BALTIMORE COUNTY

Baltimore County Executive Kevin Kamenetz
and the County Council

NPDES - Municipal Stormwater Discharge Permit

2015 Annual Report

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Department of Environmental Protection and Sustainability
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1.0 Permit Requirements

A. Permit Administration

Baltimore County shall designate an individual to act as liaison with the Maryland Department of the Environment (MDE) for the implementation of this permit. The County shall provide the coordinator's name, title, address, phone number, and email address. Additionally, the County shall, in its annual reports, submit to MDE an organizational chart detailing personnel and groups responsible for major NPDES program tasks in this permit. MDE shall be notified of any changes in personnel or organization relative to NPDES program tasks.

B. Legal Authority

Baltimore County shall maintain adequate legal authority in accordance with NPDES regulations 40 CFR Part 122.26 throughout the term of this permit. In the event that any provision of its legal authority is found to be invalid, the County shall notify MDE within 30 days and make the necessary changes to maintain adequate legal authority. All changes shall be included in the County's annual report.

1.1 Permit Administration

The designated individual to act as a liaison with Maryland Department of the Environment is:

Steve Stewart
Manager, Watershed Management and Monitoring Section
Baltimore County Department of Environmental Protection and Sustainability
111 West Chesapeake Avenue, Room 319
Towson, MD 21204
410-887-7678
sstewart@baltimorecountymd.gov

The major NPDES program tasks are listed in Table 1-1, along with the Baltimore County Departments and associated bureaus or sections responsible for implementation. The County has designated an NPDES Management Committee, composed of representatives from agencies involved in NPDES activities, that meets on a periodic basis for updates and coordination.

There were no major organizational changes over the last year.

Table 1-1: Major NPDES Program Tasks and Responsible Baltimore County Agencies

NPDES Program Task	Department - Section
Program Administration	EPS – Watershed Management and Monitoring
Legal Authority	EPS- Administration Office of Law
Source Identification	EPS – Watershed Management and Monitoring OIT – Geographic Information Systems
Stormwater Management – Review Stormwater Management – Inspections Stormwater Facility Maintenance	EPS– Stormwater Management

Erosion and Sediment Control	PAI – Building and Inspection Section
Illicit Discharge Detection and Elimination	EPS – Watershed Management and Monitoring Health Department – Environmental Health Section
County Property Management and Maintenance	DPW – Highways Bureau DPW – Utilities Bureau Office of Budget and Finance – County Property Management Section, Vehicle Operations and Maintenance Community College of Baltimore County Baltimore County Public Schools
Road Maintenance	DPW – Highways Bureau – Street Sweeping DPW – Utilities Bureau – Storm Drain Cleaning
Public Education	EPS – All Sections
Watershed Assessment and Planning	EPS – Watershed Management and Monitoring
Watershed Restoration	EPS – Watershed Restoration Section EPS – Sustainability & Forest Management Section DPW – Storm Drains Design
Assessment of Controls	EPS – Watershed Management and Monitoring
Program Funding	EPS – Finance and Administration
Total Maximum Daily Loads	EPS– Watershed Management and Monitoring
Annual Report	EPS – Watershed Management and Monitoring
Reapplication for NPDES Permit	EPS – Watershed Management and Monitoring

EPS = Department of Environmental Protection and Sustainability
DPW = Department of Public Works
OIT = Office of Information Technology
PAI = Permits, Approvals and Inspections

1.2 Legal Authority

The County continues to maintain adequate legal authority in all areas related to implementation of its NPDES permit. The only regulatory change in FY2015 was to the fee structure of the Stormwater Remediation Fee.

1.2.1 Stormwater Remediation Fee

As required by the State legislature (HB987, passed in 2012) Baltimore County enacted a stormwater remediation fee with the passage of County Council Bill 20-13 (http://www.baltimorecountymd.gov/countycouncil/legislation/13bills.html) on March 18, 2013. This bill establishes the Stormwater Remediation Fee, and

- details the uses of the funds collected through the fee,
- sets the initial fee rates,
- provides for an appeal process,
- provides for hardship exemptions for land owners that meet qualifications,
- provides for fee reduction credits,
- provides for annual review of rates by the County Executive and submission to the County Council for approval, and
- requires a biennial report on the amount of fee collected and the uses of the funds starting July 1, 2014.

The County Council passed County Council Bill No. 9-15 on February 2, 2015 that established a new rate structure for the Stormwater Remediation Fee.

Further details may be found by accessing the County Council Bill through the link provided above, or through the informational webpage:
http://www.baltimorecountymd.gov/Agencies/budfin/customerservice/taxpayerservices/stormwaterfee.html

2.0 Permit Requirements

C. Source Identification

Sources of pollutants in stormwater runoff countywide shall be identified and linked to specific water quality impacts on a watershed basis. The source identification process shall be used to develop watershed restoration plans. The following information shall be submitted annually for all County watersheds within the permit area in geographic information system (GIS) format with associated tables as required in PART V of this permit:

1. Storm drain system: all infrastructure, major outfalls, inlets, and associated drainage areas delineated;
2. Industrial/Commercial sources: industrial and commercial land uses and sites that the County has determined have the potential to contribute significant pollutants;
3. Urban best management practices (BMPs): stormwater management facility data including outfall locations and delineated drainage areas;
4. Impervious surfaces: public and private land use delineated, controlled and uncontrolled impervious areas based on, at a minimum, Maryland hierarchical eight-digit sub-basins;
5. Monitoring locations: locations established for chemical, biological, and physical monitoring of watershed restoration efforts and the *2000 Maryland Stormwater Design Manual*; and
6. Water quality improvement projects: projects proposed, under construction, and completed with associated drainage areas delineated.

PART V. PROGRAM REVIEW AND ANNUAL PROGRESS REPORTING

A. Annual Reporting

2. To enable MDE to evaluate the effectiveness of permit requirements, the following information shall be submitted in a format consistent with Attachment A:

   a. Storm drain system mapping (PART IV.C.1);
   b. Urban BMP locations (PART IV.C.2);
   c. Impervious surfaces (PART IV.C.3);
   d. Water quality improvement locations (PART IV.C.6);
   e. Monitoring site locations (PART IV.C.4);
   f. Chemical monitoring results (PART IV.F.1);
   g. Pollutant load reductions (PART IV.E.4 and IV.F.1);
   h. Biological and habitat monitoring (PART IV.F.1)

i. Illicit discharge detection and elimination activities (PART IV.D.3);

j. Responsible personnel certification information (PART IV.D.1);

k. Grading permit information – quarterly (PART IV.D.2);

l. Fiscal analyses – cost for NPDES related implementation (PART IV.G).

This section describes the Geographic Information System (GIS) data layers and the databases submitted with the Annual Report. The GIS data layers are described in Section 2.1. Section 2.2 describes the databases that have been created for the NPDES Report, along with data sources and limitations. Table 2-2, at the end of this section identifies the file folders and locations of the mentioned GIS data layers and databases, along with additional databases that have been created to meet NPDES MS4 Permit requirements.

2.1 Source Identification – Geographic Information System Data Layers

The GIS Data Layers are discussed below along with the associated databases contained in the Attachment A Excel file. Table 2-1 summarizes the relationship between the section discussion, the GIS data layer, and the Attachment A Excel file database tab.

Table 2-1: Relationship between Source Identification Topic, Section Discussion, and Attachment A Databases

Source Identification Topic	Section Discussion	GIS Layers	Attachment A Tab
Storm Drain System Mapping	2.1.1	outfall_maj.shp outfall_min.shp StormDrains geodatabase OutfallDrainageAreas geodatabase: sdOutfallDrainageArea	A
Industrial/Commercial Sources	2.1.2	BUSINESS2014.shp	None
Urban Best Management Practices	2.1.3	SWMfacilities geodatabase: sdSWMPondPoint sdSWMDrainageArea	B
Impervious Surfaces	2.1.4	ImperviousSurfaces geodatabase: IMPERV_BASELINE_2002_FINAL …RESTORATION_C	C
Monitoring Locations	2.1.5	MonitoringLocations geodatabase: …Bacteria …Biological_Geomorph_Monitoring …Random …Scotts_Level_Chemical_Monitoring …Tidal …Trash_Monitoring …Trend …SCOTTS_LEVEL_LU …SCOTTS_LEVEL_BMP …DrainageAreas	E E1 and E2
Water quality improvement projects	2.1.6	WQIP geodatabase <various feature classes>	D

Baltimore County continues to prepare for migration to the MDE NPDES geodatabase. In 2016, an analysis of existing business practices and database infrastructure will be

performed. This analysis will become the basis for a migration plan, and the eventual migration from Attachment A to the MDE NPDES geodatabase.

2.1.1 Storm Drain System

The storm drain system GIS geodatabase has been submitted with this year's report in the 2015 GIS Datalayers folder. Inside the URDL, the stormdrain system features were captured by a consultant digitizing construction drawings. Outside the URDL, the stormdrain system features were captured using GPS followed by editing in the office. The inside and outside the URDL data has been combined into a single geodatabase, found on the accompanying CD under Data/2015 GIS Datalayers/Storm Drain System. The depiction of the storm drain system in this geodatabase remains incomplete: some systems have no outfalls, and state and private storm drain systems are not included.

The storm drain system is also represented by two files for the outfall locations, outfall_maj.shp and outfall_min.shp. The drainage areas to the major outfalls are presented in the OutfallDrainageAreas.gdb geodatabase. These three files can be found on the accompanying CD under Data/2015 GIS Datalayers/Storm Drain System. The database for the storm drain system mapping with associated GIS coverage can be found in Attachment A tab A. Here the outfall ID is shown with the dimensions, watershed code, outfall type and associated drainage area and predominant land use.

2.1.2 Industrial/Commercial Sources

A database of businesses located in Baltimore County attributed with North American Industry Classification System (NAICS) codes was obtained from Infogroup during 2014, containing 32,049 records. Place of business addresses were geocoded, creating a GIS data layer with 27,875 records. The Excel file, GIS shapefile, and a code sheet are located under Data/2015 GIS Datalayers/IndustrialCommercialSources.

