CITY OF BALTIMORE
DEPARTMENT OF PUBLIC WORKS
BUREAU OF WATER AND WASTEWATER
SURFACE WATER MANAGEMENT DIVISION

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Preface

This report describes activities done by the City of Baltimore during 2010 in association with its National Pollutant Discharge Elimination System municipal separate storm sewer system discharge permit (Permit Number: MD0068292).

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List of As-Built Drawings in the Storage Box Accompanying Report

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University of Maryland Medical Systems Phase IV Capital Project - 250 West Pratt Street Baltimore, MD 21201

Proposed New Research Building - 801 West Baltimore Street, Baltimore MD 21201

Center for Urban Families - 2201 North Monroe Street, Baltimore, MD 21217

Kenneth Square (a residential townhouse community) - 6006-6008 York Road, Baltimore, MD 21212

List of Files on CD-ROM Accompanying Report

2010 Annual Report for City of Baltimore MS4 Permit.pdf
This is a copy of this report in an Acrobat file.

***Section_C1_sw_pipe* folder**
This folder contains the set of seven files which comprise the GIS coverage of the City's storm drain infrastructure that is referred to in Section C1.

***Buildings* and *Edge_Of_Pavement* folders**
These two folders together contain the GIS files which comprise the coverage of the City's impervious area that is referred to in Section C3.

***Chemical Monitoring* folder**
This folder contains the set of seven files which comprise the GIS coverage of the City's chemical and biological monitoring locations that are referred to in Section C4.

***CIP_Projects* folder**
This folder contains the set of seven files which comprise the GIS coverage of the City's watershed restoration projects that are referred to in Section C5.

Baltimore City_Renewal Application 2010.pdf
This is an Acrobat file containing the *Application for Continued Delegation of Erosion and Sediment Control Enforcement Authority* form that the City completed and sent to the Water Management Administration of the Maryland Department of the Environment in September 2010. This is discussed in Section D2.

2010 Erosion & Sediment Control Violation Notices & Stop Work Orders.pdf

This is an Acrobat file containing photocopied images of the six violation notices and three stop work orders issued by City erosion and sediment control inspectors during 2010. This is discussed in Section D2.

SWM & ESC Tables 2010.xls

Urban BMP Mgt Practices

This is the first tab of the Excel file. It contains the records of management practices approved during 2010 that are referred to in Section D1a.

NPDES Construction General Perm

This is the second tab of the Excel file. It contains the records of plans for earth disturbances greater than one acre which were approved during 2010. This table is referred to in Section D2b.

Baltimore City NPDES Stormwater Permit Data 2010.mdb

Baltimore City Responsible Personnel Certification Info 2010

This is an Access table with information on the people who attended this training during 2010 that is referred to in Section D2a.

Baltimore City Monitoring Sample Results 2010

This is an Access table with the 2010 sample results from: stream impact sampling (SIS); ammonia screening (AS); baseline and discrete stormwater samples from Moores Run monitoring at Hamilton Avenue and Radecke Avenue stations; and restoration monitoring for Biddison Run, Stony Run, Powder Mill Run and Watershed 263. This table is referred to in Sections D3a, F2a, F2b, F2c and G1a.

Baltimore City Chemical Monitoring 2010

This is an Access table that contains the 2010 results for stormwater EMCs and baseline discrete samples for monitoring in Moores Run at the Hamilton Avenue and Radecke Avenue stations; and restoration monitoring for Biddison Run, Stony Run, Powder Mill Run and Watershed 263. It is referred to in Sections D3a, F2a, F2b, F2c and G1a.

Private Properties Believed to Be Illicitly Discharging Sewage.pdf

This is an Acrobat file containing a letter on September 9, 2009, from Wazir Qadri of the Bureau of Water and Wastewater to Eric Uttenreither, Superintendent of Plumbing & Building Inspections in the Department of Housing and Community Development, in which there is a list of private properties believed to be illicitly discharging sewage. This was discussed in the 2009 annual report and an update on removing the illicit connections is given in Section D3a.

***City Streams Dry Weather Time Concentration Graphs* folder**

This is a folder that contains 16 Excel files: each file has a set of concentration over time scatterplots for each of the 35 monitoring stations for a given parameter. These graphs have been updated since the set that was sent with the 2009 Annual

Report to include sample results through December 2010. These graphs are referred to in Sections D3a, D5c, F2a, and G1a.

MD Attorney General Press Release on Convicted Brickwasher.pdf

This is an Acrobat file containing the news release from the Maryland Attorney General on January 14, 2011, announcing the conviction of a person who in 2009 was discovered by the Pollution Control Secretion allowing waste from his exterior lead paint removal project to enter the City's storm drain network. This information is discussed in Section D3b.

Inspection Report Checklist Rev. 9 2010.doc

This is a Word file containing the checklist used by inspectors from the Pollution Control Section during their annual inspections of the significant industrial users of the sanitary sewer system. This checklist is discussed in Section D6b.

Parsons Brinckerhoff Summary of Environmental Requirements Applicable to Watershed Plans.pdf

This Acrobat file contains a list of criteria to assess existing watershed plans to determine updates needed to be in compliance with current and anticipated requirements based on EPA, City, and region-specific provisions. It is mentioned in Section E1.

Macroinvertebrate Sample Results 2002 through 2010.xls

This is an Excel file that contains a record for each one of the 279 macroinvertebrate samples collected at fixed and random sites from 2002 through 2010. Each record has the benthic IBI score calculated for the sample using the method endorsed by the Maryland Biological Stream Survey (MBSS) in their October 2005 report, "New Biological Indicators to Better Assess the Condition of Maryland Streams". These samples are discussed in Sections E3, F2a and G1b.

Watershed 263 Time Graphs.xls

This is an Excel file that contains concentration over time graphs of the dry weather (baseline) and storm composite concentrations for Baltimore St. and Lanvale St. from September 2004 through May 2010. These graphs are referred to in Section F2b.

MR SWMM Report 2010 v2.doc

This is a Word document that contains the report from EA Engineering, Science & Technology, Inc., on the SWMM model loads estimated for 2010. This report is referred to in Section G1a.

Hamilton & Radecke Stm EMC Time Graphs.xls

This is an Excel file that contains the storm event mean concentrations (EMCs) over time scatterplots for Hamilton Avenue and Radecke Avenue. These graphs have been updated since the set that was sent with the 2009 Annual Report to

include storm EMCs through the storm on December 1, 2010. These graphs are referred to in Section G1a.

Moores Run Habitat Assessments 2005 through 2011 Graphs.xls

This is an Excel file that contains bar graphs depicting the scores from the Moores Run habitat assessment conducted from 2005 through 2011. There is one bar graph for each segment for each parameter. There are a total of 144 graphs. These graphs are referred to in Section G1c.

Fiscal Analyses Table.xls

This is an Excel file that contains the Fiscal Analyses table that is referred to in Section H.

A. Permit Administration

Kimberly Burgess, Chief of the Surface Water Management Division (SWMD), has replaced Ralph Cullison as the liaison with the Maryland Department of the Environment (MDE). Ms. Burgess' address is 3001 Druid Park Dr., Baltimore, MD, 21215. Her phone number is (410) 396-0732. Her e-mail address is Kimberly.Burgess@baltimorecity.gov.

Here are the other changes in the management of City agencies that have responsibilities for programs related to stormwater pollution control:

- The Director of the Department of Public Works is now Alfred H. Foxx.
- The Chief of the Bureau of Water and Wastewater is now Rudolph S. Chow, P.E.
- The Director of the Department of Transportation is now Khalil A. Zaied.
- The Director of the Department of General Services is now Ted Atwood.

B. Legal Authority

The City maintained adequate legal authority in accordance with NPDES regulations 40 CFR 122.26(d)(2)(i) during 2010.

C. Source Identification- GIS Data

1. **Storm Drain System**
   The seven GIS files which map the City's storm drain infrastructure can be found in the folder "Section_C1_sw_pipe" on the CD-ROM accompanying this report.

2. **Urban Best Management Practices (BMP)**
   SWMD continues working with consultants to build a new database system to better manage records of existing BMPs, and have a place where records can be created as new BMPs are approved and then built. The City anticipates having a working database by December 2013.

3. **Impervious Surfaces**
   The "Buildings" and "Edge_Of_Pavement" folders on the CD-ROM accompanying this report together provide the GIS files which map the impervious area of the City.

4. **Monitoring Locations**
   A set of seven GIS files (with files names beginning "Monitoring_Site_Locations_2010") containing this information can be found in the "Chemical Monitoring" folder on the CD-ROM accompanying this report. The GIS coverage made up by these files gives the location for each of the City's chemical and biological monitoring stations including:
   - the stations associated with the long-term discharge characterization in Moores Run;

- the monitoring associated with the restoration projects in Biddison Run, Stony Run and Watershed 263;
- chemical monitoring stations that are a part of the Stream Impact Surveys (SIS) and ammonia screening surveys;
- the fixed biological monitoring sites; and
- the random biological monitoring sites.

These files are an update of the ones sent with the 2009 Annual Report. This GIS coverage does not include the locations of physical monitoring stations associated with the long-term discharge characterization in Moores Run, or the restoration projects in Biddison Run or Stony Run.

5. **Watershed Restoration**
The folder "CIP_Projects" on the CD-ROM accompanying this report contains the GIS files which map the City's watershed restoration projects which were conceived to meet requirements of the City's storm water discharge NPDES permit.

D. <u>Management Programs</u>

1. **Stormwater Management**
SWMD has the responsibility to maintain programmatic and implementation information. During 2010, there were 222 projects that were exempted from stormwater management based on project size (less than 5,000 square feet of disturbed area). Nineteen (19) projects were allowed to meet the associated stormwater management development requirements by using a fee-in-lieu, resulting in a total of $648,975.77 in collected fees. Only one project was multi-jurisdictional, crossing the City and Baltimore County line. For this project, the City reviewed erosion and sediment control and Baltimore County reviewed stormwater management. Baltimore County collected a fee-in-lieu for this project.

   a. **New BMPs**
   SWMD received as-built drawings for 5 stormwater management BMPs in 2010. The project names with street addresses are as follows:
      - The Boy's Latin School of Maryland New Middle School - 822 West Lake Avenue Baltimore, MD 21210
      - University of Maryland Medical Systems Phase IV Capital Project - 250 West Pratt Street Baltimore, MD 21201
      - Proposed New Research Building - 801 West Baltimore Street, Baltimore MD 21201
      - Center for Urban Families - 2201 North Monroe Street, Baltimore, MD 21217
      - Kenneth Square (a residential townhouse community) - 6006-6008 York Road, Baltimore, MD 21212

These five sets of as-built drawings are enclosed in the storage box accompanying this report.

SWMD approved 91 BMPs for construction in 2010. A summary table of BMPs is provided in the tab labeled "Urban BMP Mgt Practices" in the Excel file "SWM & ESC Tables 2010.xls" on the CD-ROM accompanying this report.

b. **Maintenance Inspections**
SWMD did not conduct any BMP maintenance inspections during 2010. SWMD anticipates that maintenance inspections will resume in 2012.

2. **Erosion and Sediment Control**
In July 2009, the responsibility for the erosion and sediment control program was moved to the newly formed SWMD. At that time, only one sediment and erosion control inspector was transferred to the new division. This inspector was responsible for the entire City, making it almost impossible to inspect every active construction site in a timely manner. During 2010, a second inspector was hired and two DPW staff members were temporarily transferred to SWMD to perform erosion and sediment control inspections. Additional staffing is scheduled for 2011 and 2012, pending funding.

In September 2010, SWMD submitted to the State the application form for continued delegation of erosion and sediment control enforcement authority. A copy of this completed form is contained in the Acrobat file "Baltimore City_Renewal Application 2010.pdf" on the CD-ROM accompanying this report. This form required information divided by fiscal year (July 1 to June 30). Summary information for fiscal years 2009 and 2010 taken from this form is compiled in Table D2.1 to demonstrate activities during the calendar year 2010.

Table D2.1 Sediment Control Inspections Summary Fiscal Years 2009 & 2010

	Fiscal Year 2009 (7/1/2008 to 6/30/2009)	Fiscal Year 2010 (7/1/2009 to 6/30/2010)
Number of sediment control inspectors	4	1
Number of sediment control inspections	866	557
Number of sediment control violation notices issued	3	4
Number of stop work orders issued	0	7
Number of fines	0	1
Amount of fines	0	$1,000
Number of court cases	0	0
Number of sediment control complaints received	13	26

During calendar year 2010, the City's erosion and sediment control inspectors issued six violation notices and three stop work orders. Copies of these documents can be found in the Acrobat file "2010 Erosion & Sediment Control Violation Notices & Stop Work Orders.pdf" on the CD-ROM accompanying this report.

a. **Responsible Personnel**
SWMD conducted one "responsible personnel" certification class on June 10, 2010. Nine people attended and earned a green card. Tracy Moffatt was the instructor for the class. Information on those who attended can be found in table "Baltimore City Responsible Personnel Certification Info 2010" in the Access database "Baltimore City NPDES Stormwater Permit Data 2010.mdb" on the CD-ROM accompanying this report.

b. **Grading (Earth Disturbances) Permits**
A summary table of projects that exceeded 1 acre in land disturbance and were approved during 2010 is provided in the tab labeled "NPDES Construction General Perm" in the Excel file "SWM & ESC Tables 2010.xls" on the CD-ROM accompanying this report. SWMD approved 48 projects. The summary table only lists the disturbance area of 46 out of 48 of the projects. The total area of disturbance for these 46 projects is 255.5 acres. The two projects that do not list the disturbed area had phased waivers because these projects were covered in storm water management master plans which were approved in 2007, and as such the disturbed area should have been accounted for in the data submitted with the 2007 annual report.

3. **Illicit Discharge**

a. **Pollution Source Tracking (PST)**
SWMD relies on ammonia screening (AS) and stream impact sampling (SIS), two water quality monitoring programs run by the Water Quality Monitoring and Inspection Section, to initiate PSTs. The monitoring results from the surveys for the AS and SIS programs for 2010 are listed within table "Baltimore City Monitoring Sample Results 2010" in the Access database "Baltimore City NPDES Stormwater Permit Data 2010.mdb" on the CD-ROM accompanying this report. A summary of the water quality analyses performed during 2010 is listed in Table D3a.1. The data for Herring Run SIS does not include the samples collected for the Biddison Run restoration project monitoring (see Section F2a) or the Moores Run long-term discharge characterization monitoring (see Section G1a). The data for Jones Falls SIS does not include the samples collected at the Linkwood station on Stony Run (see Section F2c).

Table D3a.1 Monitoring Associated with Illicit Discharge Detection During 2010			
Program	Number of Surveys	Number of Stations Visited	Number of Water Quality Analyses Performed
Herring Run SIS	10	80	1,397
Jones Falls SIS	11	44	800
Gwynns Falls SIS	12	107	1,966
Harbor SIS	11	88	1,731
Quality Control Replicates	44	44	589
Quality Control Blanks for Harbor SIS Enterococci	11	0	11
Herring Run Ammonia Screening	21	290	1,726
Jones Falls Ammonia Screening	24	260	1,536
Gwynns Falls Ammonia Screening	21	269	1,561
Harbor Ammonia Screening	28	233	1,477
Quality Control Replicates for Harbor Ammonia Screening Enterococci	10	10	10
Quality Control Blanks for Harbor Ammonia Screening Enterococci	10	0	10
Total	138	1,371	12,814

The dates for surveys during 2010 in each watershed are listed in Table D3a.2.

Table D3a.2 Dates for Ammonia Screening and Stream Impact Sampling Surveys During 2010 in Each Watershed

Back River		Jones Falls		Gwynns Falls		Harbor	
Date	**Type**	**Date**	**Type**	**Date**	**Type**	**Date**	**Type**
1/6/2010	AS	1/5/2010	AS	1/4/2010	SIS	1/7/2010	AS+E
1/14/2010	AS	1/11/2010	SIS	1/12/2010	AS	1/13/2010	AS
1/21/2010	AS	1/19/2010	AS	1/20/2010	AS	1/19/2010	SIS
1/26/2010	SIS	1/27/2010	AS	1/29/2010	AS	1/27/2010	AS
2/4/2010	AS	2/2/2010	AS	2/1/2010	SIS	2/2/2010	AS
3/3/2010	AS	3/1/2010	AS	3/2/2010	AS	2/22/2010	AS
3/17/2010	AS	3/8/2010	SIS	3/9/2010	AS	3/5/2010	AS+E
3/24/2010	AS	3/17/2010	AS	3/17/2010	AS	3/16/2010	SIS
3/29/2010	SIS	3/23/2010	AS	3/22/2010	SIS	3/23/2010	AS
4/9/2010	AS	3/31/2010	AS	3/31/2010	AS	4/1/2010	AS
4/21/2010	AS	4/5/2010	SIS	4/7/2010	AS	4/12/2010	SIS
4/26/2010	SIS	4/14/2010	AS	4/13/2010	AS	4/29/2010	AS+E
5/6/2010	AS	4/20/2010	AS	4/19/2010	SIS	5/7/2010	AS
5/13/2010	AS	5/3/2010	SIS	4/27/2010	AS	5/10/2010	SIS
5/24/2010	SIS	5/11/2010	AS	5/5/2010	AS	5/19/2010	AS
6/28/2010	SIS	5/19/2010	AS	5/10/2010	AS	6/4/2010	AS
7/8/2010	AS	5/25/2010	AS	5/17/2010	SIS	6/14/2010	SIS
7/16/2010	AS	6/7/2010	SIS	6/21/2010	SIS	6/25/2010	AS+E
7/26/2010	SIS	6/30/2010	AS	7/15/2010	AS	7/12/2010	SIS
8/6/2010	AS	7/6/2010	SIS	7/19/2010	SIS	7/22/2010	AS
8/23/2010	SIS	7/20/2010	AS	8/4/2010	AS	7/30/2010	AS+E
9/9/2010	AS	7/29/2010	AS	8/9/2010	SIS	8/5/2010	AS
10/7/2010	AS	8/2/2010	SIS	8/27/2010	AS	8/16/2010	SIS
10/25/2010	SIS	8/13/2010	AS	9/1/2010	AS	8/24/2010	AS
11/3/2010	AS	8/31/2010	AS	9/16/2010	AS	8/30/2010	AS+E
11/10/2010	AS	9/7/2010	SIS	9/20/2010	SIS	9/8/2010	AS
11/18/2010	AS	9/14/2010	AS	10/6/2010	AS	9/13/2010	SIS
11/29/2010	SIS	9/21/2010	AS	10/13/2010	AS	9/24/2010	AS+E
12/9/2010	AS	10/4/2010	SIS	10/18/2010	SIS	10/6/2010	AS
12/14/2010	SIS	10/25/2010	AS	11/8/2010	SIS	10/12/2010	SIS
12/21/2010	AS	11/1/2010	SIS	11/17/2010	AS	10/22/2010	AS+E
		11/9/2010	AS	12/6/2010	SIS	10/29/2010	AS
		11/22/2010	AS	12/21/2010	AS	11/5/2010	AS+E
		12/7/2010	SIS			11/15/2010	SIS
		12/15/2010	AS			11/23/2010	AS
						12/3/2010	AS+E
						12/8/2010	AS
						12/13/2010	SIS
						12/20/2010	AS

Gray highlight indicates that the survey was done during, or just after, a precipitation event. AS+E means that samples were collected for enterococci MPN counts during the ammonia screening survey.

Table D3a.3 shows a comparison of the number of sites visited and the number of water quality analyses performed for ammonia surveys for each year from 2003 through 2010.

Table D3a.3 Compare Number of Ammonia Screenings Surveys 2003-2010			
Program	Number of Surveys	Number of Stations Visited	Number of Water Quality Analyses Performed
2003 Herring Run Ammonia Screening	23	287	1,682
2004 Herring Run Ammonia Screening	32	370	1,999
2005 Herring Run Ammonia Screening	37	485	1,884
2006 Herring Run Ammonia Screening	45	530	1,116
2007 Herring Run Ammonia Screening	34	453	2,242
2008 Herring Run Ammonia Screening	34	454	2,442
2009 Herring Run Ammonia Screening	28	365	2,152
2010 Herring Run Ammonia Screening	21	290	1,726
2003 Jones Falls Ammonia Screening	25	220	1,290
2004 Jones Falls Ammonia Screening	33	345	1,866
2005 Jones Falls Ammonia Screening	33	333	1,832
2006 Jones Falls Ammonia Screening	32	326	1,554
2007 Jones Falls Ammonia Screening	39	409	2,091
2008 Jones Falls Ammonia Screening	34	366	2,105
2009 Jones Falls Ammonia Screening	30	331	1,965
2010 Jones Falls Ammonia Screening	24	260	1,536
2003 Gwynns Falls Ammonia Screening	32	366	2,102
2004 Gwynns Falls Ammonia Screening	36	403	2,228
2005 Gwynns Falls Ammonia Screening	32	381	2,256
2006 Gwynns Falls Ammonia Screening	32	382	1,878
2007 Gwynns Falls Ammonia Screening	32	405	2,049
2008 Gwynns Falls Ammonia Screening	33	422	2,449
2009 Gwynns Falls Ammonia Screening	32	366	2,168
2010 Gwynns Falls Ammonia Screening	21	269	1,561
2003 Harbor Ammonia Screening	24	189	1,090
2004 Harbor Ammonia Screening	38	306	1,685
2005 Harbor Ammonia Screening	33	259	1,461
2006 Harbor Ammonia Screening	32	250	1,332
2007 Harbor Ammonia Screening	34	267	1,269
2008 Harbor Ammonia Screening	33	261	1,479
2009 Harbor Ammonia Screening	34	283	1,638
2010 Harbor Ammonia Screening	28	233	1,477

In February 2008, the Bureau of Water and Wastewater formed an inter-agency group to address sanitary sewer inputs to the storm drain system. This group meets monthly to discuss progress and develop plans to resolve ongoing and newly discovered illicit discharges of

sanitary sewage. The Department of Housing and Community Development (DHCD) is the agency vested with the authority to force private property owners to remove their illicit connections.

The City's 2009 Annual Report presented a letter dated September 9, 2009, from Wazir Qadri of the Bureau of Water and Wastewater to Eric Uttenreither, Superintendent of Plumbing & Building Inspections in the Department of Housing and Community Development, wherein Mr. Qadri described eight investigations of possible sanitary sewer illicit connections to the storm drain network. A copy of this letter is provided in the Acrobat file "Private Properties Believed to Be Illicitly Discharging Sewage.pdf" on the CD-ROM accompanying this report. An update, as of March 30, 2011, of the progress of resolving seven of the investigations, is provided below. The eighth case- Marble Hall Road- was not a case of illicit connection to the storm drain network and so this case was not included in the update prepared for this annual report.

1. Hopkins House Apartment Bldg.: This site is still under investigation. A violation has not been sent.
2. Roger Post Apartments: letter drafted, but not yet sent.
3. 2400 block of Maryland Ave.:
    a. All the house connections in question, along the 2400 block of Maryland Ave., were tested.
    b. The properties at 2417 and 2433 Maryland Ave. were found to have illicit connections to the storm drain and were issued violation notices.
    c. 2439 Maryland Ave. was connected properly to the sanitary, but it was leaking. This problem was repaired and retested; the problem was abated.
4. 2901 Chestnut Ave: Problem was abated.
5. John Hopkins University: The City is in the process of submitting a violation notice.
6. 2558 Oswego Ave.: A violation notice was issued.
7. Fairview Ave.:
    a. 4027 Fairview Ave.: The house connection was repaired by the City.
    b. 4029 Fairview Ave.: A violation notice was issued.

Most PSTs are initiated when unusually field surveys yield unusually high measurements. However, staff also can use the accumulated history of field and lab water quality data for a given station to decide to initiate a PST. On the CD-ROM accompanying this report, there is a folder entitled "City Streams Dry Weather Time Concentration Graphs". This folder contains 16 Excel files: each file has a set of

concentration over time scatterplots for each of the 35 monitoring stations for a given parameter. The parameters graphed are:

- ammonia nitrogen (lab measurement),
- ammonia nitrogen (field measurements- this file has graphs for an additional 14 stations that are only visited during ammonia screening surveys),
- BOD,
- chlorides,
- COD,
- conductivity (measured in the lab),
- total copper,
- fecal coliform counts,
- fluoride,
- nitrate+nitrite nitrogen,
- sodium (only 4 stations),
- suspended solids,
- TKN,
- total nitrogen (estimated by adding together nitrate+nitrite nitrogen and TKN),
- total phosphorus, and
- total zinc.

Further discussion of these graphs is provided in Section E2, "Watershed Assessment from Chemical Monitoring" of this report.

Figure D3a.3 shows the number of PSTs initiated each year from 1997 through 2010 for each watershed. During 2010 there were 109 PSTs initiated. This is the largest number for one-year period for this program. The increased number of PSTs were in part due to the suspension of the fish sampling by the SWMD; consequently, the staff could devote more time to this activity. Furthermore, SWMD screened more small outfalls than just the stream stations that are a part of their normal SIS sampling and AS programs. Some of this smaller-scale screening was done in conjunction with the Center for Watershed Protection in the Western Run subwatershed in the Jones Falls watershed. Table D3a.4 lists the number of PSTs initiated from 2004 through 2010, as well as a current breakdown of the counts of those PSTs for each status category. Figure D3a.4 presents a stacked-bar graph representation of the data in Table D3a.4.

Figure D3a.3 Number of PSTs Initiated in Each Watershed in Each Year 1997-2010

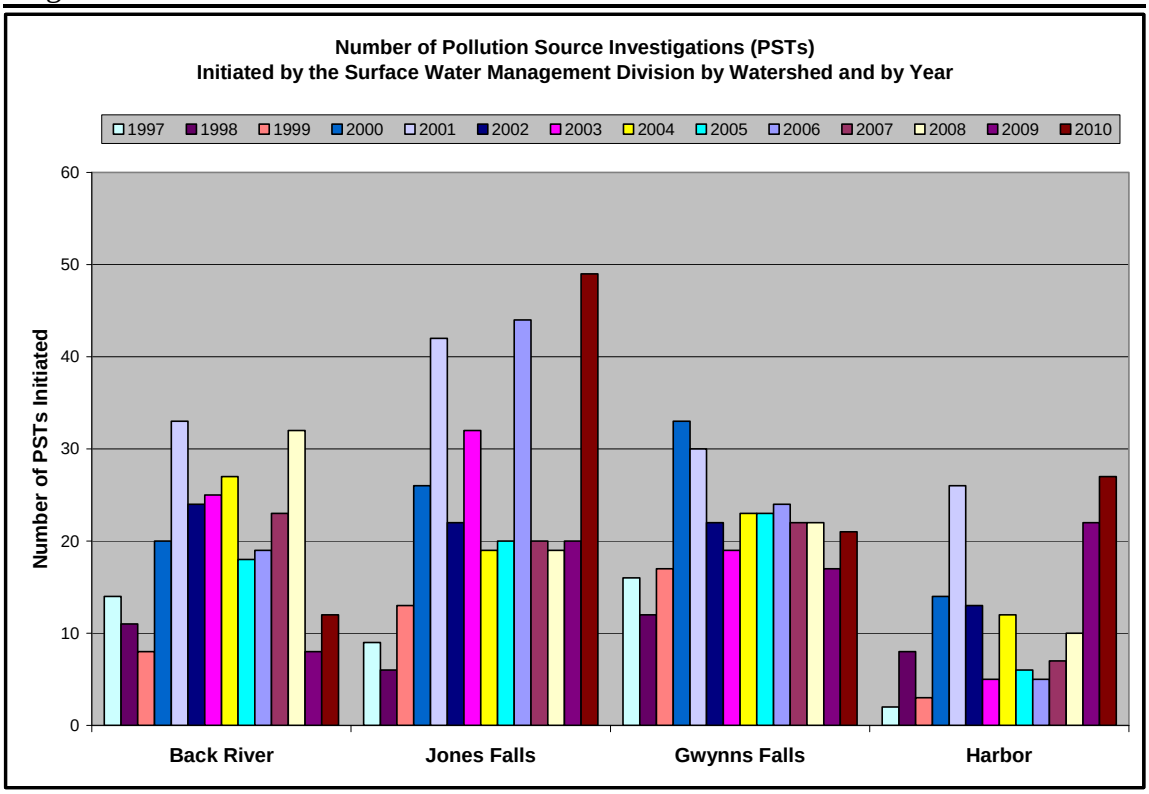
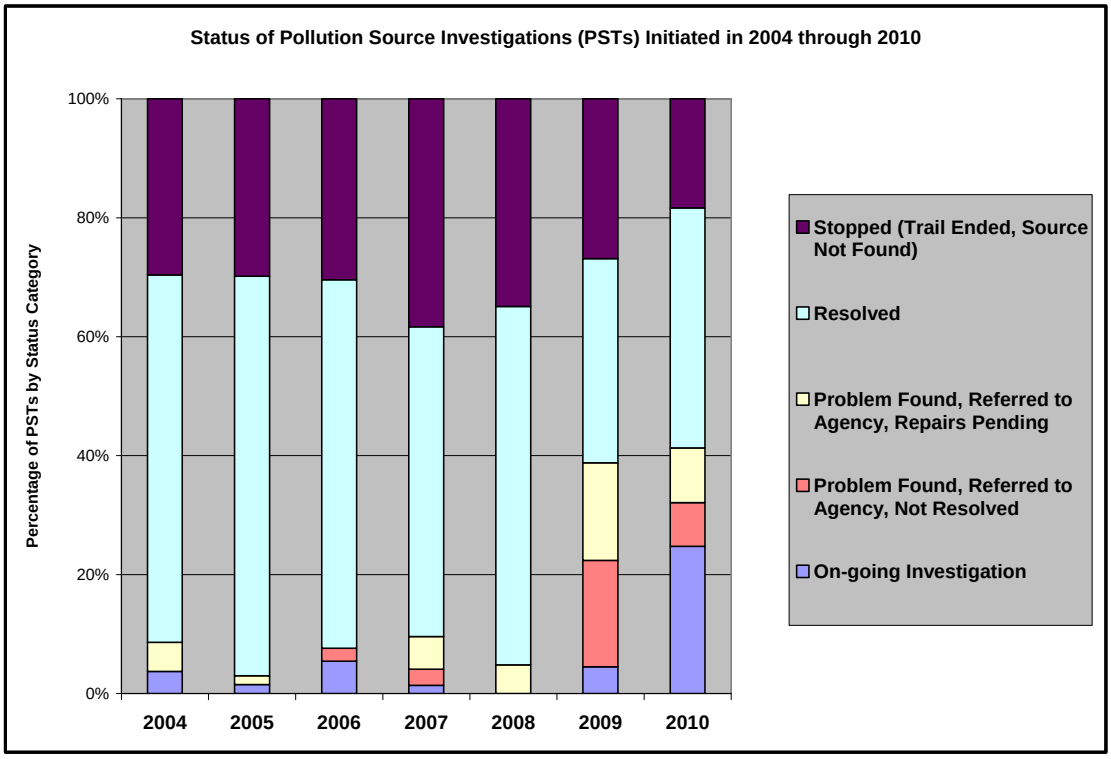


Table D3a.4 PST Counts by Status Code by Year

Status Code	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
On-going Investigation	3	1	5	1	0	3	27
Problem Found, Referred to Agency, Not Resolved	0	0	2	2	0	12	8
Problem Found, Referred to Agency, Repairs Pending	4	1	0	4	4	11	10
Resolved	50	45	57	38	50	23	44
Stopped (Trail Ended, Source Not Found)	24	20	28	28	29	18	20
Total Number of PSTs Initiated	**81**	**67**	**92**	**73**	**83**	**67**	**109**

Figure D3a.4 100% Stacked Bar Graph Comparing Percentages of PSTs by Status Category for 2004 through 2010



Waterview Avenue Chromium PST

The Waterview Avenue SIS station has a history of total chromium values that are usually significantly higher than those encountered at other SIS stations. Figure D3a.5 shows the total chromium concentrations for Waterview Avenue over the period of monitoring. In the 2005 Annual Report, the City reported on its unsuccessful efforts to find the source of the high total chromium readings at the Waterview Avenue station.

Since then, SWMD has continued to collect monthly samples at the Waterview Avenue SIS station. Since September 2009, SWMD has analyzed each sample from this station for dissolved metals concentrations; previously, only one out of four monthly samples had been analyzed for dissolved metals concentrations. Table D3a.6 lists the total and dissolved metals results for the Waterview Avenue station during 2010. Table D3a.7 lists all of the pairs of total and dissolved chromium concentrations for samples from the Waterview Avenue station through January 19, 2011.

Figure D3a.5 Total Chromium Concentrations for Waterview Avenue SIS Station March 28, 2000 through January 19, 2011

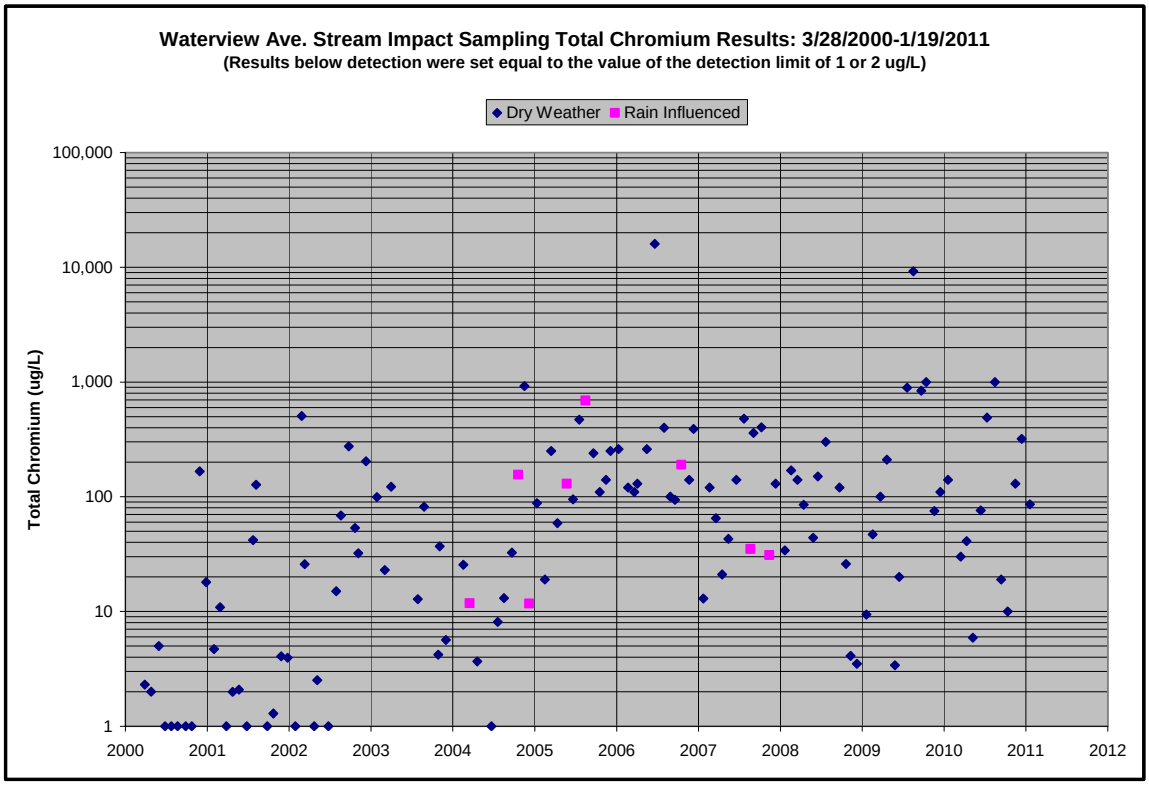


Table D3a.6 Waterview Ave. Metals Results Dry Weather Screening During 2010

Date	Total Chromium (ug/L)	Dissolved Chromium (ug/L)	Total Copper (ug/L)	Dissolved Copper (ug/L)	Total Lead (ug/L)	Dissolved Lead (ug/L)	Total Zinc (ug/L)	Dissolved Zinc (ug/L)	Total Hardness (mg/L)
1/19/2010	140	<2	12.0	4.1	1.50	0.11	100	49	360
3/16/2010	30	<2	8.9	2.6	5.10	0.05	89	44	350
4/12/2010	41	<2	3.0	<2	<2	<2	48	32	340
5/10/2010	6	<2	2.2	<2	<2	<2	34	17	320
6/14/2010	76	<2	5.8	<2	2.40	0.14	61	14	320
7/12/2010	490	23	8.5	3.2	3.80	0.16	52	40	250
8/16/2010	1,000	870	7.3	4.1	<2	<2	44	21	220
9/13/2010	19	<2	3.6	2	1.70	<0.05	45	<10	240
10/12/2010	10	<2	<2	<2	0.96	<0.05	35	22	280
11/15/2010	130	28	6.8	<2	0.92	<0.05	27	19	250
12/13/2010	320	150	6.3	2.7	1.20	0.26	54	28	190

Table D3a.7 Waterview Ave.: Compare Total & Dissolved Chromium Concentrations		
Date	Total Chromium (ug/L)	Dissolved Chromium (ug/L)
4/25/2000	2	<2
5/30/2000	<5	<5
4/24/2001	1.99	<1
10/23/2001	1.29	<1
11/27/2001	4.06	<1
12/26/2001	3.96	1.27
1/29/2002	<1	<1
3/12/2002	25.9	6.64
7/30/2002	15	<1
9/24/2002	275	3.22
12/10/2002	204	31.2
1/28/2003	99.2	29.6
11/4/2003	37	<2
9/21/2004	32.6	16.4
2/15/2005	19	<2
5/24/2005	130	<2
9/20/2005	240	2.8
1/10/2006	260	<2
5/16/2006	260	4
1/23/2007	13	<2
5/15/2007	43	<2
9/4/2007	360	2.1
1/22/2008	34	<2
5/27/2008	44	2.2
10/21/2008	26	<2
3/23/2009	100	<2
7/20/2009	890	1000
9/21/2009	840	200
10/13/2009	1000	680
11/19/2009	75	<2
12/15/2009	110	2.2
1/19/2010	140	<2
3/16/2010	30	<2
4/12/2010	41	<2
5/10/2010	5.9	<2
6/14/2010	76	<2
7/12/2010	490	23
8/16/2010	1000	870
9/13/2010	19	<2
10/12/2010	10	<2
11/15/2010	130	28
12/13/2010	320	150
1/19/2011	86	3.2
Gray highlight indicates that it rained during the survey done that day.		
Light yellow highlight indicates that the dissolved chromium concentration reported by the lab was greater than the total chromium concentration.		

b. **Exterior Lead Paint Removal Waste Control Program**
This program is administered by the Pollution Control Section of the Environmental Services Division of the Bureau of Water and Wastewater. Table D3b.1 and Figure D3b.1 show annual statistics from this program for 2001 through 2010.

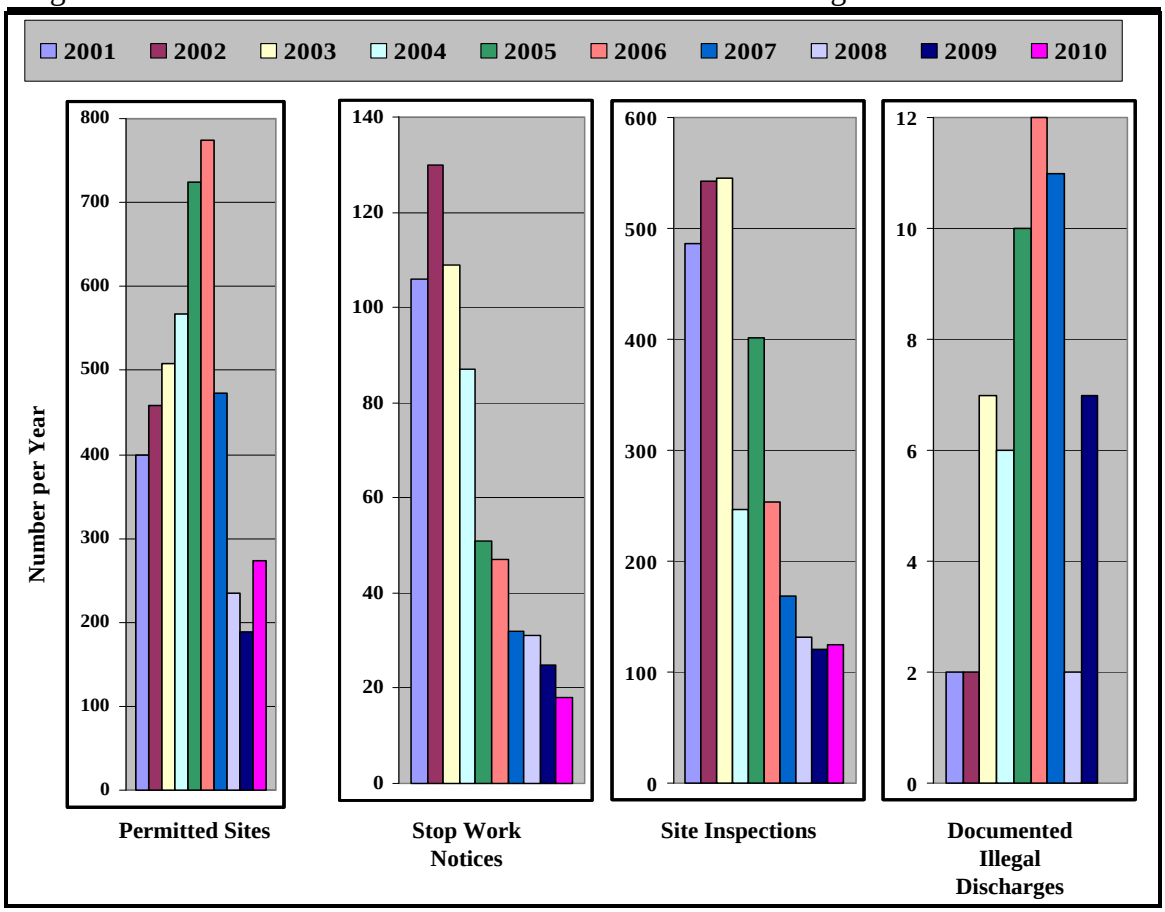
During 2010, the vast majority of worksites were managed by contractors that have operated under the pollution prevention guidelines for many years, even decades in some cases. This fact and aggressive enforcement contributed to the high rate of compliance observed during inspections.

