital Program expenditures by watershed. The watersheds are organized in accordance with the Maryland Tributary Strategies boundaries. There are three budget categories that are not watershed specific. These are listed separately. Each two-year funding cycle is represented as a separate table.

Table 11-4: Baltimore County Environmental Capital Improvement Program - Fiscal Year 2008 & 2009

Project	Budget Number	Total ($)
Upper Western Shore Watershed		
Deer Creek	-	0
Prettyboy Watershed	-	0
Loch Raven Watershed	221-0103	350,000
Lower Gunpowder Watershed	221-0106	881,000
Little Gunpowder Watershed	221-0104	0
Bird River Watershed	221-0105	459,000
Gunpowder Watershed	221-0107	350,000
Middle River Watershed	221-0108	100,000
Patapsco Back Watershed		
Liberty Watershed	-	0
Patapsco Watershed	221-0110	0
Gwynns Falls Watershed	221-0111	1,000,000
Jones Falls Watershed	221-0112	1,950,000
Back River Watershed	221-0114	550,000
Baltimore Harbor Watershed	221-0113	6,130,000
Non-Watershed Specific Funding		
Watershed Restoration	221-0100	1,351,000
Environmental Management	221-0200	1,630,000
Waterway Improvement Projects	221-0300	1,610,000
Comm. Conservation Waterway Impr.	221-0900	1,625,000
Total:		**17,986,000**

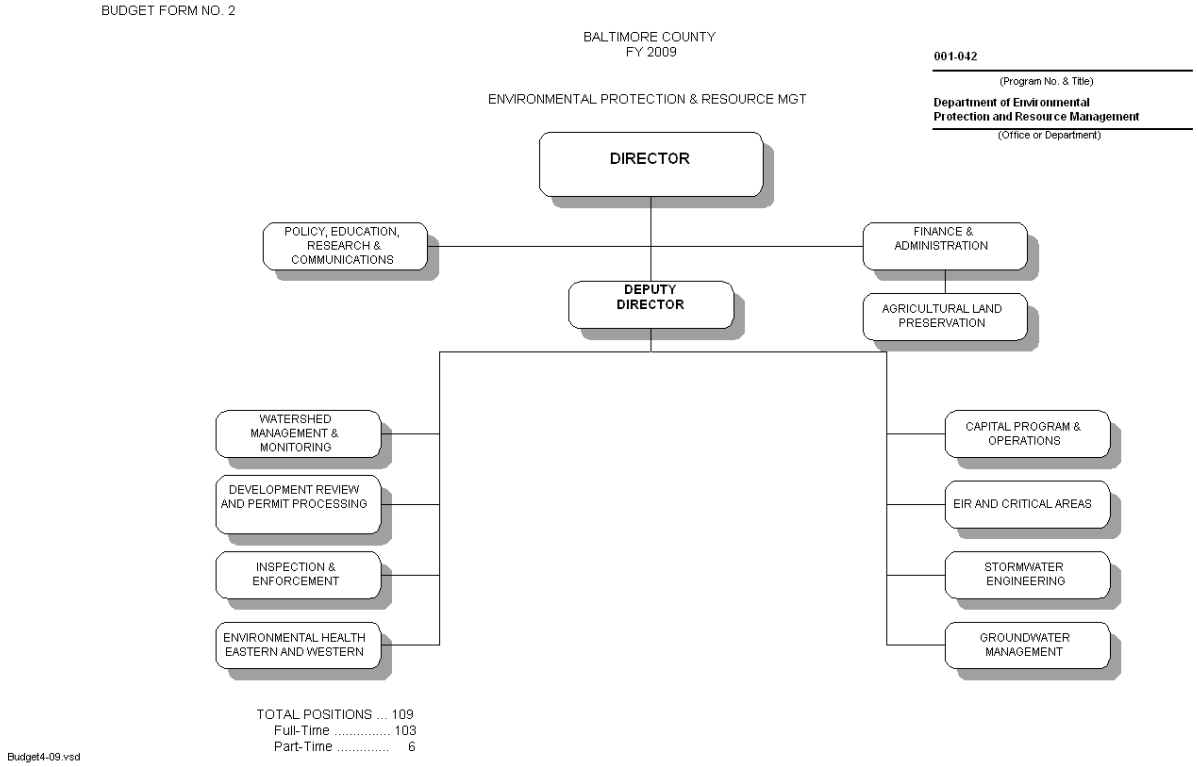
Table 11-5: Baltimore County Environmental Capital Improvement Program - Fiscal Years 2010 & 2011

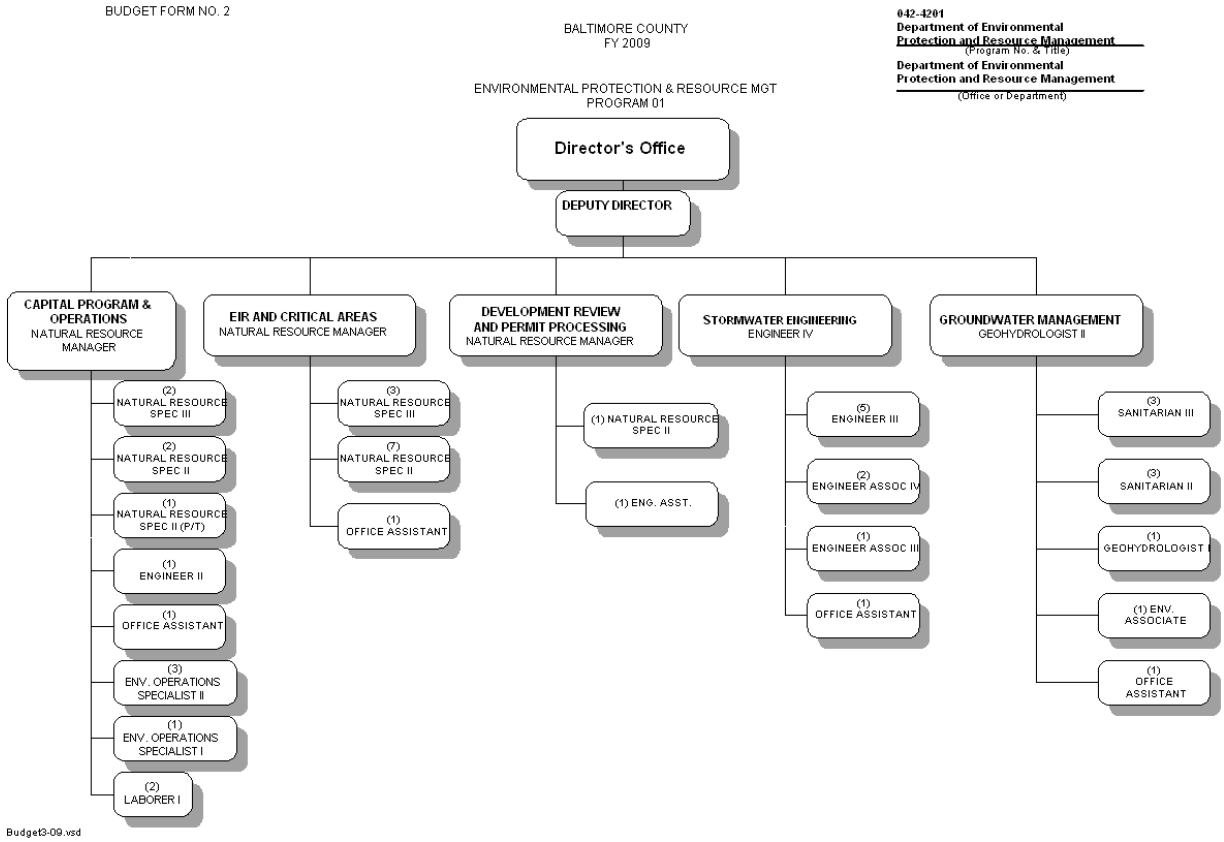
Project	Budget Number	Total ($)
Upper Western Shore Watershed		
Deer Creek	-	0
Prettyboy Watershed	-	0
Loch Raven Watershed	221-0103	850,000
Lower Gunpowder Watershed	221-0106	500,000
Little Gunpowder Watershed	221-0104	0
Bird River Watershed	221-0105	300,000
Gunpowder Watershed	221-0107	0
Middle River Watershed	221-0108	800,000
Patapsco Back Watershed		
Liberty Watershed	-	0
Patapsco Watershed	221-0110	0
Gwynns Falls Watershed	221-0111	3,100,000
Jones Falls Watershed	221-0112	400,000
Back River Watershed	221-0114	200,000
Baltimore Harbor Watershed	221-0113	50,000
Non-Watershed Specific Funding		
Watershed Restoration	221-0100	1,190,000
Environmental Management	221-0200	1,525,000