Baltimore County is still evaluating the suitability of this data for identifying potential pollution sources. We intend to query the database for high pollution potential NAICS codes, and do field investigations on a sample of the records returned. Results will guide both the further prioritization of field investigations, and the use of this particular database. Address accuracy and closed businesses are a concern: 4,174 records (13%) contained erroneous or incomplete addresses information and could not be geocoded. Similarly, the Baltimore County Department of Economic Development utilized the database for mailing and telephone campaigns, and found that ~20% of addresses were undeliverable and ~40% of phone numbers were out of service.

2.1.3 Urban Best Management Practices

The urban best management practices are represented by two feature classes, Stormwater_Network\sdSWMPondPoint and Stormwater_Areas\sdSWMDrainageArea, stored in the SWMfacilities.gdb geodatabase. These layers are located under Data/2015 GIS Datalayers/Urban Best Management Practices. The locations layer displays the site of the stormwater management facilities as a point, while the drainage area layer displays the drainage areas to constructed facilities.

Attachment A tab B contains the database for the above mentioned data layers. It includes the structure type, location, land use, drainage areas, other attributes necessary

for pollutant load and impervious surface credit calculations, and other information requested by MDE.

The location data layer will have errors due to incorrect coordinates in County databases. Some of this is historical, as until 2000 the County required engineers to submit drawings based on the Baltimore County Metropolitan District coordinate system. Conversion to Maryland State Plane resulted in errors in point locations and shifting of drainage areas.

2.1.4 Impervious Surfaces

The impervious surfaces in Baltimore County are represented by one layer showing the 2002 baseline, with ownership, watershed, and SWM BMP treatment credit level information. These layers are located under Data/2015 GIS Datalayers/Impervious surfaces. The data were created based on aerials flown in 1995, 1996, 1997, 2001, and 2005, with modifications made based on razing and construction permits issued between those years and the 2002 baseline year.

The data includes all residential, commercial, and industrial buildings, sheds, barns and other accessory structures, and roads and parking lots. It does not include residential driveways, except those longer than 200 feet. Sidewalks are not depicted.

Attachment A tab C contains the database for the impervious surfaces with associated GIS coverage. It includes the 2002 baseline impervious acreage and the amount treated by BMPs. The impervious acreage proposed and under construction for watershed restoration was not calculated for this reporting year.

2.1.5 Monitoring Locations

Monitoring locations for Baltimore County are presented in the five separate GIS files, one for chemical monitoring, one for biological monitoring, one for trash monitoring, one for bacteria monitoring and one for geomorphological monitoring. The files are located under Data/2015 GIS Datalayers/Monitoring Locations in a GIS file geo-database.

Attachment A tab E contains the database for all current monitoring sites in Baltimore County, which includes water quality trend, bacteria, trash, geomorphic and biological. It includes the site location, watershed code and associated drainage area (when possible). The additional databases E.1 and E.2 have been completed for this reporting year. They include the predominant land use and ranking of the multiple BMPs within each drainage area for the Scotts Level and Spring Branch chemical monitoring sites.

2.1.6 Water Quality Improvement Projects

The WQIP.gdb geodatabase is submitted with this report. When possible, data is stored with the geometry type indicated by the MDE NPDES geodatabase. The data in this geodatabase is used to calculate the pollutant load reductions and impervious surface restoration that result from stream restoration, shoreline enhancement, tree planting, impervious surface removal, street sweeping, storm drain and inlet cleaning, and septic practices. It is located under Data/2015 GIS Datalayers/Water quality improvement projects.

Attachment A tab D contains the database for the various water quality improvement projects. It contains the structure type, land use, drainage area (when possible), pounds

removed by street sweeping and inlet cleaning, attributes necessary for pollutant load and impervious surface credit calculations, and other information requested by MDE.

2.2 Databases

All databases can be found in Attachment A on the accompanying CD under the file folder named Data, sub file NPDES Required Databases. Each type of monitoring has its own tab in the Attachment A Excel spreadsheet.

2.2.1 Chemical Monitoring Results

Databases containing the raw baseflow monitoring data, storm event and baseflow monitoring data from Scotts Level Branch can be found in the 2015 Chemical Data file folder. Also included is the file containing the Scotts Level Branch in-stream gage data and the calculated pollutant concentrations and loads at 15-minute intervals. The final database contains the calculated EMCs for each storm at the Scotts Level Branch in-stream monitoring site. The chemical monitoring site locations can be found in Attachment A tab E along with the results in tab F.

2.2.2 Pollutant Load Reductions

Pollutant load reductions from various County projects and County funded projects are shown in Attachment A tab G. It contains the pre-treatment load and load reductions by the associated BMP for total nitrogen, total phosphorus and total suspended solids.

2.2.3 Biological and Habitat Monitoring

Attachment A tab H contains the annual reporting database for biological and habitat monitoring. Several databases, stored in the 2014 Data folder under the 2014 Biological Data sub folder, contain biological macroinvertebrate, fish assemblage, and habitat data collected by Baltimore County from 2003 through 2014. The random point biological data is presented in two Access97 databases titled – Benthic EDAS 2014.mdb and Benthic EDAS 2015.mdb. This Access application was created by Tetra Tech, Inc for the specific purpose of calculating biological and habitat metric data in accordance with the Maryland Biological Stream Survey (MBSS) protocols. In addition, benthic macroinvertebrate data is summarized is an Excel file titled BC_Random_Benthic_20082014_BIBI.xls. Fish assemblage data is presented in four Access97 databases titled Fish_Reference.mdb, Fish_restoration.mdb, Fish_Scotts.mdb, and Fish_Sentinel.mdb, and is summarized in an Excel file titled MFSum-MBSSPied_2014_CompiledSites.xls. Habitat data is summarized in an Excel file titled PHI Worksheet_WORK_2014.xls.

Four Excel spreadsheet files in the 2014 Data folder under the 2014 Geomorphic Data sub folder contain the geomorphological data. These files are:

- Scotts Level 2015.xls – This file contains data from the 20 cross section in Scotts Level Branch, including the overlay charts from previous years, and the calculations of cut/fill volumes
- Scotts Level Geo Pollutant Load Calcs.xls – Contains monitoring site characteristics and pollutant load calculations derived from the cut/fill volumes from Scotts Level 2015.xls.

- WRCX 2015.xls – Contains the cross section data for Windlass Run
- Powder Mill 2015.xls – Contains the cross section data for Powder Mill Run

2.2.4 Illicit Discharge Detection and Elimination Activities

The results from the illicit discharge monitoring program are presented in Attachment A tab I. Since the inception of the program only major outfalls were screened, however we initiated the screening of minor outfalls in CY 2012 and now report screening results for both major and minor outfalls.

2.2.5 Responsable Personnel Certification Information

A database of Responsible Personnel Certification has been submitted with this report and the information is displayed in Attachment A tab J.

2.2.6 Grading Permit Information

Grading permit information is presented in Attachment A tab K. This includes all grading permits from July 1, 2013 through June 30, 2014.

2.2.7 Fiscal Analyses

The database for the Fiscal Analyses indicating the cost for NPDES related implementation has not been submitted with this report. Baltimore County will have to work on developing methodology for translating expenditures into the various categories. Since many departments, bureaus, and sections address the requirements of the NPDES MS4 permit, as well as other duties that are not specifically required in the permit, the fiscal analysis will require at a minimum the development of a methodology to determine what portion of a staff person's time is devoted to what NPDES task. Baltimore County would welcome additional dialogue with MDE on development of this database.

Table 2-2: file locations of data layers and databases

Databases	GIS Layer	GIS layer folder	Attachment A EXCEL file Tab	Data folder
Storm drain system mapping	Y	2015 GIS Datalayers/Storm Drain System	A	
Industrial and Commercial Facilities	Y	2015 GIS Datalayers/Industrial Commercial Sources	not applicable	
Urban BMP locations	Y	2015 GIS Datalayers/Urban Best Management Practices	B	
Impervious Surfaces	Y	2015 GIS Datalayers/Impervious Surfaces	C	
Water quality improvement projects	Y	2015 GIS Datalayers/Water Quality Improvement Projects	D	
Monitoring sites	Y	2015 GIS Datalayers/Monitoring Locations	E E1 E2	2015 Geomorphic Data
Chemical monitoring results			F	2015 Chemical Data
Pollutant load reductions			G	
Biological & habitat monitoring			H	2015 Biological Data
IDDE activities			I	
Responsible personnel certification			J	
Grading Permits			K	
Fiscal Analysis			L	

3.0 Permit Requirements

D. <u>Management Programs</u>

1. <u>Stormwater Management</u>

An acceptable stormwater management program shall be maintained in accordance with Environment Article, Title 4, Subtitle 2, Annotated Code of Maryland. Activities to be undertaken by the County shall include, but not be limited to:

a. Implementing the stormwater management design policies, principles, methods, and practices found in the latest version of the *2000 Maryland Stormwater Design Manual*. This includes:

i. Comply with the Stormwater Management Act of 2007 (Act) by implementing environmental site design (ESD) to the MEP for new and redevelopment projects;

ii. Tracking the progress toward satisfying the requirements of the Act and identifying and reporting annually the problems and modifications necessary to implement ESD to the MEP; and

iii. Reporting annually the modifications that have been or need to be made to all ordinances, regulations, and new development plan review and approval process to comply with the requirements of the Act.

b. Maintaining programmatic and implementation information including, but not limited to:

i. Number of Concept, Site Development, and Final plans received. Plans that are re-submitted as a result of a revision or in response to comments should not be considered separate projects;

ii. Number of redevelopment projects received;

iii. Number of stormwater exemptions issued; and

iv. Number and type of waivers received and issued, including those for quantity control, quality control, or both. Multiple requests for waivers may be received for a single project and each should be counted separately, whether part of the same project or plan. The total number of waivers requested and granted for qualitative and quantitative control shall be documented.

Stormwater program data shall be recorded on MDE's annual report database and submitted as required in PART V of this permit.

c. Maintaining construction inspection information according to COMAR 26.17.02 for all ESD treatment practices and structural stormwater

management facilities including the number of inspections conducted and violation notices issued by Baltimore County.

d. Conducting preventative maintenance inspections, according to COMAR 26.17.02, of all ESD treatment systems and structural stormwater management facilities at least on a triennial basis. Documentation identifying the ESD systems and structural stormwater management facilities inspected, the number of maintenance inspections, follow-up inspection, the enforcement actions used to ensure compliance, the maintenance inspection schedules, and any other relevant information shall be submitted in the County's annual reports.