On January 14, 2011, the Office of the Maryland Attorney General announced a conviction for a case from 2009 wherein staff from the Pollution Control Section had witnessed discharge from an exterior lead paint removal project into the storm drain network. The contractor was convicted in the Circuit Court of Baltimore City; sentenced to 90 days in jail (all suspended); fined $5,000 (all but $1,000 suspended); and placed on two years probation. A copy of the news release from the Maryland Attorney General can be found in the Acrobat file "MD Attorney General Press Release on Convicted Brickwasher.pdf" on the CD-ROM accompanying this report.

Table D3b.1 Exterior Lead Paint Removal Waste Control Program Statistics

	2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Number of permitted sites	400	459	509	568	724	774	473	234	189	274
Number of stop work notices	106	130	109	87	51	47	32	31	25	18
Number of site inspections	486	542	545	246	402	254	168	131	120	125
Number of documented illegal discharges to the storm drain system	2	2	7	6	10	12	11	2	7	0

Figure D3b.1 Exterior Lead Paint Removal Waste Control Program 2001-2010



4. **City Property Management**

a. **Wastewater Treatment Plants**
The Department of Public Works (DPW), Bureau of Water and Wastewater, Facilities Division is responsible for the Back River Wastewater Treatment Plant and the Patapsco Wastewater Treatment Plant. DPW updated the stormwater pollution prevent plan (SWPPP) for each of these sites and delivered copies to EPA in September 2010.

b. **Landfills**
The Department of Public Works, Bureau of Solid Waste has the responsibility to administer the pollution prevention plans for the City's seven landfills. The Quarantine Road Landfill is the only one that is currently active; the others have been closed

- Reedbird in 1976,
- Cold Spring Lane in 1980,
- Monument Street in 1980,
- Pennington Avenue in 1981 and
- Bowley's Lane in 1985.

During 2010, DPW prepared a comprehensive erosion and sediment control plan to address conditions encountered at both Quarantine Road Landfill and the adjacent Millennium Stockpile. The completion of the construction is anticipated for the end of 2011.

c. **Sub-stations**

Sub-stations are facilities where City-owned vehicles are maintained and fueled. Road salt is stored at some of the facilities. The Department of General Services (DGS), Fleet Division is responsible for the administration of the stormwater pollution prevention plans (SWPPPs) for the City's sub-stations. SWPPP training was provided to sub-station superintendents on June 2nd, November 19th, and November 20th.

The six facilities listed below (with their respective registration numbers) remain permitted under the General Discharge Permit for Stormwater Associated with Industrial Activities, Permit Number 02-SW. The SWPPPs for each of these facilities was updated in May 2010, and a signed copy of each SWPPP was delivered to MDE in August 2010.

List of Facilities Registered Under the General Discharge Permit 02-SW:

- Midtown Fueling Station – 410 Front St. – 02SW0704
  Main fueling facility for the entire City, open 24 hours. Replenish fluids for vehicles.
- Fallsway Substation – 201 Fallsway – 02SW0707
  Open 16 hours (2 shifts). Provide preventive maintenance services of vehicles located in the downtown area. Conduct moderate repair for vehicles, motorcycle shop, carwash and towing.
- Northeastern Substation – 4325 York Road – 02SW0702
  Open 16 hours (2 shifts). Fueling station, provide moderate repairs on vehicles and houses the Department of Transportations' salt dome and towing.
- Mechanic Shop – 6400 Pulaski Highway – 02SW0708
  Open 8 hours. Repair mowing and complex equipment; towing.
- Western Substation – 239 North Calverton Street – 02SW0703
  Open 16 hours (2 shifts). Provide preventive maintenance for City vehicles, moderate repair and towing.
- Northwestern Substation – 4410 Lewin Avenue – 02SW0705
  Open 16 hours (2 shifts). Fueling station, provide moderate repairs on vehicles and houses the Department of Transportation's salt dome and towing.

d. **Northwest Transfer Station (02SW1307)**
The Department of Public Works, Bureau of Solid Waste is responsible for this facility. The City completed a stormwater pollution prevent plan (SWPPP) for this site in January 2010. A signed copy of this SWPPP was delivered to MDE in August 2010.

5. **Road Construction and Maintenance**

a. **Street Sweeping and Storm Drain Cleaning**

Street Sweeping
Table D5a.1 and Figure D5a.1 present the number of road miles swept and amount of debris collected each year from 1999 through 2010 by the street sweepers operated by the Bureau of Solid Waste. The main reason the street sweeping numbers were so low for 2010 was that there was an extraordinary amount of snowfall in February. Table D5a.2 shows the monthly totals for street sweeping during 2010. Note the very low production for February (320 miles swept and 54 tons of debris removed) compared to January (4,759 miles swept and 375 tons of debris removed) and March (5,209 miles swept and 693 tons of debris removed). Figure D5a.2 shows the relationship between miles of roads swept and amount of debris removed using the data from Table D5a.1. Further discussions of the benefit of street sweeping and its relation to the City's impervious area goal are provided under "Street Sweeping and Inlet Cleaning" in Section F3, "Annual Reporting" of this report.

D5a.1 Street Sweeping Statistics 1999-2010

Year	Roads Swept (miles)	Debris Removed (tons)
1999	93,600	16,000
2000	145,600	16,897
2001	102,500	15,569
2002	74,400	14,437
2003	75,098	11,347
2004	42,098	8,686
2005	47,050	6,208
2006	80,000	7,261
2007	82,481	7,800
2008	79,075	9,308
2009	70,143	8,186
2010	63,203	5,652

D5a.2 Monthly Street Sweeping Statistics 2010		
Month	Roads Swept (miles)	Debris Removed (tons)
January	4,759	375
February	320	54
March	5,209	693
April	5,260	683
May	5,177	627
June	6,095	562
July	8,331	747
August	6,746	569
September	6,543	651
October	6,075	740
November	5,160	798
December	3,528	282
Total	**63,203**	**6,783**

Figure D5a.1 Street Sweeping Statistics 1999-2010

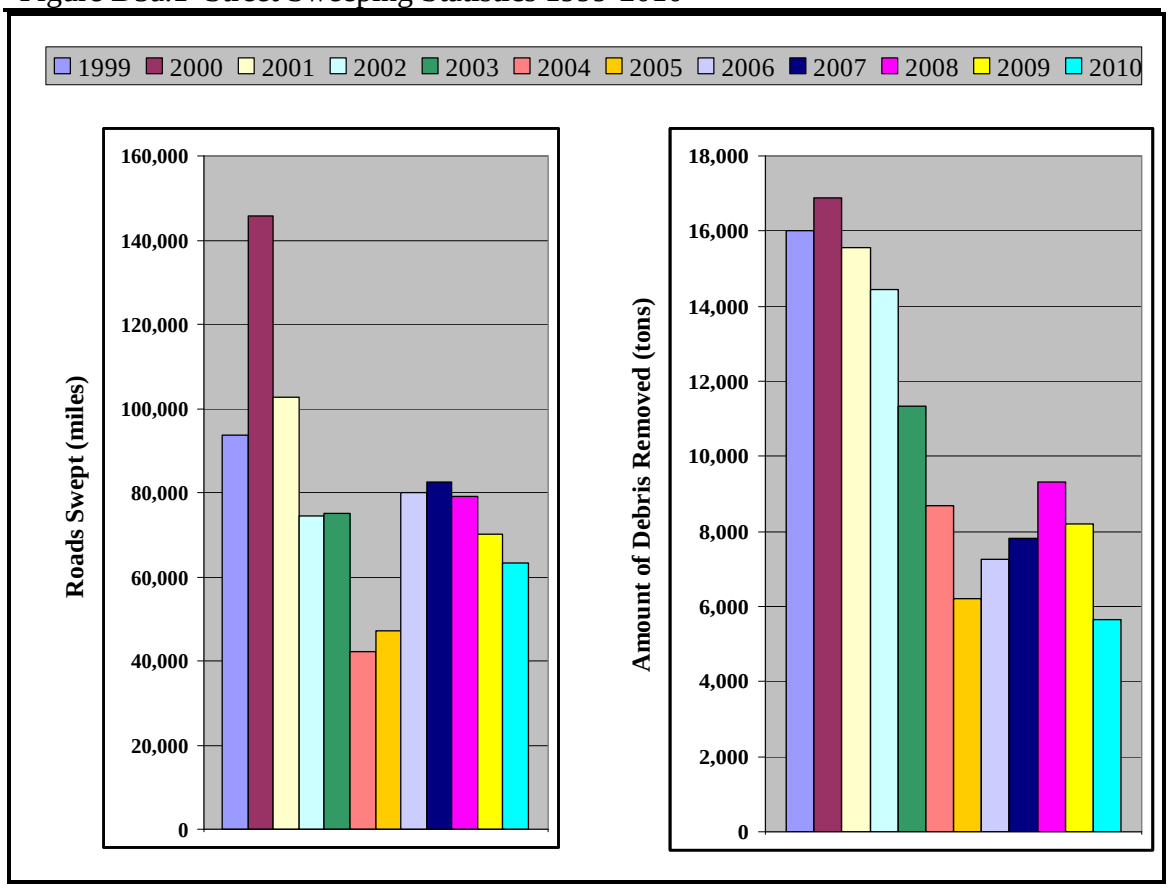
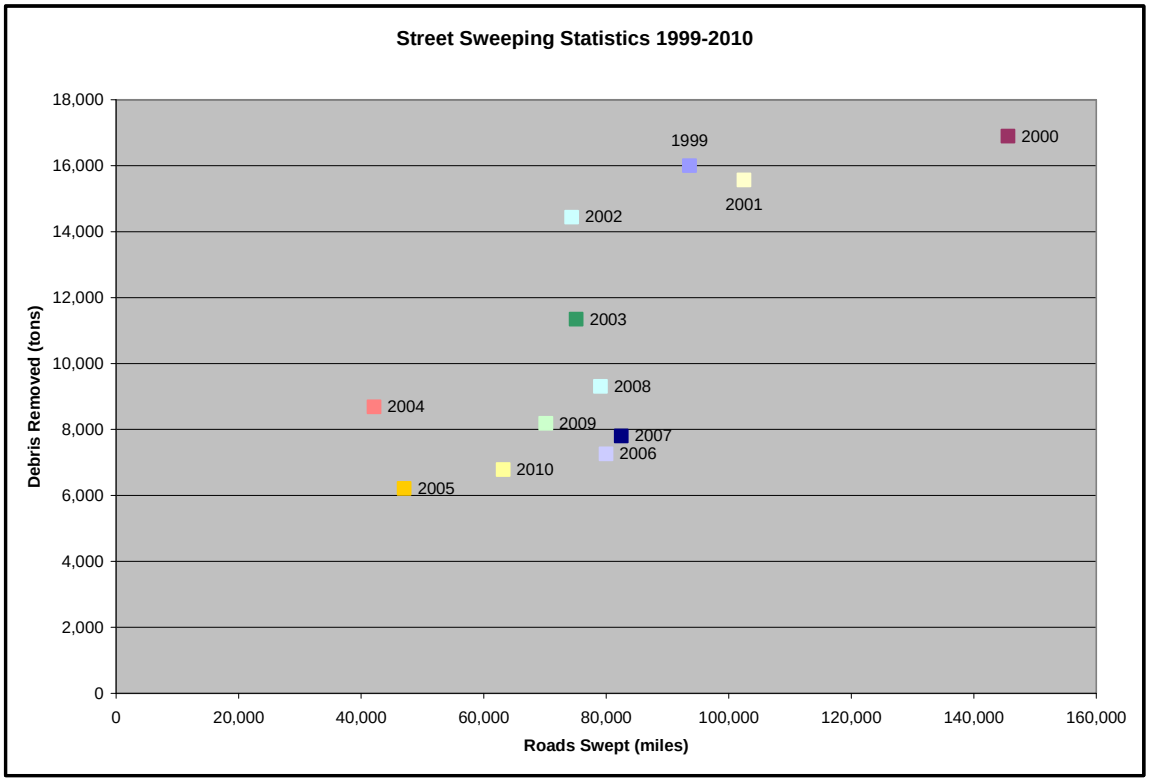


Figure D5a.2 Relationship Between Miles of Roads Swept and Amount of Debris Removed (Using 1999-2010 Statistics)



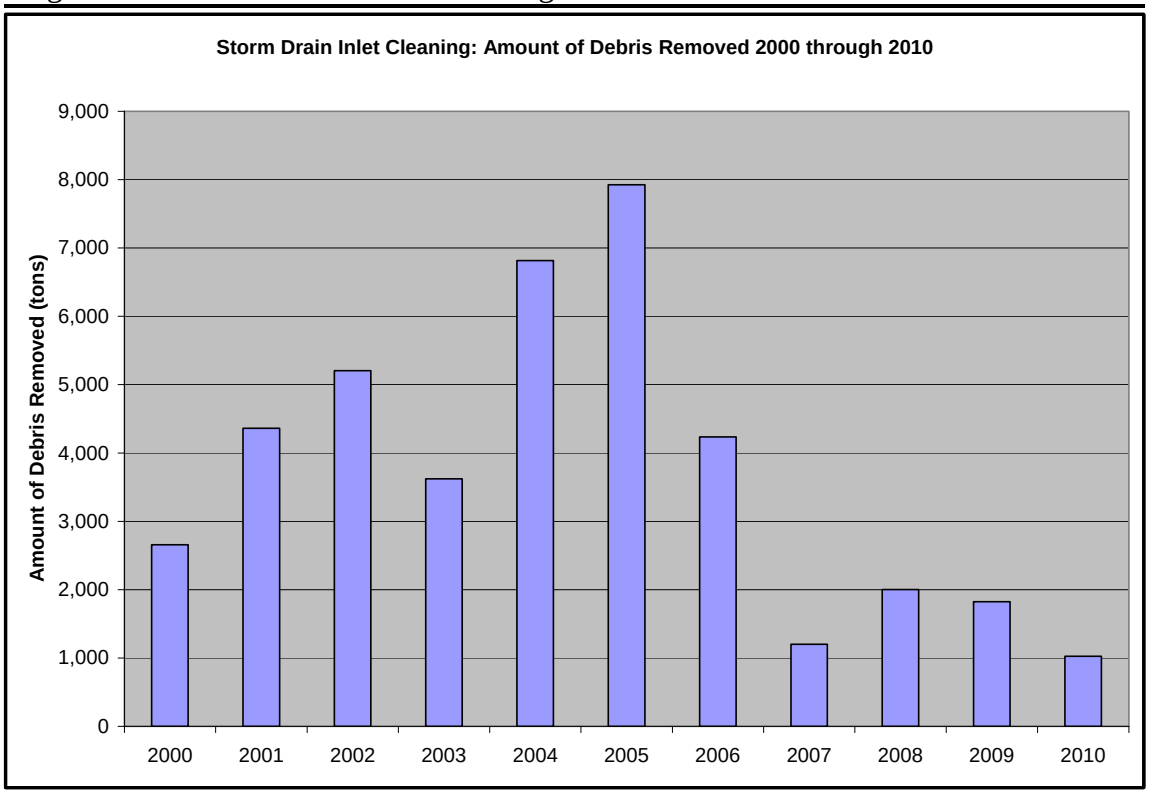
Storm Drain Cleaning

Table D5a.2 and Figure D5a.3 present the amount of debris removed by storm drain and inlet maintenance activities by the Water and Wastewater Maintenance Division of the Bureau of Water and Wastewater from 2000 through 2010. During 2010, 2,891 inlets were cleaned in response to choked inlet complaints (using the City's non-emergency 3-1-1 system); while another 2,154 inlets were cleaned as part of the routine, pro-active maintenance plan. Similar to the data shown for street sweeping, the number of inlets cleaned and subsequent removal of debris decreased due to severe weather conditions in February 2010.

Table D5a.2 Storm Drain and Inlet Cleaning Amount of Debris Removed 2000 through 2010

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Debris Removed (tons)	2,658	4,362	5,204	3,624	6,817	7,925	4,234	1,202	2,001	1,824	1,027

Figure D5a.3 Storm Drain Inlet Cleaning: Amount of Debris Removed 2000-2010



Further discussions of the benefit of street sweeping and its relation to the City's impervious area goal are provided under "Street Sweeping and Inlet Cleaning" in Section F3, "Annual Reporting" of this report.

b. **Integrated Pest Management**

Table D5b.1 lists the type and amount of pesticide, herbicide and fertilizer used by the Department of Transportation each year for 1999 through 2010.

Table D5b.1 Bureau of Highways Pesticide, Herbicide and Fertilizer Usage

Product	Unit	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Snapshot 2.5 TG	lb	150	150	0	0	0	0	0	0	0	0	0	0
Brushmaster	gal	18	15	0	10	3	40	60	120	100	135	125	135
Lesco Three Way	gal	78	33	0	70	0	0	0	0	0	0	0	0
Oust	gal	69	0	0	0	0	0	0	0	0	0	0	0
Round-up Pro	gal	171	145	256	160	120	120	125	175	125	140	135	145
Proxy	gal	20	10.5	14	14	5	0	0	0	0	0	0	0
Lesco Professional Turf Fertilizer	lb	1000	0	0	0	0	0	0	0	0	0	0	0
Scythe	gal	0	28	0	0	0	0	0	0	0	0	0	0
Sahara Herbicide	gal	0	0	0	20	0	0	0	0	0	0	0	0
Sahara Herbicide	lb	0	0	0	0	7	20	16	20	0	0	0	0

c. **Deicing Materials**

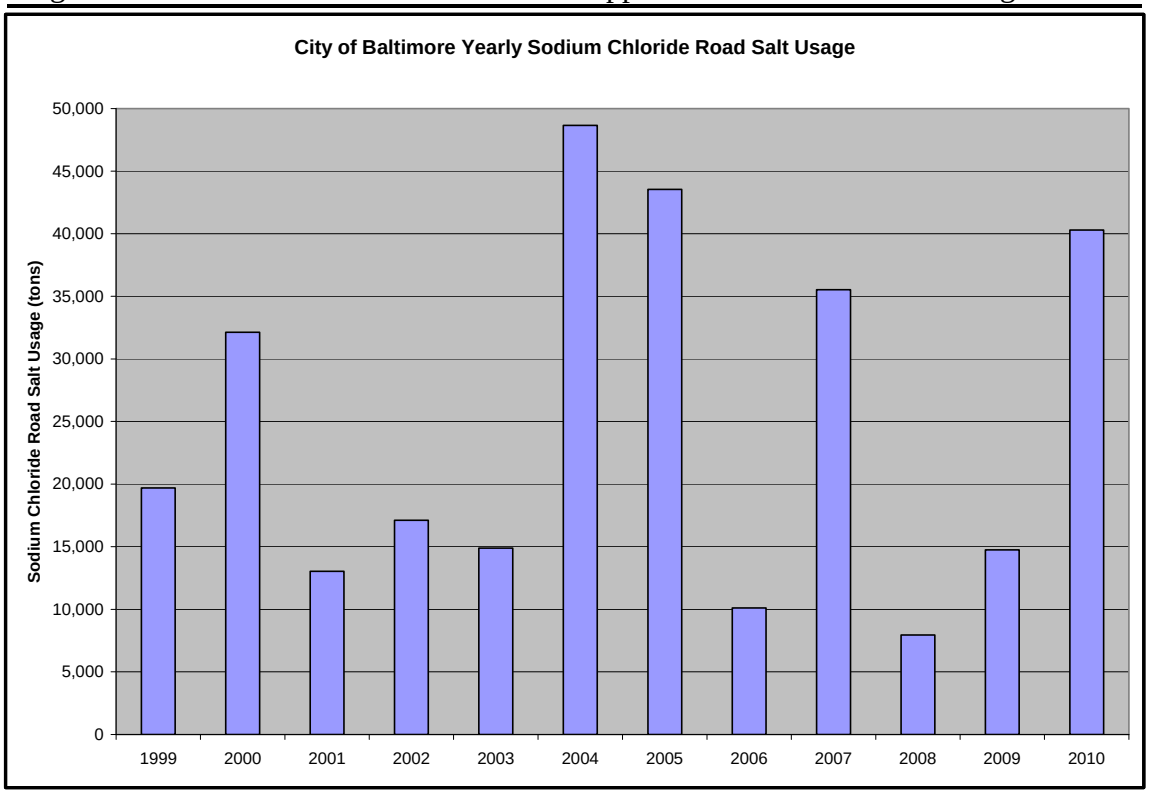
Table D5c.1 lists the amounts of deicing materials that the Department of Transportation applied each year for 1999 through 2010. Figure D5c.1 displays the amount of sodium chloride applied by year for

1999 through 2010. The severe weather events in the early part of 2010, especially February, resulted in the significant increase of application of de-icing materials.

Table D5c.1 Bureau of Highways De-icing Material Applied Data

Year	Sodium Chloride (tons)	Magnesium Chloride Flakes (tons)	Liquid Calcium Chloride (gal)	Calcium Chloride (tons)	Ice-Ban (gal)	Number of Snow Events	Snow Fall (in.)
1999	19,697	0	0	0	0	not known	12.2
2000	32,135	6.1	0	5	2,005	not known	35.0
2001	13,036	0	0	1	10,200	not known	6.0
2002	17,108	0	0	5	0	not known	3.5
2003	14,883	1	0	0	0	not known	56.5
2004	48,660	6	0	0	0	5	not known
2005	43,550	0	0	0	0	9	18.5
2006	10,106	0	0	0	0	1	13.0
2007	35,533	0	0	0	0	8	15.8
2008	7,944	0	0	0	0	4	4.3
2009	14,734	0	0	0	0	3	28.6
2010	40,302	0	0	0	0	6	54.0

Figure D5c.1 Amount of Sodium Chloride Applied to Roads for 1999 through 2010



6. **Public Education**
   a. **Outreach Efforts to the Public**

<u>Overview: Stormwater Public Education and Citizen Involvement</u>
Public outreach and education are important components of stormwater management; one of the highest priority goals is pollution prevention. The City believes that education is the most cost-effective practice for water quality improvements. Throughout 2010, SWMD, the Department of Public Works Communications Office and non-government organizations (NGOs) presented stormwater pollution prevention principles to citizens, other City agencies, businesses, consultants and elected-officials.

<u>Department of Public Works Public Meetings</u>
Here is a list of dates on which the Department of Public Works held public meetings during which surface water quality and the MS4 permit were main topics:

- 3/1/10 – Surface Water Management Quadrant Presentation
- 3/18/10 – Surface Water Management & Community Relations Council Southern District Meeting
- 3/24/10 – Surface Water Management & Community Relations Council Central District Meeting
- 3/26/10 – Water Partnership Board Presentation
- 4/13/10 – DPW Discussions – Central

- 5/6/10 – DPW Discussions – South, Southeast
- 5/11/10 – Donna Langley (Main Streets) and DPW Joined Outreach Efforts
- 5/13/10 – DPW Discussions – Northern
- 5/19/10 – DPW Discussions – Southern, Southwest
- 5/24/10 – DPW Discussions – Northwest
- 6/10/10 – DPW Discussions – East, Northeast

Water Quality Monitoring and Inspection Section Presentations
Pollution Control Analysts from the Water Quality Monitoring and Inspection Section of SWMD were involved in the following three outreach events during 2010:

- April 8, 2010: Staff attended an Environmental Fair at Franklin Square Elementary and Middle School, and presented their hands-on storm drain display, skit, water quality testing equipment and preserved macroinvertebrates collected from City's streams.
- April 17, 2010: Staff presented their automated hands-on storm drain display at "Ecofest".
- May 13, 2010: Staff participated in the career day festival at Franklin Square Elementary and Middle School by informing students of the duties of a Pollution Control Analyst. The Presentation included the equipment used in water quality testing, and macroinvertebrates collecting. Students were also informed of the requirements and employment opportunities available in the environmental field.

Reporting Pollution: CitiTrack Service Request System
The City has an online CitiTrack Service Request System as an alternative to dialing 311. The 311 Call Center is open seven days a week from 6:00 AM through 10:00 PM, including holidays. Citizens can use this service to report such water quality problems as hazardous waste; sewage or sewer investigation; stormwater inlet choked or damaged; dirty alley or street cleaning; or missed mixed refuse pickup. The complainant is given a service request tracking number. The requests feed into a mainframe computer and managers report in weekly meetings how many requests have been addressed with workable solutions. Two non-government organizations, Blue Water Baltimore and the Patapsco Waterkeeper, also have a reporting system that ties directly to the City's Environmental Crimes Unit and the 311 Center.

Cleaner Greener Baltimore Campaign
The City started the Cleaner Greener Baltimore program in 2007. The program has continuously expanded as a partnership with the DPW Office of Communications, other City and Baltimore County agencies and watershed associations. The campaign educates the public on stormwater issues and the costs of meeting regulatory mandates. An integral part of

this outreach includes how to address stormwater issues at their homes and neighborhoods by planting trees and improving streams and parks. Cleaner Greener Baltimore was also set up to reduce litter and to increase recycling. More information about this program can be found through the City's website: www.cleanergreenerbaltimore.org.

TreeBaltimore

TreeBaltimore is an effort to double the City's tree canopy by 2030. The web address is: http://www.baltimorecity.gov/Government/AgenciesDepartments/RecreationandParks/TreeBaltimore.aspx. This site has a link to the Tree Benefit Calculator, which allows anyone to make a simple estimation of the benefits individual street-side trees provide. This tool is based on i-Tree's (from the USDA Forest Service) street tree assessment tool called STRATUM. With inputs of location, species and tree size, users will get an understanding of the environmental and economic value trees provide on an annual basis. Evapotranspiration and uptake of nutrients can significantly reduce stormwater pollution and improve water quality. In 2010, TreeBaltimore planted approximately 8,000 trees.

Legislation: 2010 Stormwater Ordinance and Guidelines

DPW staff met with a key group of stakeholders to develop a new Stormwater Ordinance for the City as mandated by Maryland's 2007 Stormwater Law. The City's Ordinance was passed by the deadline of May 4, 2010. The stakeholder group continued to meet monthly and updated a companion document called "The City of Baltimore's Stormwater Guidelines". In December 2010, SWMD submitted a draft copy of the guidelines to MDE for review.

Baltimore City/Baltimore County Watershed Agreement (BWA)

The City and Baltimore County continue to implement the Watershed Agreement Action Plan under the BWA. On March 13, 2010, Baltimore City and Baltimore County hosted a "State of Our Watershed" Conference at Notre Dame College. Approximately 150 residents attended. In addition to presentations addressing current water quality issues, there were presentations addressing climate change, environmental associations, and public survey data. Afternoon break-out sessions focused on redevelopment, public health, greening, and trash.

Green Cleaning

GO GREEN CLEANING was introduced as a pilot program in City Hall and several other City buildings. The Department of General Services now uses environmentally friendly cleaning agents that are safer and healthier for the maintenance workers, building occupants, as well as for our planet. There is an online survey for educating citizens and allows them to provide feedback on recycled products, natural hand soap, green

toilet cleaners, etc. (http://www.baltimorecity.gov/Government/AgenciesDepartments/GeneralServices/GoGreenCleaning.aspx).

Lawn Care and Landscape Management

Residents are encouraged to bring unused lawn chemicals for Household Hazardous Waste Days. The Department of Recreation and Parks staff has been trained not to use any fertilizer or pesticides on over 6,000 acres of parkland within the City boundaries (except minor amounts on some ball fields) and none is used on over 17,000 acres the City owns surrounding the three water supply reservoirs in Baltimore and Carroll Counties.

Litter Control, Recycling, and Composting

Department of Public Works Office of Communications is providing outreach on litter, trash, recycling as part of the One-Plus-One Campaign (went to once a week pick-up of trash and recyclables from twice a week). Because of this effort, recycling has increased dramatically. The components of the campaign include: the cost of litter and City and citizen responsibilities.

Non-Governmental Organizations (NGOs)

The City has partnered with numerous groups to educate citizens about stormwater quality and pollution prevention. Below is a discussion of the interaction with the City of three prominent NGOs involved with stormwater pollution prevention efforts: The Waterfront Partnership, Blue Water Baltimore and the Parks and People Foundation.

The Waterfront Partnership

The Waterfront Partnership, Inc., which formed in October 2005, is governed by a 25-member board comprised of key property owners and City government officials. Members contribute time, expertise and funding; and the Partnership is under contract by the City to manage public spaces adjacent to the Harbor. Currently bounded by the Rusty Scupper on the south and extending around the Harbor to the Bond Street Wharf on the east, the Partnership improves cleanliness and water quality by:

- Sweeping and cleaning the Promenade;
- Installing trash receptacles; in 2010 the Partnership's "Clean Team" installed 40 new cigarette butt urns, which made a noticeable difference in keeping the Waterfront clean.
- Job-Training-Project SERVE (Service-Empowerment-Revitalization-Volunteerism-Employment) is a community-based program that works in the City's underserved neighborhoods and trains disadvantaged residents with marketable skills while they revitalize their communities. SERVE dedicates 11 workers in

summer months and 5 workers in winter months to sweep the promenade and keep litter and trash from going into the Harbor.

Blue Water Baltimore (BWB): Five Organizations Become One
BWB is now the principal watershed group in Baltimore. BWB began as five separate Baltimore organizations. Although individually successful, BWB staff, their boards and Baltimore residents realized that to continue growing and be even more effective, they needed to work together toward a shared mission. Two years ago, BWB started that process, and on September 8, 2010, the Jones Falls Watershed Association, Herring Run Watershed Association, Gwynns Falls Watershed Association, Baltimore Harbor Watershed Association, and Baltimore Harbor Waterkeeper legally merged. The watershed groups, now BWB, and the City have worked together for years as partners on water quality education, pollution prevention and restoration projects. BWB has also been involved in Maryland's new environmental literacy graduation requirement. The "No Child Left Inside" campaign supports environmental education because complex environmental challenges confronting the nation and world require an informed citizenry, and engaged, knowledgeable individuals. Environmental education excites students by engaging them in their world and getting them outdoors. Studies have shown that environmental education also promotes higher-order thinking skills and is correlated with higher test scores in math and reading.

BWB develops and offers applied environmental education opportunities that meet State curriculum standards; engages students by combining in-class and outdoor education with hands-on pollution prevention and restoration work; and inspires students to continue to explore nature and gives them the skills to actively protect and speak out for healthy, vibrant environment. Currently, Blue Water Baltimore works with a number of schools on such projects as:

- Planting trees on and off campus
- Cleaning local streams
- Teaching fishing, water chemistry, and bird identification
- Installing rain barrels and rain gardens on campus
- Planting butterfly gardens
- Tree identification and seed and nut collection.

BWB also speaks to classes, church groups or community groups to discuss what they can do and how to get involved. BWB attends fairs, celebrations, and outreach events to help spread the word about water quality, trees, habitat and pollution prevention. The Maryland Association of Environmental and Outdoor Education (MAEOE) has created a nationwide model, called the Maryland Green Schools Program, to inspire and help area schools become models of sustainability, reduce school operating costs, and improve the health and test scores of students. As a

certified Green Center, BWB is helping schools with their Green School application process. From developing quality, lasting student greening initiatives to providing hands-on professional development opportunities for faculty and staff, BWB is helping schools become leaders in sustainability and stormwater pollution prevention while helping today's students become tomorrow's environmental stewards.

Every Baltimore resident is aware of how much trash litters sidewalks, streets and alleys. Unfortunately, most people don't realize that when the rain washes that trash into a storm drain, it ends up in neighborhood streams, and eventually, Baltimore Harbor, the Patapsco River, or Back River. In fact, according to a 2007 survey, only about 1 in 5 people realize that water entering our storm drains receives no treatment whatsoever before running into our creek and rivers. Labeling storm drains raises awareness about the connection between streets and streams. To help people recognize the connection between litter and clean water, BWB organizes periodic storm drain labeling events with neighborhood associations, scout troops, and other groups. These dedicated volunteers head out into the neighborhoods across the City to raise awareness about the connection between streets and streams, painting "Don't Dump: Chesapeake Bay Drainage" on storm drains. BWB has stencils, required permits, and the experience to help citizens make a difference for our streams.

BWB created their "Water Audit Program" to help property owners understand the impact their land and homes have on water quality and what they can do about it. This program includes:

- Rain Barrels: BWB can help set up a rainwater collection system that is one of the easiest and most cost-effective ways to reduce water bills and minimize the pollution.
- Tree Planting: Baltimore has only 27% tree canopy. BWB helps residents plant native trees, which help filter polluted runoff, air pollution, and cool our neighborhoods.
- Rain Gardens: BWB helps homeowners and businesses capture rain runoff and reduce the amount of polluted runoff that winds up in storm drains and streams by installing rain gardens on private property.
- Conservation Landscaping: BWB helps citizens rework their property's landscaping to reduce pollution and improving the local environment.
- Downspout Disconnection: BWB helps reduce stormwater flow in the storm drain system by redirecting home and business owners' downspouts to flow into yards or gardens.

BWB's "Community Greening Program" is about educating and involving the community in a green future that everyone will benefit from and enjoy. BWB works to reduce polluted runoff and excessive pavement.

- Invasive Plant Control: "Baltimore Weed Warriors" fight to removes invasive plant species.
- Rain Garden: BWB helps residents plan and design residential-scale BMPs.
- Tree Planting: BWB runs the Herring Run Nursery, a low-cost native nursery.
- Pavement Reduction: BWB can help residents remove some of the asphalt or concrete on their property.

Parks and People Foundation (PPF)

Watershed 263 is a 930-acre storm drain area with a population of 31,000 in west and southwest Baltimore City that encompasses part of 12 highly impervious neighborhoods from Sandtown-Winchester in the north to the Carroll-Camden Business Park in the South. Stormwater flows through a 43-mile storm drain system that converges into one outfall pipe near the mouth of Gwynns Falls in the Middle Branch of the Patapsco River. An approved watershed restoration plan was adopted and includes: planting trees; cleaning and greening vacant lots; reducing litter; cleaning streets and alleys; creating community gardens, improving city parks and greening schoolyards where asphalt has been removed; increasing recycling; and supporting community stewardship and involvement. The Watershed 263 Community Stakeholder Council was formed by 20 residents who represent the watershed neighborhoods. The Council's role is to sustain community involvement and stewardship in the project, review proposals for water quality and quality of life improvements, monitor its implementation using measurable indicators and generally work to support the project. The Council meets periodically and is supported by the Parks & People Foundation (PPF). The work completed during 2010 in Watershed 263 is discussed further in Section F3 of this report.

In Watershed 246 (Harris Creek), PPF is partnering with the Blue Water Baltimore, Baltimore City Department of Public Works and the Cleaner Greener Campaign, Center for Watershed Protection, and the Chesapeake Bay Trust to focus greening resources on the Harris Creek stormshed, a 1,200 acre area with 44,000 residents. The historic Harris Creek now lies completely underground and is fed by the multitude of storm drains scattered throughout Watershed 246. This stormshed empties directly into the Northwest Branch of the Patapsco River and routinely dumps over three tons of trash into the Harbor every month. The Harris Creek project aims to bring various stakeholders together including residents, community garden clubs, church groups, municipal agencies, schools and others community organizations. By bringing these groups together and

working to align their goals and concerns around the benefits of a cleaner and greener community, PPF et al. will develop a watershed plan aimed at reducing trash, increasing green space, creating more natural hydrology, and improving the livability of the community. A trash collector at the outfall to the Harbor will allow measurement of improvements brought about by this watershed initiative.

Some of PPF's accomplishments during 2008-2010:

- Completed schoolyard greening projects on 11 of 14 sites, 3 sites in planning process.
- Working with four watershed neighborhoods on greening plans and implementing projects.
- Removed 12.5 acres of asphalt: city-wide have now removed 20 acres total.
- Planted more than 2,155 new trees.
- Installed 10 large urban bio-retention and infiltration BMPs and 91 greening projects.

b. **Outreach to Industry**

The Pollution Control Section of the Environmental Services Division conducts annual inspections of "significant industrial users" of the sanitary sewer system: currently there are 33 significant industrial users. The Pollution Control Section revised their check list in September 2010 to include additional stormwater related industrial site information. A copy of the revised inspection check list can be found in the Word file "Inspection Report Checklist Rev. 9 2010.doc" on the CD-ROM accompanying this response. After the checklist was revised in September 2010, the Pollution Control Section completed seven inspections through the end of 2010. Copies of these inspection reports are available to view by appointment at the offices of Pollution Control Section.

E. <u>Watershed Assessment and Planning</u>

1. **Watershed Management Plans**

There are five watersheds at the 8-digit scale into which parts of the City drain. The 8-digit watersheds and associated subwatersheds are listed in Table E1.1. The City completed watershed studies of Gwynns Falls in 2004, and Jones Falls and Back River in 2008. In 2010, SWMD hired Parsons Brinckerhoff to assess existing watershed plans (listed in Table E1.2) to determine updates needed to be in compliance with current and anticipated requirements based on EPA, City, and region-specific provisions. The results of the evaluation are provided in the file entitled "Parsons Brinckerhoff Summary of Environmental Requirements Applicable to Watershed Plans.pdf" on the CD-ROM accompanying this report. With this analysis, the

City has started the preparation to meet the anticipated requirements for management plans in the City's next MS4 permit.

Table E1.1 Baltimore City Watersheds

Major Watersheds	MDE 8-digit Watershed Number	Subwatersheds
Back River	**2130901**	West Branch Herring Run
		East Branch Herring Run
		Herring Run Mainstem
		Chinquapin Run
		Tiffany Run
		Armistead Run
		Biddison Run
		Moores Run
		Redhouse Run
		Unnamed Tributary
		Stemmers Run
Baltimore Harbor	**2130903**	SW Harbor
		Middle Branch
		Inner Harbor
		East Patapsco
Jones Falls	**2130904**	Western Run
		Stony Run
		Lower Jones Falls
Gwynns Falls	**2130905**	Gwynns Run North
		Gwynns Run South
		Lower Gwynns Falls
		Middle Gwynns Falls
		Dead Run
		Maidens Choice
		Powder Mill
Patapsco River	**2130906**	Lower North Branch

Table E1.2 Baltimore City Watersheds Plans			
Planning Area	**Major Watershed**	**Report Title**	**Year**
Upper Back River	Back River	Small Watershed Action Plan	2008
Biddison Run	Back River	Stormwater Improvement Feasibility & Conceptual Design	2006
Herring Run	Back River	Stream Assessment & Restoration Concept Plan	2004
Moores Run	Back River	Watershed Restoration Plan	2001
Watershed 263	Baltimore Harbor	Management Plan	2006
Lower Jones Falls	Jones Falls	Small Watershed Action Plan	2008
Western Run	Jones Falls	Stream Assessment	2004
Stony Run	Jones Falls	Watershed Restoration Plan	2001
Gwynns Falls	Gwynns Falls	Water Quality Management Plan	2004
Powder Mill	Gwynns Falls	Targeted Watershed Assessment	2004
Maidens Choice	Gwynns Falls	Watershed Restoration Plan	2001

2. **Watershed Assessment from Chemical Monitoring**
   The folder "City Streams Dry Weather Time Concentration Graphs" on the accompanying CD-ROM of this report contains a set of sixteen Excel files. Each Excel file contains a set of concentration versus sampling date time graphs for a given water quality parameter for samples collected during dry weather for all the City's stations, including the two Biddison Run stations (discussed in Section F2a), and the four Moores Run stations (discussed in Section G1a). The parameters that were graphed are (alphabetically by file name):
   - ammonia nitrogen (lab measurement);
   - ammonia nitrogen (field measurement);
   - biological oxygen demand (BOD 5-day);
   - chlorides;
   - chemical oxygen demand (COD);
   - conductivity (lab measurement);
   - total copper;
   - fecal coliform counts;
   - fluoride;
   - nitrate+nitrite nitrogen;
   - sodium (only measured for the stations Powder Mill, Dead Run Dnst., Maidens Choice and Radecke Ave.);
   - total suspended solids;
   - total Kjeldahl nitrogen (TKN);
   - total nitrogen (estimated by the sum of TKN with nitrate+nitrite nitrogen);
   - total phosphorus; and
   - total zinc.

Starting on September 10, 2003, the DPW lab which SWMD used switched to automated technology made by Skalar to measure nitrogen and phosphorus. SWMD noted a difference in the results following the switch in analytical technologies. On each graph for nitrogen and phosphorus parameters there is a green vertical line marking the date the switch was made. Beginning in January 20, 2009, SWMD had to using a contracted lab for total phosphorus, TKN and nitrate+nitrite nitrogen analyses because the State de-certified the DPW lab for measuring those analytes. On each graph for nitrogen and phosphorus parameters, there is a red vertical line marking this date. The concentrations since the switch to the contracted lab appear lower than they were for the period- September 10, 2003 through January 20, 2009- when the DPW lab was using the Skalar equipment to measure phosphorus and nitrogen.

Dissolved Metals Analysis

Each year since March 2003, the City analyses three out of twelve batches of monthly SIS samples from each watershed for total hardness and dissolved copper, lead and zinc. The purpose has been to detect concentrations exceed the State's freshwater chronic criteria for these metals. Formulas for adjusting the freshwater criteria for hardness were taken from two reports prepared by MDE: (1) Water Quality Analysis of Copper and Lead for the Jones Falls in Baltimore County and Baltimore City, Maryland and (2) Water Quality Analysis of Zinc Contamination for the Jones Falls Baltimore City and Baltimore County, Maryland.