Waterway Improvement Projects	221-0300	0
Comm. Conservation Waterway Impr.	221-0900	500,000
Total:		**9,640,000**

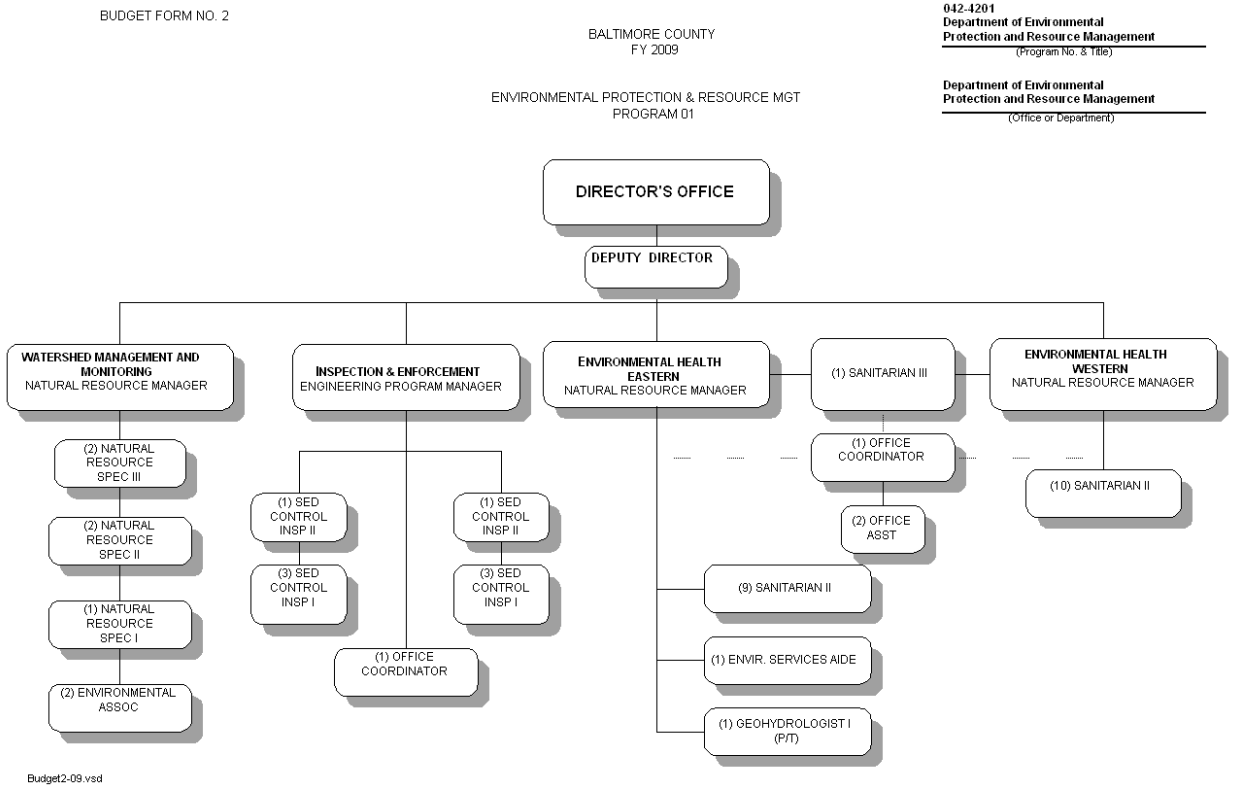
Table 11-6: Baltimore County Environmental Capital Improvement Program - Fiscal Years 2012 & 2013

Project	Budget Number	Total ($)
Upper Western Shore Watershed		
Deer Creek	-	0
Prettyboy Watershed	221-0102	450,000
Loch Raven Watershed	221-0103	1,000,000
Lower Gunpowder Watershed	221-0106	1,050,000
Little Gunpowder Watershed	221-0104	250,000
Bird River Watershed	221-0105	850,000
Gunpowder Watershed	221-0107	0
Middle River Watershed	221-0108	0
Patapsco Back Watershed		
Liberty Watershed	-	0
Patapsco Watershed	221-0110	300,000
Gwynns Falls Watershed	221-0111	1,450,000
Jones Falls Watershed	221-0112	0
Back River Watershed	221-0114	880,000
Baltimore Harbor Watershed	221-0113	500,000
Non-Watershed Specific Funding		
Watershed Restoration	221-0100	1,405,000
Environmental Management	221-0200	1,525,000
Comm. Conservation Waterway Impr.	221-0900	500,000
Total:		**10,160,000**