3.1 Introduction

The Stormwater Management Program addresses the impacts on stormwater quantity and quality resulting from new development and redevelopment after the construction phase is complete. These impacts are mainly associated with the increase in impervious area due to the installation of roadways and buildings. Baltimore County has been delegated authority by the State of Maryland to enforce stormwater management regulations. The Stormwater Management Program is located within the EPS – Stormwater Management Section. EPS currently implements the requirements of the 2000 Maryland Stormwater Design Manual, revised in 2009, for new and redevelopment activities. The Stormwater Management Act of 2007 was incorporated into the County's regulations in May 2010. The delegation of this program is periodically reviewed by the Maryland Department of the Environment (MDE) and has consistently passed the review requirements.

The Stormwater Management Program contains several components, including:

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

All inspections of public and private facilities and maintenance of public facilities are conducted by the Stormwater Management Section.

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

3.2.1 Plan Reviews

During fiscal year 2015 the following new plan reviews were conducted:

- Concept Plans – 88
- Site Development Plans – 34
- Final Development Plans – 484

This does not include multiple reviews for the same development project, only new projects. In FY 2015, there were 5 exemptions granted.

3.2.2 Variance and Fee-in-lieu Reviews

A variance in accordance with the Baltimore County Council Bill 33-4-113 may be approved for a project when exceptional circumstances are applicable to the site. This

option is only acceptable to Baltimore County if it is proven to be infeasible to provide stormwater management (SWM) on site and a suitable outfall has been identified for the project. An accompanying fee-in-lieu is generally required with variance approval. The fee-in-lieu money is utilized by EPS's Watershed Restoration Section for water quality restoration projects. In FY 2015, there were a total of 61 variances granted: 21 of those variances required a fee-in-lieu. Projects do not receive their grading permit until the fee-in-lieu money is received. Twelve of the twenty one projects that were approved for fee-in-lieu have not yet paid as of June 30, 2015 and therefore did not start development in fiscal year 2015. Table 3-1 shows the number of projects, amount of fee-in-lieu due, and the fee-in-lieu money received by watershed during fiscal year 2015.

Table 3-1: Fee-in-lieu money received from July 1, 2014 through June 30, 2015

Watershed	# of Projects	Fee-in-lieu Due	Fee-in-lieu Collected
Upper Western Shore			
Deer Creek	0	$0	$0
Prettyboy Reservoir	0	$0	$0
Loch Raven Reservoir	4	$23,808	$18,720
Lower Gunpowder Falls	3	$21,108	$15,600
Little Gunpowder Falls	0	$0	$0
Bird River	3	$253,080	$30,240
Gunpowder River	2	$17,880	$0
Middle River	1	$7,885	$0
Upper Western Shore Total	**13**	**$323,761**	**$64,560**
Patapsco/Back River			
Liberty Reservoir	0	$0	$0
Patapsco River	4	$72,760	$26,200
Gwynns Falls	3	$11,132	$11,132
Jones Falls	4	$21,564	$21,564
Back River	6	$14,805	$14,481
Baltimore Harbor	0	$0	$0
Patapsco/Back River Total	**17**	**$120,261**	**$73,377**
County Totals	**30**	**$444,022**	**$137,937**

3.3 Approved Stormwater Management Facility Analysis

The database of approved stormwater management facilities indicates that a total of 4,315 facilities have been approved through June 30, 2015. Of the 4,315 approved facilities 2,759 have been built and have approved as-builts (1,015 public and 1,744 private). Table 3-2 lists approved facilities, but not necessarily built, by watershed, type and ownership.

The 4,315 approved facilities listed in Table 3-2 will, if built, serve 40,472 acres of land. The private facilities represent 61% of all approved facilities and 45% of the drainage area served by stormwater management facilities.

It is possible for a facility to be active, that is functioning and passing regular inspections, but not have an approved as-built. This scenario occurs in several situations. For example, sometimes a developer builds a facility but never submits an as-built drawing. These facilities without approved as-builts still provide important stormwater management as intended. There are 2,759 built facilities with approved as-builts serving 29,765 acres of land, with 45% of the drainage area served by private facilities. However, when we include built facilities without approved as-builts,that number increases to 3,233

built facilities serving 35,470 acres of land. Table 3-3 shows the total approved and built facilities by watershed and includes facilities with and without approved as-builts.

In order to avoid double counting, these figures do not include those facilities that have been converted by the County, nor those facilities that have been installed as retrofits to address water quality. Converted and retrofit facilities are discussed further in Section 10 of this report.

Stormwater management facilities classified as detention ponds provide minimal water quality. An assessment of the existing stormwater management facilities and possibilities for conversion is a component of each watershed management plan. Conversions are typically cost effective only for facilities with greater than ten acres of drainage. However, to meet the pollutant reduction requirements facilities with acreage less than 10 acres are also considered. Preparation of Small Watershed Action Plans (see Section 10) will result in assessing each built stormwater management facility for conversion possibilities.

Table 3-2: Approved Stormwater Management Facilities by Watershed through Fiscal Year 2015

Watershed	Detention Ponds, Underground Storage & Oil/Grit Separator				Extended Detention Ponds			
	Private		Public		Private		Public	
	#	D.A.	#	D.A.	#	D.A.	#	D.A.
Upper Western Shore								
Deer Creek	0	0	0	0	0	0	0	0
Prettyboy Reservoir	0	0	0	0	0	0	5	36
Loch Raven Reservoir	83	869	22	1,095	111	977	63	1,415
Lower Gunpowder Falls	16	148	33	693	40	237	58	775
Little Gunpowder Falls	4	4	2	10	6	15	8	93
Bird River	41	561	26	618	63	404	72	779
Gunpowder River	1	14	3	39	2	4	4	30
Middle River	4	7	6	90	15	105	4	32
UWS Totals	**149**	**1,603**	**92**	**2,544**	**237**	**1,742**	**214**	**3,159**
Patapsco/Back River								
Liberty Reservoir	4	2	1	8	9	59	11	197
Patapsco River	34	356	36	1,282	85	630	74	674
Gwynns Falls	111	1,147	44	1,525	205	1,736	160	2,231
Jones Falls	46	677	23	602	104	935	35	647
Back River	63	276	23	383	99	614	43	383
Baltimore Harbor	12	174	18	181	16	131	1	79
Patapsco/Back R. Tot	**270**	**2,632**	**145**	**3,981**	**518**	**4,104**	**324**	**4,211**
County Totals	**419**	**4,234**	**237**	**6,525**	**755**	**5,846**	**538**	**7,370**

Table 3-2: Approved Stormwater Management Facilities by Watershed through Fiscal Year 2015 (continued)

Watershed	Retention Ponds and Wet Ponds				Infil. Basins, Trenches, Dry Wells, Porous Paving, Level Spreader			
	Private		Public		Private		Public	
	#	D.A.	#	D.A.	#	D.A.	#	D.A.
Upper Western Shore								
Deer Creek	0	0	0	0	0	0	0	0
Prettyboy Reservoir	0	0	0	0	1	16	1	13
Loch Raven Reservoir	16	482	10	358	78	239	20	217
Lower Gunpowder Falls	2	297	11	166	11	23	27	84
Little Gunpowder Falls	1	50	2	21	8	117	2	32
Bird River	22	516	26	948	25	59	12	52
Gunpowder River	13	124	6	114	4	22	3	2
Middle River	18	332	14	300	13	18	4	7
UWS Totals	**72**	**1,799**	**69**	**1,907**	**140**	**494**	**69**	**408**
Patapsco/Back River								
Liberty Reservoir	1	22	0	0	22	45	2	3
Patapsco River	14	364	15	231	62	154	13	208
Gwynns Falls	20	1,025	16	345	75	128	29	188
Jones Falls	8	953	8	227	28	85	25	86
Back River	23	242	13	944	24	28	11	19
Baltimore Harbor	9	73	11	402	11	17	1	2
Patapsco/Back R. Tot	**75**	**2,679**	**63**	**2,150**	**222**	**456**	**81**	**505**
County Totals	**147**	**4,478**	**132**	**4,057**	**362**	**951**	**150**	**913**

Watershed	Sand Filter, Bioretention, Filter Strip, Swales				Environmental Site Design			
	Private		Public		Private		Public	
	#	D.A.	#	D.A.	#	D.A.	#	D.A.
Upper Western Shore								
Deer Creek	0	0	0	0	0	0	0	0
Prettyboy Reservoir	2	3	6	73	9	5	1	0
Loch Raven Reservoir	84	426	102	835	44	73	18	63
Lower Gunpowder Falls	26	71	41	306	27	34	2	5
Little Gunpowder Falls	8	10	9	79	6	15	1	0
Bird River	79	238	76	474	30	52	12	42
Gunpowder River	8	16	3	14	1	0	3	2
Middle River	32	86	11	43	11	49	2	4
UWS Totals	**239**	**850**	**248**	**1,824**	**128**	**228**	**39**	**116**
Patapsco/Back River								
Liberty Reservoir	19	56	26	166	5	7	4	15
Patapsco River	78	226	50	339	32	55	9	39
Gwynns Falls	148	615	107	474	42	39	18	16
Jones Falls	81	166	43	221	39	40	6	10
Back River	83	214	49	247	30	56	17	6
Baltimore Harbor	13	31	3	5	8	5	2	6
Patapsco/Back R. Tot	**422**	**1,308**	**278**	**1,452**	**156**	**202**	**56**	**93**
County Totals	**661**	**2,158**	**526**	**3,276**	**284**	**431**	**95**	**209**

Note: Drainage areas are rounded to the nearest acre.