SWMD obtained 853 dry weather samples to examine after combining the results from all the SIS stations for samples collected through December 2010. The total hardness results for 96 samples were above 400 mg/L, which is out of range for this set of adjustment curves. Almost all of these samples were from stations around the Harbor. One dissolved lead result, reported by the lab as below the reporting limit, could not be used because the hardness-adjusted freshwater chronic criterion for lead for this sample was below the lab's reporting limit for lead for this sample. Out of the remaining samples, 9 of 757 samples (1%) had a dissolved copper concentration that exceeded the hardness-adjusted freshwater chronic criterion; 3 of 756 samples (less than 1%) had a dissolved lead concentration that exceeded the hardness-adjusted freshwater chronic criterion; and none of the 754 samples had a dissolved zinc concentration that exceeded the hardness-adjusted freshwater chronic criterion.

Four of the samples that exceeded the copper freshwater chronic criterion came from the Central & Lancaster station in the Direct Harbor watershed. There were only 10 samples that could be evaluated at this station; thus 40% of the samples from this station exceeded the copper freshwater chronic criterion. Another station in this watershed, Warner & Alluvion, had 3 of 15 (20%) of its dissolved copper samples above the hardness-adjusted freshwater

chronic criterion. The Gwynns Falls Pkwy. station in the Gwynns Falls watershed and the Smith Ave. station in the Jones Falls watershed each had 1 of 21 (5%) of their dissolved copper samples above the hardness-adjusted freshwater chronic criterion.

Three stations had one dissolved lead sample exceed the hardness-adjusted freshwater chronic criterion: Stony Run (1 out of 22 samples) in the Jones Falls watershed, and Hamilton Avenue (1 out of 76 samples) and Mary Avenue (1 out of 77 samples) in the Moores Run sub-watershed of the Back River watershed. This analysis was also applied to the samples from Watershed 263 (discussed in Section F2b) and Moores Run (discussed in Section G1a.).

E. Coli and Enterococci MPN Count Analysis

Since November 2008, SWMD modified SIS protocol to replace fecal coliform MPN counts with e. coli MPN counts. Since April 2009, SWMD switched to having enterococci MPN counts performed on the Direct Harbor watershed SIS stations and the Lombard St. station in the Jones Falls watershed since enterococci are considered a better indicator to use for marine waters. Since April 2009, SWMD has been collecting samples for enterococci MPN counts at the marine water SIS stations twice each month.

Table E2.1 lists the e. coli MPN count geometric mean and the percentage of dry weather samples for which the e. coli MPN count was at below each of the four water contact use categories for each freshwater sampling station. Figure E2.1 depicts the percentage of dry weather samples for which the e. coli MPN count was at below the infrequent full body contact recreation guideline (576 MPN/100 ml) for each freshwater sampling station.

Table E2.2 lists the enterococci MPN count geometric mean and the percentage of dry weather samples for which the enterococci MPN count was at below each of the four water contact use categories for each marine water sampling station. Figure E2.2 depicts the percentage of dry weather samples for which the enterococci MPN count was at below the infrequent full body contact recreation guideline (500 MPN/100 ml) for each marine water sampling station.

Table E2.1 E. Coli MPN Counts: Geometric Means and Comparison to State's Criteria for Frequency of Use
(Dry Weather Samples November 2008 through January 2011)

Station	ID	Number of Samples	Geometric Mean (MPN/100 ml)	Percent At or Below Frequent Full Body Contact Recreation (235 MPN/100 ml)	Percent At or Below Moderately Frequent Full Body Contact Recreation (298 MPN/100 ml)	Percent At or Below Occasional Full Body Contact Recreation (410 MPN/100 ml)	Percent At or Below Infrequent Full Body Contact Recreation (576 MPN/100 ml)	Percent Above Infrequent Full Body Contact Recreation (576 MPN/100 ml)
Back River Watershed								
PERRING PKWY	HR-1	21	1,341	5%	5%	14%	33%	67%
MT. PLEASANT GC	HR-2	21	2,376	10%	10%	10%	10%	90%
CHINQUAPIN RUN	HR-3	21	739	19%	19%	24%	38%	62%
TIFFANY RUN	HR-4	21	424	33%	33%	48%	67%	33%
HARFORD RD.	HR-5	21	863	19%	19%	38%	38%	62%
WRIGHT AVE.	HR-6	21	880	24%	24%	33%	48%	52%
PULASKI HWY.	HR-7	21	630	10%	10%	24%	52%	48%
Moores Run Sub-watershed of Back River Watershed								
MARY AVE.	MR-1	21	4,792	0%	0%	0%	5%	95%
HAMILTON AVE.	MR-2	21	2,906	0%	5%	5%	5%	95%
RADECKE AVE.	MR-3	21	2,398	0%	0%	14%	19%	81%
BIDDLE ST. & 62ND ST	MR-4	21	1,325	14%	14%	24%	29%	71%
Biddison Run Sub-watershed of Back River Watershed								
BIDDISON RUN UPSTRM	BR-1	12	1,292	17%	33%	42%	42%	58%
BIDDISON RUN DWNSTRM	BR-2	12	815	42%	42%	58%	58%	42%
Jones Falls Watershed								
SMITH AVE.	JF-1	24	125	75%	75%	79%	83%	17%
WESTERN RUN	JF-2	24	853	25%	25%	29%	46%	54%
STONY RUN	JF-3	24	254	58%	58%	75%	79%	21%
Gwynns Falls Watershed								
POWDER MILL	GF-1	24	844	17%	17%	33%	38%	63%
PURNELL DR.	GF-2	23	576	26%	26%	39%	61%	39%
DEAD RUN DNST.	GF-3	23	307	39%	43%	65%	74%	26%
GWYNNS FALLS PKWY.	GF-4	23	167	57%	57%	65%	74%	26%
GRUN HILTON ST.	GF-5	23	3,049	0%	0%	4%	9%	91%
GF HILTON ST.	GF-6	23	501	39%	39%	52%	61%	39%
MAIDENS CHOICE	GF-7	23	549	30%	30%	39%	61%	39%
GRUN CARROLL PARK	GF-8	23	16,078	0%	0%	0%	0%	100%
WASHINGTON BLVD.	GF-9	23	2,346	0%	0%	4%	9%	91%

Figure E2.1 Percent E. Coli MPN Counts At or Below the Infrequent Full Body Contact Recreation Guideline (576 MPN/100 ml)

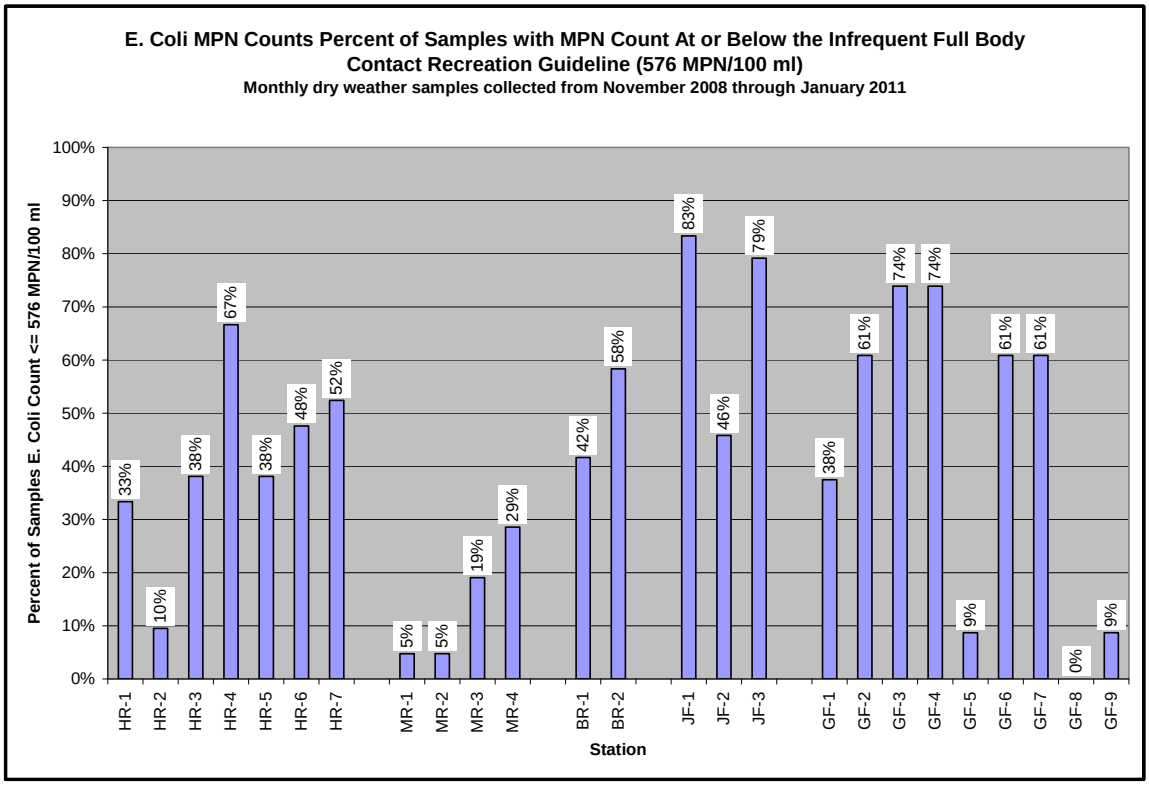
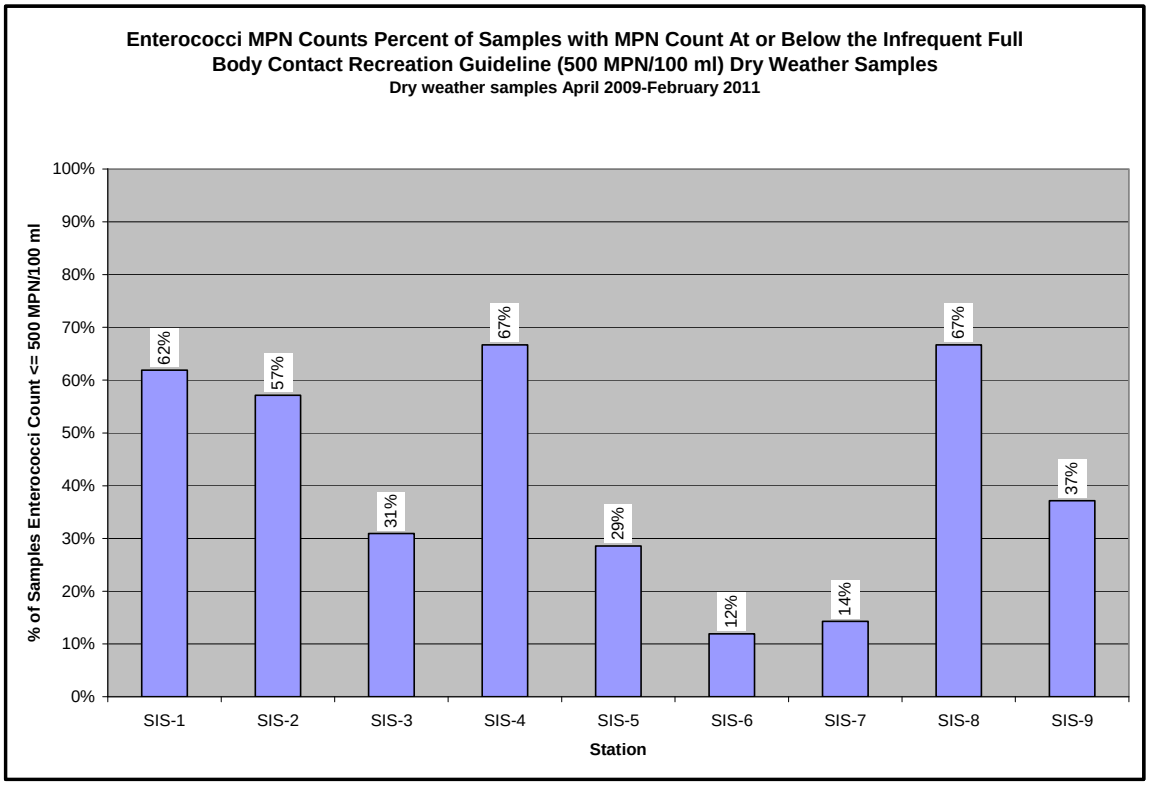


Table E2.2 Enterococci MPN Counts: Geometric Means and Comparision to State's Criteria for Frequency of Use (April 2009 through February 2011)

Station	Station ID	Number of Samples	Geometric Mean (MPN/100 ml)	Per Cent At or Below Frequent Full Body Contact Recreation (104 MPN/100 ml)	Per Cent At or Below Moderately Frequent Full Body Contact Recreation (158 MPN/100 ml)	Per Cent At or Below Occasional Full Body Contact Recreation (275 MPN/100 ml)	Per Cent At or Below Infrequent Full Body Contact Recreation (500 MPN/100 ml)	Per Cent Above Infrequent Full Body Contact Recreation (500 MPN/100 ml)
Direct Harbor Watershed SIS Stations								
REEDBIRD AVE.	SIS-1	42	237	36%	45%	55%	62%	38%
WATERVIEW AVE.	SIS-2	42	417	17%	19%	36%	57%	43%
WARNER & ALLUVION	SIS-3	42	1,043	10%	12%	24%	31%	69%
LIGHT ST.	SIS-4	42	147	40%	48%	50%	67%	33%
CENTRAL & LANCASTER	SIS-5	42	1,404	5%	7%	19%	29%	71%
LAKEWOOD AVE.	SIS-6	42	2,335	0%	0%	7%	12%	88%
LINWOOD AVE.	SIS-7	42	6,083	0%	2%	7%	14%	86%
JANEY RUN	SIS-8	42	147	45%	48%	55%	67%	33%
LOMBARD ST.	SIS-9	35	938	11%	11%	20%	37%	63%

Figure E2.2 Percent Enterococci MPN Counts At or Below the Infrequent Full Body Contact Recreation Guideline (500 MPN/100 ml)



Total Phosphorus and Total Nitrogen Analyses

From November 1997 through January 12, 2010, the dry weather stream samples were analyzed for total phosphorus, total Kjeldahl nitrogen and nitrate+nitrite nitrogen by a DPW lab. In early 2010, the State review of this DPW lab found problems with the lab's abilities to measure phosphorus and nitrogen. Thus, beginning with samples collected on January 20, 2010, SWMD used a contracted lab with appropriate certification to analyze the samples for phosphorus and nitrogen.

Table E2.3 lists the percentages for each station of the dry weather samples analyzed by the contracted lab which were at or exceeded these nutrient concentration guidelines: total phosphorus at 0.1 mg/L, and total nitrogen (estimated by the sum of total Kjeldahl nitrogen and nitrate+nitrite nitrogen) at 3 mg/L. Following a convention that the State used in its Maryland Water Quality Inventory, 1993-1995, a water quality level was assigned for each station's sample sets: "normal" (shown by light green highlight) if the percentage was less than 11%; "elevated" (shown by light yellow highlight) if it was between 11% and 25%; and "high" (shown by rose highlight) if it was greater than 25%. The Direct Harbor set of stations have the worst problems with phosphorus and nitrogen; the Back River watershed stations have the least problems with phosphorus and nitrogen. The worst stations are Linwood

Ave. in the Direct Harbor watershed and GRUN CARROLL PARK in the Gwynns Falls watershed.

Table E2.3 Percent of Dry Weather Samples Exceeding Guidelines for Total Phosphorus or Total Nitrogen (January 20, 2009 through January 24, 2011)

Station	Percent of Samples Total Phosphorus >=0.1 mg/L	Percent of Samples Total Nitrogen >=3 mg/L
Back River Watershed		
PERRING PKWY	10%	0%
MT. PLEASANT GC	25%	5%
CHINQUAPIN RUN	5%	5%
TIFFANY RUN	5%	0%
HARFORD RD.	15%	0%
WRIGHT AVE.	20%	5%
PULASKI HWY.	10%	5%
Moores Run Sub-watershed (Back River Watershed)		
MARY AVE.	20%	0%
HAMILTON AVE.	30%	10%
RADECKE AVE.	20%	5%
BIDDLE ST. & 62ND ST.	45%	0%
Biddison Run Sub-watershed (Back River Watershed)		
BIDDISON RUN UPSTRM	17%	0%
BIDDISON RUN DWNSTRM	17%	8%
Jones Falls Watershed		
SMITH AVE.	25%	0%
WESTERN RUN	15%	0%
LINKWOOD	23%	10%
STONY RUN	20%	5%
LOMBARD ST.	48%	0%
Gwynns Falls Watershed		
POWDER MILL	15%	5%
PURNELL DR.	25%	0%
DEAD RUN DNST.	30%	0%
GWYNNS FALLS PKWY.	30%	5%
GRUN HILTON ST.	30%	0%
GF HILTON ST.	35%	0%
MAIDENS CHOICE	20%	5%
GRUN CARROLL PARK	75%	21%
WASHINGTON BLVD.	20%	5%

Table E2.3 (continued) Percent of Dry Weather Samples Exceeding Guidelines for Total Phosphorus or Total Nitrogen (January 20, 2009 through January 19, 2011)		
Station	Percent of Samples Total Phosphorus >=0.1 mg/L	Percent of Samples Total Nitrogen >=3 mg/L
Direct Harbor Watershed		
LINWOOD AVE.	87%	46%
LAKEWOOD AVE.	54%	17%
CENTRAL & LANCASTER	54%	4%
LIGHT ST.	38%	9%
WARNER & ALLUVION	42%	0%
WATERVIEW AVE.	21%	4%
REEDBIRD AVE.	42%	13%
JANEY RUN	46%	4%
Key		
	Normal: <= 11% of Samples	
	Elevated: Between 11-25% of Samples	
	High: >25% of Samples	

3. **Watershed Assessment from Biological Monitoring**
SWMD conducts biological monitoring for benthic macroinvertebrates within three of the four watersheds: Gwynns Falls, Jones Falls and Back River- using a combination of random and fixed site sampling. Each year, one watershed is chosen for the random sampling; in 2010, the Back River Watershed was selected. During 2010, benthic macroinvertebrates were collected at 23 stations:
    - 15 random stations in the Back River watershed;
    - 2 fixed stations in the Gwynns Falls watershed;
    - 1 fixed station on Biddison Run (in the Back River watershed) associated with the stream restoration monitoring;
    - 3 fixed stations on Stony Run (in the Jones Falls watershed) associated with the stream restoration monitoring; and
    - 2 fixed stations in the upper Moores Run sub-watershed (in the Back River watershed) associated with the two long-term discharge characterization stations.

A record for each macroinvertebrate sample and its resulting BIBI score is provided in the Excel file "Macroinvertebrate Sample Results 2002 through 2010.xls" on the CD-ROM accompanying this report. Biomonitoring results for the fixed Biddison Run stations and for the fixed Moores Run stations are discussed in Section F2a and Section G1b, respectively.

SWMD uses the method for calculating genus IBI scores for benthic macroinvertebrates and fish that the Maryland Biological Stream Survey (MBSS) presented in their October 2005 report, "New Biological Indicators to

Better Assess the Condition of Maryland Streams". Figure E3.1 presents the genus BIBI scores for the macroinvertebrates collected at the 15 random sites in the Back River watershed collected in 2010.

Figure E3.2 presents percentile rank versus genus IBI scores for the benthic macroinvertebrate samples from the random sampling stations for 2002 through 2010. Each curve presents the distribution of the scores for a given year. Figure E3.3 displays box-and-whisker plots for the three years during which random samples were collected in the Back River watershed: 2004, 2007 and 2010.

Figure E3.1 Benthic Macroinvertebrates Genus BIBI Scores for Back River Watershed Random Stations Sampled During 2010

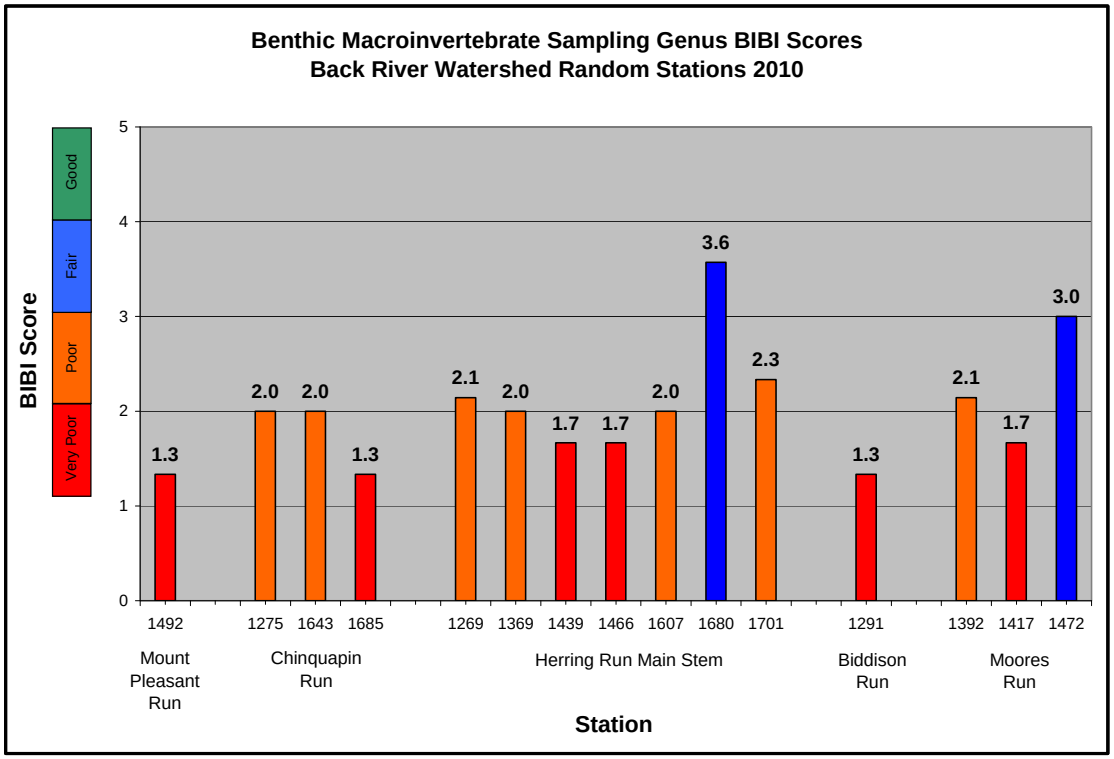


Figure E3.2 Comparison of the Genus BIBI Scores for Macroinvertebrate Samples from Random Stations 2002-2010

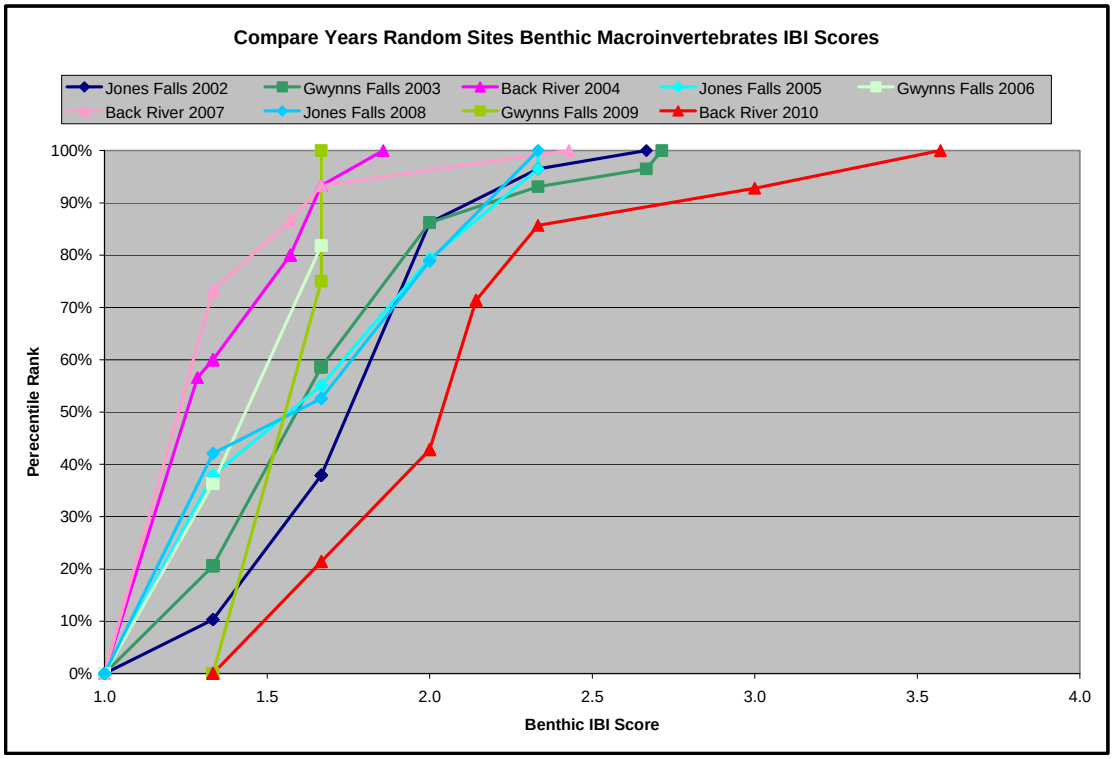


Figure E3.3 Box-and-Whisker Plots Back River Watershed Random Stations Sample Sets Genus BIBI Scores for Macroinvertebrate Samples from 2004, 2007 & 2010

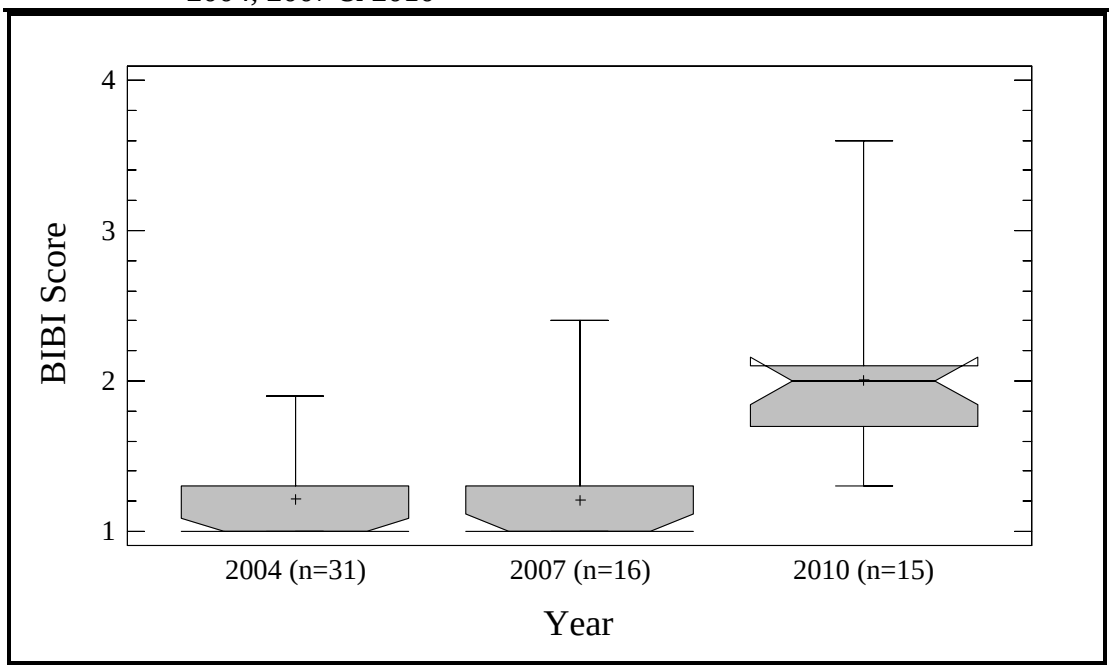


Table E3.2 lists the genus BIBI scores for the fixed site samples from 2002 through 2010.

Table E3.2 Comparison of Benthic Macroinvertebrate BIBI Results for Samples from the Fixed Stations for 2002-2010
(Shaded rows indicate the fixed stations that will be sampled in 2011)

Station	Stream	2002	2003	2004	2005	2006	2007	2008	2009	2010
Gwynns Falls Watershed										
PM03	Powder Mill Run	---	---	1.3	1.0	---	---	---	---	---
BCY106	Gwynns Falls	1.3	---	1.0	1.0	---	---	---	---	---
BCY107	Gwynns Falls	1.0	---	---	---	---	---	---	---	---
BCY108	Dead Run	1.7	1.0	---	---	---	---	---	---	---
DR02	Dead Run	---	---	1.0	1.0	1.7	---	---	1.3	1.0
582	Maidens Choice Run	---	---	---	---	---	---	---	---	1.0
BCY110	Maidens Choice Run	1.3	1.3	1.0	1.3	---	---	---	---	---
Jones Falls Watershed										
BCY112	Western Run	1.3	1.7	---	2.0	---	---	---	---	---
JF02	Jones Falls	---	---	1.0	1.0	---	---	---	---	---
880	Stony Run	---	---	---	---	---	---	---	---	1.3
949	Stony Run	---	---	---	---	---	---	---	---	1.3
BCY114	Stony Run	1.3	1.3	---	---	---	---	---	---	---
BCY115	Stony Run	1.3	1.0	1.0	1.3	---	1.0	1.0	1.3	2.3
Back River Watershed										
BCY118	Chinquapin Run	1.0	1.0	1.0	---	---	---	---	---	---
HR06	Herring Run	---	---	1.0	1.7	---	---	---	---	---
HR07	Herring Run	2.0	1.0	---	---	---	---	---	---	---
BCY116	Herring Run	1.3	1.0	---	---	---	---	---	---	---
BCY117	Herring Run	1.3	1.0	---	---	---	---	---	---	---
BR01	Biddison Run	---	3.3	1.3	1.9	1.3	1.3	1.0	1.0	1.9
BR02	Biddison Run	---	2.4	1.9	1.6	1.6	1.0	1.6	---	---
HAMT02	Moores Run Trib.	1.3	1.3	1.3	1.7	---	1.0	---	---	---
HAMT01	Moores Run Trib.	1.3	1.7	1.0	1.3	1.7	1.3	1.7	1.3	1.7
BCY119	Moores Run	1.3	1.3	1.0	1.3	1.7	1.3	---	1.3	1.3
MR03	Moores Run	1.9	1.6	1.0	1.3	1.0	1.0	2.4	---	---

SWMD ended its fish sampling efforts after 2009 because there was insufficient staff to continue this monitoring and perform all other duties required by the MS4 permit.

F. Watershed Restoration

During 2010, SWMD completed the stream restoration efforts at Western Run and Lower Stony Run, in addition to a facility greening project at Yorkwood Elementary School.

1. Implementation Schedule

This section presents the watershed restoration practices that are under construction, pending construction or were recently completed. It should

be noted that the projects reported as "pending" are subject to many unforeseen variables that can result in schedule and budget impacts. A description of the delays and a revised schedule for the affected projects is presented below.

Gwynns Falls Watershed Capital Improvements

ER4018 Powder Mill Environmental Restoration Project 1

Design Cost: $478,422
Construction Cost: $2,500,000

Description: Stream Restoration of 3,900 linear feet of Powder Mill Run near Northern Parkway.

Status: Completed 60% design in August 2009. Design to 90% was put on hold because the City is negotiating an agreement with the Army Corps of Engineers for design and construction assistance for the Powder Mill Restoration Project.

In 2010, Additional forest delineation efforts were performed to satisfy a request by the Department of Recreation & Parks. Dr. Art Parola from the University of Louisville completed dendrochronology study and estimated amount of fine sediments that have been eroded.

Design completion is currently scheduled for December 2012.

Jones Falls Watershed Capital Improvements

ER4014 Western Run Stream Restoration Project 1

Design Cost: $235,776
Construction Cost: $422,859 (funded by the Maryland Port Administration (MPA) as mitigation for the Masonville Dredge Spoil site)

Description: Stream Restoration of 2,100 feet of the main stem of Western Run, in the vicinity of Greenspring Avenue and Pimlico Road, and along Cross Country Boulevard.

Status: Construction of the project was completed in December 2010.

Open Channel Improvements- Lower Stony Run

Design Cost: $200,341
Construction Cost: $967,000 (does not include coming repair costs)

Description: Stream Restoration of approximately 4,300 feet of Lower Stony Run, except for the piped portions of the stream. This project begins below the culvert under Coldspring Lane and continues through Linkwood Park down to Ridgemead Road. Work continues just below University Parkway for another 1,400 feet.

Status: completed in April 2010, but in need of some repair: due to heavy storms some parts of the project were damaged. The estimated repair cost is being reviewed by the City's Construction Management Office.

Open Channel Improvements- East Stony Run

Design Cost: $459,000
Construction Cost: $699,385

Description: Stream Restoration of approximately 800 feet of the East Stony Run.

Status: In 2010, revised design plans were completed and all easements were obtained. The project construction is scheduled to begin in 2012.

Lower Lower Stony Run Stream Restoration Project (ER4020)

Design Cost: $408,000
Construction Cost: $2,700,000
Description: Stream Restoration of the lowest reach of the Stony Run stream, from approximately 1,400 feet below University Parkway until the stream enters a culvert in Wyman Park. The original plan was to restore only 4,500 linear feet of the stream. An additional 500 linear feet of a tributary has been added to the plan. The goals for this additional design will be to stabilize the channel and prevent erosion and undermining of the existing bridge crossing under San Martin Blvd. on Johns Hopkins University.

Status: In 2010, 60% designs were complete and submitted to City agencies for review. Construction is anticipated to begin in 2012.

Back River Watershed Capital Improvements

Moores Run Wetland

Design Cost: $147,500
Construction Cost: $3,200,000

Description: Wetland creation project in the Frankford neighborhood, located east of Denview Way between Relcrest Road and Force Drive and

west of Moores Run. The facility will divert storm flows from Moores Run through a new wetland area. The facility is designed to treat approximately 18% of the upstream runoff from the contributing drainage area (2,800 acres). To address forest mitigation requirements, trees will be planted at the Moravia Park Elementary School.

Status: In 2010, 95% designs were completed and submitted to City agencies for review. Construction is anticipated to begin 2012.

Yorkwood Elementary School Greening Project

Design Cost: $30,000
Construction Cost: $150,000

Description: Removal of approximately 0.5 acre of asphalt pavement in the playground area of the school. A soil amendment technique, known as sub-soiling, was used in a portion of the project footprint to improve the infiltration potential of the highly compacted sub-soils. Roof drains for the temporary buildings were re-aligned to discharge to a new rain garden.

Status: Construction was completed in the summer of 2010.

Biddison Run Stream Stabilization (Project ER4023)

Design Cost: $310,474
Construction Cost: not yet determined

Description: Stream restoration of approximately 6,900 linear feet of the Biddison Run, from Sipple Avenue to Moravia Road. This project is part of the Masonville Dredge Spoil mitigation plan. Significant slope failure along the right stream bank increased in 2010, extending under the roadway of Moravia Road.

Status: In 2010, 30% designs were completed and submitted to City agencies for review. Construction is anticipated to begin 2013. Design efforts were diverted to address the slope failure portion of the project; construction efforts to address the slope failure are anticipated to be completed in 2012.

Harbor Watershed Capital Improvements

Bush Street Trash-Debris Collector

Design Cost: $242,550
Construction Cost: $2,000,000

Description: Debris collection system to capture floatable debris from the heavily urbanized 930 acre Watershed 263. This project is part of the Masonville Dredge Spoil mitigation plan.

Status: In 2010, an alternatives analysis was performed as requested by MPA. Construction is anticipated to begin in 2012.

Watershed 263 Ultra-Urban BMP Project Phase 2

Design Cost: $200,000
Construction Cost: $493,025

Description: Installation of BMPs for two locations in Watershed 263: curb extension and a conversion of a paved park to a bio-retention cell. Since the 2009 Annual Report, the scope has been reduced to these two locations due to ownership problems and a cost-benefit analysis.

Status: In 2010, 60% designs were completed and submitted to City agencies for review. Construction is anticipated to begin in 2012.

2. **Restoration Monitoring**

This section describes the monitoring that the City does to determine the effectiveness of the restoration practices being implemented as per Part III.H of the Permit. The following projects are featured:

- Biddison Run stream restoration;
- Stony Run stream restoration; and
- Watershed 263.

A discussion on the monitoring activities during 2010 for the Moores Run appears in Section G1 of this report. A discussion of the monitoring activities during 2010 for the Biddison Run, Stony Run and Watershed 263 follows in this section.

a. **Biddison Run**

The stream restoration construction began in the late summer of 2005 and was completed in March 2006. The City established six monumented cross-sections. It was the plan to resurvey these annually; however, these activities have not been performed.

From October 2002 through April 2010, the City collected monthly baseline (dry weather) samples at the two Biddison Run stations ("BIDDISON RUN UPSTRM" and "BIDDISON RUN DWNSTRM") that are associated with the restoration. SWMD ended sampling in 2010 after meeting monitoring obligations set by the project's funding partner. Water quality sample results from 2010 are provided in tables "Baltimore City Chemical Monitoring 2010" and "Baltimore City

Monitoring Sample Results 2010" in the Access database "Baltimore City NPDES Stormwater Permit Data 2010.mdb" on the CD-ROM accompanying this report. During 2010, there were 3 sampling events, with a total of 6 samples collected; a total of 3 discharge measurements made using a pygmy meter; and a total of 102 water quality analyses performed on those samples. One sampling event, on March 26, 2010, occurred during rain; the results from that pair of samples are not included in the "Baltimore City Chemical Monitoring 2010" Access table, but are included in the "Baltimore City Monitoring Sample Results 2010" Access table, on the CD-ROM accompanying this report.

Graphs for these two stations of the concentration over time can be found in the Excel files in the folder entitled "City Streams Dry Weather Time Concentration Graphs" on the CD-ROM accompanying this report. Each Excel file has a set of concentration over time scatterplots for each of the 35 monitoring stations for a given parameter. The two Biddison Run stations' graphs are the last in the series and are in tabs with names that begin "BidR Up", and "BidR Dwn". The parameters graphed are: ammonia nitrogen (lab measurement), ammonia nitrogen (field measurements- there are more data for the BIDDISON RUN UPSTRM station because it is also visited during Herring Run ammonia screening surveys), BOD, chlorides, COD, conductivity (lab measurement), total copper, fecal coliform counts, fluoride, nitrate+nitrite nitrogen, total suspended solids, TKN, total nitrogen (estimated by adding together nitrate+nitrite nitrogen and TKN), total phosphorus, and total zinc. Unlike other freshwater stations where SWMD collects dry weather samples, these stations do not show a long-term increase for chlorides for the period since monitoring began in October 2002.

A summary of the e. coli MPN counts from November 2008 through January 2011 for the two Biddison Run water quality sampling stations is presented in Table E2.1. The geometric mean for the upstream station was 1,292 MPN/100 ml, and 815 MPN/100 ml for the downstream station. The percent of dry weather samples which had an e. coli MPN count at or below the infrequent full body contact recreation criteria (576 MPN/100 ml) was 42% for the upstream station and 58% for the downstream station.

A summary of the total phosphorus and total nitrogen results from January 2009 through January 2011 for the two Biddison Run water quality sampling stations is presented in Table E2.3. Both stations were at or exceeded the total phosphorus guideline of 0.1 mg/L in 17% of the samples. This indicates an "elevated" level for total phosphorus. The upstream station did not have any samples at or

exceeding the total nitrogen guideline of 3 mg/L; the downstream station had 8% of the samples at or exceeding the guideline. Both stations rate in the "normal" range for total nitrogen.

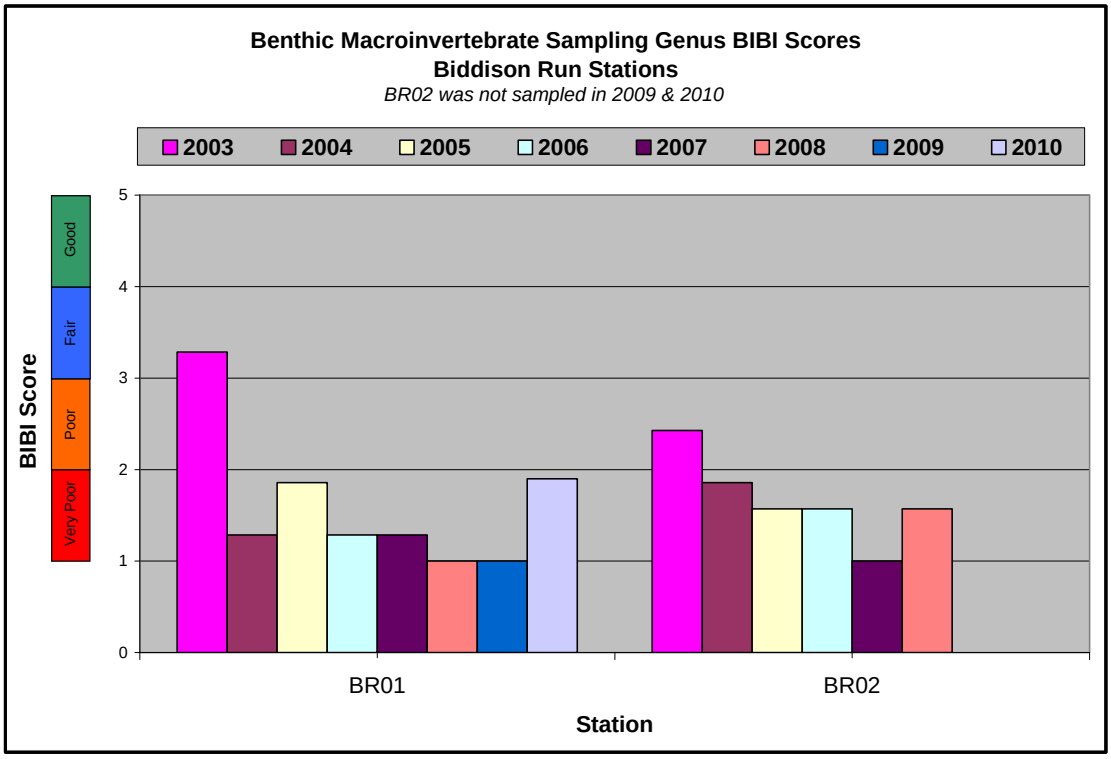
There are two fixed stations on Biddison Run (BR01 and BR02) where the City has sampled for benthic macroinvertebrates. Benthic macroinvertebrates were first collected at each station in 2003. A record for each macroinvertebrate sample and its resulting BIBI score can be found in the Excel file "Macroinvertebrate Sample Results 2002 through 2010.xls" on the CD-ROM accompanying this report. For more information on the City's biological monitoring efforts please see Section E3, "Watershed Assessment from Biological Monitoring".