Exhibit 11-1: Department of Environmental Protection and Resource Management Table of Organization for FY2008




BUDGET FORM NO. 2
BALTIMORE COUNTY
FY 2009
ENVIRONMENTAL PROTECTION & RESOURCE MGT
PROGRAM 01
042-4201
Department of Environmental
Protection and Resource Management
(Program No. & Title)
Department of Environmental
Protection and Resource Management
(Office or Department)
Director's Office
DEPUTY DIRECTOR
CAPITAL PROGRAM & OPERATIONS
NATURAL RESOURCE MANAGER
(2) NATURAL RESOURCE SPEC III
(2) NATURAL RESOURCE SPEC II
(1) NATURAL RESOURCE SPEC II (P/T)
(1) ENGINEER II
(1) OFFICE ASSISTANT
(3) ENV. OPERATIONS SPECIALIST II
(1) ENV. OPERATIONS SPECIALIST I
(2) LABORER I
EIR AND CRITICAL AREAS
NATURAL RESOURCE MANAGER
(3) NATURAL RESOURCE SPEC III
(7) NATURAL RESOURCE SPEC II
(1) OFFICE ASSISTANT
DEVELOPMENT REVIEW AND PERMIT PROCESSING
NATURAL RESOURCE MANAGER
(1) NATURAL RESOURCE SPEC II
(1) ENG. ASST.
STORMWATER ENGINEERING
ENGINEER IV
(5) ENGINEER III
(2) ENGINEER ASSOC IV
(1) ENGINEER ASSOC III
(1) OFFICE ASSISTANT