Table 3-3: Total Facilities Built by Watershed and Ownership through Fiscal Year 2015

Watershed	Detention Ponds Underground Storage & Oil/Grit Separator				Extended Detention Ponds			
	Private		Public		Private		Public	
	#	D.A.	#	D.A.	#	D.A.	#	D.A.
Upper Western Shore								
Deer Creek	0	0	0	0	0	0	0	0
Prettyboy Reservoir	0	0	0	0	0	0	5	36
Loch Raven Reservoir	76	845	20	859	99	883	60	1,251
Lower Gunpowder Falls	11	135	30	640	38	214	53	729
Little Gunpowder Falls	0	0	2	10	6	15	6	75
Bird River	36	481	25	604	52	301	67	744
Gunpowder River	0	0	3	39	1	2	4	30
Middle River	4	7	6	90	14	104	4	32
UWS Totals	**127**	**1,468**	**86**	**2,242**	**210**	**1,520**	**199**	**2,896**
Patapsco/Back River								
Liberty Reservoir	4	2	0	0	7	54	10	186
Patapsco River	30	241	32	1,263	75	548	66	596
Gwynns Falls	85	621	41	1,511	183	1,607	146	2,116
Jones Falls	39	636	23	602	93	879	32	603
Back River	46	171	19	372	83	580	38	322
Baltimore Harbor	8	168	15	178	15	130	1	79
Patapsco/Back R. Tot	**212**	**1,839**	**130**	**3,927**	**456**	**3,799**	**293**	**3,902**
County Totals	**339**	**3,307**	**216**	**6,169**	**666**	**5,319**	**492**	**6,797**
Watershed	Retention Ponds and Wet Ponds				Infil. Basins, Trenches, Dry Wells, Porous Paving, Level Spreader			
	Private		Public		Private		Public	
	#	D.A.	N	D.A.	#	D.A.	#	D.A.
Upper Western Shore								
Deer Creek	0	0	0	0	0	0	0	0
Prettyboy Reservoir	0	0	0	0	0	0	1	13
Loch Raven Reservoir	14	474	7	311	50	223	20	217
Lower Gunpowder Falls	2	297	9	138	6	13	25	80
Little Gunpowder Falls	1	50	2	21	5	114	2	32
Bird River	19	480	22	841	19	55	10	52
Gunpowder River	7	47	5	114	4	22	3	2
Middle River	12	229	11	266	9	14	4	7
UWS Totals	**55**	**1,577**	**56**	**1,692**	**93**	**441**	**65**	**404**
Patapsco/Back River								
Liberty Reservoir	1	22	0	0	13	27	1	2
Patapsco River	12	358	13	219	47	137	13	208
Gwynns Falls	18	802	11	295	65	110	28	187
Jones Falls	6	944	8	227	24	84	24	85
Back River	17	220	11	922	15	17	5	14
Baltimore Harbor	5	38	7	723	9	14	1	2
Patapsco/Back R. Tot	**59**	**2,385**	**50**	**2,386**	**173**	**388**	**72**	**498**
County Totals	**114**	**3,962**	**106**	**4,078**	**266**	**829**	**137**	**901**

Table 3-3: Total Facilities Built by Watershed and Ownership through Fiscal Year 2015 (continued)

Watershed	Sand Filter, Bioretention, Filter Strip, Swales				Environmental Site Design			
	Private		Public		Private		Public	
	#	D.A.	#	D.A.	#	D.A.	#	D.A.
Upper Western Shore								
Deer Creek	0	0	0	0	0	0	0	0
Prettyboy Reservoir	0	0	5	43	1	0	0	0
Loch Raven Reservoir	51	349	90	788	20	25	4	8
Lower Gunpowder Falls	14	23	29	259	11	21	0	0
Little Gunpowder Falls	8	10	6	48	1	7	0	0
Bird River	47	146	43	253	14	29	7	15
Gunpowder River	5	13	3	14	0	0	0	0
Middle River	12	58	6	33	1	1	1	1
UWS Totals	**137**	**598**	**182**	**1,439**	**48**	**83**	**12**	**25**
Patapsco/Back River								
Liberty Reservoir	13	24	6	41	2	0	1	2
Patapsco River	50	160	35	260	6	3	3	22
Gwynns Falls	93	370	47	306	14	12	3	3
Jones Falls	58	135	33	184	19	9	3	8
Back River	58	149	38	204	18	33	3	2
Baltimore Harbor	6	20	0	0	4	3	1	2
Patapsco/Back R. Tot	**278**	**859**	**159**	**995**	**63**	**60**	**14**	**38**
County Totals	**415**	**1,457**	**341**	**2,434**	**111**	**143**	**26**	**63**

Note: Drainage areas are rounded to the nearest acre.

Figure 3-1 displays the number of approved facilities, both private and public, by watershed. The Gwynns Falls watershed continues to have the greatest total number of existing and newly approved facilities. The large number of facilities in the Gwynns Falls watershed can be attributed to the fact that the Owings Mills growth area was built mostly after SWM regulations were in place. Many older communities, developed prior to regulatory authority, do not have any SWM facilities. Deer Creek, Prettyboy Reservoir, Liberty Reservoir, the Little Gunpowder Falls and the Gunpowder River watersheds have only a few facilities, which is reflective of fewer development projects and the small size of those watersheds. This pattern has not changed from past reports.

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

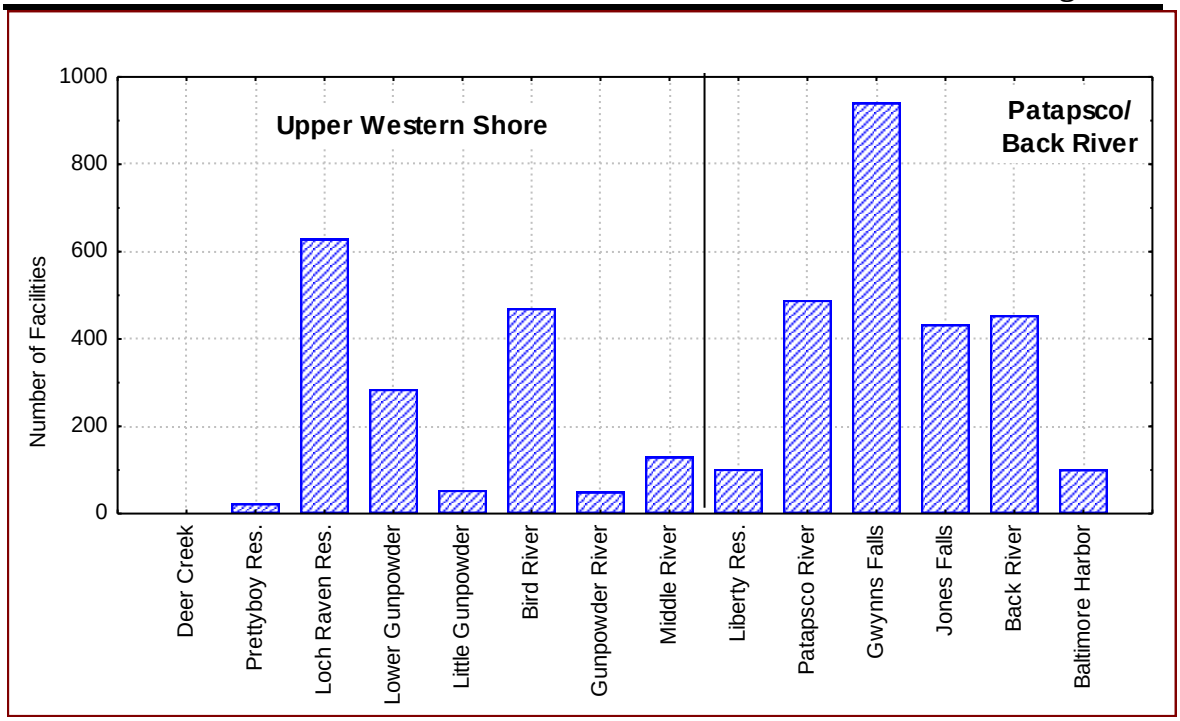


Figure 3-1: Number of Approved SWM Facilities by Watershed through Fiscal Year 2015

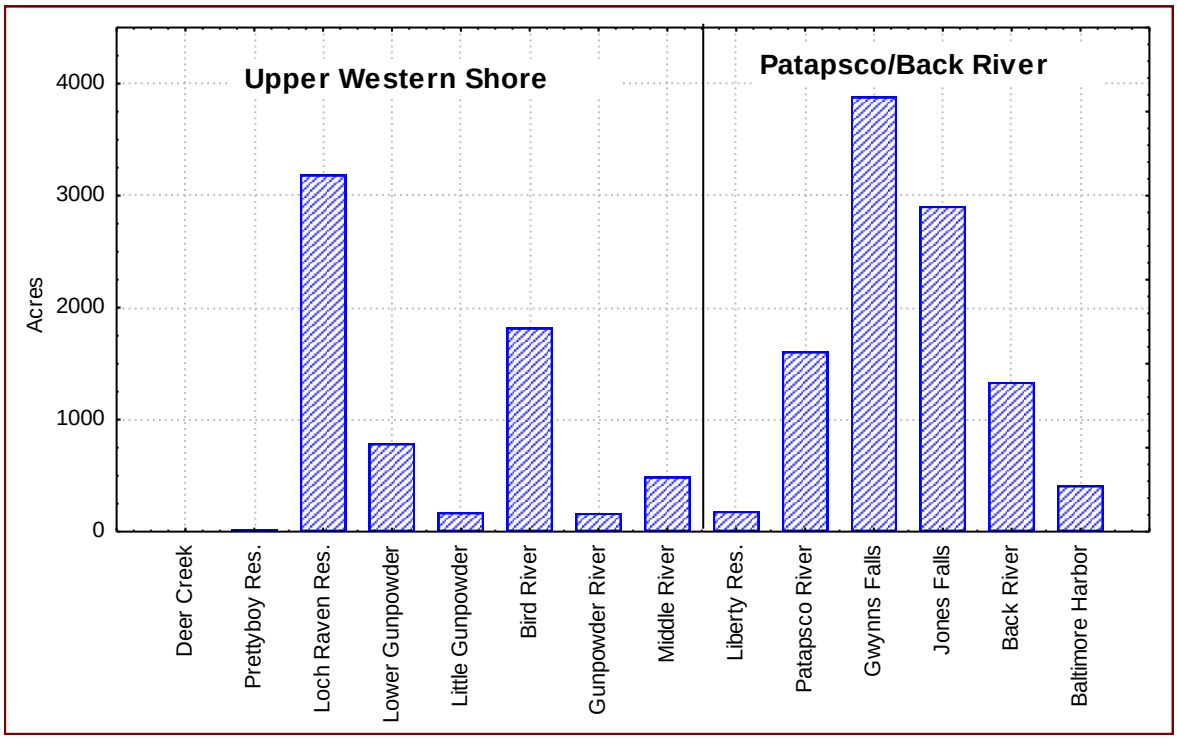


Figure 3-2: Acreage Served by Approved Private SWM Facilities by Watershed through Fiscal Year 2015