Table F2a.1 and Figure F2a.1 present the results from benthic macroinvertebrate sampling at the Biddison Run sampling stations for 2003 through 2010. Please note that all of these scores have been computed using the method endorsed by the MBSS in 2005. Station BR02 was not sampled in 2009 or 2010, and this station has been removed from the list of fixed stations to sample for future years. Station BR01 has gone from a high score of 3.3 (a rating of "fair") in 2003 down to a score of 1.0 (the lowest score possible, with a rating of "very poor") in both 2008 and 2009. The score slightly improved for 2010, but still remains classified in the "very poor" range.

Table F2a.1 Biddison Run Benthic Macroinvertebrate Genus BIBI Scores 2003-2010

Station	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
BR01	3.3	1.3	1.9	1.3	1.3	1.0	1.0	1.9
BR02	2.4	1.9	1.6	1.6	1.0	1.6	---	---

Figure F2a.1 Comparison of the Genus BIBI Scores for Benthic Macroinvertebrate Samples from Biddison Run Stations 2003-2010



b. **Watershed 263**

Table F2b.1 lists the number of samples collected, and number of water quality analyses performed on those samples, in Watershed 263 during 2010. The results from dry weather grab samples during 2010 at the monitoring stations at Baltimore Street (Catchment O) and Lanvale Street (Catchment F) can be found in tables "Baltimore City Chemical Monitoring 2010" and "Baltimore City Monitoring Sample Results 2010" in the Access database "Baltimore City NPDES Stormwater Permit Data 2010.mdb" on the CD-ROM accompanying this report. Storms monitoring at these stations was suspended after June 2009 because of persistent problems with the sampling and flow monitoring equipment being damaged or washed out during intense storms. In May 2010, SWMD decided to also suspend dry weather sampling since they could not resume storm sampling over the past year.

The Excel file "Watershed 263 Time Graphs.xls" on the CD-ROM accompanying this report contains concentration over time graphs of the dry weather (baseline) and storm composite concentrations for Baltimore St. and Lanvale St. from September 2004 through May 2010 for the following parameters: BOD, nitrate+nitrite nitrogen, total Kjeldahl nitrogen, total nitrogen, total phosphorus, total suspended solids, total copper, dissolved copper, total lead, dissolved lead, total

zinc, dissolved zinc, total hardness, e. coli count, enterococci count (begun in October 2008), fecal coliform count (ended July 2008) and fluoride (ended April 2008). The green vertical line on each of these graphs demarcates the beginning of street sweeping in mid-January 2006 within Catchment O. Based on the data shown in the graphs, the baseline nitrate+nitrite nitrogen, total phosphorus and fluoride have decreased for both Baltimore St. and Lanvale St. after street sweeping operations. Additionally, the Lanvale St. baseline BOD has decreased.

Table F2b.1 Watershed 263 Monitoring During 2010

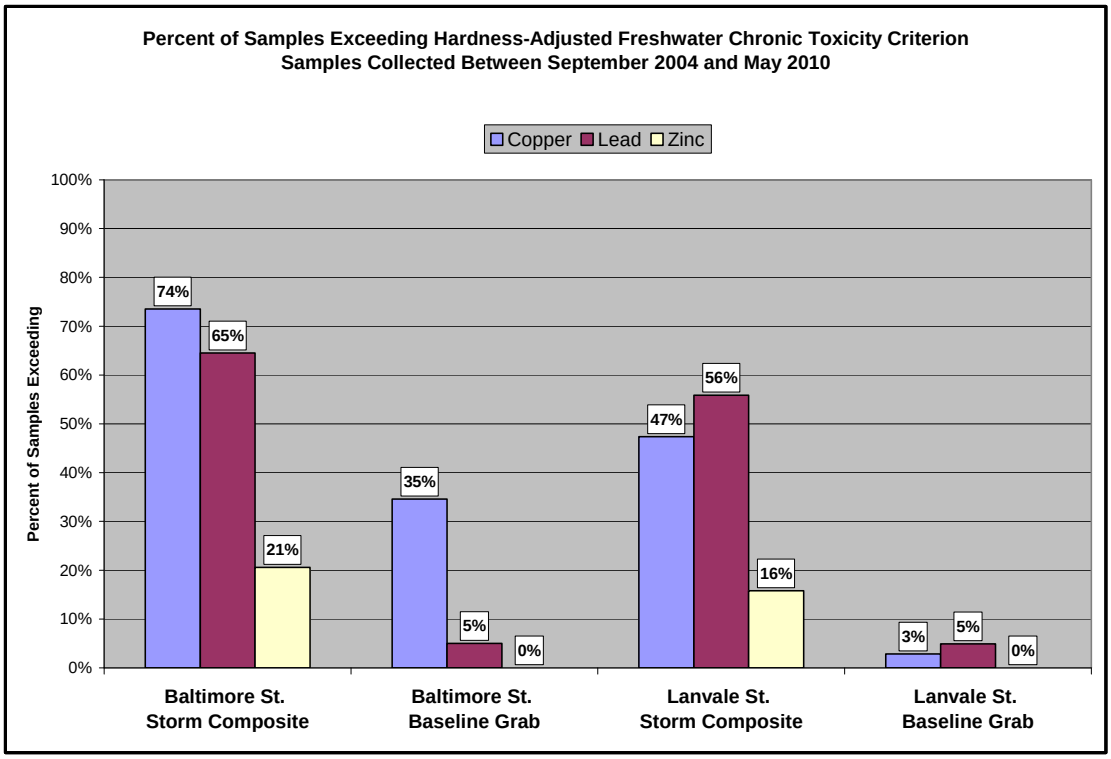
Station and Type	Number of Samples	Number of Water Quality Analyses Performed
Baltimore St. Baseline	6	83
Lanvale St. Baseline	6	83
Quality Control Replicates	4	56
Baltimore St. Storm	0	0
Lanvale St. Storm	0	0
Total		222

SWMD analyzed the majority of the collected samples from the two Watershed 263 stations for total hardness and dissolved copper, lead and zinc. An evaluation was performed for the sample results collected through May 2010 to find out how often the samples exceed the State's freshwater chronic criteria for these metals. Formulas for adjusting the freshwater criteria for hardness were taken from these reports prepared by MDE: Water Quality Analysis of Copper and Lead for the Jones Falls in Baltimore County and Baltimore City, Maryland and Water Quality Analysis of Zinc Contamination for the Jones Falls Baltimore City and Baltimore County, Maryland. Table F2b.2 and Figure F2b.1 present the percentage of samples that exceeded the criteria for samples from the Baltimore St. and Lanvale St. stations. It may not be appropriate to compare stormwater results to the chronic criteria; the acute criteria may be more appropriate. However, at the time of the evaluation, SWMD did not make the adjustments for hardness to the acute criteria.

Copper toxicity was detected during the dry weather sampling at Baltimore St. The stormwater composites at both the Baltimore St. and Lanvale St. stations had high percentages exceeding the criteria for each of the metals.

Table F2b.2 Percentage of Samples from Watershed 263 Monitoring for which the Copper, Lead or Zinc Concentration Exceeded the Hardness-Adjusted Freshwater Chronic Criteria (September 2004 through May 2010)			
Station and Type of Sample	**Percent of Copper Samples**	**Percent of Lead Samples**	**Percent of Zinc Samples**
Baltimore St. Storm Composite	74%	65%	21%
Baltimore St. Baseline Grab	35%	5%	0%
Lanvale St. Storm Composite	47%	56%	16%
Lanvale St. Baseline Grab	3%	5%	0%

Figure F2b.1 Percent of Samples Exceeding the Freshwater Chronic Criteria for Copper, Lead or Zinc at Baltimore St. and Lanvale St.



E. coli MPN counts have been performed on Watershed 263 samples from the beginning of sampling in October 2004. An evaluation was done comparing each count to the State's criteria for frequency of use. Table F2b.3 lists the geometric mean and percent of samples at below the critical counts for each station and sample type. Using this analysis, the dry weather measurements showed higher counts at the Lanvale St. station than the Baltimore St. station.

Table F2b.3 E. Coli MPN Counts: Geometric Means and Comparision to State's Criteria for Frequency of Use (Dry Weather Samples October 2004-May 2010; Storm Samples December 2004-June 2009)							
Station and Type	Number of Samples	Geometric Mean (MPN/100 ml)	Percent At or Below Frequent Full Body Contact Recreation (235 MPN/100 ml)	Percent At or Below Moderately Frequent Full Body Contact Recreation (298 MPN/100 ml)	Percent At or Below Occasional Full Body Contact Recreation (410 MPN/100 ml)	Percent At or Below Infrequent Full Body Contact Recreation (576 MPN/100 ml)	Percent Above Infrequent Full Body Contact Recreation (576 MPN/100 ml)
BALTIMORE ST. Baseline Grab	131	187	54%	55%	63%	69%	31%
BALTIMORE ST. Storm Composite	32	33,603	3%	3%	3%	3%	97%
LANVALE ST. Baseline Grab	110	1,415	26%	28%	34%	39%	61%
LANVALE ST. Storm Composite	35	22,701	0%	0%	0%	0%	100%

The total phosphorus and total nitrogen (estimated by the sum of total Kjeldahl nitrogen and nitrate+nitrite nitrogen) for each Watershed 263 sample was compared to the nutrient concentration guidelines of 0.1 mg/L for total phosphorus and 3 mg/L for total nitrogen. Table F2b.4 lists the number of samples- with percentages- at or exceeding the guidelines for each station and each sample type. Both stations are regarded as being "high" for total phosphorus and total nitrogen since the percentages for dry weather samples are at or exceed the guidelines more than 25% of the time. Based on this data, the Baltimore St. station showed greater concentrations of nutrients than the Lanvale St. station.

Table F2b.4 Watershed 263 Dry Weather & Storm Samples: Compare to Nutrient Concentration Guidelines (September 2004 through May 2010)						
Station and Type	Number of Total Phosphorus Samples	Number of Samples Total Phosphorus >=0.1 mg/L	Percent of Samples Total Phosphorus >=0.1 mg/L	Number of Total Nitrogen Samples	Number of Samples Total Nitrogen >=3 mg/L	Percent of Samples Total Nitrogen >=3 mg/L
Baltimore St. Baseline Grab	134	118	88%	114	83	73%
Baltimore St. Storm Composite	37	35	95%	34	23	68%
Lanvale St. Baseline Grab	113	53	47%	97	51	53%
Lanvale St. Storm Composite	42	40	95%	31	8	26%

c. **Stony Run and Powder Mill Run**

In June 2005, the City established the Linkwood stormwater monitoring station on Stony Run in the Jones Falls watershed to use for assessing restoration in Stony Run, and to meet MS4 permit requirements. In December 2005, the City decided to use its Powder Mill SIS station located in the Gwynns Falls watershed as the control in this study. The USGS provides flow monitoring at both the

Linkwood (USGS station ID 01589464) and the Powder Mill (USGS station ID 01589305) stations.

In June 2009, the City established the stormwater sampling station Kennison at one of the outfalls to Powder Mill Run. The USGS does not have flow monitoring equipment at this station; therefore, a flow rating has not been established yet to use with the water level measuring equipment. The Kennison sampling station was established in anticipation of restoration construction planned for Powder Mill Run, which is anticipated to begin in 2012. Table F2c.1 lists the number of samples, and the number of water quality analyses performed on those samples, collected for this monitoring project during 2010.

Table F2c.1 Stony Run and Powder Mill Restoration Monitoring During 2010

Station and Type	Number of Surveys or Storm Events	Number of Samples	Number of Water Quality Analyses Performed
Linkwood Baseline	11	11	115
Powder Mill Baseline	11	11	211
Linkwood Storm	9	65	325
Powder Mill Storm	10	81	405
Kennison Storm	11	77	385
Total			1,441

Metals and bacteria analysis are not performed on samples collected at the Linkwood sampling station. Only total phosphorus, nitrate+nitrite nitrogen and total Kjeldahl nitrogen are analyzed for samples collected at the Linkwood station. Table E2.3 lists the percentage of dry weather samples from Linkwood from January 2009 through January 2011 which exceed the guideline for total phosphorus (0.1 mg/L) as 23%, which is in the “elevated” range; and for total nitrogen (3 mg/L) as 10%, which is in the “normal” range.

At each station, discrete stormwater samples were collected by an automated sampler at timed intervals once the stream level rises above the programmed trigger level. Figures F2c.1 through F2c.14 show the concentration versus flow per watershed area for the discrete stormwater samples analyzed from Linkwood (June 2005 through December 2010) and Powder Mill (January 2006 through December 2010) for the following parameters: total phosphorus, total nitrogen (estimated as the sum of TKN and nitrate+nitrite nitrogen), TKN, nitrate+nitrite nitrogen, total suspended solids, volatile suspended solids and percent volatile suspended solids.

Using the discrete sample concentrations and the storm's flow records, a storm event mean concentration (EMC) was calculated for each station for each parameter for each storm. Figures F2c.15 through F2c.20 present the storm EMC for each storm for both Linkwood and Powder Mill for the following parameters: total phosphorus, total nitrogen (estimated as the sum of TKN and nitrate+nitrite nitrogen), TKN, nitrate+nitrite nitrogen, total suspended solids and volatile suspended solids.

The storm EMC and baseline results for Linkwood and Powder Mill stations for 2010 are included in the table "Baltimore City Chemical Monitoring 2010" in the Access database "Baltimore City NPDES Stormwater Permit Data 2010.mdb" on the CD-ROM accompanying this report. The results from discrete storm samples, as well as all other sample results, from these stations during 2010 can be found in the table "Baltimore City Monitoring Sample Results 2010" in that Access database.