GROUNDWATER MANAGEMENT
GEOHYDROLOGIST II
(3) SANITARIAN III
(3) SANITARIAN II
(1) GEOHYDROLOGIST I
(1) ENV. ASSOCIATE
(1) OFFICE ASSISTANT
Budget3-09.vsd


BUDGET FORM NO. 2
BALTIMORE COUNTY
FY 2009
ENVIRONMENTAL PROTECTION & RESOURCE MGT
PROGRAM 01
042-4201
Department of Environmental
Protection and Resource Management
(Program No. & Title)
Department of Environmental
Protection and Resource Management
(Office or Department)
DIRECTOR'S OFFICE
DEPUTY DIRECTOR
WATERSHED MANAGEMENT AND MONITORING
NATURAL RESOURCE MANAGER
(2) NATURAL RESOURCE SPEC III
(2) NATURAL RESOURCE SPEC II
(1) NATURAL RESOURCE SPEC I
(2) ENVIRONMENTAL ASSOC
INSPECTION & ENFORCEMENT
ENGINEERING PROGRAM MANAGER
(1) SED CONTROL INSP II
(3) SED CONTROL INSP I
(1) SED CONTROL INSP II
(3) SED CONTROL INSP I
(1) OFFICE COORDINATOR
ENVIRONMENTAL HEALTH EASTERN
NATURAL RESOURCE MANAGER
(1) SANITARIAN III
(1) OFFICE COORDINATOR
(2) OFFICE ASST
(9) SANITARIAN II
(1) ENVIR. SERVICES AIDE
(1) GEOHYDROLOGIST I (P/T)
ENVIRONMENTAL HEALTH WESTERN
NATURAL RESOURCE MANAGER
(10) SANITARIAN II