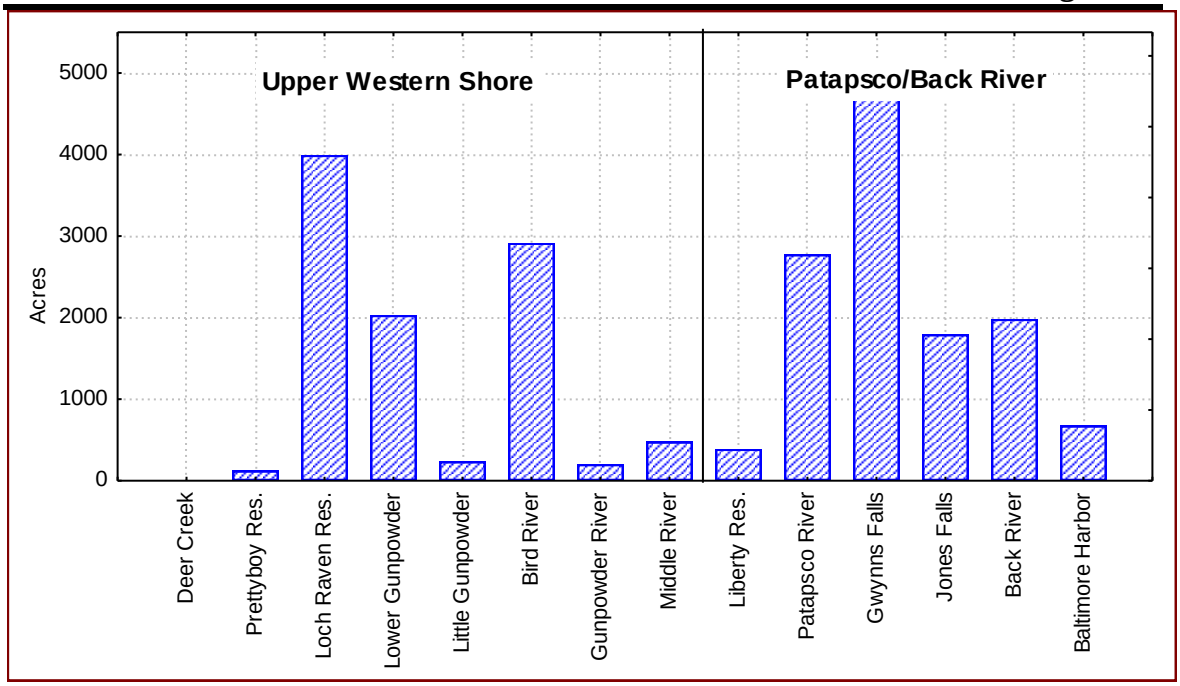


Figure 3-3: Acreage Served by Approved Public SWM Facilities by Watershed through Fiscal Year 2015

3.3.1 As-built Analysis

As stated earlier, it is possible for a facility to be active, that is functioning and passing regular inspections, but not have an approved as-built. This scenario occurs in several situations. Table 3-4 presents the SWM facilities by sector that do not have an as-built with their corresponding drainage area and pollutant removal capabilities. This analysis includes all facilities, including retrofits, conversions, redevelopment and new development. Table 3-5 presents the load reductions for facilities without as-builts.

Table 3-4: Count and Drainage Area of SWM Facilities with Missing As-builts

	Count	Drainage Area (acres)
Public Stormwater Facilities	301	3,780
Private Stormwater Facilities	192	1,685
Total	**493**	**5,465**

Table 3-5: Load Reductions from SWM Facilities with Missing As-builts

	TN (pounds)	TP (pounds)	TSS (pounds)
Public Stormwater Facilities	6,498	551	653,530
Private Stormwater Facilities	3,838	377	530,198
Total	10,335	928	1,183,728

When an inspection happens for a facility with no approved as-built, the inspector attempts to contact the pond owner to ask for an as-built.

In order to address the missing as-builts, the County proposes several methods, depending on whether the facility is privately or publically owned. For private facilities, the County will determine if there are any monies being withheld from the developer. If

so, developers could be incentivized to submit an as-built in order to get their security deposit back. The stormwater remediation fee may also be an incentive for developers to submit an as-built. If the property has an approved as-built, they may be eligible for a credit towards their stormwater remediation fee.

For public facilities, there is typically no security deposit required, so there is often no financial incentive to prepare and submit an as-built, or to pass an as-built inspection. EPS is working with other agencies in the County to determine a plan to address missing as-builts.

3.4 Inspections

As of October 1, 2013, all SWM inspections and maintenance have been consolidated under the Stormwater Management Section. Prior to October 1, 2013, staff in the Stormwater Engineering Section completed all as-built inspections and one-year inspections, while all three-year inspections of public facilities were conducted by the Capital Programs and Operations Section and for private facilities by the Stormwater Engineering Section. Increases in inspection staff in FY2014, hiring of a crew chief and contractual maintenance of public facilities have increased both the number of three year inspections conducted and the maintenance of public facilities.

Table 3-6 presents the SWM facility inspections conducted by EPS during the reporting period of July 1, 2014 through June 30, 2015.

Table 3-6: SWM Inspections from July 1, 2014 through June 30, 2015

	As-built	One year	Three year	Totals
Public Stormwater Facilities	61	71	425	**557**
Private Stormwater Facilities	91	120	725	**936**
Totals	**152**	**191**	**1,150**	**1,493**

A total of 152 as-built inspections were completed for the reporting period. A total of 191 one year inspections were completed. Approval of the one year maintenance inspection initiates the three-year maintenance inspection cycle. A total of 425 three-year inspections were completed for public facilities and 725 three year inspections were completed for private facilities. A total of 1,150 three year inspections of public and private stormwater facilities were conducted. The inspection program's goal is to inspect all built facilities every three years. A total of 1,493 inspections were completed for all built facilities. There are 1,320 public facilities built with and without as-builts so the County's goal is to inspect 440 facilities: there are 1,913 private facilities built with and without approved as-builts so the goal is to inspect 638 facilities. While the County missed its public facility inspection goal by just 15 facilities, it exceeded its private inspections by 87 facilities.

3.5 Stormwater Management Facility Maintenance

The Baltimore County Department of Environmental Protection and Sustainability has an operations crew in the Stormwater Management Section, responsible for inspection and maintenance of public facilities. Their staff consists of one supervisor, five field crew members with one vacancy. Additionally there are two contracted inspectors and two contracted field crews consisting of four field workers for each crew for a total of eight field crew members. The crews are divided geographically into eastern and western districts. The private facility inspection staff consists of a supervisor and five inspectors.

The implementation of the stormwater remediation fee resulted in an increase in the number of inspectors, with 3 additional inspectors being added in FY 2014, and a new crew chief for the maintenance crews. In addition, starting in FY 2014, some of the inspection and maintenance work is now performed by contractual services. These staff additions have resulted in an improved inspection and maintenance program.

A database has been developed to track all routine maintenance and responses to complaints. Table 3-7 summarizes the number of maintenance visits due to complaints versus routine maintenance. There were 77 routine maintenance assessments and 86 complaint driven site assessments during the reporting period for a total of 163 maintenance visits.

Table 3-7: Stormwater Facility Maintenance Visits by Type FY 2015

# of Routine Maintenance Visits	# of Complaint Maintenance Visits
77	86

3.6 Constructed Stormwater Management Facility Data Analysis

An analysis of the databases related to stormwater management facilities indicated that a total of 3,233 facilities have been built to date. The 3,233 built facilities have a combined drainage area of 35,470 acres. The drainage areas of 3,093 built facilities have been delineated and digitized into the County GIS. As new facilities are built their drainage areas will also be added to the GIS data layer. Overall, built stormwater management facilities serve 22.7% of the designated urban acreage (156,099 acres). This is exclusive of the stormwater facilities converted by the county for greater pollutant removal efficiency and retrofits installed by the county. The total urban acreage is based on the October 2011 Maryland Assessment Scenario Tool (MAST) data.

The drainage areas were overlaid on the National Land Cover Database 2011 land use data and the Baltimore County 2011 impervious surface data to determine the specific land use and impervious cover draining to each facility. Table 3-8 presents a summary of the land use served by built SWM facilities by watershed. It should be noted that the date of the creation of the GIS land use data layer might precede the building of a number of the stormwater management facilities. This fact will result in some error in the determination of land use draining to those facilities.

Table 3-8: Constructed SWM Facility Drainage Area Land Use (Acres) through June 30, 2015

Watershed	Pervious Urban	Impervious Urban	Forest and Wetlands	Pasture	Crops	Extractive	Open Water	Total Acres
Upper Western Shore								
PR	24.8	12.2	28.4	5.5	16.3	0	0	87.2
LR	2,640.5	1,495.5	1,058.5	230.2	201.4	0.2	7.5	5,633.8
GU	1,312.3	563.6	301.0	80.6	53.9	3.4	0	2,314.8
LG	138.4	47.6	98.1	44.7	28.1	0	0	357.0
BI	1,903.7	1,210.8	321.0	26.4	35.4	10.9	0	3,508.1
GR	133.3	84.3	24.4	0.1	0.9	9.7	1.5	254.2
MR	386.3	239.4	31.0	0	0	4.1	0.1	660.8
Total	**6,539.3**	**3,653.3**	**1,862.6**	**387.4**	**335.9**	**28.3**	**9.1**	**12,816.0**
Patapsco/Back River								
LI	123.7	85.3	42.1	27.3	47.3	0	0	325.6
PA	1,691.8	1,158.8	496.7	161.0	143.8	0	0	3,652.2
GW	3,635.3	2,461.2	527.1	39.5	93.2	2.4	0	6,760.8
JF	1,846.7	957.6	769.2	51.6	60.9	3.2	2.0	3,701.1
BR	1,216.3	969.7	131.8	0.6	0.1	3.5	11.9	2,322.1
BH	433.1	331.6	30.8	0	0	0	0	795.5
P/B	**8,946.9**	**5,964.2**	**1,997.7**	**280.1**	**345.3**	**9.1**	**13.9**	**17,557.2**
County	**15,486.2**	**9,617.5**	**3,860.3**	**667.6**	**681.2**	**37.4**	**23.0**	**30,373.2**

LR = Loch Raven Reservoir
PR = Prettyboy Reservoir
GU = Lower Gunpowder Falls
LG = Little Gunpowder Falls
BI = Bird River
GR = Gunpowder River
PA = Patapsco River
LI = Liberty Reservoir
GW = Gwynns Falls
JF = Jones Falls
MR = Middle River
BH = Baltimore Harbor
BR = Back River

3.7 Pollutant Loads

MDE and the EPA Chesapeake Bay Program currently endorse two methods for calculating stormwater management facility load reductions: the "BMP Removal Rate Adjustor Curve" method (Schueler and Lane 2015a, Maryland Department of the Environment 2014) and, for facilities that do not qualify for the curve method, the "Approved CBP BMP Efficiency Rates" method (Schueler and Lane 2015a, 12 & 40).