Figure F2c.1 Linkwood Storm Samples Total Phosphorus Versus Flow

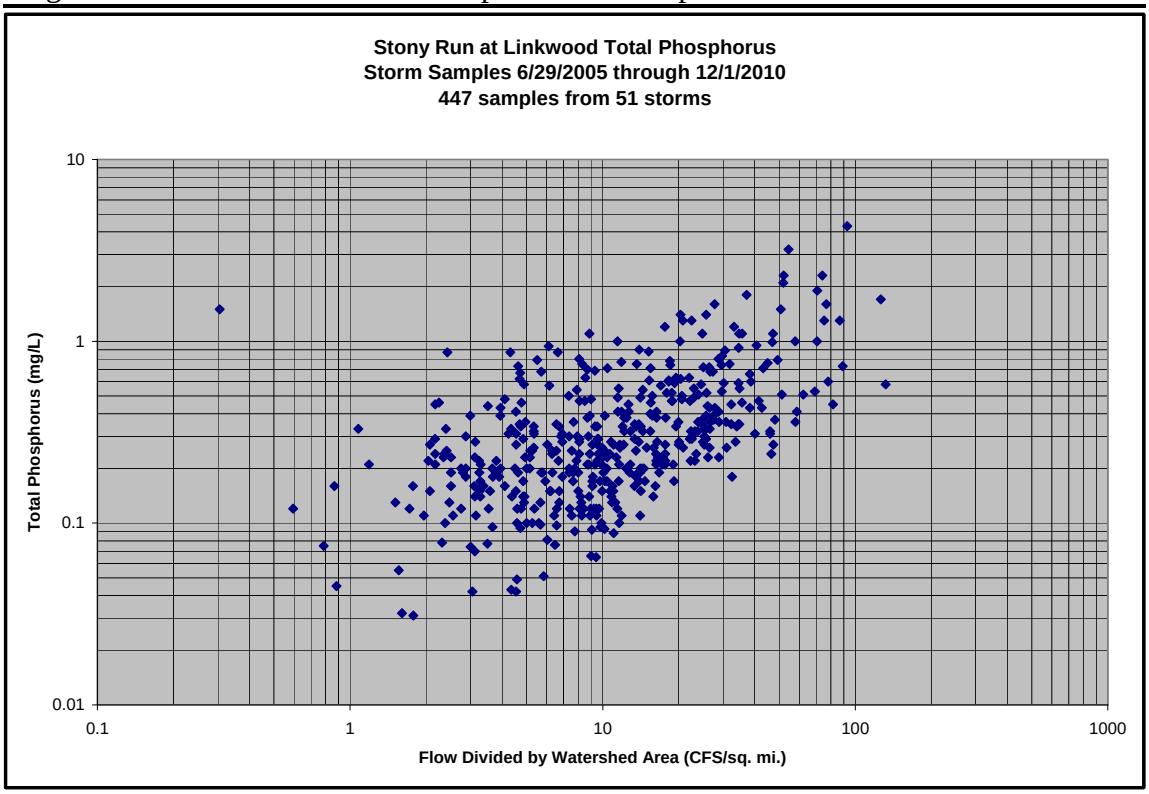


Figure F2c.2 Powder Mill Storm Samples Total Phosphorus Versus Flow

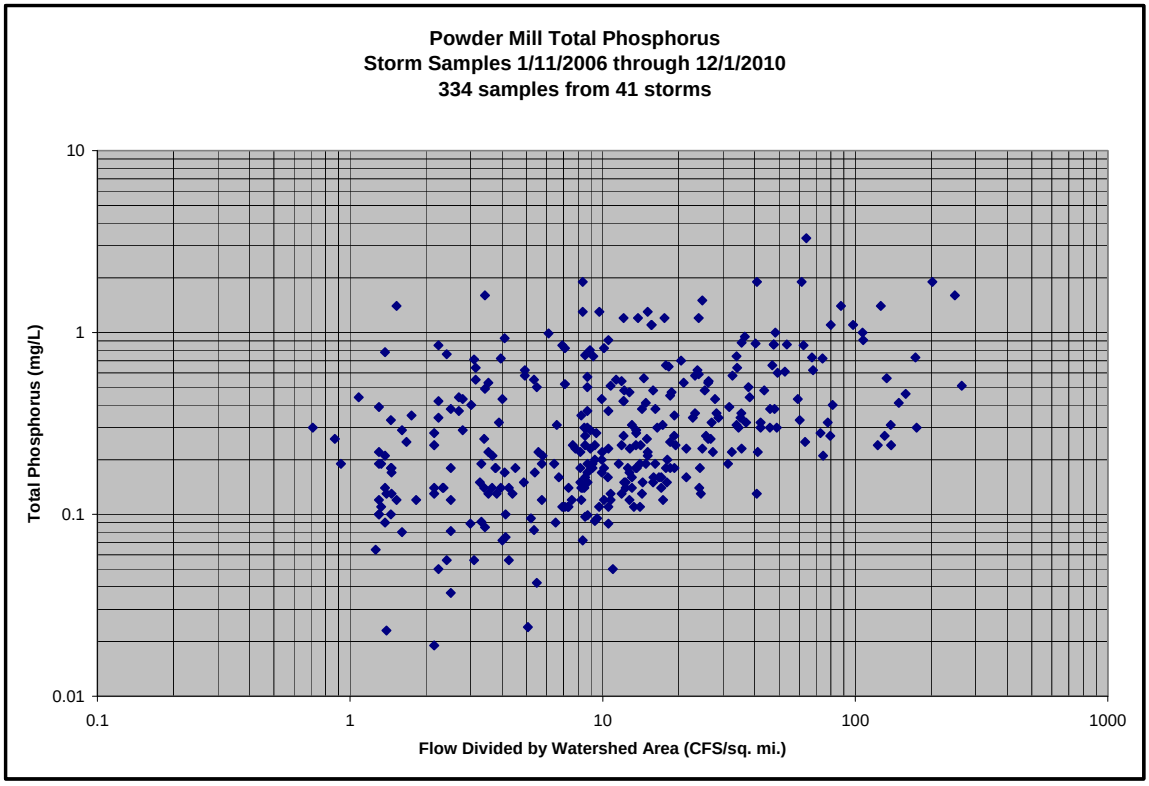


Figure F2c.3 Linkwood Storm Samples Total Nitrogen Versus Flow

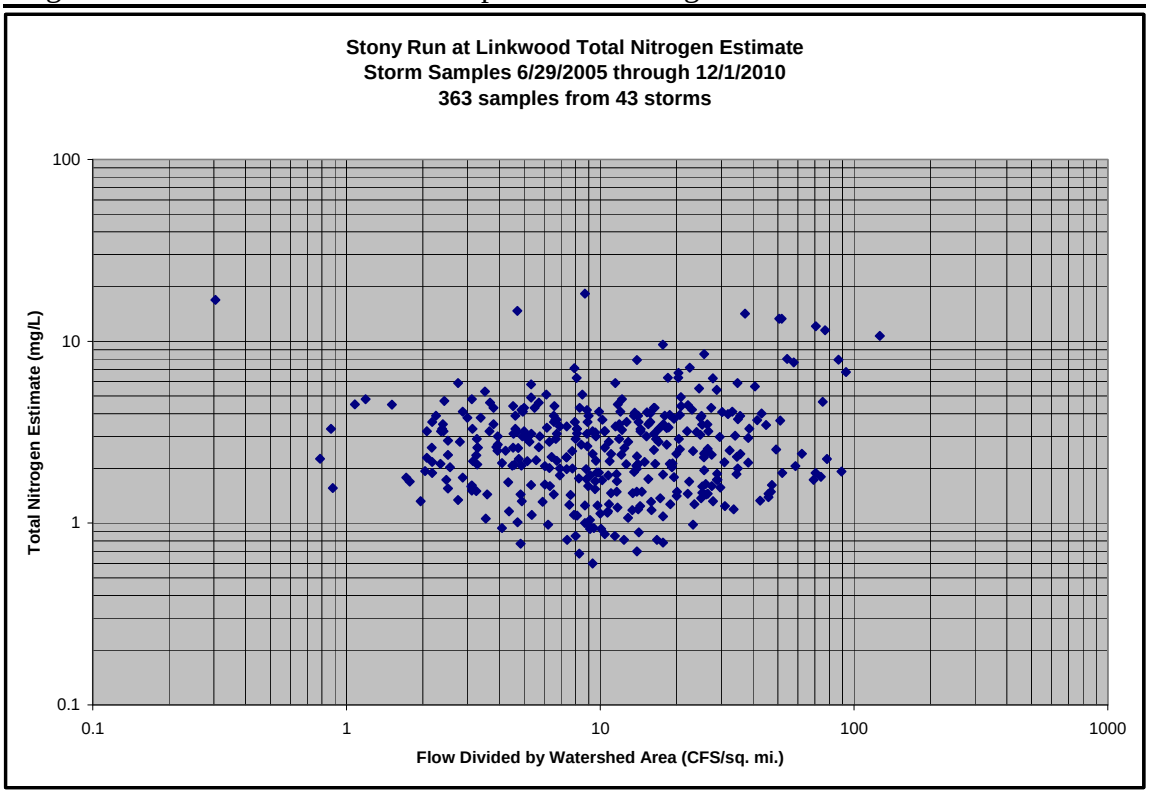


Figure F2c.4 Powder Mill Storm Samples Total Nitrogen Versus Flow

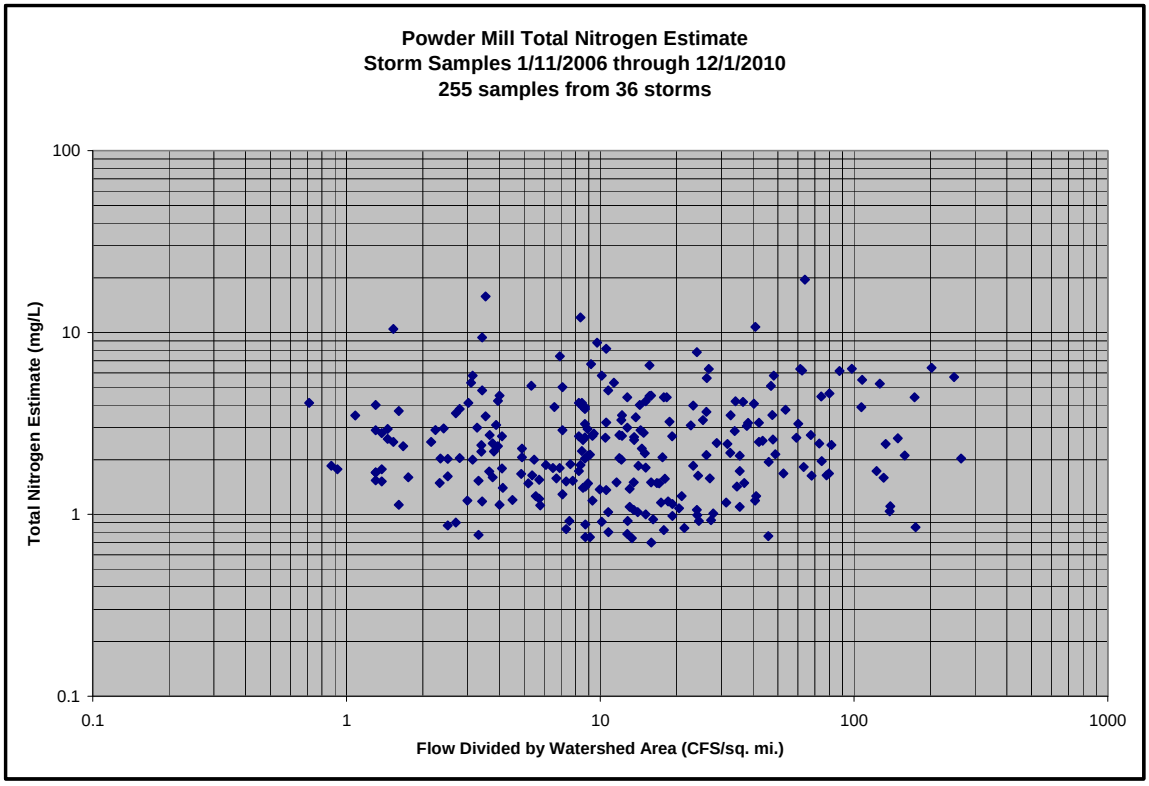


Figure F2c.5 Linkwood Storm Samples TKN Versus Flow

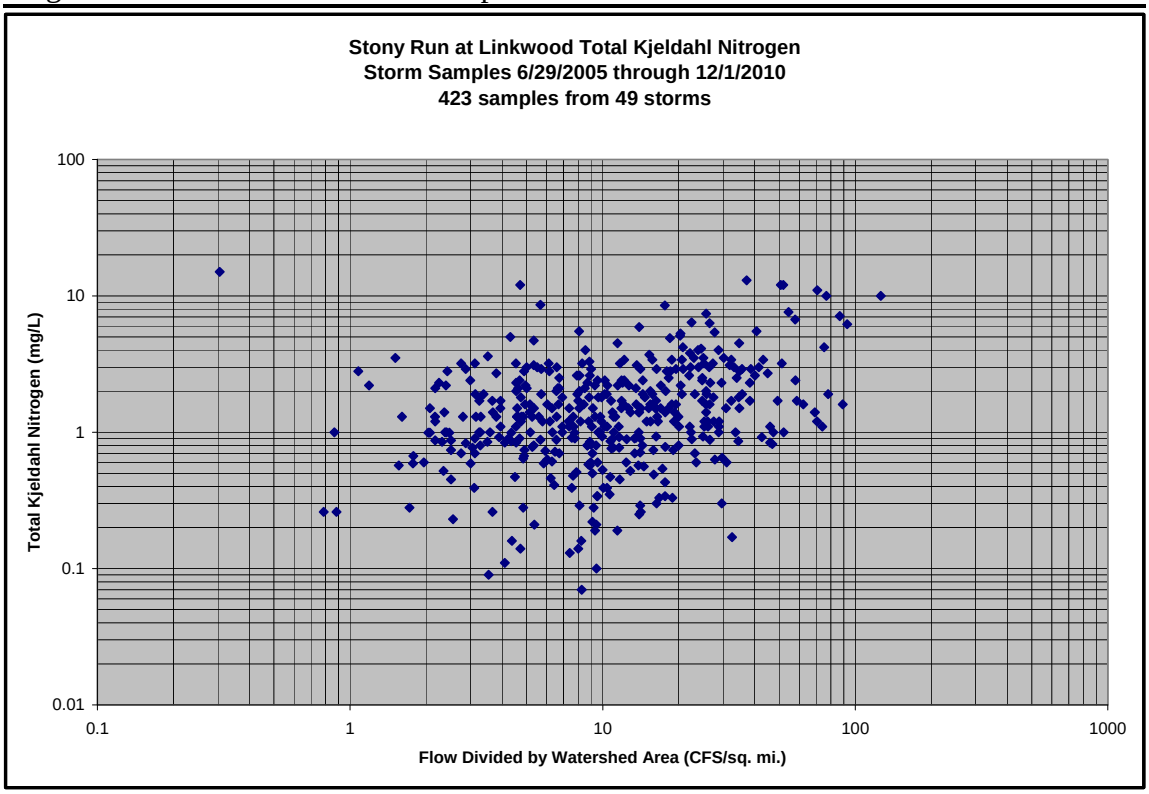


Figure F2c.6 Powder Mill Storm Samples TKN Versus Flow

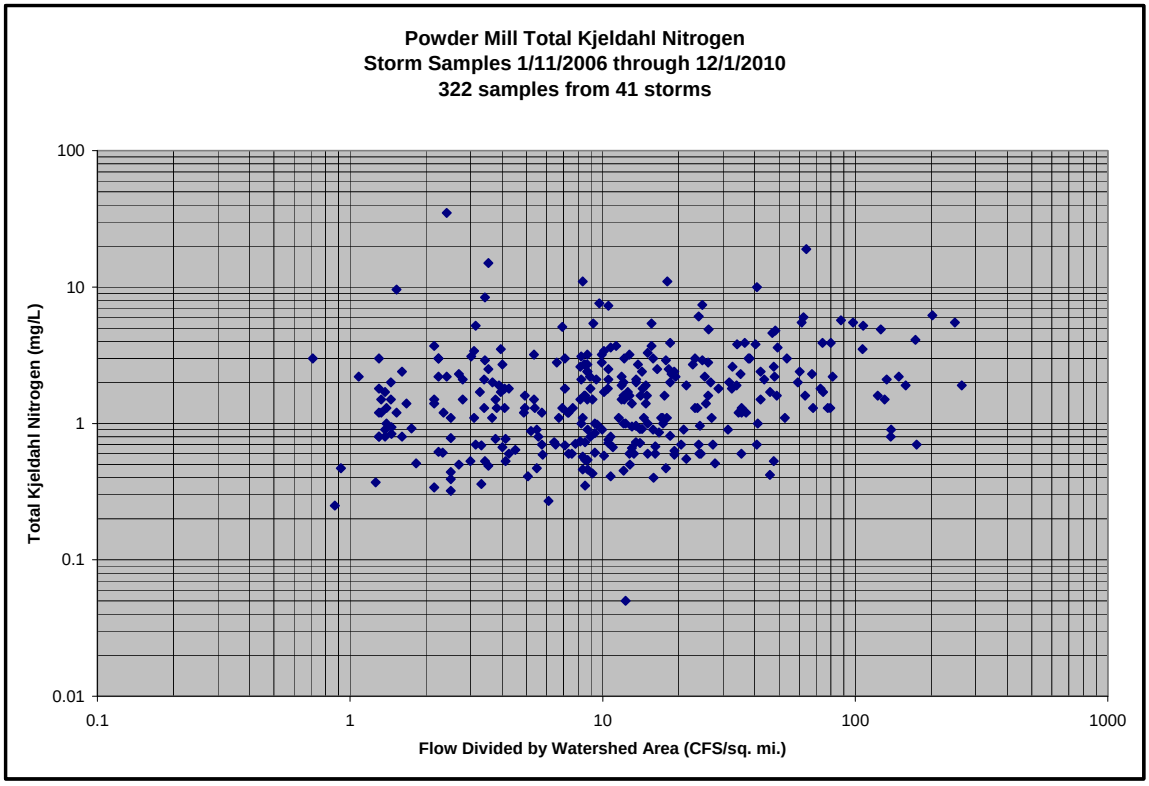


Figure F2c.7 Linkwood Storm Samples Nitrate+Nitrite Nitrogen Versus Flow

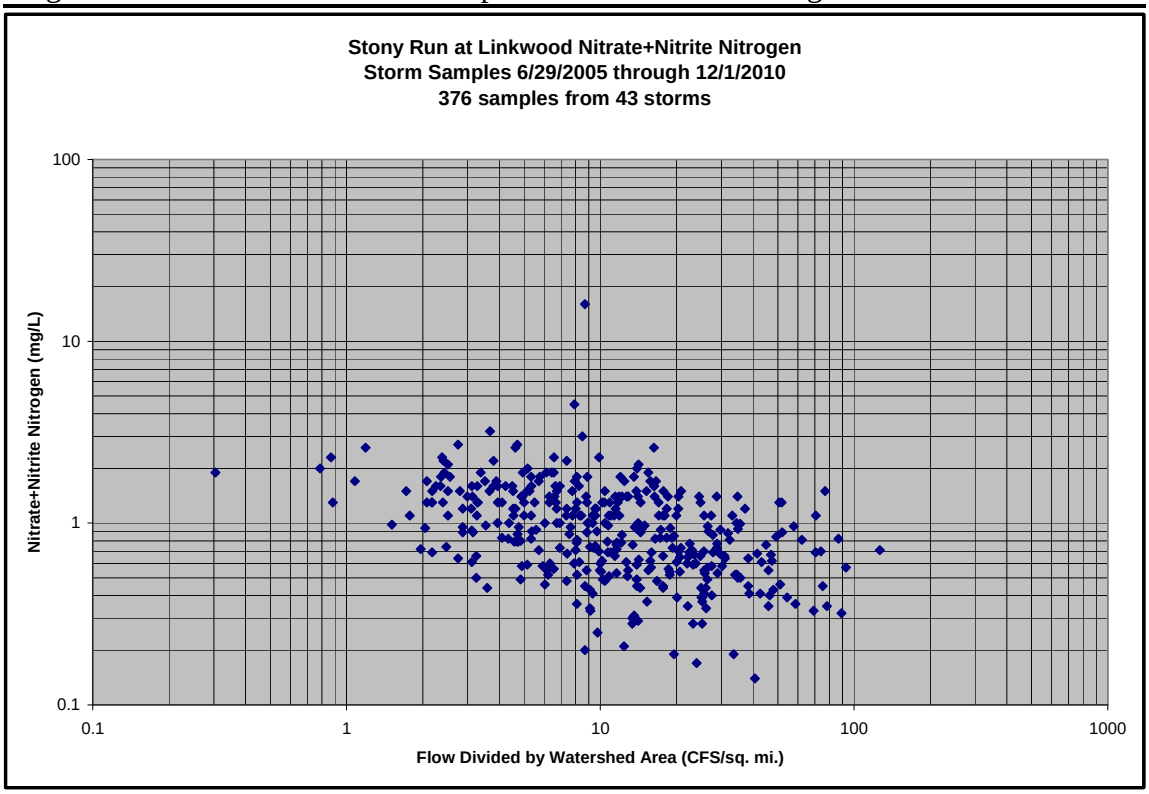


Figure F2c.8 Powder Mill Storm Samples Nitrate+Nitrite Nitrogen Versus Flow

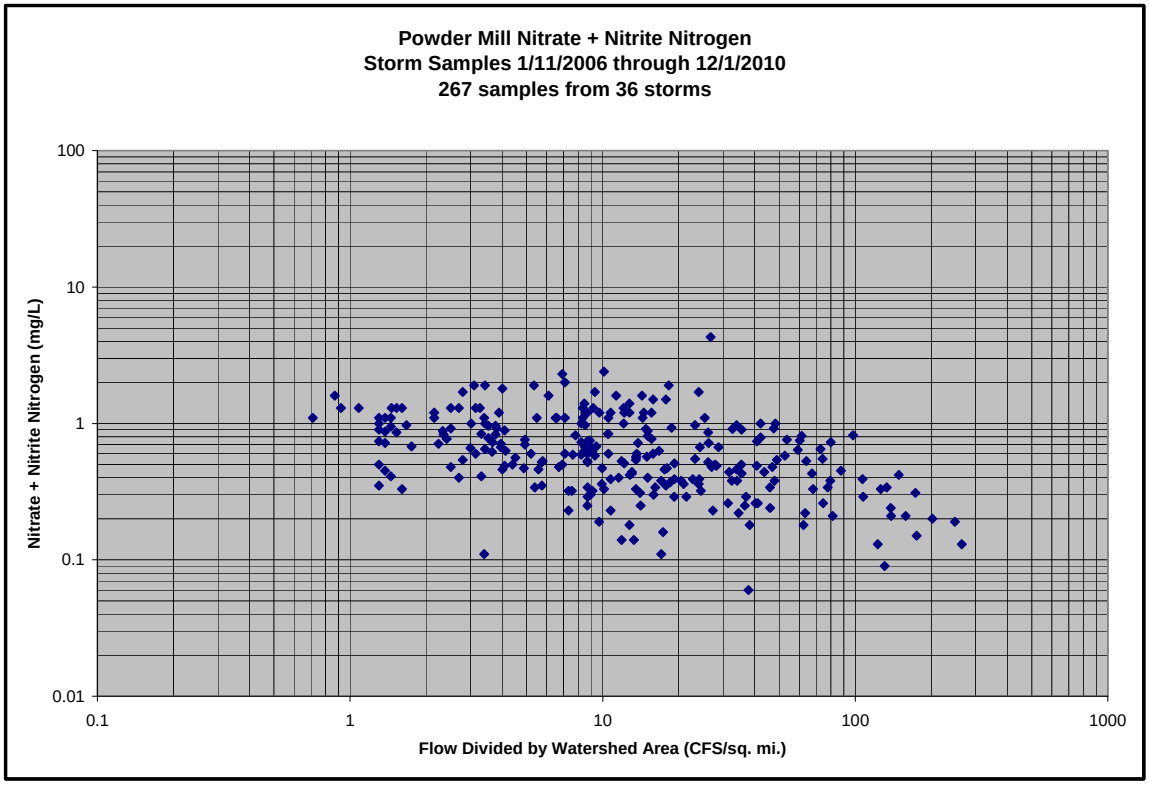


Figure F2c.9 Linkwood Storm Samples Total Suspended Solids Versus Flow

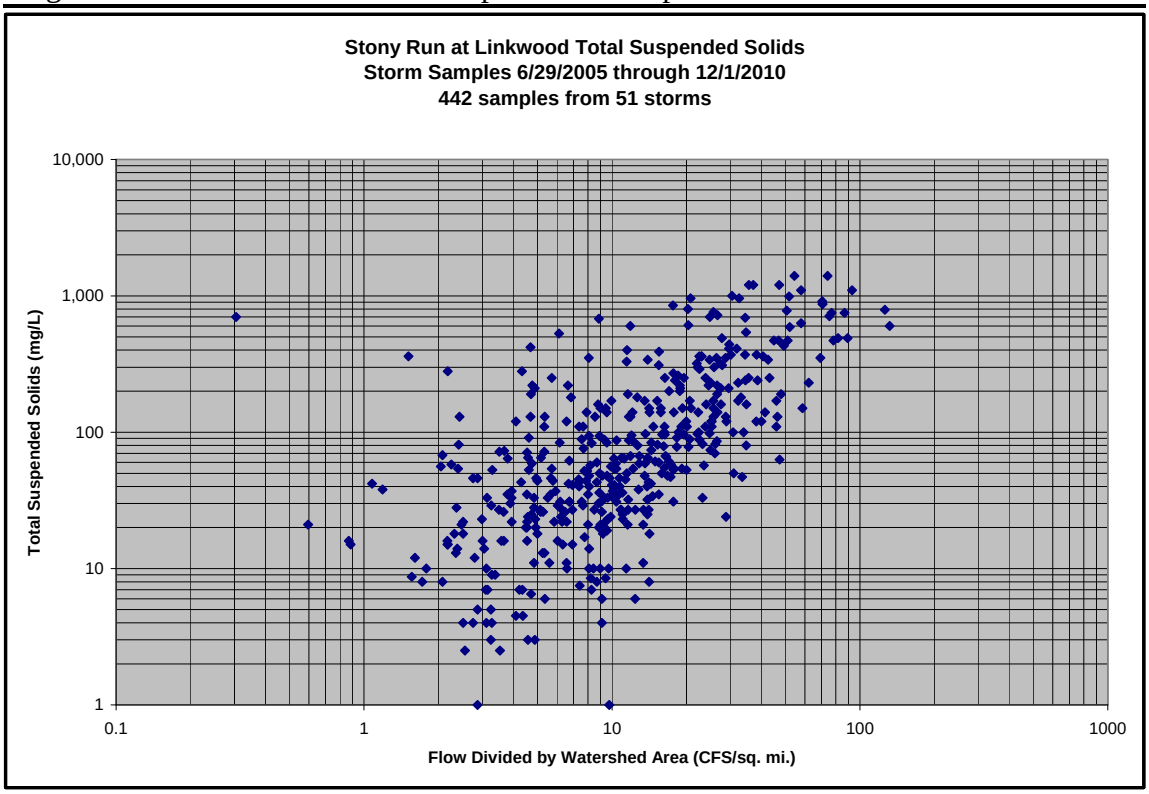


Figure F2c.10 Powder Mill Storm Samples Total Suspended Solids Versus Flow

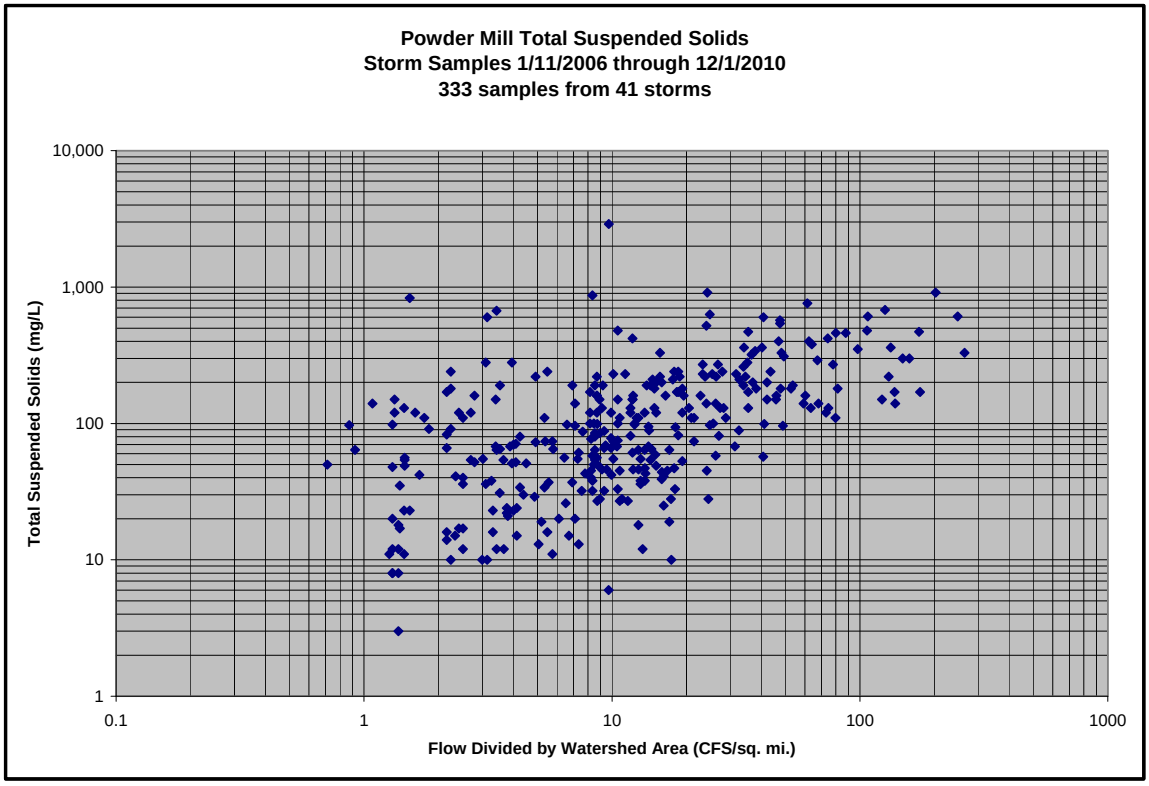


Figure F2c.11 Linkwood Storm Samples Volatile Suspended Solids Versus Flow

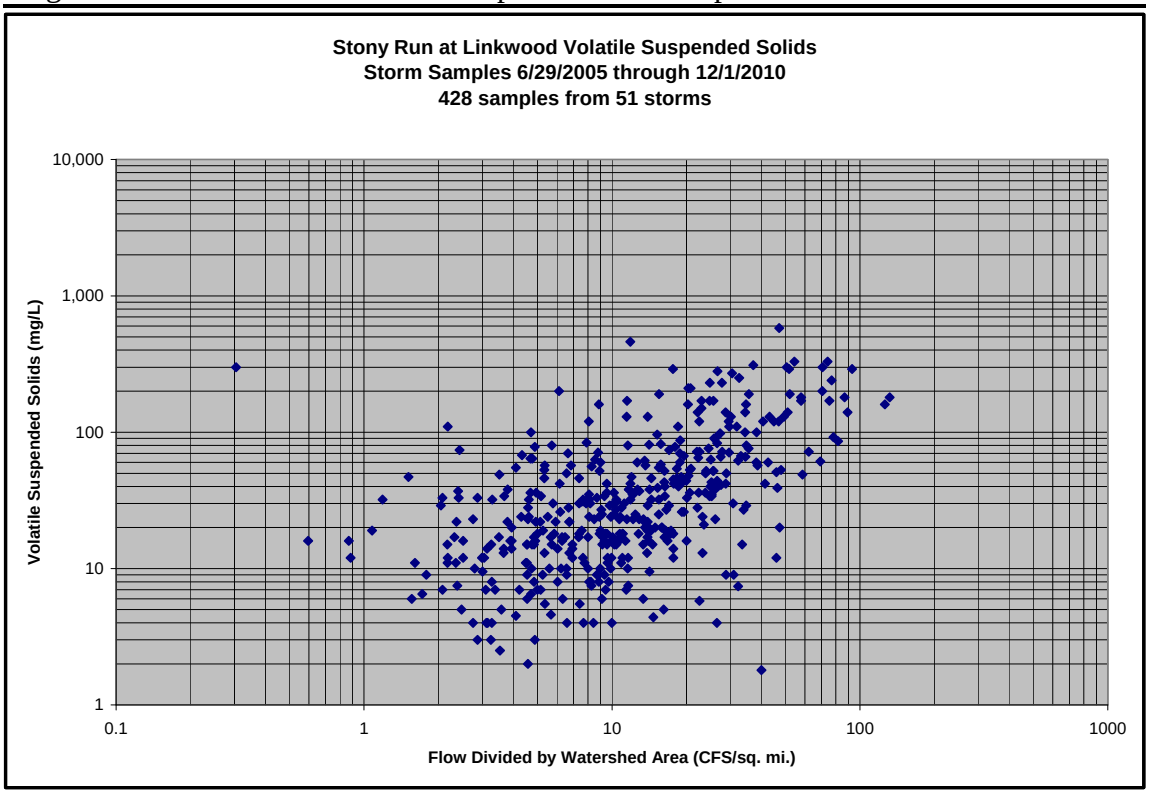


Figure F2c.12 Powder Mill Storm Samples Volatile Suspended Solids Versus Flow

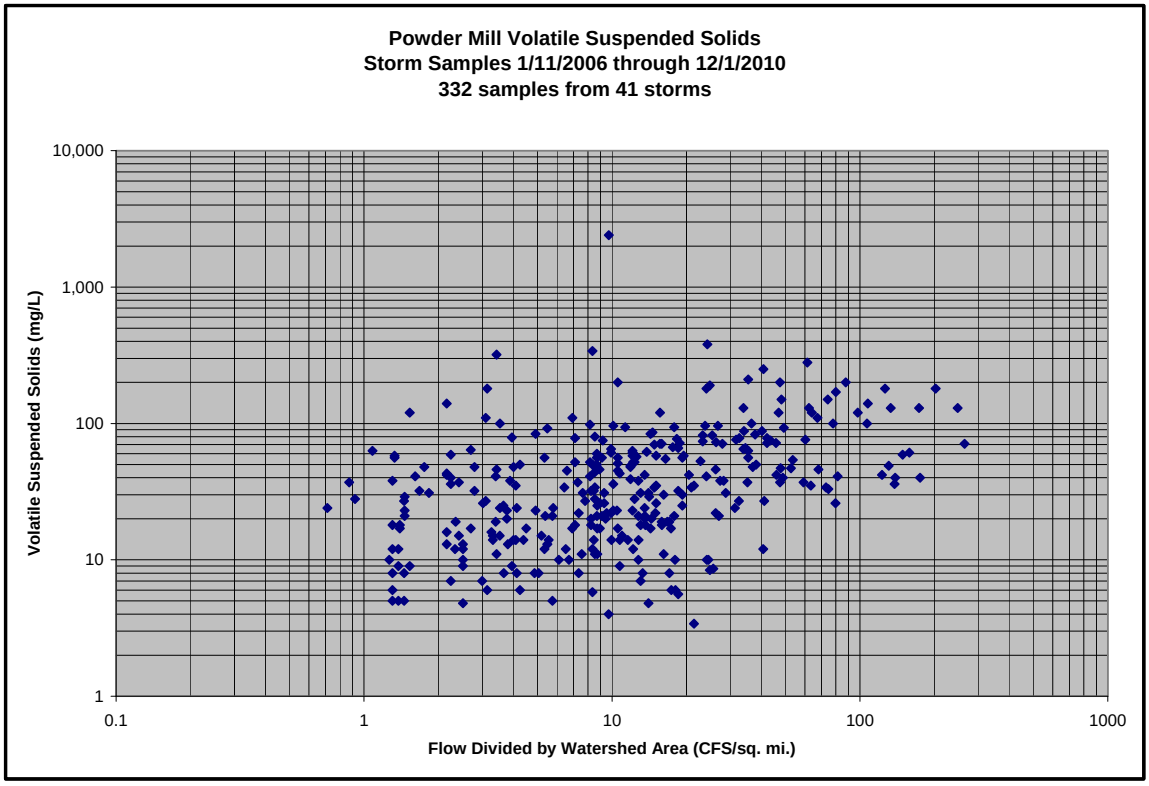


Figure F2c.13 Linkwood Storm Samples % Volatile Suspended Solids Versus Flow

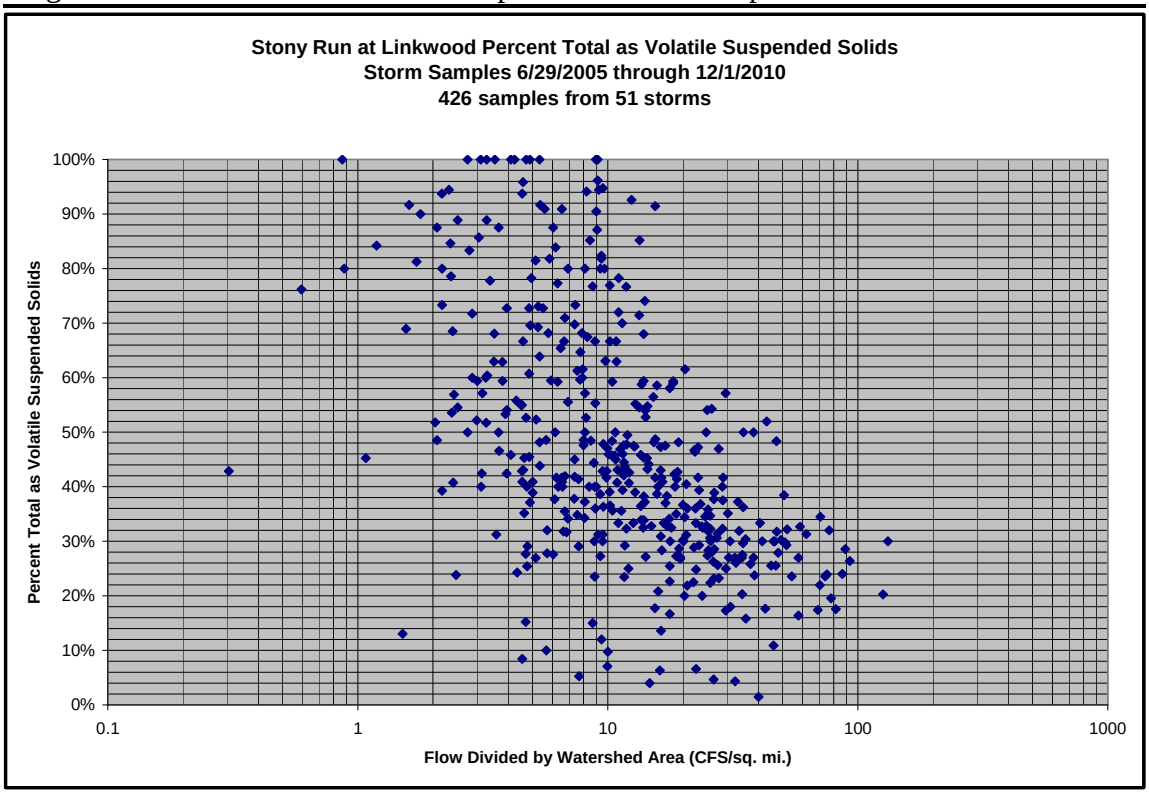


Figure F2c.14 Powder Mill Storm Samples % Volatile Suspended Solids Versus Flow

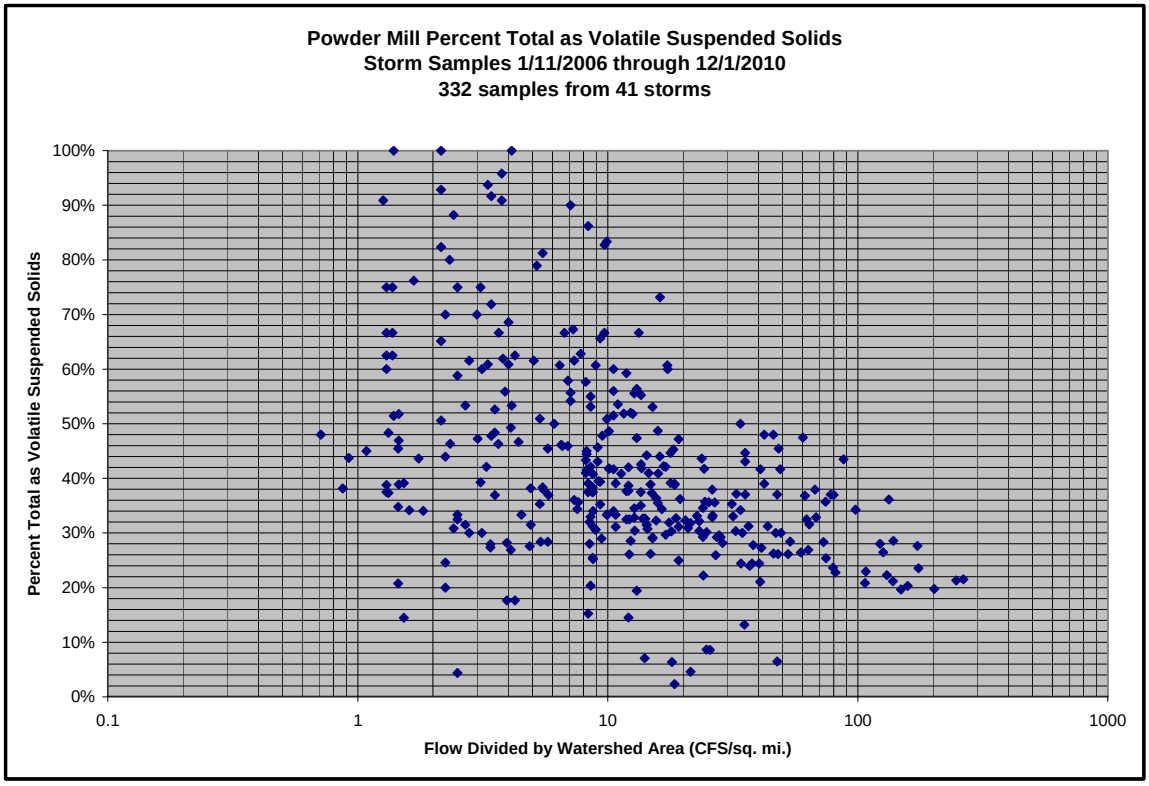


Figure F2c.15 Linkwood & Powder Mill Total Phosphorus Storm EMCs

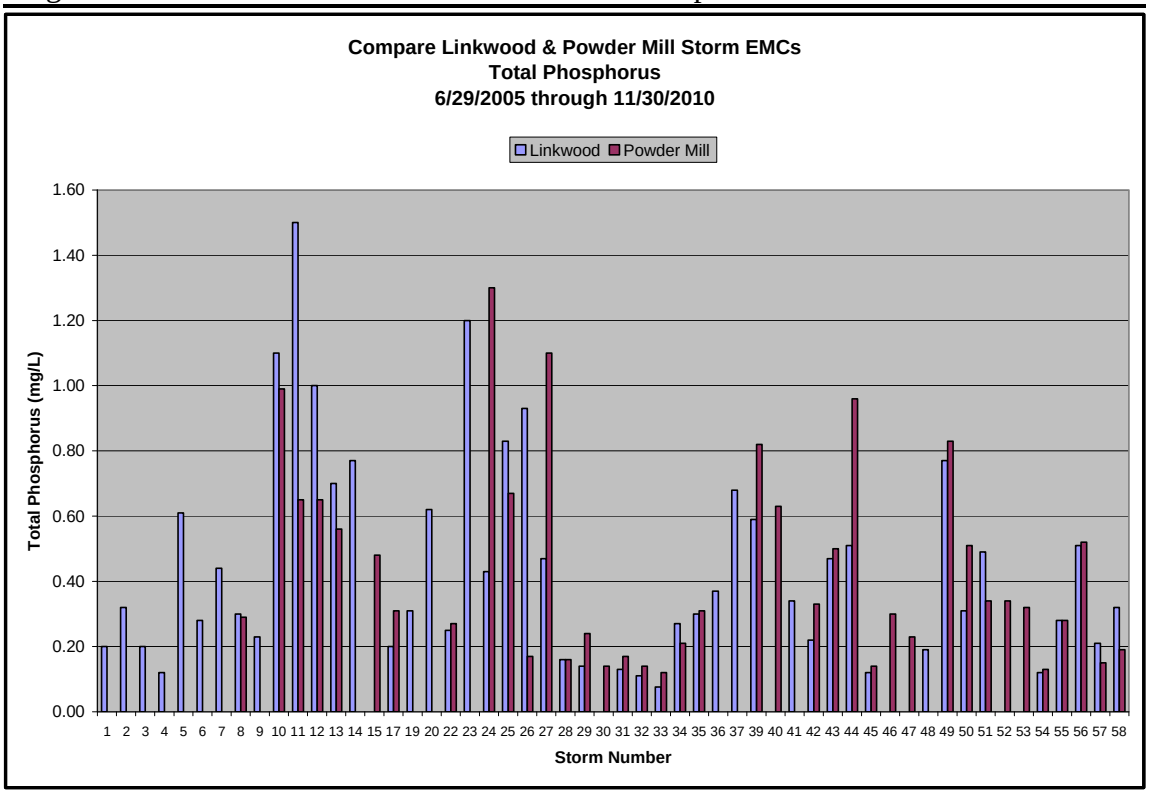


Figure F2c.16 Linkwood & Powder Mill Total Nitrogen Storm EMCs

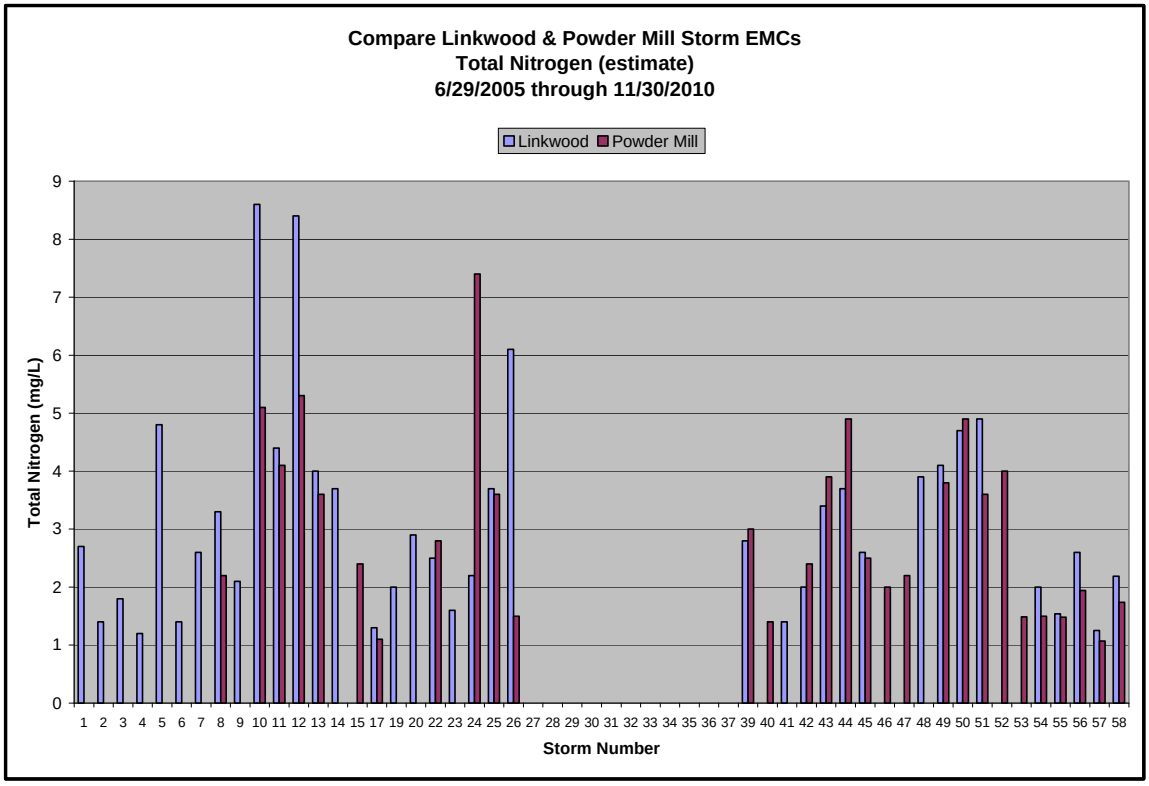


Figure F2c.17 Linkwood & Powder Mill TKN Storm EMCs

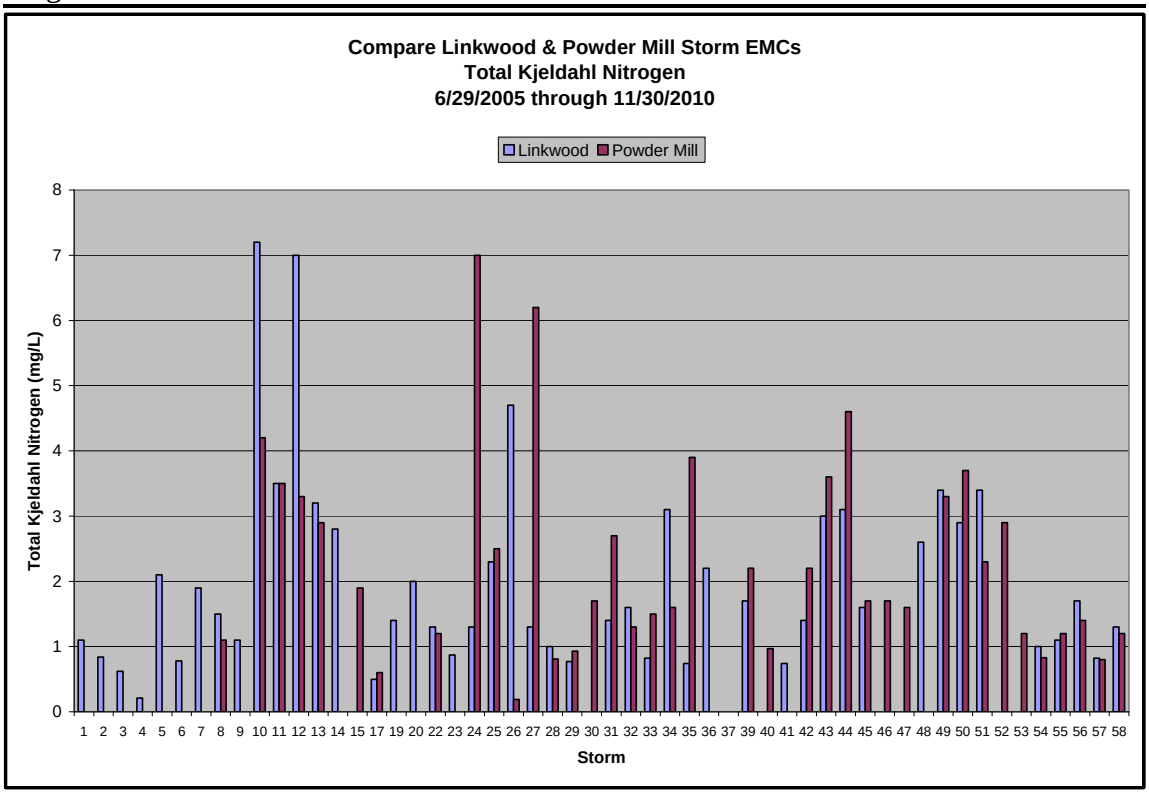


Figure F2c.18 Linkwood & Powder Mill Nitrate+Nitrite Nitrogen Storm EMCs

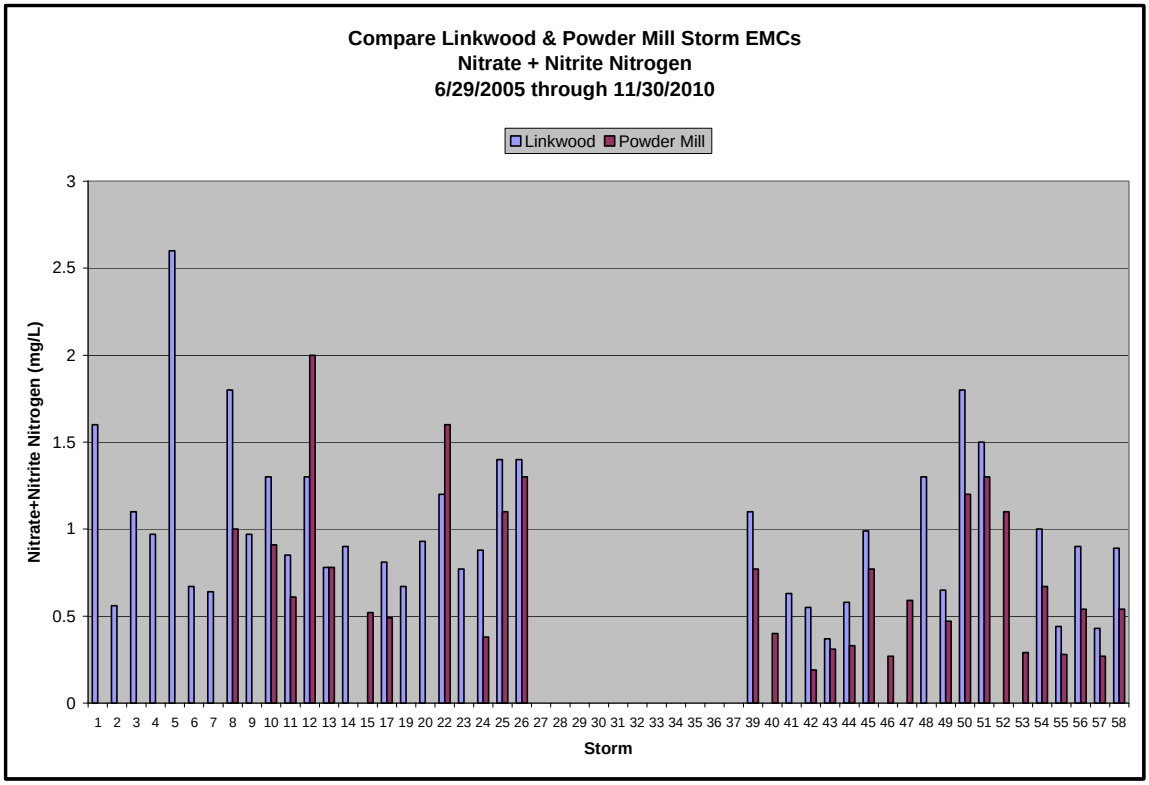


Figure F2c.19 Linkwood & Powder Mill Total Suspended Storm EMCs

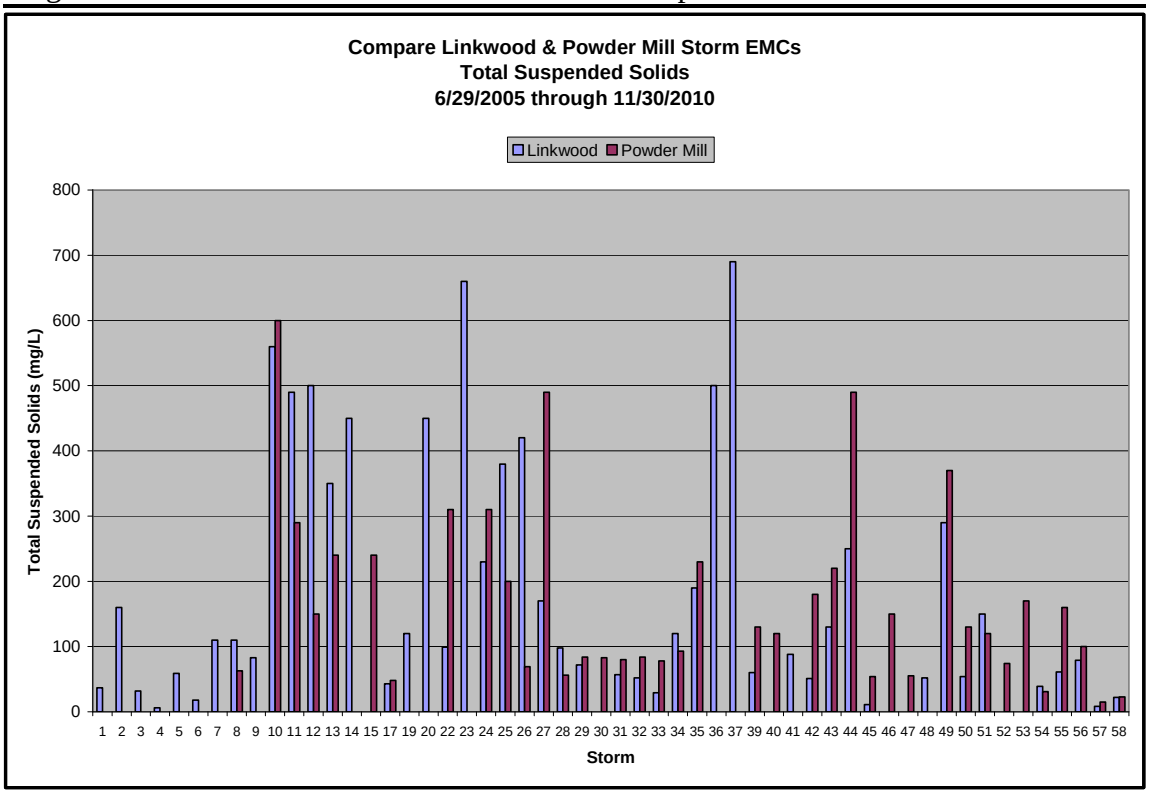
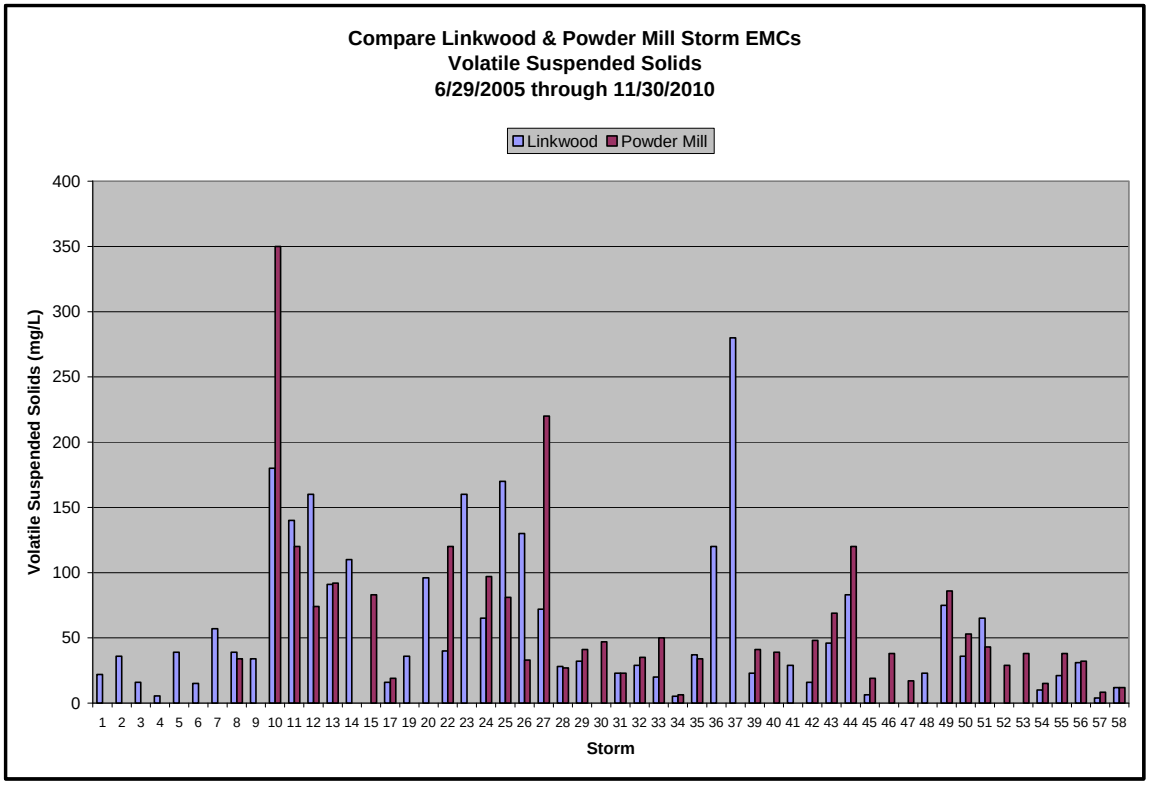


Figure F2c.20 Linkwood & Powder Mill Volatile Suspended Solids Storm EMCs



3. **Annual Reporting**

The 5-year MS4 permit that expired in January 2010 required the City to restore or treat 20% of the City's impervious area, which amounts to 4,675 impervious acres out of a total of 23,373 impervious acres. As a means of measuring how well the practices implemented under the permit have met the goal of treating 20% of the impervious area, the City has estimated the amount of phosphorus annually controlled (retained or removed) by these practices. The State assumes that each acre of impervious surface area generates 2.35 pounds of phosphorus per year. It should be noted that in previous annual reports the City had used a loading rate of 2.21 pounds of phosphorus per year per acre of impervious area. The State set the efficiency for treatment at 40% removal of the phosphorus load, which is 0.94 pounds of phosphorus per year per acre of impervious area. Therefore, the control of a non-traditional practice for every 0.94 pounds of phosphorus is equivalent to the traditional treatment of one acre of impervious area. Thus the goal of treating 20% of the City's impervious area can be described as either the traditional treatment of 4,675 impervious acres or the control of 4,390 pounds of phosphorus per year. Below is a discussion of the SWMD's method of estimating the amount of phosphorus annually retained or removed by each of these groups of practices: street sweeping and inlet cleaning; volume control BMPs; stream restoration; and school and vacant lot greening with asphalt removal.

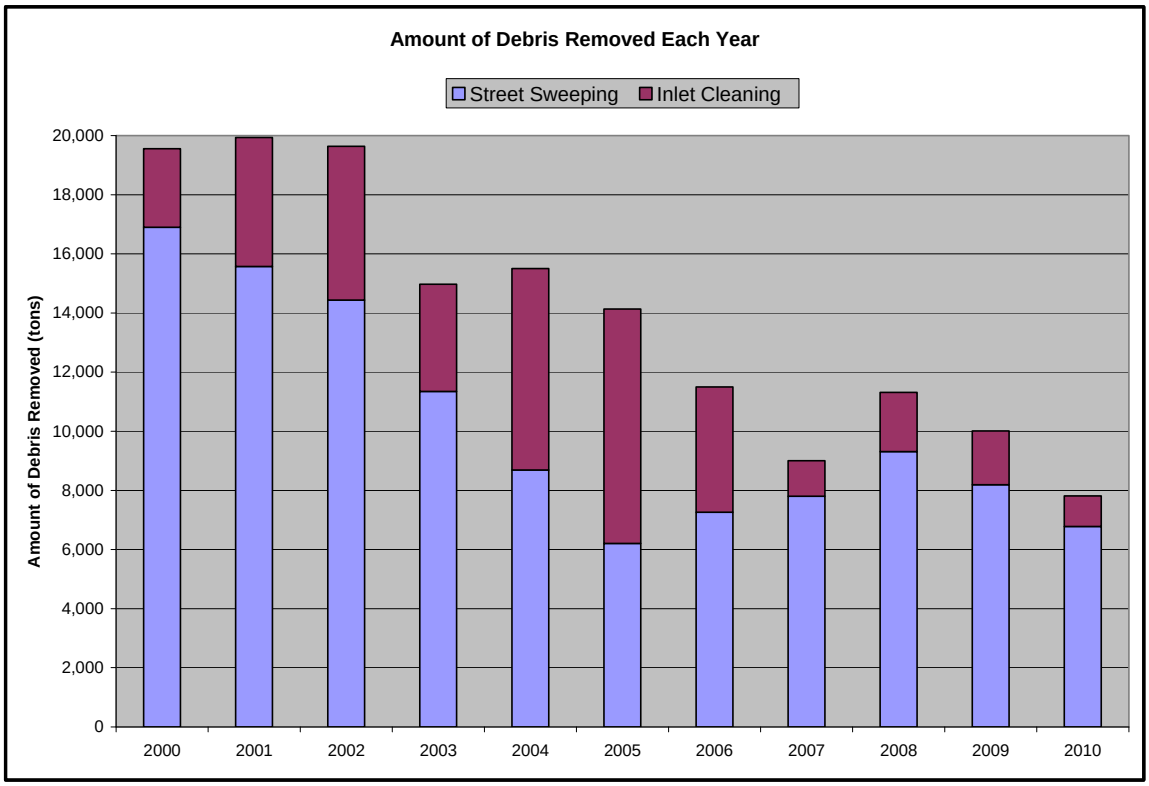
Street Sweeping and Inlet Cleaning:

The tonnage of debris collected is multiplied by the median concentration of phosphorus (120 ppm) in the debris collected from the Hamilton Street Sweeping Study to relate the benefit of the City's Street Sweeping and Inlet Cleaning Program to percent impervious area treated. The estimated amount of phosphorus removed by street sweeping and inlet cleaning is converted to an equivalent area of impervious surface treated using the assumptions that the average total phosphorus loading for 1 acre of impervious area is 2.35 pounds per acre per year; and a traditional BMP should remove 40% of the phosphorus. Therefore, each 0.94 pounds of phosphorus controlled by a non-traditional practice is the equivalent of traditional treatment of one acre of impervious surface.

Table F3.1 and Figure F3.1 present the amount of debris removed each year by street sweeping and inlet cleaning. During 2010, there were 7,810 tons of debris removed, which is equivalent of treating 2,000 acres of impervious surface, which equals 8.6% of the City's impervious surface area.

Table F3.1 Conversions of Debris Removed by Street Sweeping & Inlet Cleaning to Equivalent Treated Area for 2000 through 2010					
Year	Inlet Cleaning Debris Removed (tons)	Street Sweeping Debris Removed (tons)	Sum of Debris Removed (tons)	Estimated Amount of Total Phosphorus (pounds)	Equivalent Treatment (acres of impervious surface)
2000	2,658	16,897	19,555	4,693	4,993
2001	4,362	15,569	19,931	4,783	5,089
2002	5,204	14,437	19,641	4,714	5,015
2003	3,624	11,347	14,971	3,593	3,822
2004	6,817	8,686	15,503	3,721	3,958
2005	7,925	6,208	14,133	3,392	3,608
2006	4,234	7,261	11,495	2,759	2,935
2007	1,202	7,800	9,002	2,160	2,298
2008	2,001	9,308	11,309	2,714	2,887
2009	1,824	8,186	10,010	2,402	2,556
2010	1,027	6,783	7,810	1,874	1,994

Figure F3.1 Amount of Debris Removed by Street Sweeping and Inlet Cleaning



Volume Control BMPs:

The volume-control BMPs (see Table F3.2) treat runoff from approximately 1,679 acres, of which, 831 acres are covered with

impervious surface. The three completed projects have a combined treatment volume of 13.3 acre-feet. One acre-foot of treatment volume provides the necessary water quality treatment volume of 13.3 acres of impervious area.

Table F3.2 Volume Control BMPs Estimated Annual Phosphorus Removal

Project	Status	Watershed Area (acres)	Impervious Area (acres)	Treatment Volume (acre-feet)	Equivalent Treatment Impervious Area (acre)	Estimated Annual Phosphorus Removal (lbs)
Completed						
Brooklyn Park Stormwater BMP	Completed 2004	306	138	7.5	100	94
Gwynns Run Stormwater BMP	Completed 2003	1,373	693	5.8	77	72
Watershed 263 Six BMPs	Completed 2009			0.037	0.5	0.5
Total Completed		1,679	831	13.3	178	167
Pending						
Moores Run Wetlands	Pending	2,803	947	17.0	226	212

Stream Restoration:

In previous annual reports by using phosphorus loading rate reduction as a proxy, the City maintained that each 16.25 feet of the City's stream restoration projects was equivalent to 100% treatment of one acre of impervious surface. This assertion is greatly different from that espoused by the Chesapeake Bay Program. Using phosphorus reduction as a proxy and the efficiencies approved by the Chesapeake Bay Program, each 90 feet of a stream restoration project results in the same amount of phosphorus reduction as achieved using a traditional practice with a 40% treatment on the runoff from one acre of impervious surface. The City will use the equivalency supported by the Chesapeake Bay Program for this report, but may elect in the future to assign a higher phosphorus reduction efficiency to stream restoration. To date the City's stream restoration projects have modified about 13,225 feet, which is equivalent to traditional practices treating 151 acres of impervious surface.