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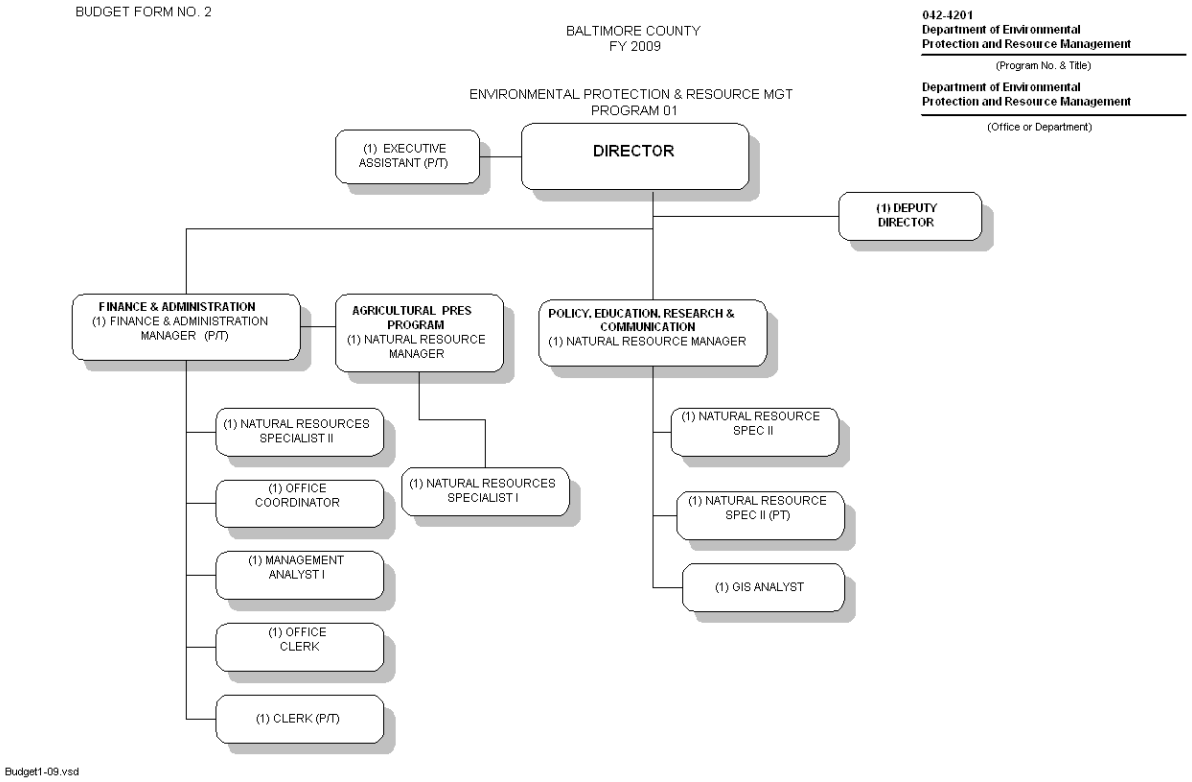
BUDGET FORM NO. 2
BALTIMORE COUNTY
FY 2009
042-4201
Department of Environmental
Protection and Resource Management
(Program No. & Title)
Department of Environmental
Protection and Resource Management
(Office or Department)
ENVIRONMENTAL PROTECTION & RESOURCE MGT
PROGRAM 01
(1) EXECUTIVE ASSISTANT (P/T)
DIRECTOR
(1) DEPUTY DIRECTOR
FINANCE & ADMINISTRATION
(1) FINANCE & ADMINISTRATION MANAGER (P/T)
AGRICULTURAL PRES PROGRAM
(1) NATURAL RESOURCE MANAGER
POLICY, EDUCATION, RESEARCH & COMMUNICATION
(1) NATURAL RESOURCE MANAGER
(1) NATURAL RESOURCES SPECIALIST II
(1) OFFICE COORDINATOR
(1) MANAGEMENT ANALYST I
(1) OFFICE CLERK
(1) CLERK (P/T)
(1) NATURAL RESOURCES SPECIALIST I
(1) NATURAL RESOURCE SPEC II
(1) NATURAL RESOURCE SPEC II (PT)
(1) GIS ANALYST
Budget1-09.vsd
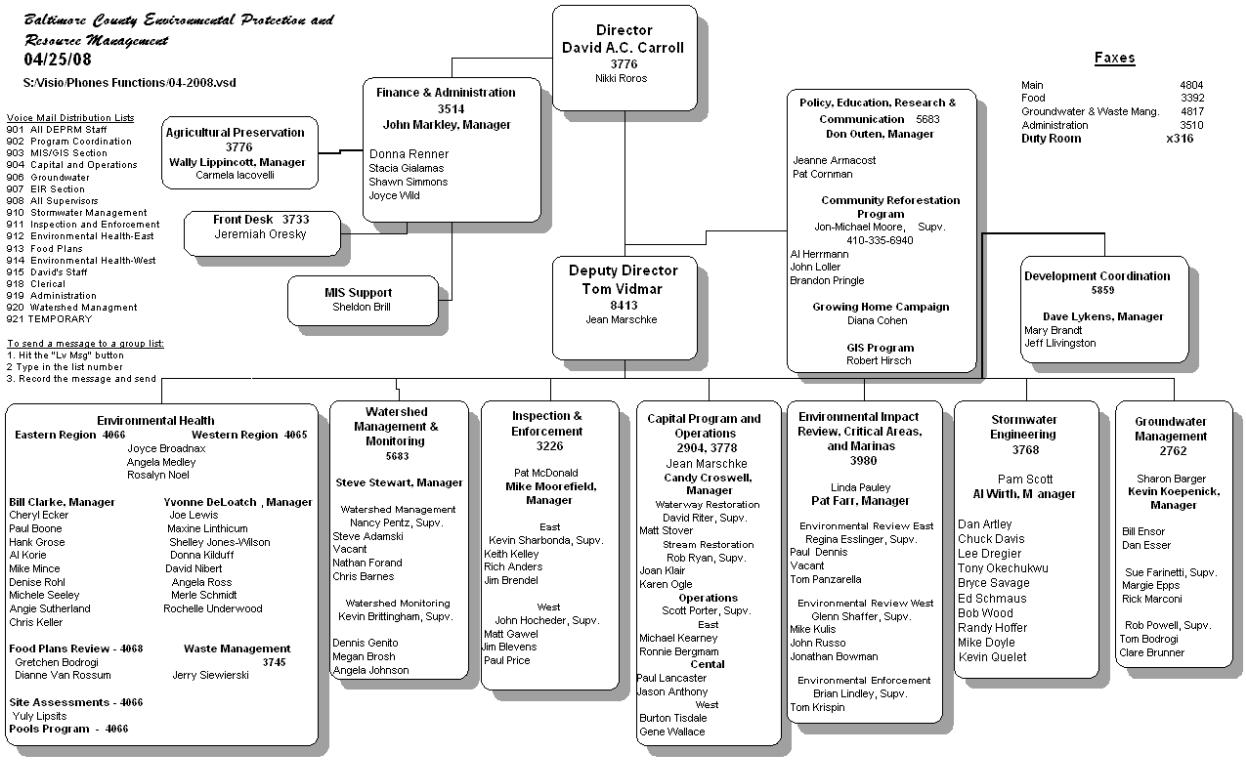
Exhibit 11-2: Department of Environmental Protection and Resource Management Staff Organizational Chart Effective April 25, 2008