These methods, which are documented in detail in SOP RT-010: Tracking, Verification, and Pollutant Load Calculations: Stormwater Management Facilities (Baltimore County EPS, 2015), were used for the 3,093 facilities that are currently active with drainage areas digitized. The results of the analysis are displayed in Tables 3-9 (Total Nitrogen), 3-10 (Total Phosphorus), and 3-11 (Total Suspended Solids), respectively. These tables and figures do not include conversions, retrofits or redevelopment projects which are analyzed in Section 10.

Table 3-9: Total Nitrogen Removal by SWM Facility Type and Watershed (pounds)

Watershed	Total pounds of N to SWM	Pounds of Removal by Facility Type						Total Removed	
		DP	EDP	WP	INF.	FIL.	ESD	Pounds	%
Upper Western Shore Watersheds									
Prettyboy Reservoir	997	0	95	0	43	150	3	292	20.0
Loch Raven Reservoir	67,725	761	4,706	1,488	2,848	3,892	251	13,946	20.6
Lower Gunpowder Falls	27,959	437	2,119	1,150	520	555	88	4,870	17.4
Little Gunpowder Falls	3,774	5	233	216	433	290	35	1,211	32.1
Bird River	25,752	319	1,442	1,993	605	838	147	5,345	20.8
Gunpowder River	1,481	11	29	237	63	69	0	409	27.7
Middle River	3,189	27	170	261	64	146	6	675	21.2
Totals	**130,877**	1,560	8,795	5,347	4,576	5,941	529	**26,748**	**20.4**
Patapsco/Back River Watersheds									
Liberty Reservoir	4,354	1	554	81	247	359	2	1,245	28.6
Patapsco River	37,746	573	2,434	1,282	1,127	1,460	28	6,904	18.3
Gwynns Falls	96,292	988	9,264	2,652	2,224	2,254	59	17,441	18.1
Jones Falls	43,979	518	3,107	2,821	953	1,227	106	8,732	19.9
Back River	16,285	175	1,114	1,005	74	669	74	3,112	19.1
Baltimore Harbor	3,713	28	277	111	67	105	10	598	16.1
Totals	**202,369**	**2,283**	**16,750**	**7,953**	**4,693**	**6,074**	**279**	**38,032**	**18.8**
County Total	**333,246**	**3,843**	**25,545**	**13,300**	**9,269**	**12,015**	**808**	**64,780**	**19.4**

Table 3-10: Total Phosphorus Removal by SWM Facility Type and Watershed (pounds)

Watershed	Total pounds of P to SWM	Pounds of Removal by Facility Type						Total Removed	
		DP	EDP	WP	INF.	FIL.	ESD	Pounds	%
Upper Western Shore Watersheds									
Prettyboy Reservoir	53	0	5	0	2	13	0	20	39.0
Loch Raven Res.	3,693	76	258	122	197	326	17	997	27.0
Lower Gunpowder	1,404	42	110	112	34	42	5	344	24.5
Little Gunpowder	191	1	13	15	21	28	1	78	40.9
Bird River	2,500	57	140	315	66	127	14	718	28.7
Gunpowder River	164	2	3	47	5	12	0	69	41.8
Middle River	318	5	17	39	9	26	1	96	30.3
Totals	**8,323**	**182**	**545**	**649**	**334**	**575**	**37**	**2,323**	**26.0**
Patapsco/Back River Watersheds									
Liberty Reservoir	252	0	31	7	16	30	0	85	33.6
Patapsco River	2,148	59	140	120	84	137	3	541	25.2
Gwynns Falls	5,411	105	529	278	132	210	5	1,258	23.2
Jones Falls	2,251	51	165	223	54	96	7	596	26.5
Back River	1,704	38	116	164	10	104	7	439	25.8
Baltimore Harbor	368	5	28	20	9	11	1	74	20.2
Totals	**12,135**	**257**	**1,009**	**813**	**305**	**587**	**22**	**2,993**	**24.7**
County Total	**20,459**	**439**	**1,554**	**1,462**	**639**	**1,162**	**60**	**5,316**	**26.0**

Table 3-11: Total Suspended Solids Removal by SWM Facility Type and Watershed (tons)

Watershed	Total TSS To SWM	Tons of Removal by Facility Type						Total Removed	
		DP	EDP	WP	INF.	FIL.	ESD	#	%
Upper Western Shore Watersheds									
Prettyboy Reservoir	45,632	0	12,821	4	2,277	14,173	159	29,435	64.5
Loch Raven Reservoir	3,508,093	74,031	752,813	141,119	208,114	355,020	16,688	1,547,785	44.1
Lower Gunpowder Falls	1,565,271	47,741	373,055	150,119	41,603	60,807	5,660	678,985	43.4
Little Gunpowder Falls	217,908	644	43,498	22,940	27,828	33,778	1,192	129,879	59.6
Bird River	1,001,529	22,131	170,505	162,157	29,114	64,263	5,652	453,821	45.3
Gunpowder River	76,685	842	4,507	27,024	2,579	7,316	0	42,267	55.1
Middle River	150,515	2,074	26,163	22,139	4,775	15,161	354	70,667	47.0
Totals	**6,565,634**	**147,463**	**1,383,362**	**525,501**	**316,289**	**550,518**	**29,705**	**2,952,838**	**45.0**
Patapsco/Back River Watersheds									
Liberty Reservoir	240,846	221	89,541	10,322	16,893	30,470	143	147,589	61.3
Patapsco River	2,354,242	66,189	472,277	152,233	94,517	182,413	2,576	970,205	41.2
Gwynns Falls	6,811,907	131,659	2,037,626	452,729	164,309	314,465	6,916	3,107,704	45.6
Jones Falls	1,285,548	29,127	291,375	156,290	33,414	64,009	4,514	578,729	45.0
Back River	612,803	13,493	127,615	73,952	3,881	45,586	2,614	267,140	43.6
Baltimore Harbor	158,206	2,177	38,603	11,428	4,155	5,311	341	62,015	39.2
Totals	**11,463,551**	**242,865**	**3,057,036**	**856,953**	**317,168**	**342,256**	**17,105**	**5,133,383**	**44.8**
County Total	**18,029,186**	**390,328**	**4,440,398**	**1,382,454**	**633,457**	**1,192,774**	**46,810**	**8,086,220**	**44.9**

3.8 Historic BMP Clean-up Process

As part of the historic BMP clean-up, Baltimore County addressed a variety of deficiencies in our SWM data. A comparison was conducted between this year's submittal which includes all the historic BMP cleanup data and last year's FY 2014 submittal but for the same time period (everything through FY 2014). In particular, water quality volume, BMP type, and drainage areas were closely reviewed and revised as needed.

The most significant change is the change in depth (inches) of rainfall treated for water quality per impervious acre (WQv). During the same reporting period, the WQv before the historic bmp clean-up was 549 inches; after the clean-up it was 2,521 inches for a difference of 1,972 inches treated.

While addressing deficiencies, plans were reviewed and sometimes drainage areas needed to be revised or delineated in our database. Before the clean-up there were 2,870 facilities with delineated drainage areas accounting for 32,785 acres. After the clean-up for the same installation time period, there were 3,162 facilities with delineated drainage areas accounting for 33,725 acres.

BMP type previously was often mis-categorized so during the BMP clean-up process, in addition to updating water quality and missing attributes, the BMP type was assessed. During the clean-up it was determined several facilities that were previously listed as one type of BMP were actually conversions or retrofits. These facilities were categorized back to their original BMP and another conversion record was made. Many of these conversions were actually built in FY15 which could account for the decrease in overall count of facilities and drainage area through FY14. Table 3-12 shows the change in BMP types before and after the BMP clean-up.

Table 3-12: Comparison of BMP Type Before and After Clean-up

	2014	Clean-up	Difference
BMP	**Count**	**Count**	**Count**
Detention	555	582	+27
Environmental Site Design	137	98	-39
Extended Detention	1,158	1,189	+31
Filtering Practice	756	718	-38
Infiltration Practice	403	409	+6
Wet Pond or Wetland	220	222	+2
County Total	**3,229**	**3,221**	**-8**

3.9 Summary

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

The stormwater management facility maintenance program within EPS has continued to inspect both publicly and privately owned facilities and maintain public facilities. The staff has compiled an extensive database of inspections and maintenance operations for the publicly and privately owned stormwater facilities. These inspections, and the

resulting actions, are improving the overall pollutant reduction efficiency of all stormwater facilities.

Constructed stormwater management facilities serve ~22.7 % of the total urban land, 156,099 acres (87,452 P/B and 68,647 UWS), in Baltimore County. For the areas served by these facilities a significant amount of pollutants are removed annually. Facilities designed and constructed for water quantity management represent an opportunity for water quality improvement through conversion to water quality facilities that will be explored through the Small Watershed Action Plan planning process (Section 10).

4.0 Permit Requirements

D. Management Programs

2. Erosion and Sediment Control

An acceptable erosion and sediment control program shall continue to be maintained and implemented in accordance with the Environment Article, Title 4, Subtitle 1, Annotated Code of Maryland. Activities to be undertaken by Baltimore County shall include, but not be limited to:

a. Implementing program improvements identified in any MDE evaluation of the County's erosion and sediment control enforcement authority;

b. At least three times per year, conducting responsible personnel certification classes to educate construction site operators regarding erosion and sediment control compliance;

c. Program activity shall be recorded on MDE's annual report database and submitted as required in PART V of this permit; and

d. Reporting quarterly, information regarding earth disturbances exceeding one acre or more. Quarters shall be based on calendar year and submittals shall be made within 30 days following each quarter. The information submitted shall cover permitting activity for the preceding three months.