Table F3.3 Stream Restoration Projects			
Project	**Stream Length (feet)**	**Phosphorus Reduction (lbs/year)**	**MS4 Permit Impervious Area Credit Claimed (acres)**
Completed			
Biddison Run Phase I	1,500	16.1	17.1
Lower Stony Run	1,850	19.8	21.1
Maidens Choice Stream #1	2,700	28.9	30.7
Middle Stony Run	2,750	29.4	31.3
Upper Stony Run	2,325	24.9	26.5
ER4014 Western Run Stream Restoration Project 1	2,100	22.5	23.9
Total for Completed Projects	**13,225**	**141.5**	**150.5**
Pending (in Design Phase or Out for Bid)			
ER4018 Powder Mill Environmental Restoration Project 1	3,900	41.7	44.4
Open Channel Improvements- East Stony Run	800	8.6	9.1
Lower Lower Stony Run Stream Restoration	5,000	53.5	56.9
Biddison Run Stream Stabilization (Project ER4023)	6,900	73.8	78.5
Total for Completed & Pending Projects	**29,825**	**319.1**	**339.5**

School and Vacant Lot Greening with Asphalt Removal:
The various school and vacant lot greening projects that have been detailed in previous reports have resulted in 18 acres of asphalt removed (see Table F3.4). Note that previously reported pavement removal projects have been solely limited to those projects completed by SWMD.

In the draft guidance document Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, which the Maryland Department of the Environment published in June 2011, impervious surface area removal is considered a land use change. The projects listed in Table F3.4 are considered to have changed the listed amount of acres from impervious to pervious. The guidance document estimates that the practice of converting impervious surface to pervious surface results in a reduction of phosphorus load of 1.47 pounds per acre per year. The guidance document allows an equivalent impervious area treatment credit of 0.62 acres per acre changed from impervious to pervious surface. The projects completed through 2010 have converted 17.65 acres of impervious surface to pervious surface for estimated reduction of 25.9 pounds of phosphorus per year. For the projects listed in Table F3.4, the City is claiming an equivalent treatment credit of 10.9 acres, which is represents 0.05% of the City's total impervious area and 0.23% toward the requirement to treat 20% of the impervious area.

Table F3.4 School and Vacant Lot Greening with Asphalt Removal					
Project	**Watershed Area (acres)**	**Percent Impervious**	**Impervious Area (acres)**	**Phosphorus Reduction (lbs/year)**	**MS4 Permit Impervious Area Credit Claimed (acres)**
School Greening Phase I	6.75	100%	6.75	9.9	4.2
School Greening Phase II	5.50	100%	5.50	8.1	3.4
School Greening Phase III	4.40	100%	4.40	6.5	2.7
Vacant Lot Greening Phase I	1.00	50%	0.50	0.7	0.3
Yorkwood Elementary School Greening	0.50	100%	0.50	0.7	0.3
Total			**17.65**	**25.9**	**10.9**

Debris Collectors:
The first debris collector that the City installed was on the Gwynns Run at Carroll Park; however, this facility was destroyed by vandals. The City has two operating debris collectors (see Table F3.5), which receive the stormwater draining from 1,318 acres, which includes 763 acres of impervious surface. The City plans to install a new facility, the Bush Street Trash-Debris Collector (see Section F1 for more information). The City has no data on the amount of phosphorus these debris collectors can remove from stormwater. They are designed to remove larger items than the fine particulates with which phosphorus is normally associated. For this report the City is not assigning an equivalent credit value (in terms of traditional treatment of impervious surface) to these practices, but the City might assign a value to these practices in the future.

Table F3.5 Debris Collectors					
Project	**Watershed Area (acres)**	**Percent Impervious**	**Impervious Area (acres)**	**Phosphorus Reduction (lbs/year)**	**MS4 Permit Impervious Area Credit Claimed (acres)**
Completed					
Briarcliff Debris Collector	47	28%	13	unknown	0
Harris Creek Debris Collector	1,271	59%	750	unknown	0
Under Design					
Bush Street Trash-Debris Collector	unknown	unknown	unknown	unknown	0

Summary of the Estimated Annual Amount of Phosphorus Retained or Removed by the City's BMPs:
Table F3.6 summarizes the estimated amount of phosphorus removed or retained by the City's BMPs that were discussed above. The total

estimated annual amount of phosphorus retained by the City's practices that were in place at the time of this report is 2,208 pounds. The permit required the equivalent of treating 20% of the impervious surface area of the City, which is 4,675 acres. The expected amount of phosphorus that 4,675 acres of impervious surface area would generate is 10,986 pounds. Traditional practices are expected to remove 40% of the phosphorus from stormwater; thus the desired phosphorus removal amount for City practices would be 4,395 pounds. The amount controlled by current City practices is only 50% of the goal set by the permit. By this accounting, the City's practices are equivalent to the treatment of only 10% of the City's total impervious area by traditional practices. The additional four projects listed as pending to which the City has assigned some value in this calculation will bring the equivalent total to 11.8% of the City's total impervious area by traditional practices. Please note that this calculation only includes the projects discussed in this section. At some point in the near future, the City will finish compiling the database of the stormwater management facilities, and then will know how many impervious acres are treated by these facilities. Also in the future, the City hopes that there will be values to assign to practices such as debris collectors, tree planting, rooftop drain disconnection and other non-traditional stormwater treatment practices.

Table F3.6 Estimated Amount of Phosphorus Retained by Practices and Equivalent Amount of Impervious Area Treatment Claimed

Project Name	**Type**	**Estimated Annual Amount of Phosphorus Withheld (lbs)**	**MS4 Permit Impervious Area Credit Claimed (acres)**
Completed			
Street Sweeping & Inlet Cleaning (2010)	cleaning practice	1,874.4	1,994.0
Brooklyn Park Stormwater BMP	volume control	94.0	100.0
Gwynns Run Stormwater BMP	volume control	72.0	76.6
Watershed 263 Six BMPs	volume control	0.5	0.5
Biddison Run Phase I	stream restoration	16.1	17.1
Upper Stony Run	stream restoration	24.9	26.5
Middle Stony Run	stream restoration	29.4	31.3
Maidens Choice Stream #1	stream restoration	28.9	30.7
Lower Stony Run	stream restoration	19.8	21.1
ER4014 Western Run Stream Restoration Project 1	stream restoration	22.5	23.9
School Greening Phase I	asphalt removal	9.9	4.2
School Greening Phase II	asphalt removal	8.1	3.4
School Greening Phase III	asphalt removal	6.5	2.7
Vacant Lot Greening Phase I	asphalt removal	0.7	0.3
Yorkwood Elementary School Greening	asphalt removal	0.7	0.3
Briarcliff Debris Collector	debris collector	unknown	0.0
Harris Creek Debris Collector	debris collector	unknown	0.0
Total Completed		**2,208.3**	**2,332.6**
Pending			
Moores Run Wetlands	volume control	212.4	226.0
ER4018 Powder Mill Environmental Restoration Project 1	stream restoration	41.7	44.4
Open Channel Improvements- East Stony Run	stream restoration	8.6	9.1
Lower Lower Stony Run	stream restoration	53.5	56.9
Biddison Run Stream Stabilization (Project ER4023)	stream restoration	73.8	78.5
Bush Street Trash-Debris Collector	debris collector	unknown	0.0
Total Completed & Pending		**2,598.3**	**2,747.5**

Parks & People Foundation: Work in Watershed 263

Guy W. Hager from the Parks & People Foundation gave this summary of their work in Watershed 263 during 2010:

"Parks & People Foundation continues to support the WS263 Community Stakeholder Council and encourage new membership and energy. We have been working to support a new initiative to link City parks within the watershed with increased programming. The Council has been meeting regularly. Progress has also been made in implementing Parks & People's seven projects. So far 271 new native trees have been planted; 11,616 square feet (0.27 acres) of concrete and asphalt have been removed to create new planting spaces for trees and bio-retention facilities by amending soil, planting native woody plants and applying hardwood mulch. All three schoolyards have been enhanced with new grass seed, aeration, and watering. In total we have completed 30 projects (see Table F3.4). Remaining to be completed is the installation of plants and rain barrels based on the site plan prepared by our designed and approved by the neighborhoods greening group on Small Street in Sandtown this spring (project #6). We have requested a no-cost extension of the contract to June 30, 2011 in order to undertake an additional project and well."

Table F3.4: Parks & People Foundation: Watershed 263 Projects Completed During 2010

PROJECT NAME	PROJECT TYPE	STREET NAME	STREET NUMBER	Trees Planted	Concrete/ Asphalt Removed (sq. ft.)
Gilmor Homes 60X60	Asphalt removal	Spray Court	1600	8	6,000
Gilmor Homes Street Trees	Tree planting	N. Mount St	1400	15	480
Gilmor Homes Street Trees	Tree planting	N. Gilmor St	1300	15	480
Gilmor Homes Street Trees	Tree planting	Booker Court	1600	10	
Gilmor Homes Street Trees	Tree planting	Lorman Court	850	10	
Gilmor Elementary School	Tree planting and grass restoration	Gilmor St	1300	24	
Sandtown Winchester Community Center	Tree planting/lot restoration	N. Mount	1114	10	3,600
N. Vincent and Riggs St Lot	Tree planting	N. Vincent St	1100	15	
Hobbs lot	Lot restoration	N. Gilmor St	1141	4	
Concrete Park	Tree planting	N. Gilmor St	1200	10	
Lee's Garden	Lot restoration	N. Gilmor St	1037		
W263 Council Lot	Lot restoration	W. Lafayette Ave	1710	6	

Table F3.4 continued: Parks & People Foundation: Watershed 263 Projects Completed During 2010					
PROJECT NAME	**PROJECT TYPE**	**STREET NAME**	**STREET NUMBER**	**Trees Planted**	**Concrete/ Asphalt Removed (sq. ft.)**
Public Housing scattered sites	Tree Planting	Multiple sites		20	
Agriculture Training site	Lot restoration	W. Lafayette Ave	1417		
Harlem Park E/M School	Asphalt removal	Harlem Ave	1500	25	
Hidden Streams Project	Asphalt removal	W. Franklin St	1306		
Franklin Square Elementary	Asphalt removal	N. Calhoun St	216	30	
Franklin Square Park/Lexington St	Tree planting	W. Lexington St	1306	10	
Stoop Lot	Lot restoration	N. Stricker St	106		
Horse Stable Lot	Lot restoration	N. Bruce St	200		
Curb Bump-out 1	Water Management	N. Mount St	203		
Fruit Tree Planting/Bruce St lot	Tree planting	N. Fulton Ave	232	8	
Curb Bump-out 2	Water Management	W. Lexington St	1801		
Tree lot, Saratoga St	Tree planting	N. Mount St	248	3	
Curb Bump-out 3	Water Management	W. Fayette St	1717		
Bio Swale 1	Water Management	N. Vincent St	12	15	
Bio Swale 2	Water Management	N. Mount St	2		
Fayette Outreach lot	Lot restoration	N. Pulaski St	100		
Sub shed 0 plantings/Franklin Square	Tree planting	W. Fayette St	1900-2000	33	1056
GFT plantings	Tree planting	Bayard St	1400-1500		
TOTAL				**271**	**11,616**

Department of General Services 2010 Annual Report

The Department of General Services (DGS) 2010 Annual Report provides a snapshot of the agency's progress in areas that include reduced building energy use, streamlined operations, and the operation of renewable energy. A copy of the report can be found at: http://cityservices.baltimorecity.gov/MOIT/2010_DGS_Annual_Report.pdf. Below is a list of some of the accomplishments from the DGS report. At this time, the City is not using these accomplishments toward credit in meeting the impervious surface area treatment requirement from the MS4 permit. However, the City may do so in the future.

- Fleet is 35% green, using alternative fuels such as compressed natural gas and biodiesel. In 2010 we purchased 95 flexible fuel vehicles.

- 10 newly purchased diesel trucks have particulate filter cleaners which remove soot from the engines.
- Installed the largest green roof in the City at the Baltimore Convention Center. This roof totals 32,000 square feet.
- The Energy Office reduces government expenditures by $5.5M each year for energy through savings from reduced purchases of electric power, steam, natural gas, chilled water and related savings on maintenance costs.
- Approximately 10% of the power the City used in 2010 and nearly 40% by 2013 will be from renewable resources. The City even generates its own renewable power- almost with 3 megawatts of capacity in 2010 and an anticipated increase to 15 megawatts in 2012.

G. Assessment of Controls

1. Watershed Restoration Assessment

a. Chemical Monitoring

Moores Run Long-term Discharge Characterization

Table G1a.1 shows the number of sampling events, the number of samples collected, and the number of water quality analyses performed for monitoring associated with the long-term discharge characterization for the Moores Run during 2010. There were nine storm events that were monitored at the Radecke Avenue station and eight that were successfully monitored at the Hamilton Avenue station. There were ten baseline monitoring events at these stations. The storm EMCs and baseline sampling results for Radecke Avenue and Hamilton Avenue during 2010 can be found in table "Baltimore City Chemical Monitoring 2010" in the Access database "Baltimore City NPDES Stormwater Permit Data 2010.mdb" on the CD-ROM accompanying this report. The results for all the discrete samples from all monitoring at theses two stations during 2010 can be found in table "Baltimore City Monitoring Sample Results 2010" in that Access database. A list of sampling activities for 2010 at the Hamilton Avenue can be found in Table G1a.2. A list of sampling activities for 2010 at the Radecke Avenue station can be found in Table G1a.3.

Table G1a.1 Moores Run Long-term Discharge Characterization During 2010			
Station and Type	Number of Surveys or Storm Events	Number of Samples	Number of Water Quality Analyses Performed
Mary Ave. Baseline	10	10	205
Hamilton Ave. Baseline	10	10	205
Radecke Ave. Baseline	10	10	215
Hamilton Ave. Ammonia Screening	21	21	125
Radecke Ave. Ammonia Screening	21	21	125
Hamilton Storm	8	55	755
Radecke Storm	9	63	906
Total			2,536

Total Petroleum Hydrocarbons (TPH)

The City uses automated samplers to collect samples during storms at the Hamilton Avenue and Radecke Avenue monitoring stations. In order to analyze storm samples for TPH, the samples must be collected manually, and preserved immediately. This incurs a great expense in overtime wages. The City did not have personnel manning these stations during any of the storm events monitored during 2010. Thus, no TPH analyses were run on storm samples during 2010.

Water Temperature and pH

The automated sampling equipment installed at the Hamilton Avenue station is capable of operating pH and water temperature sensors; however, the City did not collect pH or water temperature data during any of the storm events successfully monitored at the Hamilton Avenue station during 2010. The equipment used at the Radecke Avenue station cannot operate pH or water temperature sensors.

Table G1a.2 Summary of Monitoring Activities During 2010 for Hamilton Avenue	
First Quarter 2010	
1/6/2010	Visited site as part of Herring Run Ammonia Screening
1/14/2010	Visited site as part of Herring Run Ammonia Screening
1/21/2010	Visited site as part of Herring Run Ammonia Screening
1/26/2010	Collected 1 grab baseline sample
2/4/2010	Visited site as part of Herring Run Ammonia Screening
3/3/2010	Visited site as part of Herring Run Ammonia Screening; precipitation that day
3/12/2010	Successful storm sampling- designated Event ID 193; submitted 4 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data
3/13/2010	Successful storm sampling- designated Event ID 194; submitted 10 storm samples for lab analysis; did not analyze for TPH, e. coli, enterococci, dissolved metals, hardness or BOD; did not collect pH or water temperature data
3/17/2010	Visited site as part of Herring Run Ammonia Screening

Table G1a.2 continued Summary of Monitoring Activities During 2010 for Hamilton Avenue	
First Quarter 2010 continued	
3/24/2010	Visited site as part of Herring Run Ammonia Screening
3/29/2010	Scheduled baseline sampling. Collected 1 grab sample. It rained near or at the time of sampling. Coded sample in the database to indicate rain influence.
Second Quarter 2010	
4/9/2010	Visited site as part of Herring Run Ammonia Screening
4/21/2010	Visited site as part of Herring Run Ammonia Screening
4/26/2010	Scheduled baseline sampling. Collected 1 grab sample. It rained near or at the time of sampling. Coded sample in the database to indicate rain influence.
5/6/2010	Visited site as part of Herring Run Ammonia Screening
5/12/2010	Unsuccessful storm sampling: automated sampler collected only two samples because of the small rise and duration; did not submit samples for analysis
5/13/2010	Visited site as part of Herring Run Ammonia Screening
5/24/2010	Collected 1 grab baseline sample
6/9/2010	Successful storm sampling- designated Event ID 196; submitted 5 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data
6/28/2010	Collected 1 grab baseline sample
Third Quarter 2010	
7/8/2010	Visited site as part of Herring Run Ammonia Screening
7/13/2010	Successful storm sampling- designated Event ID 197; submitted 9 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data
7/16/2010	Visited site as part of Herring Run Ammonia Screening
7/26/2010	Collected 1 grab baseline sample
8/6/2010	Visited site as part of Herring Run Ammonia Screening
8/18/2010	Successful storm sampling- designated Event ID 198; submitted 6 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data
8/23/2010	Collected 1 grab baseline sample
9/9/2010	Visited site as part of Herring Run Ammonia Screening
9/30/2010	Successful storm sampling- designated Event ID 199; submitted 9 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data. Coverage of the storm by Hamilton samples and Radecke samples is slightly different: Hamilton samples covered another wave of rainfall- an additional 1.06 inches over 2.41 hours using the Mount Pleasant ALERT rain gage.
Fourth Quarter 2010	
10/7/2010	Visited site as part of Herring Run Ammonia Screening; precipitation that day
10/14/2010	Successful storm sampling- designated Event ID 200; submitted 6 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data. Coverage of the storm slightly longer at Radecke than Hamilton: Radecke samples covered final small wave of storm- an additional 0.07 inches of rainfall over 1.57 hours using Mount Pleasant ALERT rain gage.
10/25/2010	Collected 1 grab baseline sample
11/3/2010	Visited site as part of Herring Run Ammonia Screening
11/4/2010	Unsuccessful storm sampling: automated sampler did not initiate properly
11/10/2010	Visited site as part of Herring Run Ammonia Screening
11/18/2010	Visited site as part of Herring Run Ammonia Screening
11/29/2010	Collected 1 grab baseline sample

Table G1a.2 continued Summary of Monitoring Activities During 2010 for Hamilton Avenue	
Fourth Quarter 2010	
12/1/2010	Successful storm sampling- designated Event ID 202; submitted 6 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data. Radecke and Hamilton had samples from different parts (waves) of the storm. Treated as separate events: Radecke samples covered the initial wave of 0.23 inches of rainfall, and was designated as storm #201; Hamilton samples covered 0.75 inches of rainfall that began about 5 hours after the initial wave, and was designated as storm #202.
12/9/2010	Visited site as part of Herring Run Ammonia Screening
12/14/2010	Collected 1 grab baseline sample
12/21/2010	Visited site as part of Herring Run Ammonia Screening

Table G1a.3 Summary of Monitoring Activities During 2010 for Radecke Avenue	
First Quarter 2010	
1/6/2010	Visited site as part of Herring Run Ammonia Screening
1/14/2010	Visited site as part of Herring Run Ammonia Screening
1/21/2010	Visited site as part of Herring Run Ammonia Screening
1/26/2010	Collected 1 grab baseline sample
2/4/2010	Visited site as part of Herring Run Ammonia Screening
3/3/2010	Visited site as part of Herring Run Ammonia Screening; precipitation that day
3/12/2010	Successful storm sampling- designated Event ID 193; submitted 4 storm samples for lab analysis; samples analyzed for sodium; did not analyze for TPH; did not collect pH or water temperature data
3/13/2010	Successful storm sampling- designated Event ID 194; submitted 11 storm samples for lab analysis; did not analyze for TPH, e. coli, enterococci, dissolved metals, hardness or BOD; did not collect pH or water temperature data
3/17/2010	Visited site as part of Herring Run Ammonia Screening
3/24/2010	Visited site as part of Herring Run Ammonia Screening
3/29/2010	Scheduled baseline sampling. Collected 1 grab sample. It rained near or at the time of sampling. Coded sample in the database to indicate rain influence.
Second Quarter 2010	
4/9/2010	Visited site as part of Herring Run Ammonia Screening
4/21/2010	Visited site as part of Herring Run Ammonia Screening
4/26/2010	Scheduled baseline sampling. Collected 1 grab sample. It rained near or at the time of sampling. Coded sample in the database to indicate rain influence.
5/6/2010	Visited site as part of Herring Run Ammonia Screening
5/12/2010	Successful storm sampling- designated Event ID 195; submitted 6 storm samples for lab analysis; samples analyzed for sodium; did not analyze for TPH; did not collect pH or water temperature data
5/13/2010	Visited site as part of Herring Run Ammonia Screening
5/24/2010	Collected 1 grab baseline sample
6/9/2010	Successful storm sampling- designated Event ID 196; submitted 5 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data
6/28/2010	Collected 1 grab baseline sample
Third Quarter 2010	
7/8/2010	Visited site as part of Herring Run Ammonia Screening
7/13/2010	Successful storm sampling- designated Event ID 197; submitted 8 storm samples for lab analysis; samples analyzed for sodium; did not analyze for TPH; did not collect pH or water temperature data
7/16/2010	Visited site as part of Herring Run Ammonia Screening
7/26/2010	Collected 1 grab baseline sample

Table G1a.3 continued Summary of Monitoring Activities During 2010 for Radecke Avenue	
Third Quarter 2010 continued	
8/6/2010	Visited site as part of Herring Run Ammonia Screening
8/18/2010	Successful storm sampling- designated Event ID 198; submitted 6 storm samples for lab analysis; samples analyzed for sodium; did not analyze for TPH; did not collect pH or water temperature data
8/23/2010	Collected 1 grab baseline sample
9/9/2010	Visited site as part of Herring Run Ammonia Screening
9/30/2010	Successful storm sampling- designated Event ID 199; submitted 8 storm samples for lab analysis; did not analyze for TPH; did not collect pH or water temperature data. Coverage of the storm by Hamilton samples and Radecke samples is slightly different: Hamilton samples covered another wave of rainfall- an additional 1.06 inches over 2.41 hours using the Mount Pleasant ALERT rain gage.
Fourth Quarter 2010	
10/7/2010	Visited site as part of Herring Run Ammonia Screening; precipitation that day
10/14/2010	Successful storm sampling- designated Event ID 200; submitted 8 storm samples for lab analysis; samples analyzed for sodium; did not analyze for TPH; did not collect pH or water temperature data. Lab accident with enterococci count for first sample, so an EMC was not calculated for enterococci count. Coverage of the storm slightly longer at Radecke than Hamilton: Radecke samples covered final small wave of storm- an additional 0.07 inches of rainfall over 1.57 hours using Mount Pleasant ALERT rain gage.
10/25/2010	Collected 1 grab baseline sample
11/3/2010	Visited site as part of Herring Run Ammonia Screening
11/4/2010	Unsuccessful storm sampling: automated sampler did not initiate properly
11/10/2010	Visited site as part of Herring Run Ammonia Screening
11/18/2010	Visited site as part of Herring Run Ammonia Screening
11/29/2010	Collected 1 grab baseline sample
11/30-12/1/2010	Successful storm sampling- designated Event ID 201; submitted 7 storm samples for lab analysis; samples analyzed for sodium; did not analyze for TPH; did not collect pH or water temperature data. Radecke and Hamilton had samples from different parts (waves) of the storm. Treated as separate events: Radecke samples covered the initial wave of 0.23 inches of rainfall, and was designated as storm #201; Hamilton samples covered 0.75 inches of rainfall that began about 5 hours after the initial wave, and was designated as storm #202.
12/9/2010	Visited site as part of Herring Run Ammonia Screening
12/14/2010	Collected 1 grab baseline sample
12/21/2010	Visited site as part of Herring Run Ammonia Screening

Moores Run SWMM Model Results

SWMD hired a consultant to estimate the pollutant loads for 2010 for the Moores Run at Radecke Avenue. SWMD supplied the consultant with the following data from 2010: flow data recorded by the USGS at the Radecke Avenue station, rainfall data from the City's flood warning station at Hazelwood Elementary School, the EMCs from storms monitored at the Radecke Avenue station, and results from baseline (dry weather) samples collected at the Radecke Avenue station. A copy of the consultant's report can be found in the file "MR SWMM Report 2010 v2.doc" on the CD-ROM accompanying this report. Table G1a.4 and Figures G1a.1 through G1a.6 compare the SWMM load estimates for 2010 with previous SWMM estimates for

1999, and 2003 through 2009. Note that these loads are based on modeling runs calibrated with different data sets.

The 2010 loading rate for five of the six parameters increased compared to 2009; the loading rate for total suspended solids fell by 5%. The rates of increase ranged from 2% (for lead) to 39% (for nitrogen). For each of the increasing parameters, except total nitrogen, this was the fourth consecutive year with an increase; total nitrogen has increased each of the past three years. The 2010 loading rate for copper is the highest loading rate among the nine years that have been run through the SWMM model.

Table G1a.5 Compare the Annual Loads Computed by the Different SWMM Runs Done for the Moores Run at Radecke Avenue (in pounds/acre/year)

Parameter	**1999**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Total Suspended Solids	199	219	249	434	434	217	224	283	270
Total Phosphorus	0.874	0.990	1.31	2.50	1.49	0.612	0.765	1.02	1.21
Total Nitrogen	5.18	6.07	9.42	5.74	8.24	4.11	3.49	4.88	6.78
Total Copper	0.0446	0.0512	0.0562	0.0556	0.0949	0.0477	0.0700	0.0953	0.122
Total Zinc	0.402	0.459	0.489	0.285	0.297	0.203	0.259	0.347	0.417
Total Lead	0.0759	0.0854	0.0956	0.0689	0.0683	0.0399	0.0449	0.0562	0.0574

Figure G1a.1 Compare Annual Total Suspended Solids Loads for Moores Run

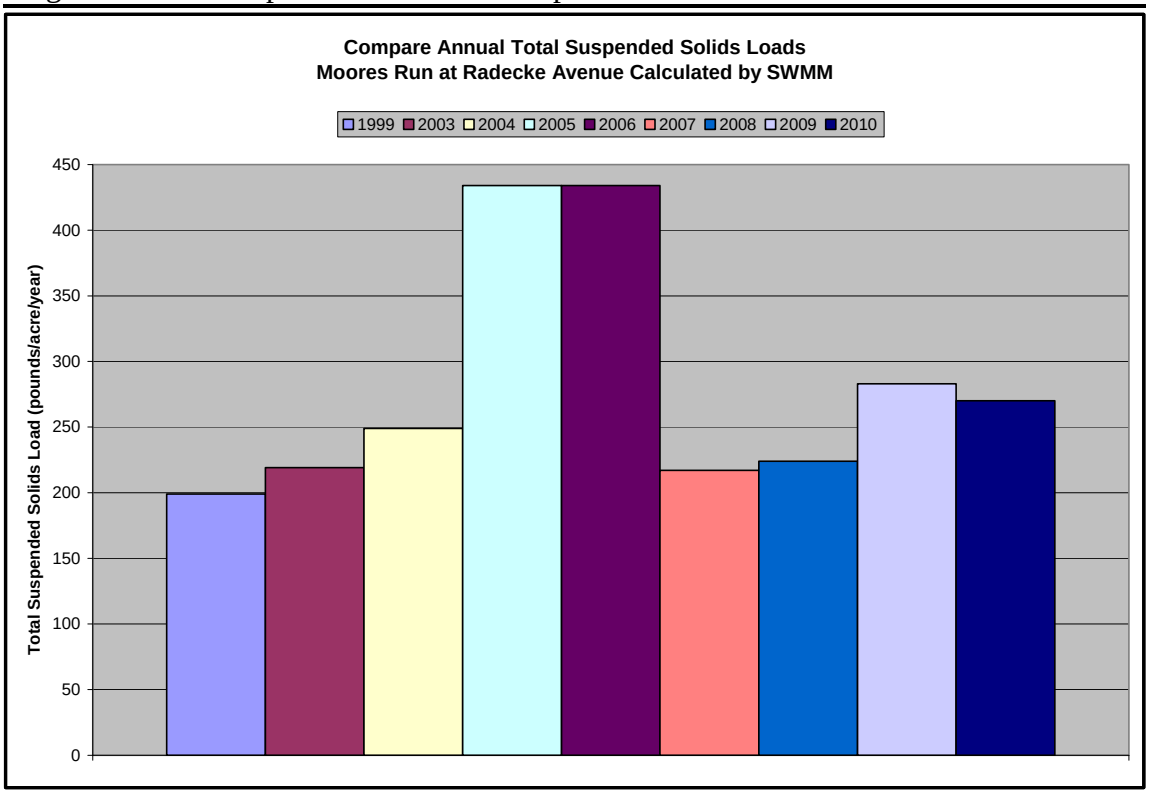


Figure G1a.2 Compare Annual Total Phosphorus Loads for Moores Run

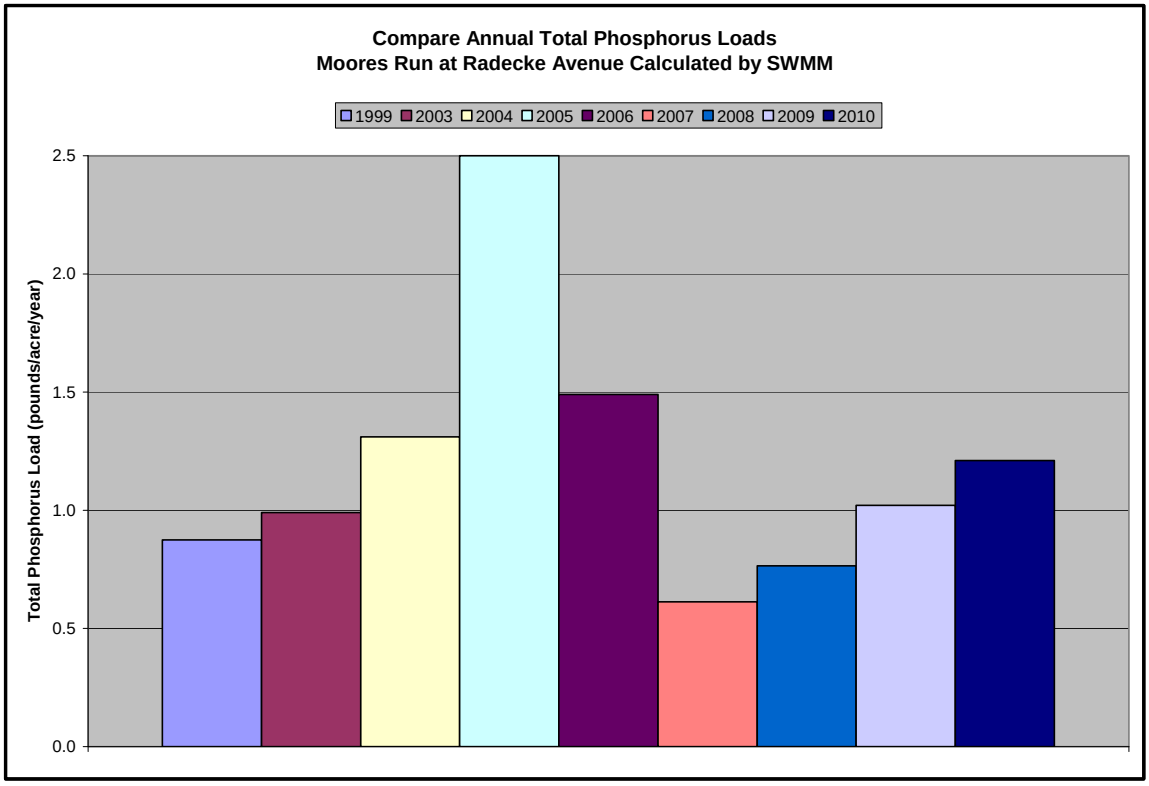


Figure G1a.3 Compare Annual Total Nitrogen Loads for Moores Run

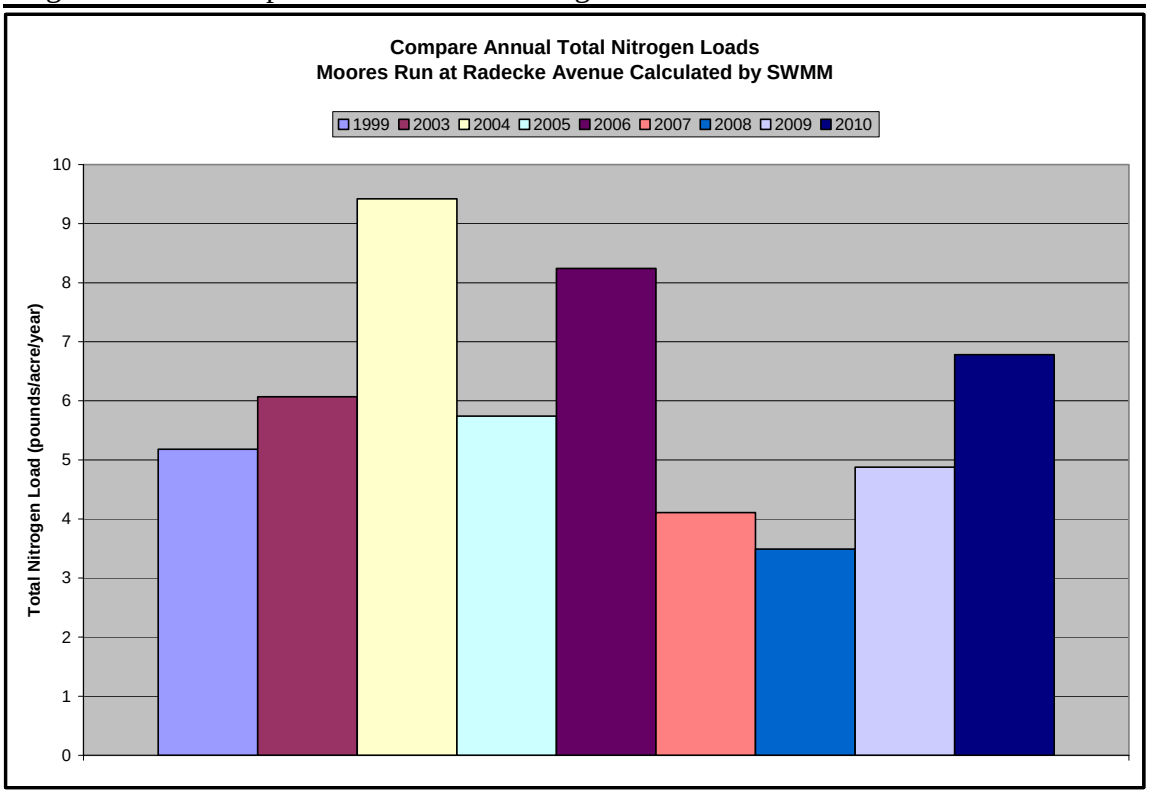


Figure G1a.4 Compare Annual Total Copper Loads for Moores Run

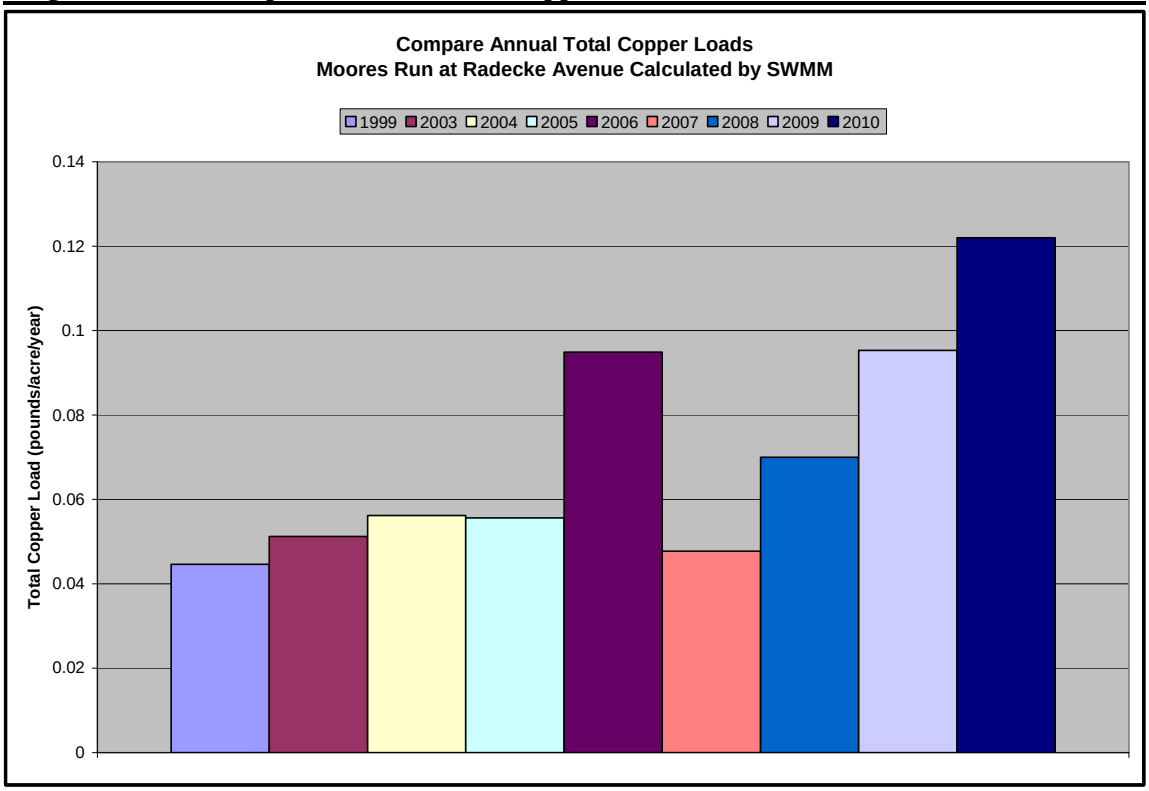


Figure G1a.5 Compare Annual Total Zinc Loads for Moores Run

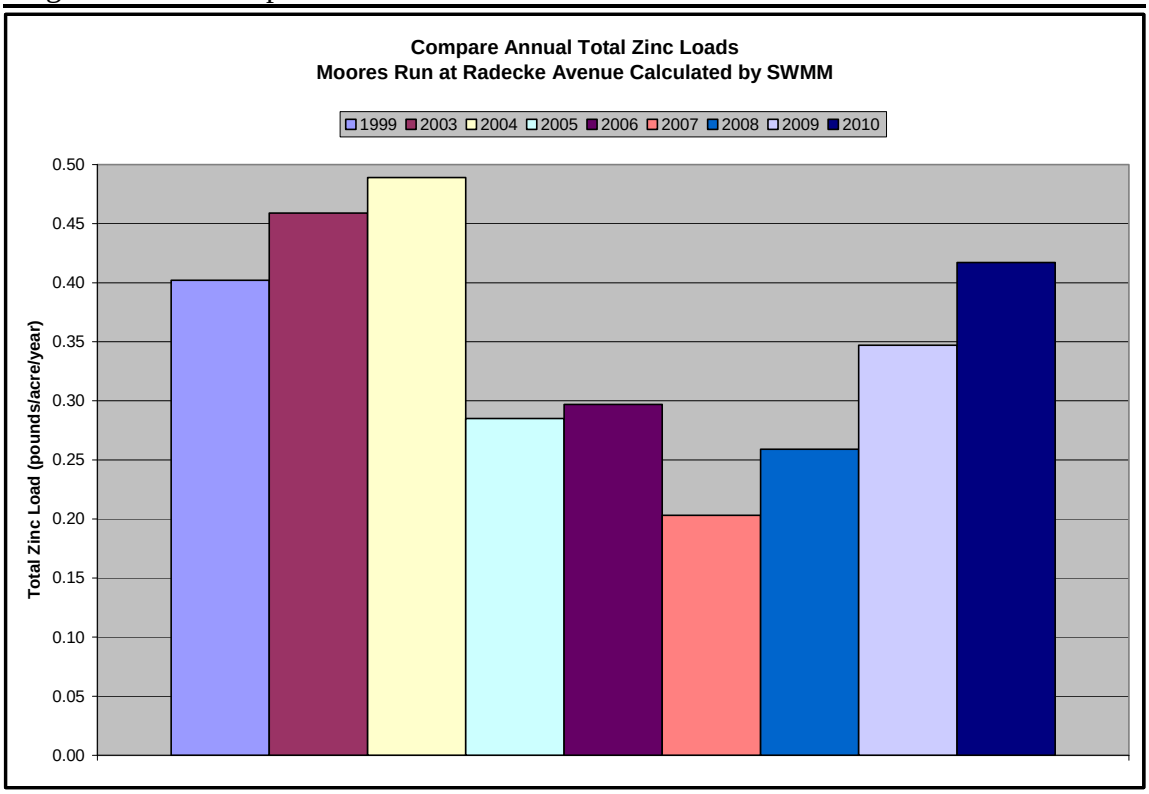
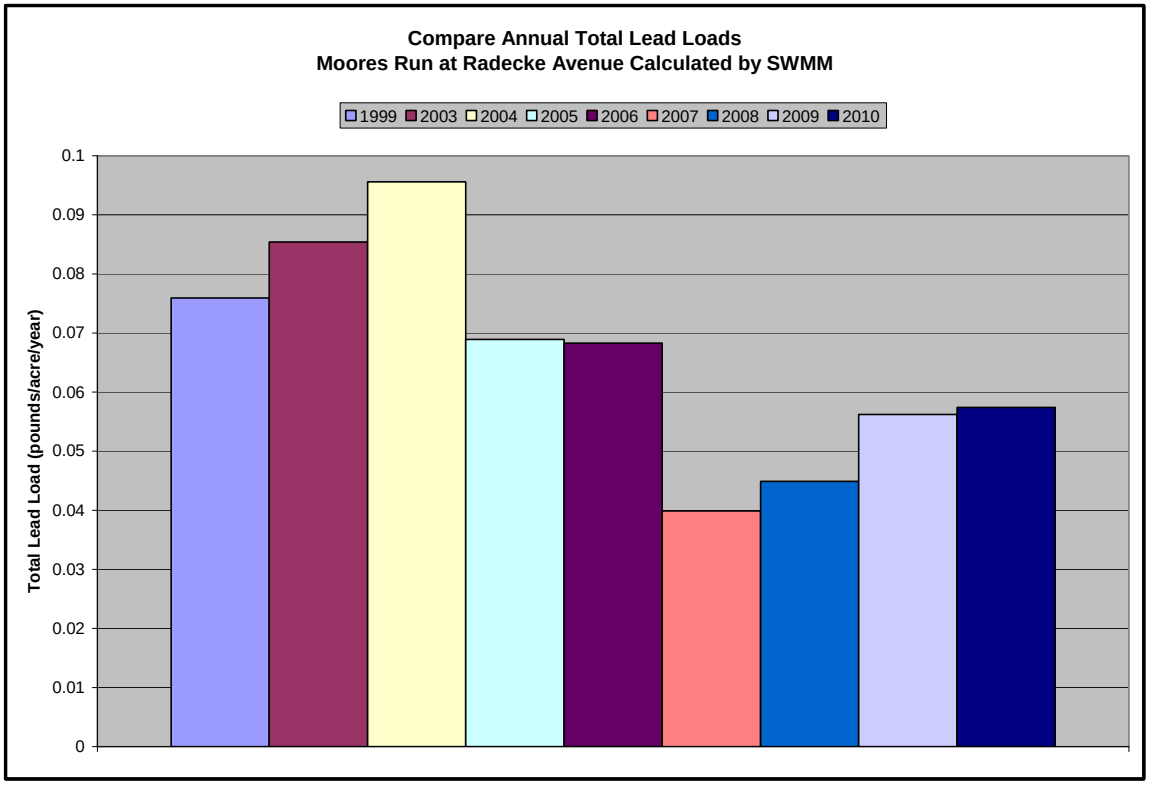


Figure G1a.6 Compare Annual Total Lead for Moores Run



Moores Run Trends Analyses

In order to look for trends over time, scatterplot graphs of the storm EMCs from monitoring at Hamilton Avenue and Radecke Avenue from May 1995 through December 2010 were made for the following parameters: total nitrogen, nitrate+nitrite nitrogen, TKN, total phosphorus, total copper, dissolved copper, total lead, dissolved lead, total zinc, dissolved zinc, fecal coliform counts, e. coli counts (begun 9/25/2008), enterococci counts (begun 9/25/2008), suspended solids, volatile suspended solids (begun 2/10/2005) and BOD. The storm EMC over time scatterplots for Hamilton Avenue and Radecke Avenue for total nitrogen, total phosphorus, total suspended solids, 5-day BOD and e. coli MPN counts can be found in Figures G1a.7 through G1a.16. Copies of the graphs of all the parameters can be found in the Excel file "Hamilton & Radecke Stm EMC Time Graphs.xls" on the CD-ROM accompanying this report. Please note that there was no storm monitoring at Hamilton Avenue from August 2004 through October 2005 while there was utilities renovation (construction) in the area- including the building of the Hamilton Avenue monitoring station.