4.1 Introduction

The Erosion and Sediment Control Program is being implemented by the Department of Permits, Approvals and Inspections (PAI), Building Inspections Division and has been since February 2012 when the program was transferred from EPS's Inspection and Enforcement Section. This program is reviewed by the Maryland Department of the Environment (MDE) on a biennial basis. On January 9, 2012 MDE formally adopted new erosion and sediment control regulations. Additionally, the 1994 Maryland Standards and Specifications Manual for Soil Erosion and Sediment Control has been revised. The 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control document received final approval and was published on January 27, 2012. The new regulations and standards will enhance erosion and sediment control practices, improve water quality of construction site runoff, and help in the Chesapeake Bay restoration efforts. In late March 2012 a letter from the Baltimore County Soil Conservation District was sent to consultants serving Baltimore County regarding the formal adoption of the new erosion and sediment control regulations and the grandfathering conditions consistent with the MDE regulations. Baltimore County adopted this manual in a manner consistent with MDE regulations on November 19, 2012 (Council Bill Number 72-12). The Erosion and Sediment Control Program contains several components:

- review of building and grading permit applications
- field inspection and enforcement of grading and sediment control regulations
- citizen complaint investigation, and

- training program for certification of responsible personnel.

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

4.2 Program Analysis – Plans Review

Currently, Sediment and Erosion Control Plans are reviewed for adequacy by the Baltimore County Soil Conservation District while EPS's Stormwater Engineering and Management Section coordinates the approval process. The Sediment and Erosion Control Plans are also reviewed by EPS's Environmental Impact Review Section to ensure that there is no encroachment into the forest buffer or forest conservation areas that are protected by County regulations.

Each Sediment and Erosion Control Plan is required to have an associated Grading Plan indicating the final topographic contours of the development site. The Grading Plan is reviewed by EPS, Development Plans Review (PAI) and the Baltimore County Soil Conservation District.

4.3 Program Analysis – Inspection and Enforcement

The Inspection and Enforcement Program maintains records of issued grading permits, conducts routine inspections of active construction sites, and issues correction notices, violation notices, and stop work orders to enforce compliance of sediment and erosion control and grading plans. Prior to the issuance of grading permits, a pre-construction meeting is held at the site. This meeting is attended, at a minimum, by the County inspector and the construction site foreman. The foreman must be certified through the "responsible personnel in erosion and sediment control" training program which is described in section 4.4. The meeting covers the sequence of operations for the installation of controls and grading involved with the overall site development. This meeting is intended to forestall any future problems.

4.3.1 Grading and Building Permits Issued

Grading permits and building permits are reviewed by PAI and EPS. Grading Permits are required for any disturbance over 5,000 square feet or for grade changes in existing neighborhoods. Baltimore County building permits are required for any new construction, additions, or alterations. Building permits are reviewed to ensure that the final drainage patterns will not impact adjacent properties and that the onsite drainage will direct stormwater away from building structures to stormwater management facilities. These permits are also reviewed to ensure that they are in compliance with other environmental regulations, such as, Chesapeake Bay Critical Area, Forest Buffer and Forest Conservation requirements.

During the fiscal year 2015, one hundred sixty (160) grading permits were issued. This represents an increase in the number of grading permits from FY14. The number of acres disturbed rose from 523 acres in FY2014 to 534 acres in FY2015. The number of grading

permits approved and the acreage of disturbance are displayed by watershed in Table 4-1 and Figure 4-1. The discrepancy in the table total acres disturbed is due to a pipeline project where 100 acres were disturbed in multiple locations so precise location information was not available. Most of the grading activity in Baltimore County has shifted to suburban watersheds with existing older communities, and with much of the activity associated with commercial uses.

Table 4.1: Number of Grading Permits and Acreage of Disturbance by Watershed for FY2015.

Watershed	Number of Permits	Acreage of Disturbance
Upper Western Shore		
Deer Creek	0	0.0
Prettyboy Reservoir	0	0.0
Loch Raven Reservoir	21	70.20
Lower Gunpowder Falls	10	25.22
Little Gunpowder Falls	3	14.16
Bird River	13	78.08
Gunpowder River	1	1.77
Middle River	10	25.83
UWS Totals	**58**	**215.26**
Patapsco/Back River		
Liberty Reservoir	3	3.17
Patapsco River	15	61.09
Gwynns Falls	28	94.76
Jones Falls	33	36.75
Back River	21	14.3
Baltimore Harbor	4	8.45
Patapsco/Back R. Totals	**104**	**218.52**
County Totals	**162**	**433.78**

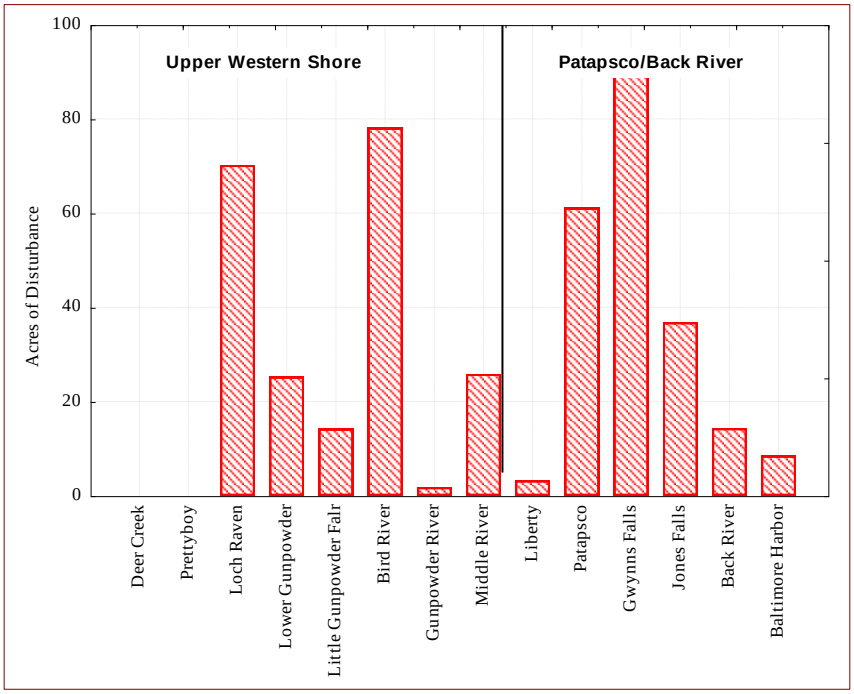


Figure 4-1: Acres of Disturbance through approved grading permits by watershed for FY2015.

During the FY2015, 1,589 permits were released for new buildings. This represents an increase from the previous year by 465 and the most since 2002. The distribution of building permits by watershed is displayed in Table 4-2 and Figure 4-2.

Table 4-2: Number of Building Permits by Watershed for FY2015.

Watershed	Number of Permits
Upper Western Shore	
Deer Creek	0
Prettyboy Reservoir	1
Loch Raven Reservoir	202
Lower Gunpowder Falls	56
Little Gunpowder Falls	13
Bird River	257
Gunpowder River	14
Middle River	85
Upper Western Shore Totals	**628**
Patapsco/Back River	
Liberty Reservoir	14
Patapsco River	191
Gwynns Falls	294
Jones Falls	233
Back River	152
Baltimore Harbor	77
Patapsco/Back River Totals	**961**
County Totals	**1,589**

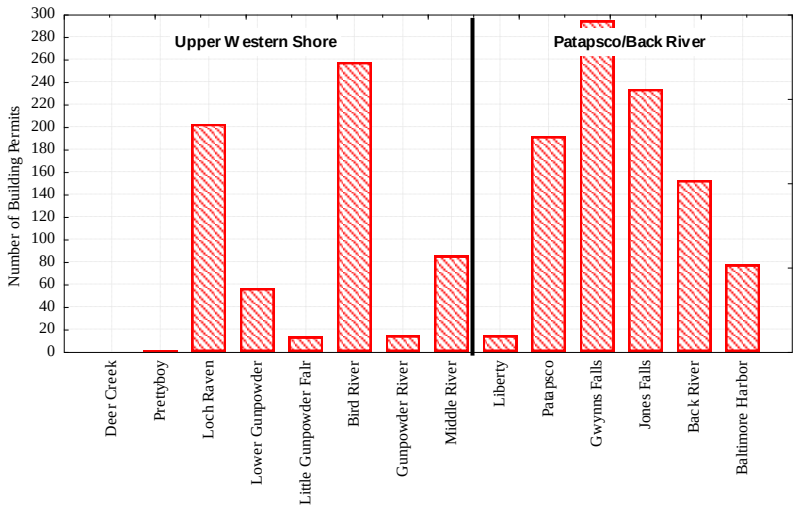


Figure 4-2: Number of building permits issued by watershed in FY2015.

Displayed in Table 4-3 and Figure 4-3 are the trends in building and grading permits, as well as acres of disturbance for a fourteen-year period. The data for the number of building permits was reevaluated in 2010 based on a new data source. The entire table was updated in the 2010 report using this data source. The data used for the building permits is now extracted from the data layer called "Landuse Permits". Residential permits include single family and multi-family

dwellings. The Other Building permits column includes all other building permits. Building permits were selected if they had an occupancy date in that year and were issued for new construction.

Table 4-3: Number of Grading and Building Permits by Year

Year	Grading Permits	Acres of Disturbance	Residential Building Permits	Other Building Permits	Total Building Permits
1999	364	1,115*	2,480	107	2,587
2000	256	1,081	2,148	143	2,291
2001	232	1,209	1,636	105	1,741
2002	216	1,093	1,548	105	1,653
2003	258	916	1,339	39	1,378
2004	249	905	1,159	103	1,262
2005	217	1,083	1,231	113	1,344
2006	230	1,147	1,349	101	1,450
2007	212	698	983	121	1,104
2008	217	670	743	105	848
2009	185	430	491	201	692
2010	188	447	500	376	876
2011 – FY12	319	647	831	803	1,634
FY13	112	339	679	474	1,153
FY14	150	523	794	330	1,124
FY15	162	434	903	686	1,589

*Excludes single permit for 6,060 acres of disturbance associated with 1999 Colonial Pipeline maintenance project.