Figure G1a.7 Hamilton Avenue Total Nitrogen Storm EMCs

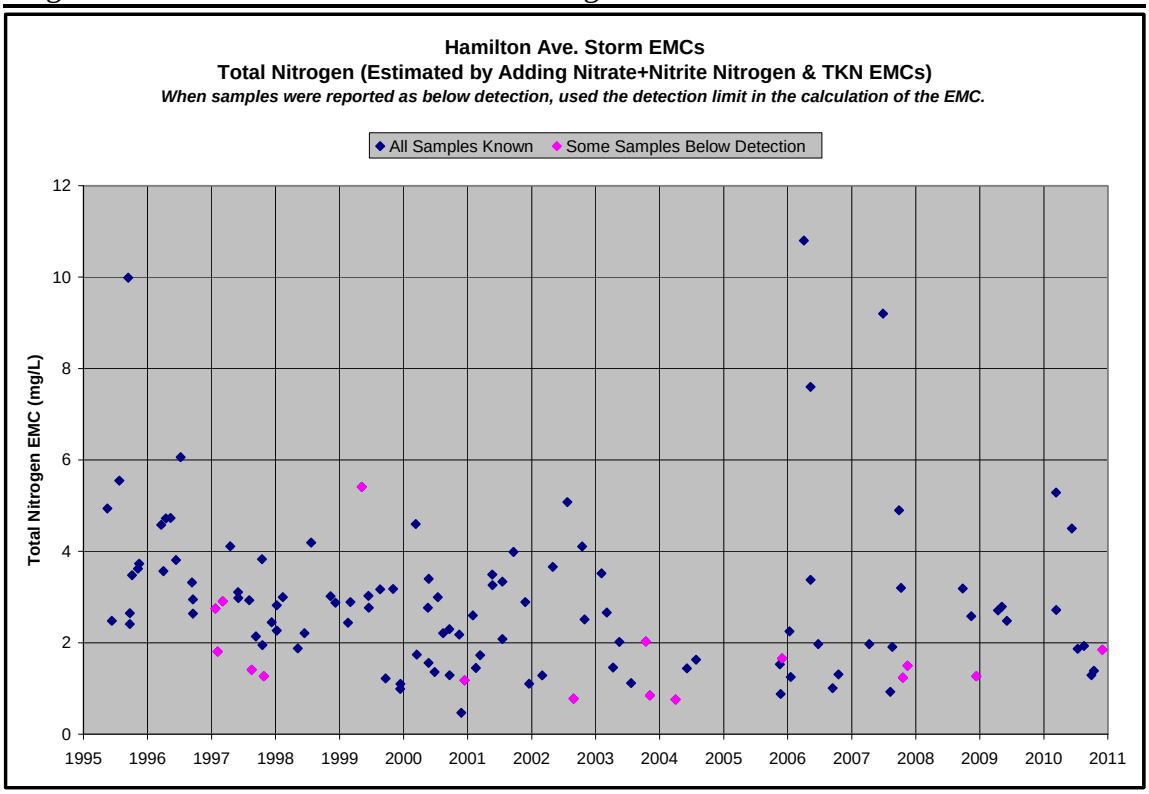


Figure G1a.8 Radecke Avenue Total Nitrogen Storm EMCs

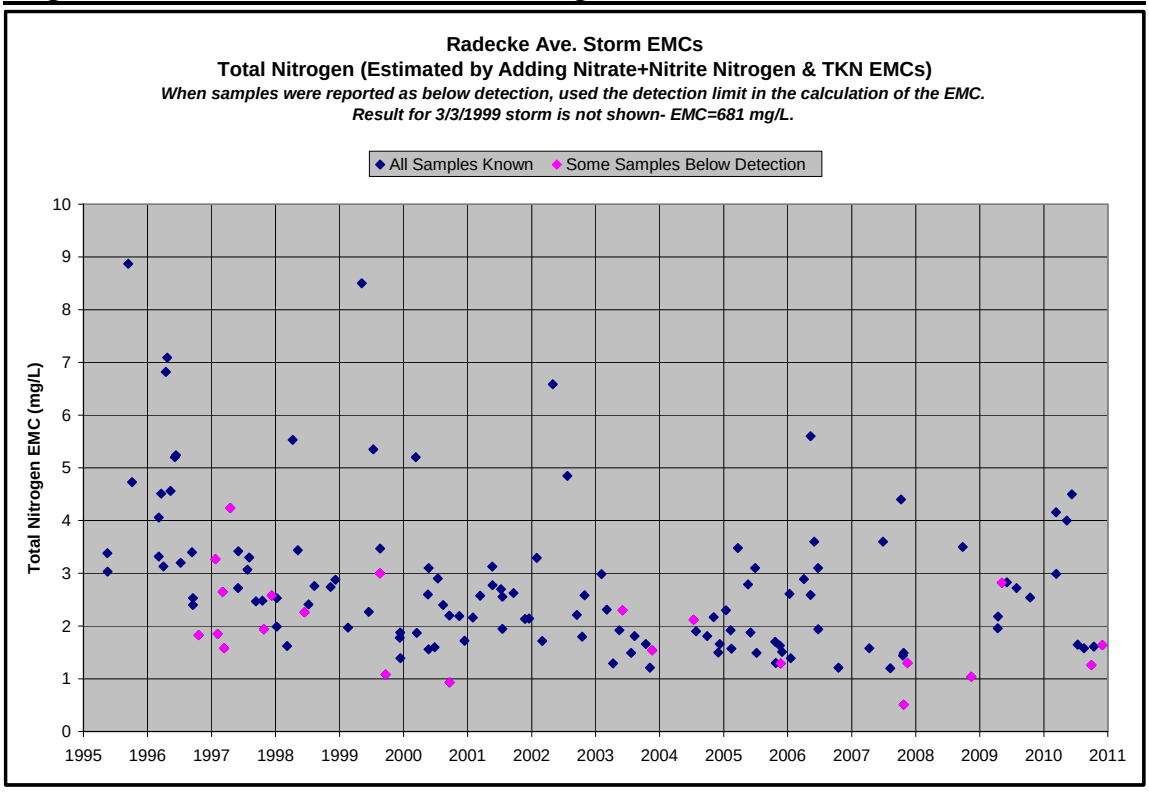


Figure G1a.9 Hamilton Avenue Total Phosphorus Storm EMCs

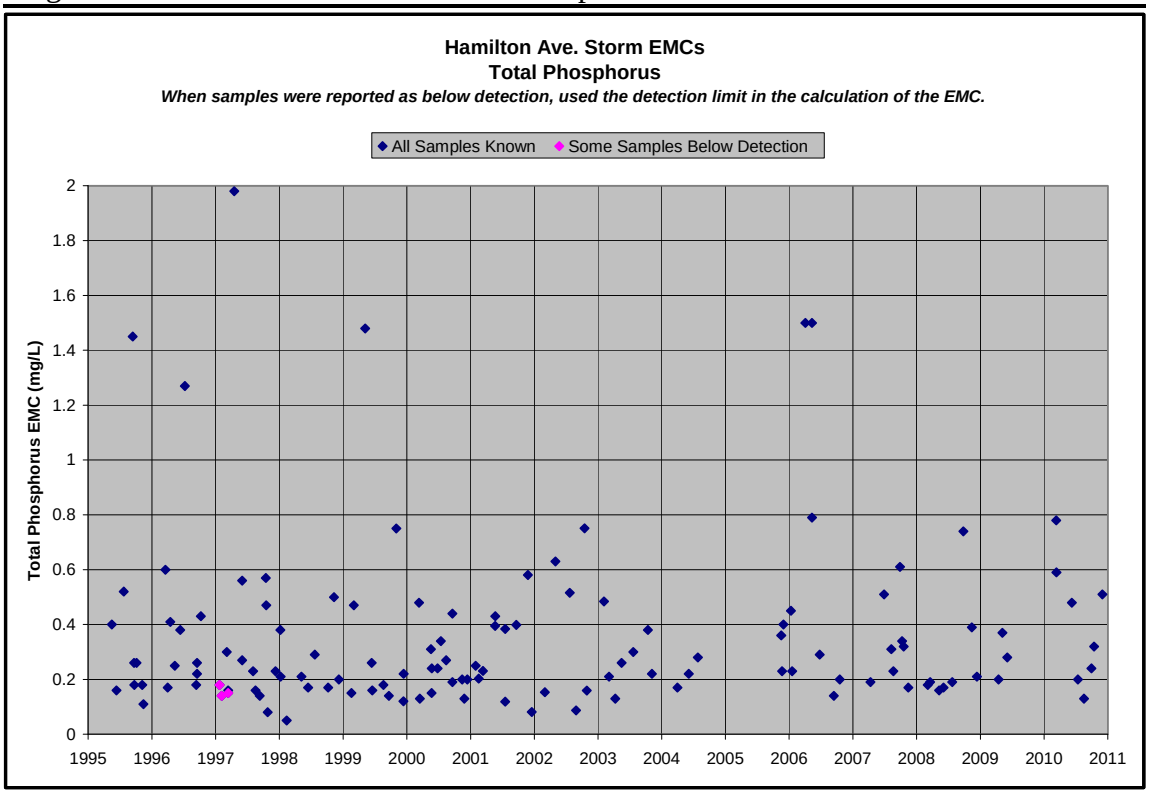


Figure G1a.10 Radecke Avenue Total Phosphorus Storm EMCs

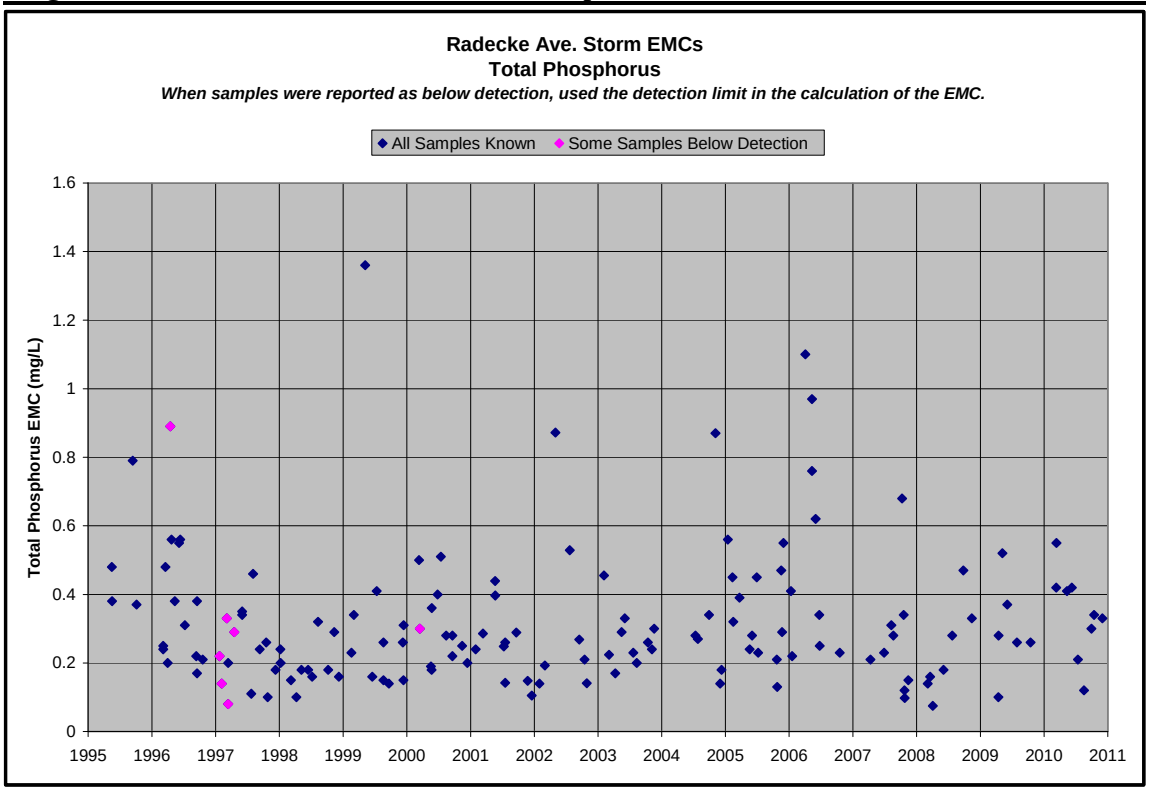


Figure G1a.11 Hamilton Avenue Suspended Solids Storm EMCs

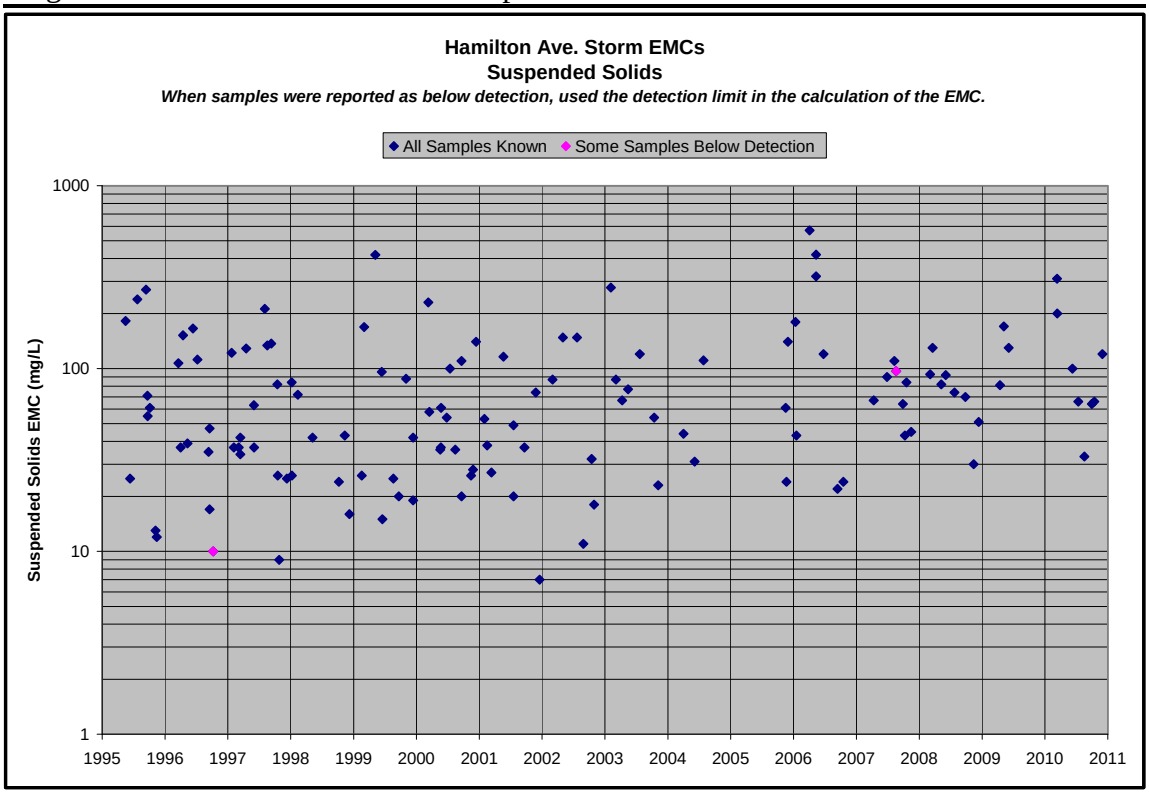


Figure G1a.12 Radecke Avenue Suspended Solids Storm EMCs

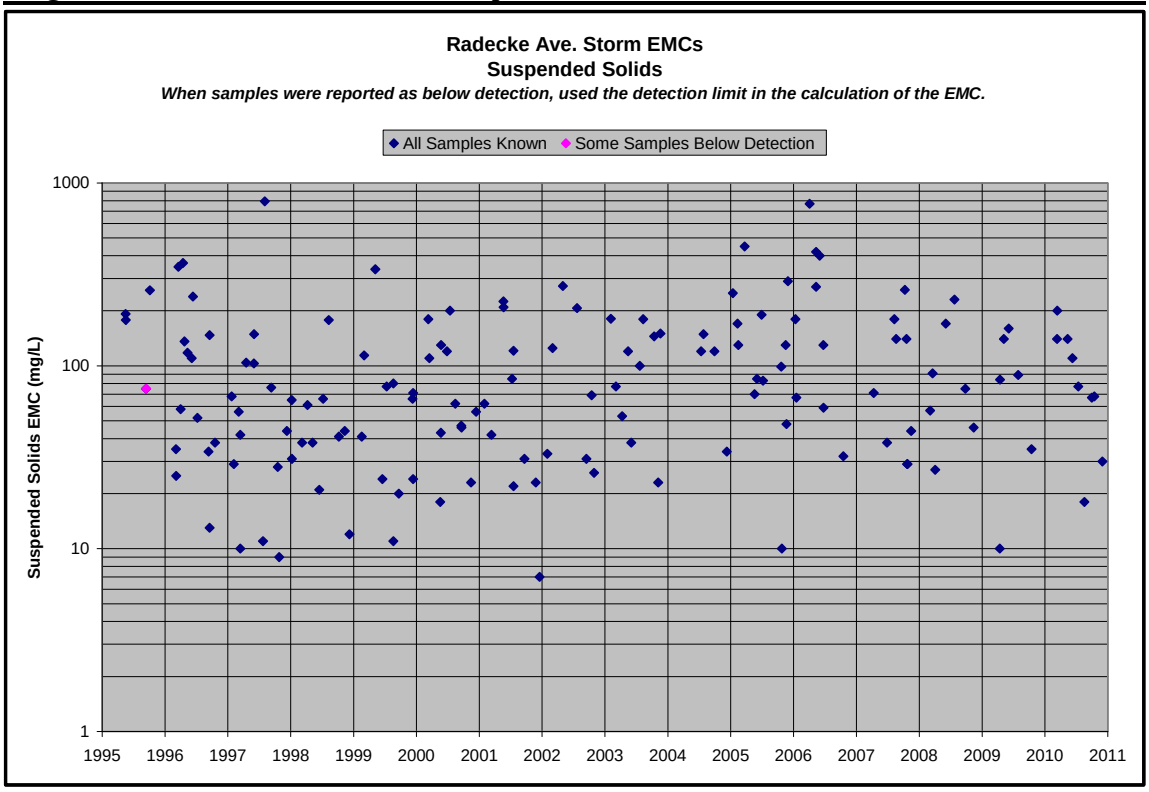


Figure G1a.13 Hamilton Avenue BOD 5-Day Storm EMCs

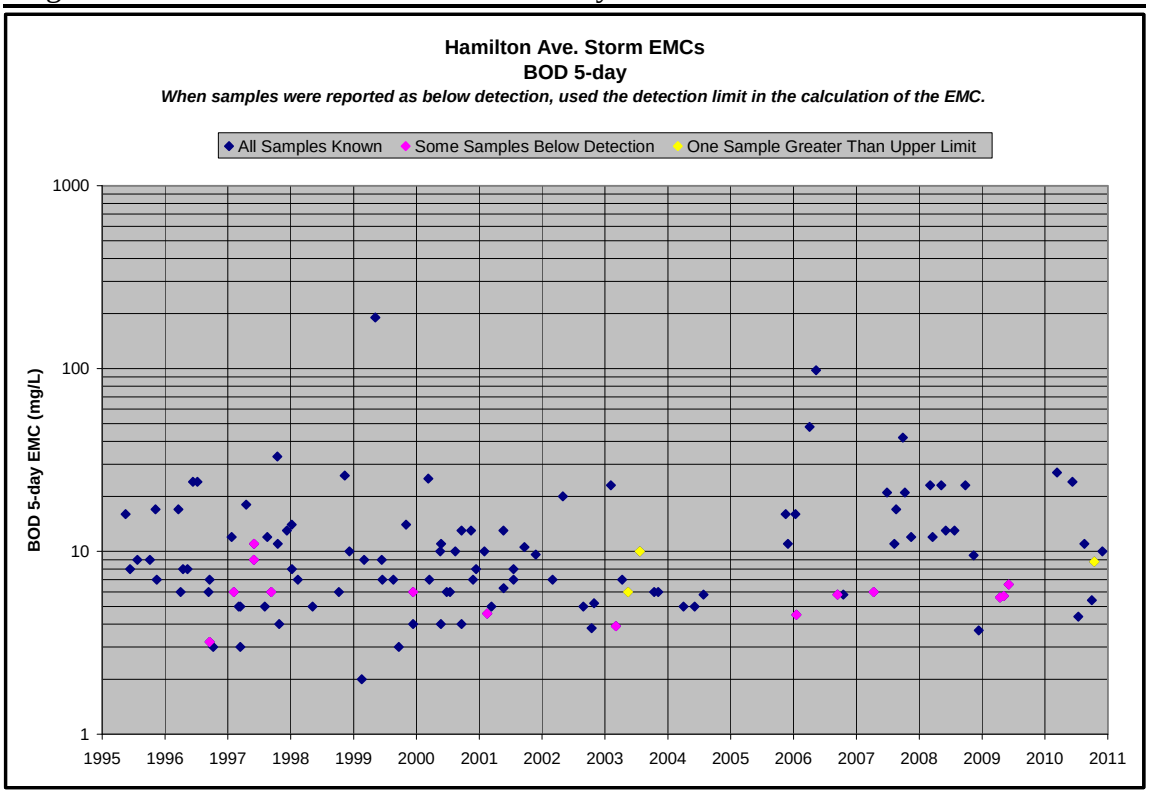


Figure G1a.14 Radecke Avenue BOD 5-Day Storm EMCs

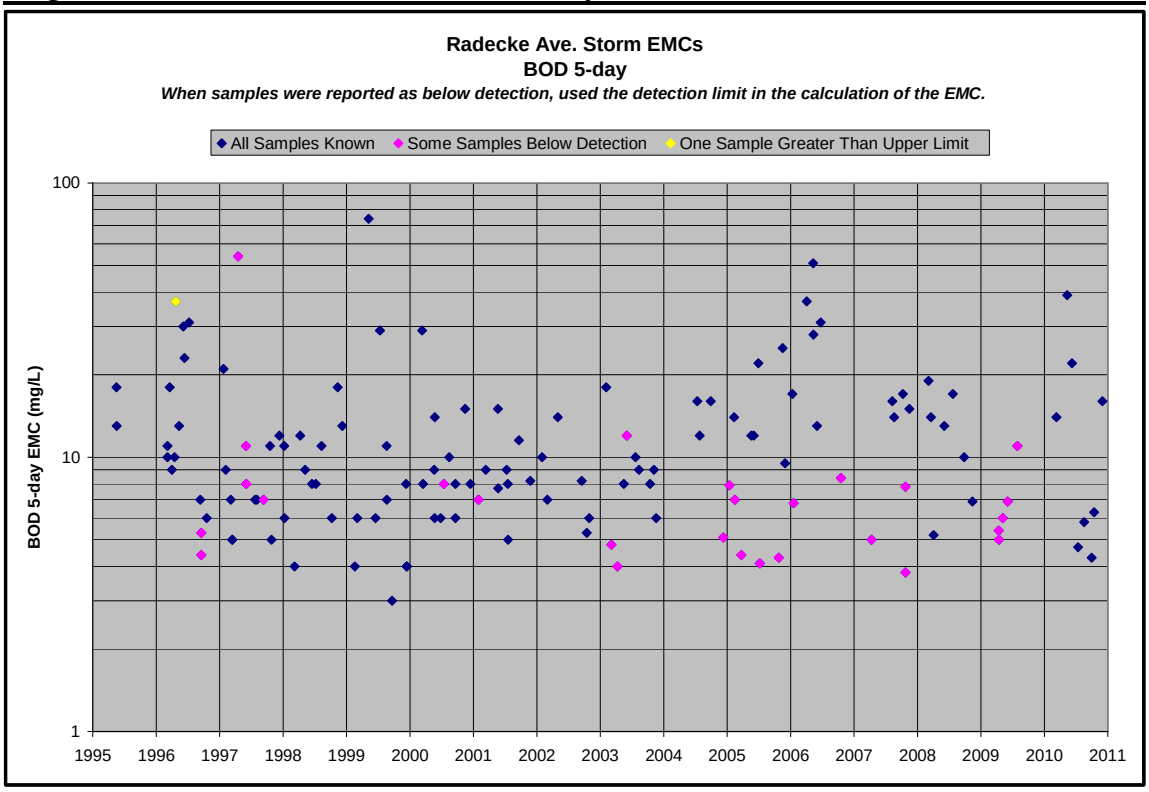


Figure G1a.15 Hamilton Avenue E. Coli MPN Count Storm EMCs

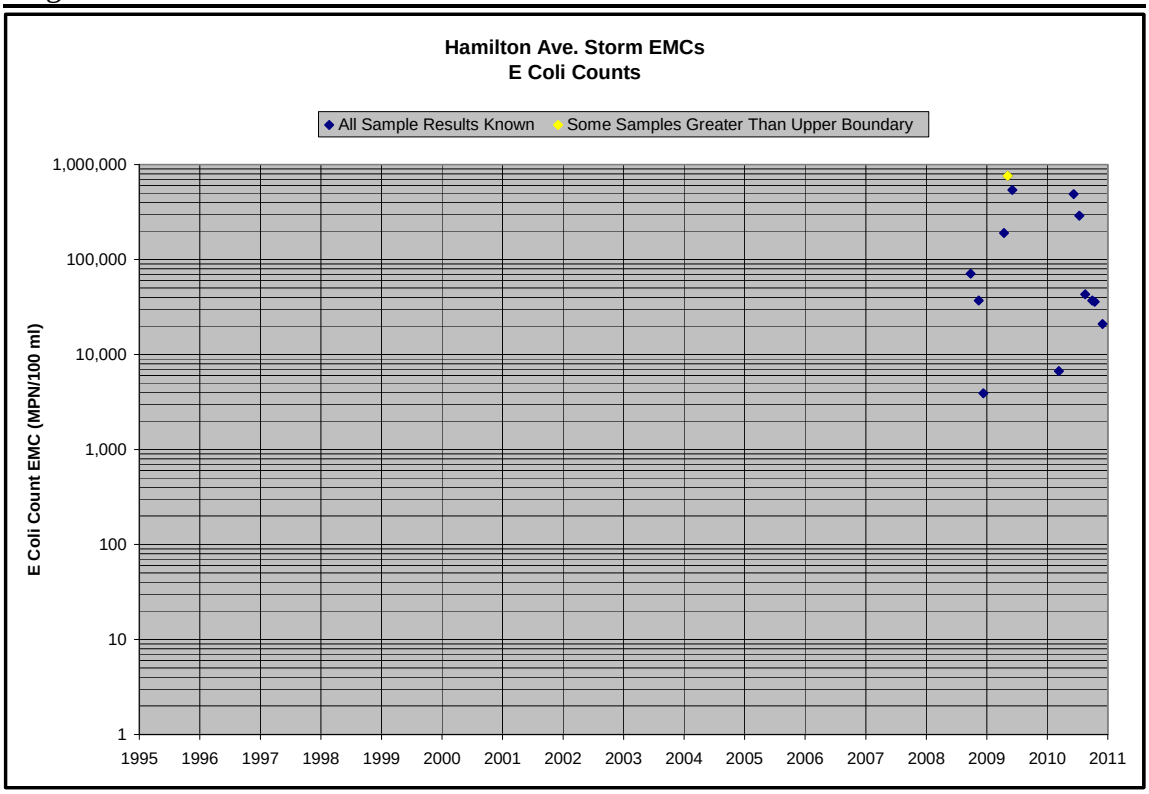
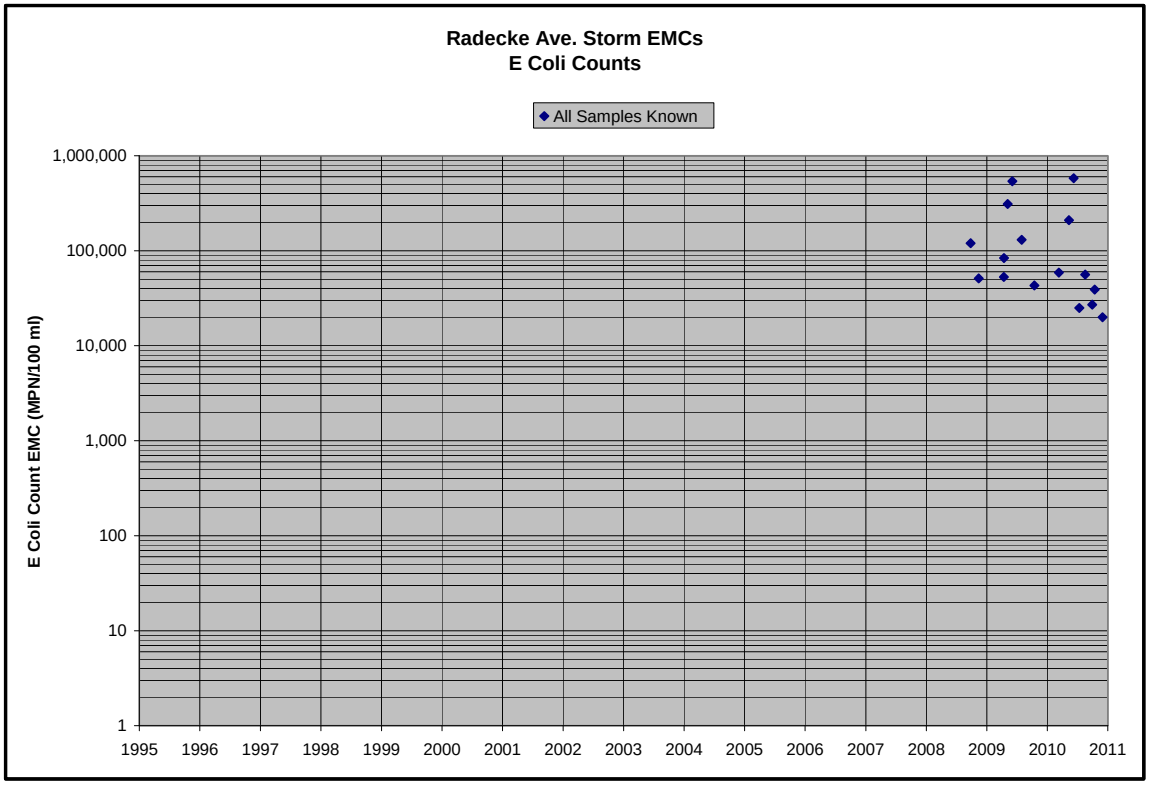


Figure G1a.16 Radecke Avenue E. Coli MPN Count Storm EMCs



In addition to Hamilton Avenue and Radecke Avenue, there are two other dry weather monitoring stations in the Moores Run. The samples at the Mary Avenue station are collected underground in the storm drain network. The flow from the Mary Avenue station, like that from the Hamilton Avenue station, contributes to the flow at Radecke Avenue. The other dry weather monitoring station is Biddle St. & 62nd St., which is well downstream of the Radecke Avenue station and near to where the Moores Run crosses the City line. Scatterplot graphs of dry weather samples collected at the monitoring stations in the Moores Run were also made. These graphs can be found in the folder "City Streams Dry Weather Time Concentration Graphs" on the CD-ROM accompanying this report.

Moores Run Metals Toxicity Analysis

Since March 2003, the City analyzed nearly every baseline sample from the Moores Run stations for total hardness and dissolved copper, lead and zinc. About one-third of the SIS samples from the Biddle St. & 62nd St. station were also analyzed for these parameters. An analysis was done for the sample results collected through December 2010 to find out how often the samples exceed the State's freshwater chronic criteria for these metals. Formulas for adjusting the freshwater criteria for hardness were taken from these reports prepared by MDE: Water Quality Analysis of Copper and Lead for the Jones Falls in Baltimore County and Baltimore City, Maryland and Water Quality Analysis of Zinc Contamination for the Jones Falls Baltimore City and Baltimore County, Maryland. The results of this analysis are shown in Table G1a.5 and Figure G1a.17.

The Hamilton Avenue station had 1 of 77 baseline samples with a hardness level outside the range of the adjustment curves: this sample was excluded from this analysis. The Hamilton Avenue station had 1 of 76 (~1%) and the Mary Avenue station had 1 of 77 (~1%) baseline samples that exceeded the lead freshwater chronic toxicity criteria. None of the four stations had any baseline samples that exceeded the copper or zinc freshwater chronic toxicity criterion.

These hardness adjustment curves were also applied to the storm EMCs from Hamilton Avenue and Radecke Avenue. It may not be appropriate to compare stormwater results to the chronic criteria; rather, it may be more appropriate to use the acute criteria. However, the City's analyst working on this did not have the formulas to make the adjustments for hardness to the acute criteria. Two of the storm events at Hamilton Avenue had a hardness EMC outside the range that can be used with these freshwater chronic criteria formulas. This analysis found that 18 of 33 (55%) of the storm EMCs for the Hamilton Avenue station and 27 of 51 (53%) of the storm EMCs for

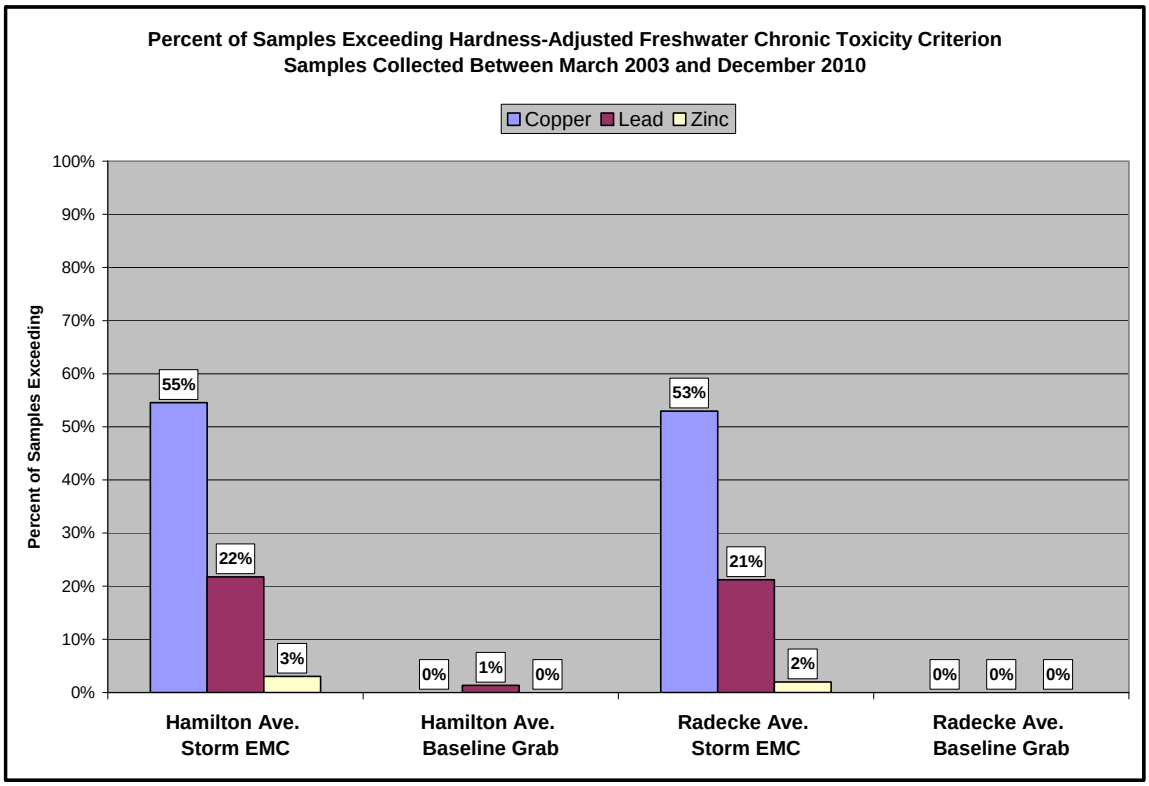
the Radecke Avenue station exceeded the copper freshwater chronic criterion; 1 of 33 (3%) of the storm EMCs for the Hamilton Avenue station, and 1 of 51 (2%) for Radecke Avenue exceeded the zinc freshwater chronic criterion.

The lead concentrations for some discrete stormwater samples are reported by the lab as below detection. This then results in an EMC calculation that is indeterminate- the EMC is bound by a range. For some of the storm events, the hardness-adjusted chronic criterion fell within the range assigned as the lead EMC, and thus a determination could not be made for that event whether or not its lead EMC exceeded the freshwater chronic criterion. This happened for 10 storms for the Hamilton Avenue station and 18 storms for the Radecke Avenue station. For those storms for which a determination could be made, 5 of 23 (22%) of the events at the Hamilton Avenue station and 7 of 33 (21%) of the events at the Radecke Avenue exceeded the hardness-adjusted freshwater chronic criterion for lead.

Table G1a.7 Percentage of Samples from Moores Run Long-term Monitoring Stations for which the Copper, Lead or Zinc Concentration Exceeded the Hardness-Adjusted Freshwater Chronic Criteria (March 2003 through December 2010)

Station and Type of Sample	Percent of Copper Samples	Percent of Lead Samples	Percent of Zinc Samples
Hamilton Ave. Storm EMC	55%	22%	3%
Hamilton Ave. Baseline Grab	0%	1%	0%
Radecke Ave. Storm EMC	53%	21%	2%
Radecke Ave. Baseline Grab	0%	0%	0%

Figure G1a.17 Moores Run Long-Term Discharge Characterization Stations: Percent of Samples Exceeding Hardness-Adjusted Freshwater Chronic Toxicity Criterion



Moores Run E. Coli MPN Count Analysis

Table G1a.8 lists the e. coli MPN count geometric mean and percentage of sample counts which were at or below each of the State's water use contact rules for the dry weather samples collected at the Hamilton Ave. and Radecke Ave. stations between November 2008 and January 2011. These metrics point to poor water quality in terms of bacteria. The storm event mean concentration (EMC) for the e. coli MPN counts were also compared to the State water contact rules and the results are listed in Table G1a.8.

Table G1a.8 E. Coli MPN Counts: Geometric Means and Comparision to State's Criteria for Frequency of Use
(Dry Weather Samples: November 2008 through January 2011; Storm EMCs: September 2008 through December 2010)

Station	Number of Samples	Geometric Mean (MPN/100 ml)	Percent At or Below Frequent Full Body Contact Recreation (235 MPN/100 ml)	Percent At or Below Moderately Frequent Full Body Contact Recreation (298 MPN/100 ml)	Percent At or Below Occasional Full Body Contact Recreation (410 MPN/100 ml)	Percent At or Below Infrequent Full Body Contact Recreation (576 MPN/100 ml)	Percent Above Infrequent Full Body Contact Recreation (576 MPN/100 ml)
HAMILTON AVE. Dry Weather Grab	21	2,906	0%	5%	5%	5%	95%
RADECKE AVE. Dry Weather Grab	21	2,398	0%	0%	14%	19%	81%
HAMILTON AVE. Storm EMC	13	69,692	0%	0%	0%	0%	100%
RADECKE AVE. Storm EMC	16	83,327	0%	0%	0%	0%	100%

Moores Run Total Phosphorus and Total Nitrogen Analyses
Table E2.3 listed the percentage of dry weather samples at Hamilton Avenue between January 2009 and January 2011 that were at or exceeded the total phosphorus guideline of 0.1 mg/L as 30%, which rates in the "high" range. The percentage of dry weather samples at Hamilton Avenue that were at or exceeded the total nitrogen guideline of 3 mg/L was 10%, which is in the "normal" range. The percentages for the dry weather samples from the Radecke Avenue station were 20% at or exceeding the total phosphorus guideline, which is in the "elevated" range and 5% at or exceeding the total nitrogen guideline, which rates in the "normal" range. The storm event mean concentrations (EMCs) for events from May 1995 through December 2010 were compared to these guidelines. Hamilton Avenue station EMCs were at or exceeded the total phosphorus guideline for 126 out of 130 events (97%), and were at or exceeded the total nitrogen guideline for 43 out of 121 events (36%). Radecke Ave. station EMCs were at or exceeded the total phosphorus guideline for all of the 152 events (100%), and were at or exceeded the total nitrogen guideline for 42 out of 142 events (30%).

Moores Run Storm Sample Total and Volatile Suspended Solids Analysis
Starting with the storm on February 10, 2005, the City began analyzing the discrete storm samples collected at the Radecke Avenue and Hamilton Avenue stations for volatile suspended solids. This is being done in conjunction with the storm monitoring at the Linkwood station on Stony Run and at the stations on Powder Mill Run. In the 52 storm events monitored at the Radecke Avenue station from February 2005 through December 2010, 398 samples were analyzed for volatile suspended solids. In the 38 storm events monitored at the Hamilton Avenue station from November 2005 through December 2010, 266 samples were analyzed for volatile suspended solids. No storms were monitored at the Hamilton Avenue station from August 2004 through October 2005 because of infrastructure construction. Figures G1a.18 through G1a.21 present the discrete storm samples results for the Hamilton Avenue and Radecke Avenue stations coded by storm for total suspended solids versus flow per area and volatile suspended solids versus flow per area. Both stations show similar relationships with total suspended solids and volatile solids concentrations positively correlated with flow per area.

Figure G1a.22 presents a comparison of the storm EMCs for total suspended solids and volatile suspended solids from the Hamilton Avenue and Radecke Avenue stations from February 2005 through December 2010. The City successfully monitored both stations only for 32 out of 58 storms during that period. For those 32 storms when

both stations were successfully sampled, the total suspended solids EMCs and volatile suspended solids EMCs for the Hamilton Avenue and Radecke Avenue stations track well together (see Figure G1a.23).

Figure G1a.18 Hamilton Avenue Discrete Storm Samples Total Suspended Solids Versus Flow per Area Coded by Storm Nov. 2005-Jun. 2009

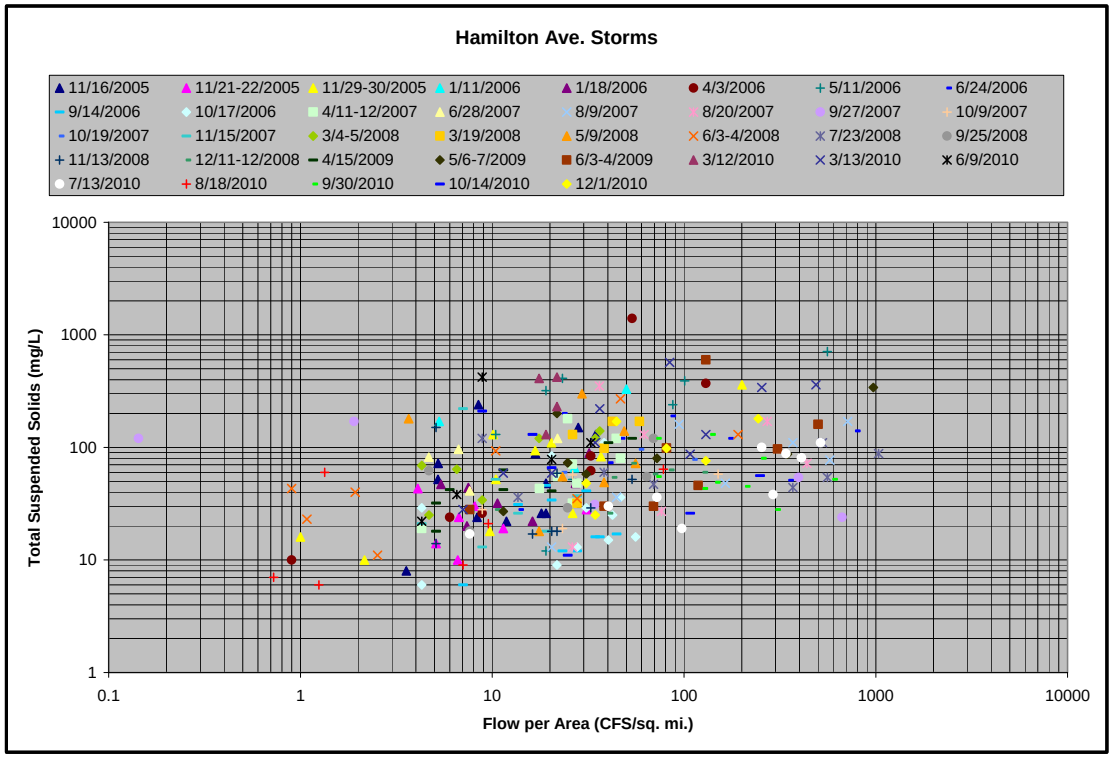


Figure G1a.19 Radecke Avenue Discrete Storm Samples Total Suspended Solids Versus Flow per Area Coded by Storm Feb. 2005-Oct. 2009

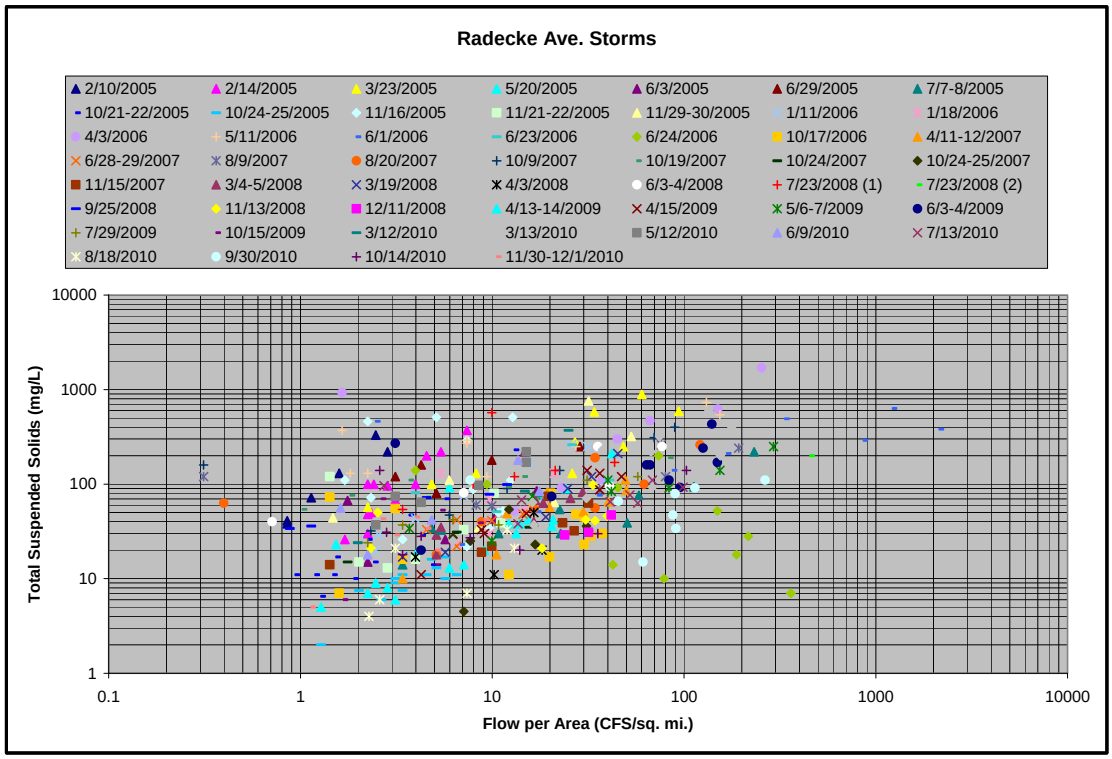


Figure G1a.20 Hamilton Ave. Discrete Storm Samples Volatile Suspended Solids Versus Flow per Area Coded by Storm Nov. 2005-Jun. 2009

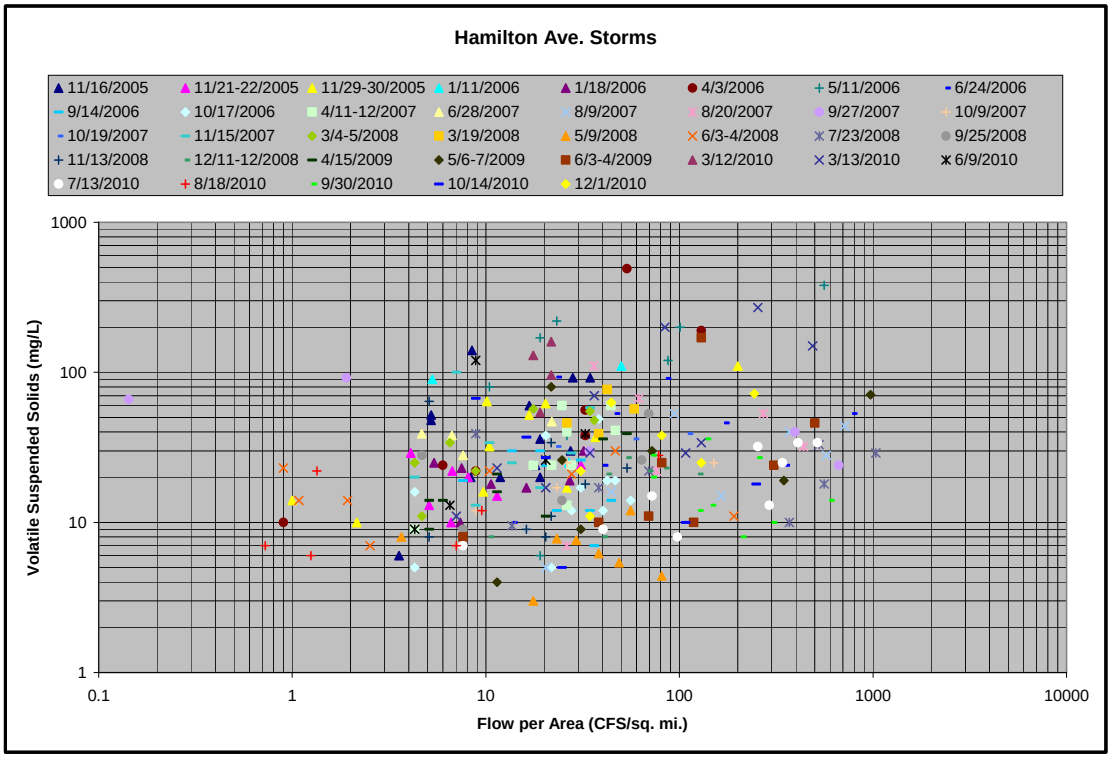


Figure G1a.21 Radecke Avenue Discrete Storm Samples Volatile Suspended Solids Versus Flow per Area Coded by Storm Feb. 2005-Oct. 2009

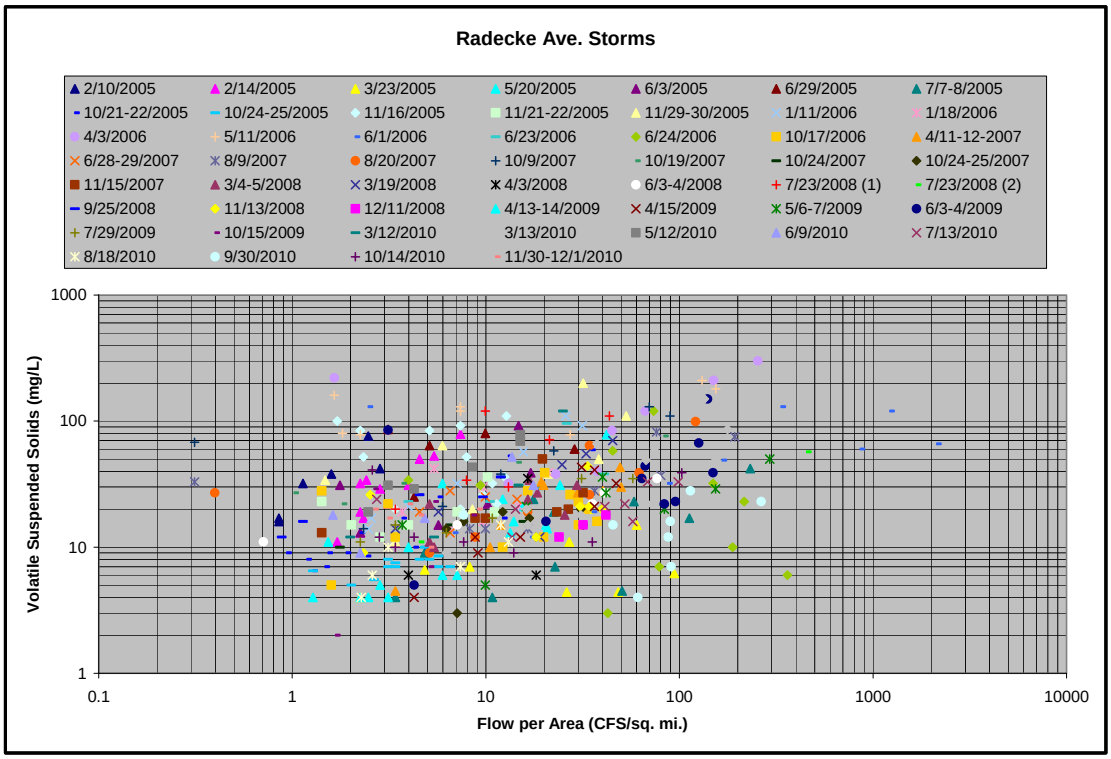


Figure G1a.22 Comparison of Storm EMCs for Total & Volatile Suspended Solids from the Hamilton Avenue & Radecke Avenue Stations

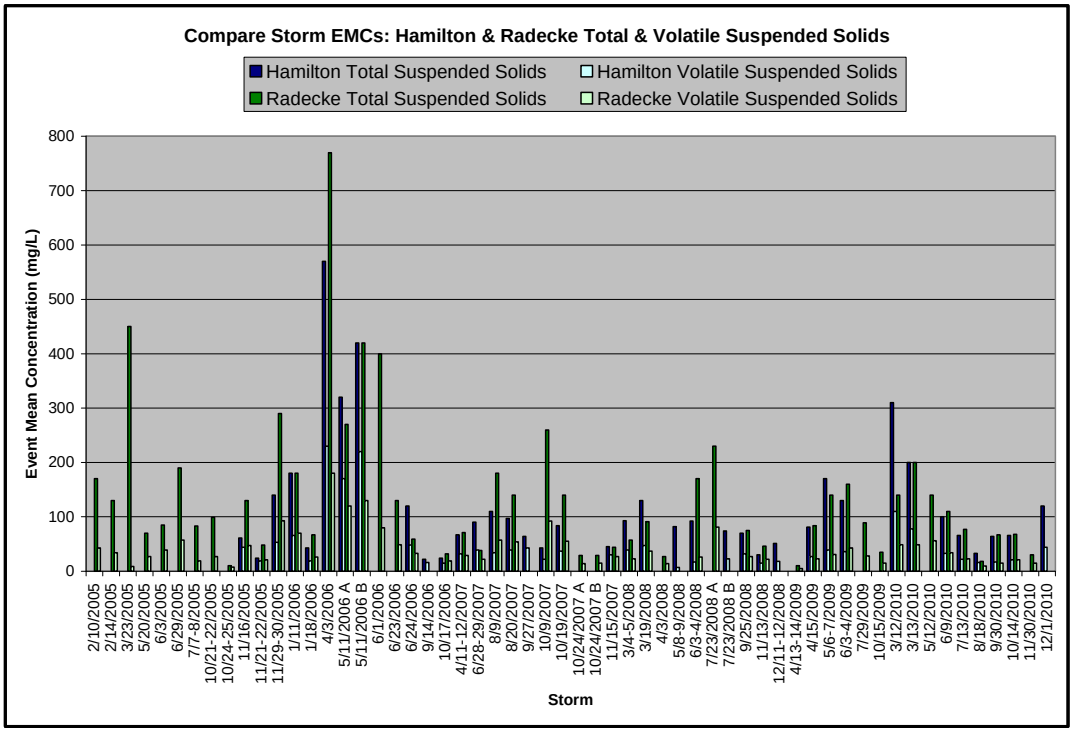
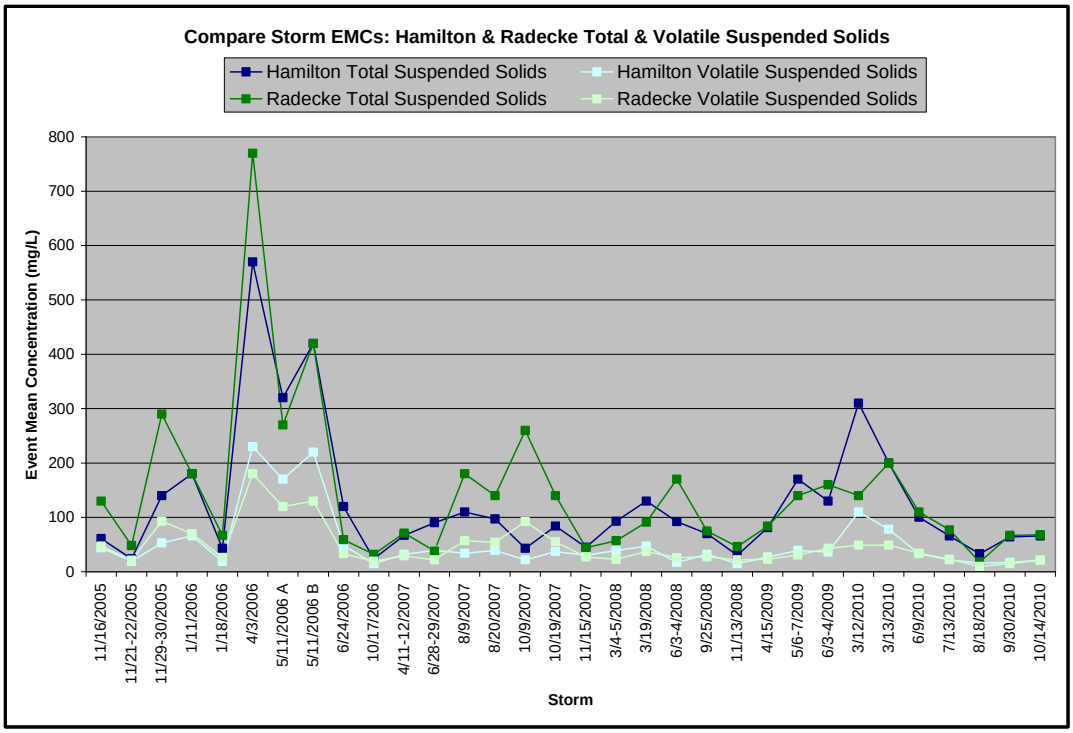


Figure G1a.23 Comparison of Storm EMCs for Total & Volatile Suspended Solids from the Hamilton Avenue & Radecke Avenue Stations When Both Stations Were Successfully Sampled



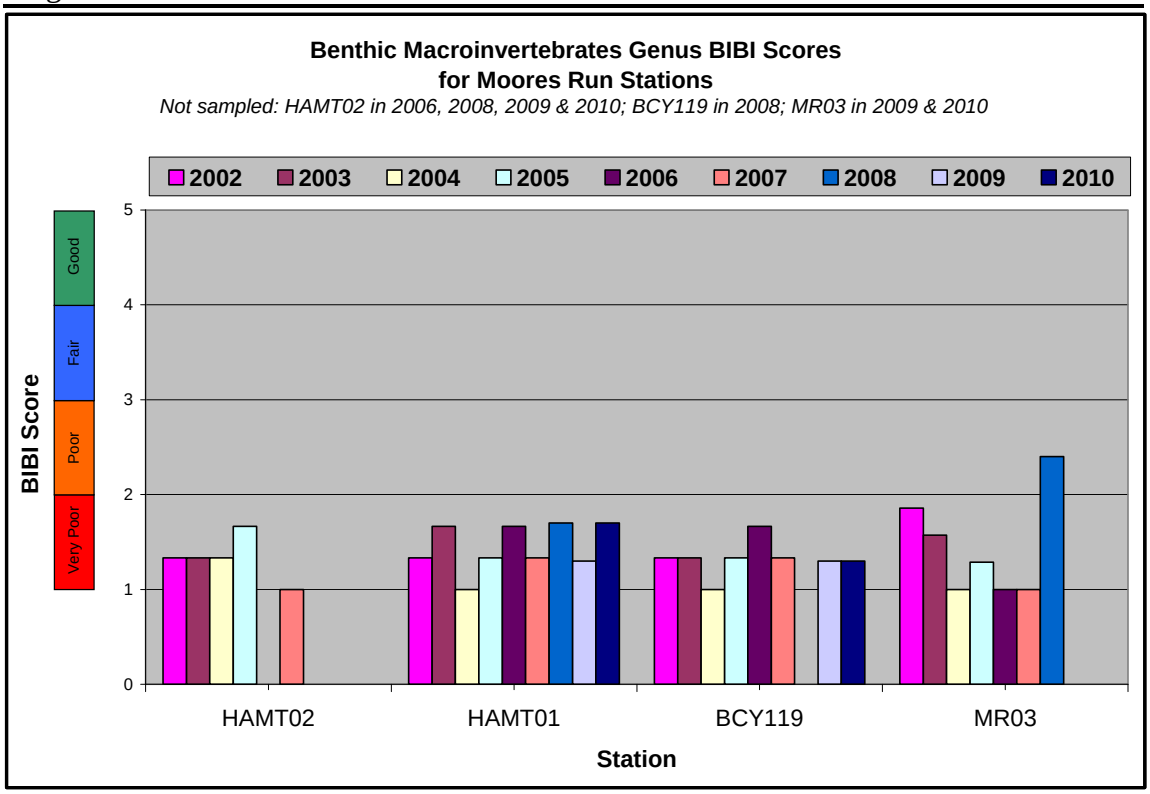
b. **Moores Run Biological Monitoring**

SWMD has conducted biological monitoring for benthic macroinvertebrates at up to four stations each year in the Moores Run: HAMT02, HAMT01, BCY119 and MR03. In 2009 and 2010, only stations HAMT01 and BCY119 were sampled. The sampling plan going forward is to continue sampling at only these two fixed stations and not collect any more samples at HAMT02 or MR03. A record for each macroinvertebrate sample collected from these stations from 2002 through 2010 can be found in the Excel file "Macroinvertebrate Sample Results 2002 through 2010.xls" on the CD-ROM accompanying this report. For more information on the City's biological monitoring efforts please see Section E3, "Watershed Assessment from Biological Monitoring". Table G1b.1 and Figure G1b.1 present the results from benthic macroinvertebrate sampling at the four Moores Run stations for 2002 through 2010. Please note that all of these scores have been computed using the method endorsed by the MBSS in 2005. The score for station HAMT01 very slightly improved from 2009 to 2010. The score of 2.4 for MR03 in 2008 is the only sample for these stations so far that has achieved a rating as high as "poor"; all other samples have been rated as "very poor".

Table G1b.1 Moores Run Benthic Macroinvertebrate Genus BIBI Scores 2002-2010

Station	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
HAMT02	1.3	1.3	1.3	1.7	---	1.0	---	---	---
HAMT01	1.3	1.7	1.0	1.3	1.7	1.3	1.7	1.3	1.7
BCY119	1.3	1.3	1.0	1.3	1.7	1.3	---	1.3	1.3
MR03	1.9	1.6	1.0	1.3	1.0	1.0	2.4	---	---

Figure G1b.1 Moores Run Benthic Macroinvertebrate BIBI Scores 2002-2010



c. **Physical Monitoring**

i. Geomorphologic Stream Assessment of Moores Run

The City did not conduct a hydrogeomorphological assessment of the Moores Run during 2010.

ii. Stream Habitat Assessment

SWMD performed a habitat assessment survey of the upper Moores Run watershed on March 3, 2011. The watershed is located in a highly residential area. The survey area covered Moores Run from the quadruple cell outfall at Hamilton Avenue to Radecke Avenue. The watershed survey also included the Moores Run tributary at Todd Avenue. This survey followed the protocols set forth in the Stream Habitat Assessment section in the Maryland Biological Stream Survey (MBSS) Sampling Manual, February 2001, which instructs surveyors to note the following parameters: instream habitat, epifaunal substrate, velocity/depth diversity, pool/glide/eddy quality, riffle/run quality, embeddedness, shading and trash rating. Since the surveys were conducted between March and May, the percent shading data was excluded from the tables below since the leaves had not reached their full growth. Additional parameters used in this survey were channel

alteration, bank vegetative protection, condition of banks and riparian vegetative zone. Each habitat parameter, except percent embeddedness, was rated with a numerical score. Each score was ranked in one of four categories. The categories from best to worst are optimal, suboptimal, marginal and poor.

Tables G1cii.1 and G1cii.2 show a comparison of the scores from the surveys done for the following reports:

- 2004 Annual Report (May 18, 2005),
- 2005 Annual Report (May 1, 2006),
- 2006 Annual Report (April 2, 2007),
- 2007 Annual Report (May 5, 2008),
- 2008 Annual Report (April 30, 2009),
- 2009 Annual Report (March 24, 2010) and
- 2010 Annual Report (March 3, 2011).

The following discussion compares the past two habitat assessments (March 24, 2010 and March 3, 2011). Additionally, in the Excel file "Moores Run Habitat Assessments 2005 through 2011 Graphs.xls" on the CD-ROM accompanying this report, there is a bar graph for each segment for each parameter showing the scores for each year's assessment for that parameter for that segment. An example of these bar graphs is shown in Figure G1cii.1.

Instream habitat: Segment 4 rating increased from poor to marginal. Segment 5 rating increased from suboptimal to optimal. Segments 6 and 7 rating decreased from optimal to suboptimal.

Epifaunal substrate: Segments 1, 2, and 5 rating increased from suboptimal to optimal. Segment 8 rating decreased from suboptimal to marginal.

Velocity/Depth diversity: Segments 2, 3, 6, and the Moores Run tributary rating decreased from suboptimal to marginal. Segments 4 and 8 rating increased from marginal to suboptimal.

Pool/glide/eddy quality: Segments 1, 6, 8, and 10 rating increased from marginal to suboptimal. Segment 4 rating increased from suboptimal to optimal.

Riffle/run quality: Segments 2, 3, and 5 rating increased from suboptimal to optimal. Segment 4 rating increased from poor

to suboptimal. Segment 10 and the Moores Run tributary rating increased marginal to suboptimal.

Embeddedness: Segment 4 rating increased from poor to suboptimal. Segment 6 decreased from suboptimal to marginal.

Trash rating: Segment 3 rating increased from poor to marginal. Segment 11 rating increased from suboptimal to optimal. The Moores Run tributary rating decreased from suboptimal to marginal.

Channel alteration: There was no significant change in rating in Moores Run and the Moores Run tributary.

Bank vegetative protection: Segments 3, 6, and 7 rating decreased from optimal to suboptimal. The Moores Run tributary rating increased from suboptimal to optimal.

Condition of banks: Segments 3, 6 and the Moores Run tributary rating decreased from optimal to suboptimal. Segments 5 and 10 rating increased from suboptimal to optimal.

Riparian vegetative zone: Segments 1 and 6 rating decreased from marginal to poor. Segment 8 rating decreased from suboptimal to marginal. Segment 9 rating decreased from optimal to marginal.

Figure G1cii.1 Moores Run Habitat Assessment Scores 2005-2009 (Part I)

	Moores Run above Radecke Ave. Segments											
	1	2	3	4	5	6	7	8	9	10	11	Tributary
Parameter												
Instream Habitat												
2005	16	16	16	4	16	16	16	16	13	16	1	13
2006	15	16	15	4	15	15	15	14	13	14	1	13
2007	15	14	16	4	15	11	15	14	13	15	1	15
2008	15	15	17	4	15	11	11	15	14	14	1	12
2009	12	14	13	13	13	15	15	15	13	15	3	10
2010	16	16	18	5	12	17	16	16	13	15	1	15
2011	17	18	18	6	17	14	14	16	15	15	1	14
Epifaunal Substrate												
2005	16	16	16	1	16	16	15	16	13	16	1	14
2006	14	15	15	4	15	15	14	14	10	14	0	14
2007	15	14	15	5	15	10	12	10	10	14	0	10
2008	14	14	17	4	14	10	8	12	11	14	0	12
2009	10	12	11	11	11	15	13	14	13	15	10	7
2010	15	14	17	8	11	12	14	11	11	10	7	15
2011	16	17	17	8	16	14	13	9	12	10	6	13
Velocity/Depth Diversity												
2005	8	10	14	6	8	8	8	10	8	9	11	8
2006	8	10	10	6	11	8	8	11	10	10	6	8
2007	10	13	12	6	6	8	8	10	9	10	6	10
2008	8	12	15	6	11	9	9	12	8	9	6	8
2009	11	11	13	8	10	15	14	15	13	15	2	10
2010	10	15	14	8	10	11	13	8	12	10	11	15
2011	10	10	10	11	10	10	14	15	15	10	12	10
Pool/Glide/Eddy Quality												
2005	5	7	12	13	10	8	10	15	12	3	13	1
2006	5	7	10	16	10	8	10	11	12	3	8	1
2007	5	7	11	16	11	10	9	10	11	4	10	1
2008	8	14	12	17	12	12	10	14	13	3	8	1
2009	9	10	13	12	7	9	13	12	11	11	13	5
2010	8	12	12	13	11	8	13	10	11	9	13	3
2011	14	14	13	17	14	13	14	15	15	13	15	3
Riffle/Run Quality												
2005	11	13	11	3	12	12	13	14	10	14	2	7
2006	11	13	11	2	11	13	13	14	12	14	2	7
2007	13	15	13	2	13	13	12	14	13	15	0	8
2008	13	13	13	1	15	15	14	14	13	13	1	6
2009	18	12	15	1	6	13	16	15	8	11	1	8
2010	12	12	13	1	13	13	13	13	11	10	2	9
2011	15	17	18	14	17	13	15	15	15	15	1	11
Embeddedness (%)												
2005	50	50	50	0	60	70	50	50	70	50	0	50
2006	50	50	50	0	60	60	60	60	60	50	0	50
2007	60	60	50	75	60	60	60	50	60	50	0	50
2008	40	50	50	0	50	60	50	50	50	50	0	50
2009	10	50	50	70	50	30	20	20	30	20	0	70
2010	40	40	40	0	40	30	30	30	40	40	0	40
2011	50	50	50	50	50	60	50	50	50	50	0	50

Scoring Color Code

Score	Category	Color Code
16 to 20	optimal	
11 to 15	suboptinal	
6 to 10	marginal	
1 to 5	poor	

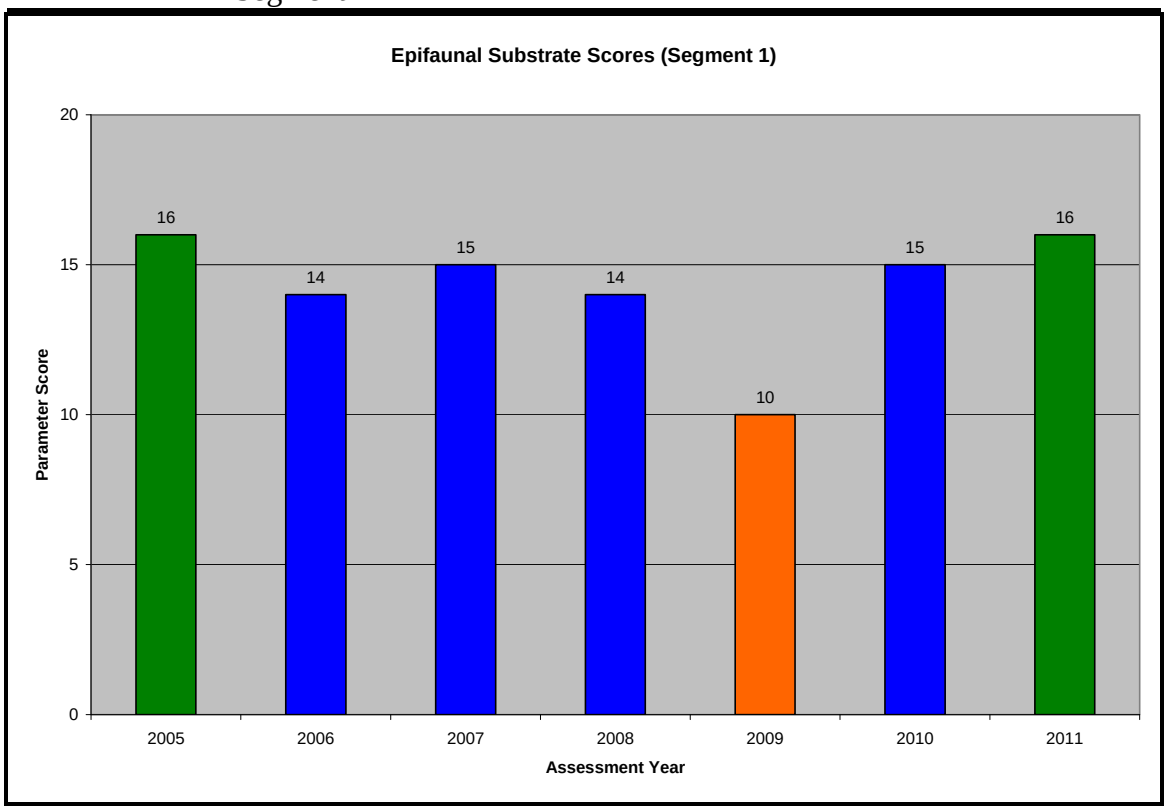
Figure G1cii.2 Moores Run Habitat Assessment Scores 2005-2009 (Part II)

	Moores Run above Radecke Ave. Segments											
	1	2	3	4	5	6	7	8	9	10	11	Tributary
Parameter												
Embeddedness												
2005	11	11	11	0	9	7	11	11	7	11	0	11
2006	12	11	11	0	9	9	10	10	10	11	0	11
2007	10	10	11	3	10	9	10	11	10	11	0	13
2008	13	13	13	0	13	8	13	13	13	13	0	12
2009	19	11	12	7	11	14	16	16	14	17	0	7
2010	14	14	14	0	14	14	13	14	13	13	0	14
2011	14	14	14	14	14	9	14	14	14	14	0	14
Trash Rating												
2005	11	8	4	8	9	8	11	7	5	7	9	11
2006	8	11	11	10	10	11	8	12	3	9	18	11
2007	8	8	7	12	11	10	9	10	5	10	18	15
2008	8	8	3	8	6	6	5	5	3	8	18	13
2009	8	8	3	9	9	8	9	8	8	10	13	6
2010	8	8	3	8	13	8	8	10	7	11	12	13
2011	6	6	8	6	13	9	10	6	7	12	18	8
Channel Alteration												
2005	16	16	16	16	16	16	16	16	17	17	1	13
2006	16	16	16	16	16	16	16	16	17	14	1	13
2007	16	16	16	16	16	16	16	16	16	15	1	15
2008	17	17	17	17	16	17	17	17	17	15	1	13
2009	15	16	16	17	16	16	16	16	16	17	1	12
2010	18	18	18	18	16	17	18	17	18	15	2	15
2011	17	17	17	17	16	17	17	17	17	15	1	15
Bank Vegetative Protection												
2005	11	12	15	15	15	15	18	16	17	11	2	8
2006	11	13	16	16	14	16	16	16	17	10	2	8
2007	12	12	16	16	14	14	16	14	16	10	2	10
2008	14	14	17	15	15	16	13	12	17	10	2	8
2009	20	18	18	20	16	13	19	15	14	13	1	20
2010	18	18	17	17	14	18	16	16	18	14	2	15
2011	17	16	15	17	14	13	15	16	16	13	2	16
Condition Of Banks												
2005	18	18	14	18	18	14	16	17	16	8	20	18
2006	18	13	14	18	18	14	16	17	15	16	20	18
2007	18	14	15	18	13	14	15	16	14	15	20	16
2008	18	17	16	16	18	14	15	16	18	16	20	18
2009	17	12	13	11	17	10	10	18	15	11	20	5
2010	18	17	16	16	15	17	14	17	18	15	20	18
2011	18	16	15	16	16	14	15	16	16	16	20	14
Riparian Vegetative Zone												
2005	7	7	9	12	6	6	9	11	10	9	2	2
2006	7	7	10	14	6	6	8	11	10	6	2	2
2007	7	4	8	15	6	6	11	11	10	6	2	2
2008	8	9	12	15	6	6	7	15	12	7	2	2
2009	2	4	8	13	5	4	7	10	16	16	5	4
2010	10	7	10	15	10	6	8	15	16	3	2	6
2011	4	8	8	12	8	4	9	10	7	4	2	7

Scoring Color Code

Score	Category	Color Code
16 to 20	optimal	
11 to 15	suboptinal	
6 to 10	marginal	
1 to 5	poor	

Figure G1cii.1 Moores Run Habitat Assessment: Epifaunal Substrate Scores for Segment 1



iii. Hydrologic Model

No work was performed on a hydraulic assessment for Moores Run during 2010. The City plans to perform this work in 2012, pending funding.

2. Stormwater Management Assessment

This section of the permit requires the City to evaluate the effectiveness of stream restoration as a BMP focusing on the Stony Run Projects. The City plans to perform this assessment in 2012, pending funding. The City continues to collect biological and chemical monitoring data in Stony Run. A discussion of these results can be found in Section F2, "Restoration Monitoring".

H. Program Funding

Table H.1 presents a breakdown of the City's budget for activities related to the City's stormwater discharge permit for Fiscal Years 2005 through 2011. The City's fiscal year spans July 1st through June 30th (i.e., Fiscal Year 2011 began July 1, 2010 and ended on June 30, 2011).

Table H.1 Fiscal Analyses (Rounded to Nearest Hundreds)							
Permit Condition	**Fiscal Year 2005**	**Fiscal Year 2006**	**Fiscal Year 2007**	**Fiscal Year 2008**	**Fiscal Year 2009**	**Fiscal Year 2010**	**Fiscal Year 2011**
B. Legal Authority	$0	$0	$0	$0	$0	$0	$182,000
C. Source Identification							
1. GIS	$24,500	$24,700	$25,200	$26,700	$28,800	$15,200	$15,200
2. Database Maintenance	$36,800	$36,200	$41,200	$41,200	$43,400	$43,400	$43,400
D. Management Programs							
1. Stormwater Management	$283,100	$297,300	$329,200	$605,000	$401,300	$300,400	$298,100
2. Pollution Prevention	$413,700	$406,400	$460,700	$464,600	$437,800	$436,700	$436,700
3. Erosion and Sediment	$240,900	$240,900	$279,200	$493,800	$278,900	$232,000	$271,100
4. Public Education	$36,700	$37,000	$41,600	$41,200	$44,100	$127,900	$143,560
5. Road Maintenance							
Street Sweeping	$2,136,500	$2,297,800	$2,504,100	$2,862,200	$2,984,500	$2,984,500	$3,698,391
Inlet Cleaning	$3,365,800	$4,350,900	$4,635,000	$4,150,300	$4,860,400	$4,660,600	$4,085,828
E. Watershed Assessment & Planning							
1. Assessment/evaluation	$936,000	$843,600	$1,117,600	$2,319,400	$768,200	$1,171,900	$1,230,500
2. Restoration Projects	$704,600	$6,225,300	$216,500	$222,300	$2,594,900	$3,176,600	$3,335,440
F. Watershed Restoration							
1. 20% Restoration	$54,000	$54,700	$59,300	$910,800	$65,300	$63,700	$74,240
2. Water Quality Improvement Monit.	$58,600	$66,400	$75,000	$74,300	$62,400	$58,100	$58,100
G. Assessment of Controls							
1. Chemical Monitoring	$40,300	$43,500	$48,600	$45,100	$47,800	$35,000	$35,000
2. Biological Monitoring	$7,900	$7,800	$9,200	$9,300	$8,800	$8,500	$8,500
3. Physical Stream Assessment	$38,800	$1,900	$39,300	$2,200	$2,300	$2,300	$2,300
4. Design Manual Monitoring	$0	$21,600	$0	$0	$0	$0	$0
Sub-Total	**$8,378,200**	**$14,956,000**	**$9,881,700**	**$12,268,400**	**$12,628,900**	**$13,316,800**	**$13,316,800**
General Expenses SWMD (Cover Many Permit Conditions)	$235,600	$317,800	$299,800	$387,200	$304,200	$329,200	$329,200
Grand Total	**$8,613,800**	**$15,273,800**	**$10,181,500**	**$12,655,600**	**$12,933,100**	**$13,646,000**	**$13,646,000**