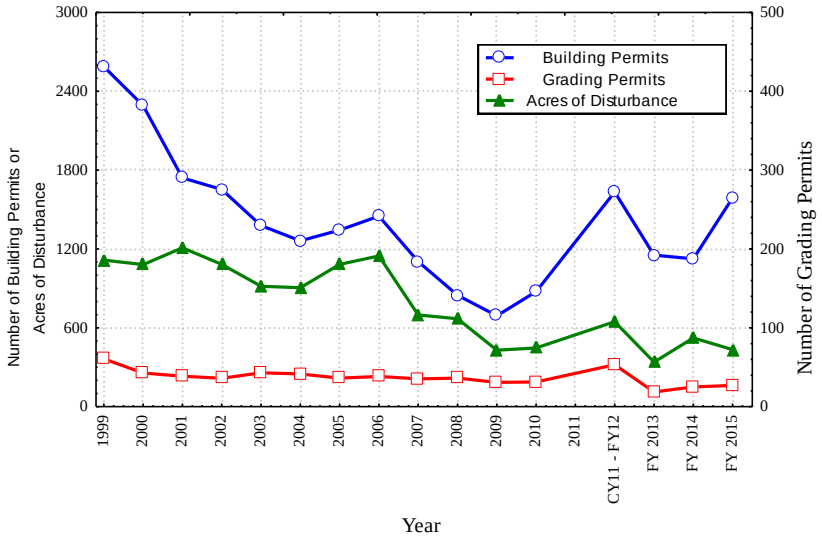


Figure 4-3: Approved Grading and Building Permits for the Period 1998 – 2013.

Construction activities in Baltimore County had been decreasing in number throughout the past fourteen years. This year the acres of disturbance is up from last year. Development has been purposefully directed towards existing urban areas within the County's Urban Rural Demarcation Line (URDL). These areas are also classified as the County's priority funding area and currently provide infrastructure and services such as: sewer, water, schools and an existing transportation network.

4.3.2 Inspections, Complaints and Enforcement

After construction begins, an inspector inspects the site an average of once every two weeks during the active constructive phase. Table 4-4 displays the number of inspections by type for Fiscal years 2012 through 2014. The data are broken down into two categories, inspections and enforcement actions.

In fiscal 2015, 1,221enforcement actions were logged (Table 4-4, last column), and 5,457 inspections were logged (Table 4-4, seventh column).

Table 4-4: Sediment Control Inspection and Enforcement Data for FY12-FY15.

Year	Inspections						Enforcement		
	Prelim.	Pre Constr.	S.C. Inspt.	Final Inspt.	Complaint	Total Inspt.	Correct. Notice	Stop Work Order	Totals Enforce
FY2012	1,623	155	6,868	139	265	9,050	616	113	729
FY2013	1,633	118	4,386	16	2	6,155	321	59	380
FY2014	1,667	128	3,808	18	9	5,630	315	61	376
FY2015	1,592	110	3,613	12	13	5,457	1,118	103	1,221

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

4.4 Program Analysis - Training Program

Two (2) Responsible Personnel Certification training sessions were held in FY2015 - February 25, and March 19, 2015. The first class totaled nineteen (19) people consisting of all Baltimore County Public School personnel. The second was offered to ten (10) Baltimore County Public Works employees. The training program is offered to construction site operators in Baltimore County on an as-needed basis. Baltimore County maintains an interest list on file and offers the certification class when enrollment requests justify the need. One hundred percent (100%) of the total class attendees in FY15 were County personnel.

4.5 MDE Delegation

The County is still in the process of reapplication for delegation. Application is due by October 1, 2015 and according to MDE the request for delegation will be acted upon by January 2016.

5.0 Permit Requirements

D. <u>Management Programs</u>

3. <u>Illicit Discharge Detection and Elimination</u>

Baltimore County shall continue to implement an inspection and enforcement program to ensure that all discharges to and from the MS4 that are not composed entirely of stormwater are either permitted by MDE or eliminated. Actions shall include, but not be limited to:

a. Field screening at least 150 outfalls annually. Each outfall having a discharge shall be sampled using a chemical test kit. Within one year of permit issuance, an alternative program may be submitted for MDE approval that methodically identifies, investigates, and eliminates illegal connections to the County storm drain system;

b. Conducting annual visual surveys of commercial and industrial areas as identified in PART IV.C.2 above for discovering, documenting, and eliminating pollutant sources. Areas surveyed shall be reported annually;

c. Maintaining a program to address illegal discharges and if necessary responding to dumping and spills;

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

e. Reporting illicit discharge detection and elimination activities as specified in Part V of this permit.

5.1 Introduction

Although the separate storm sewers in Baltimore County are intended to handle only stormwater runoff and groundwater drainage, non-storm water from commercial and industrial facilities, leaks from the sanitary sewage system, and other non-stormwater sources may contribute pollutants that ultimately reach surface waters via the storm drain system. These sources of discharge not composed entirely of storm and/or ground water, which are not authorized by an NPDES permit, are termed *illicit connections*. The Baltimore County Illicit Connection Management Program was created in partial fulfillment of the requirements of the Baltimore County National Pollutant Discharge Elimination System (NPDES) - Municipal Stormwater Discharge Permit (MD0068314). The NPDES - Municipal Stormwater Discharge permit program is federally mandated with local administration by the Maryland Department of the Environment. The requirements for the illicit connection program are detailed in 40 CFR 122.26(d)(2)(iv)(B)(1 through 7).

This year's reporting period is from January 1, 2014 to December 31, 2014. The following section will cover Program Status (5.2), Analysis of Outfall Screenings (5.3), Enforcement (5.4), Illicit Connections Investigations and Corrections (5.5), Commercial/Industrial Pollution Surveys

(5.6), Outreach (5.7), IDDE Research (5.8), Illicit Discharge Elimination Program Credit (5.9) and Summary (5.10).

5.2 Program Status

During January 2014 through December 2014, the Watershed Monitoring Section of EPS staff conducted 141 routine outfall screenings in which 20 were above water quality thresholds (table 5-3). If an outfall is above the water quality threshold an investigation may be begun immediately or a return visit may be scheduled.

Our outfall screening goal according to our permit conditions is 150. Staff time was limited for outfall screenings this year due to writing 23 TMDL implementation plans that were due 12/31/14. WMM staff investigated 97 complaints, which includes reports from citizens, other agencies, outfall screenings and issues found while conducting other fieldwork. As revealed in the analysis in the following section, routine outfall screenings for detection of illicit connections appear to compliment citizen complaints of problems they observe. The routine outfall screenings catch the chronic problems that may be missed by the public, such as chlorine leaks from the municipal water supply.

Aside from the benefits of greater public involvement and the resolution of complaints, citizens provide surveillance at a level beyond that of the monitoring staff. A majority of the time citizens call while they are actually observing a problem and often can provide immediate local information that increases the chance of eliminating illicit connections. Some of the citizen complaints are a result of the Stream Watch program. This program allows citizens to adopt a stream, which includes tracking the health of the stream and reporting problems or potential projects they observe.

5.3 Analysis of Outfall Screenings

A routine outfall screening consists of:

(1) A quantitative analysis of the effluent. This includes measuring the effluent flow rate, temperature and pH, and field-testing with the LaMotte NPDES test kit (parts per million tests for copper, chlorine, ammonia and phenol).

(2) A visual inspection of the effluent, the outfall structure and the receiving channel, noting such conditions as water color, odor, vegetative condition, sedimentation, erosion, structural damage, etc.

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

In Baltimore County, there are 3,256 total outfalls. The Department of Public Works is currently developing an updated storm drain GIS layer of outfalls. There are two types of outfalls: major and minor. Major outfalls are ≥36” and minor outfalls are <36”. There are 667 major outfalls in our database and 603 have been prioritized. The minor outfalls are still at the beginning of being prioritized and 650 have been completed so far. There are a greater number of them (2,589), so they will be dealt with in phases. Baltimore County will focus on the minor outfalls in the areas where the Small Watershed Action Plans (Section 10) are being focused.

Outfalls are prioritized as follows: Outfalls that have been screened three times are assigned one of three priority ratings. Outfalls with major problems that require immediate correction and/or

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

Table 5-1 lists the number of outfalls by watershed and by the priority classification described above. To date, 57 of the major outfalls have not been sampled sufficiently to be prioritized. Additional screening effort will allow the County to assess and prioritize the status of these outfalls. Table 5-2 lists the non-prioritized outfalls by watershed.

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

Watershed	Priority 1		Priority 2		Priority 3		Total
Upper Western Shore							
	Minor	**Major**	**Minor**	**Major**	**Minor**	**Major**	
Deer Creek	0	0	4	0	1	0	5
Prettyboy Reservoir	0	0	0	0	1	0	1
Loch Raven Reservoir	10	22	99	41	31	13	216
Lower Gunpowder	0	7	0	23	1	10	41
Gunpowder River	0	0	1	0	0	0	1
Little Gunpowder Falls	0	0	0	2	0	0	2
Bird River	0	4	6	8	4	27	49
Middle River	2	3	2	7	0	5	19
Total	**12**	**36**	**112**	**81**	**38**	**55**	**334**
Patapsco-Back River							
Liberty Reservoir	0	0	0	1	1	0	2
Patapsco River	2	7	13	24	0	46	92
Gwynns Falls	8	30	115	55	56	72	336
Jones Falls	7	14	42	27	19	16	125
Back River	14	38	118	28	67	39	304
Baltimore Harbor	2	14	15	15	9	5	60
Total	**33**	**103**	**303**	**150**	**152**	**178**	**919**
Grand Total	**45**	**139**	**415**	**231**	**190**	**233**	**1,253**

Table 5-2: Non-prioritized outfalls by Watershed

Watershed			
Upper Western Shore			
	Minor	**Major**	**Total**
Deer Creek	0	0	0
Prettyboy Reservoir	0	0	0
Loch Raven Reservoir	366	9	375
Lower Gunpowder	274	9	283
Gunpowder River	24	3	27
Little Gunpowder Falls	78	1	79
Bird River	191	4	195
Middle River	67	0	67
Total	**1,000**	**26**	**1,026**
Patapsco-Back River			
	Minor	**Major**	**Total**
Liberty Reservoir	29	0	29
Patapsco River	206	4	210
Gwynns Falls	361	19	380
Jones Falls	257	9	266
Back River	61	5	66
Baltimore Harbor	25	1	26
Total	**939**	**38**	**977**
Grand Total	**1,939**	**64**	**2,003**

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

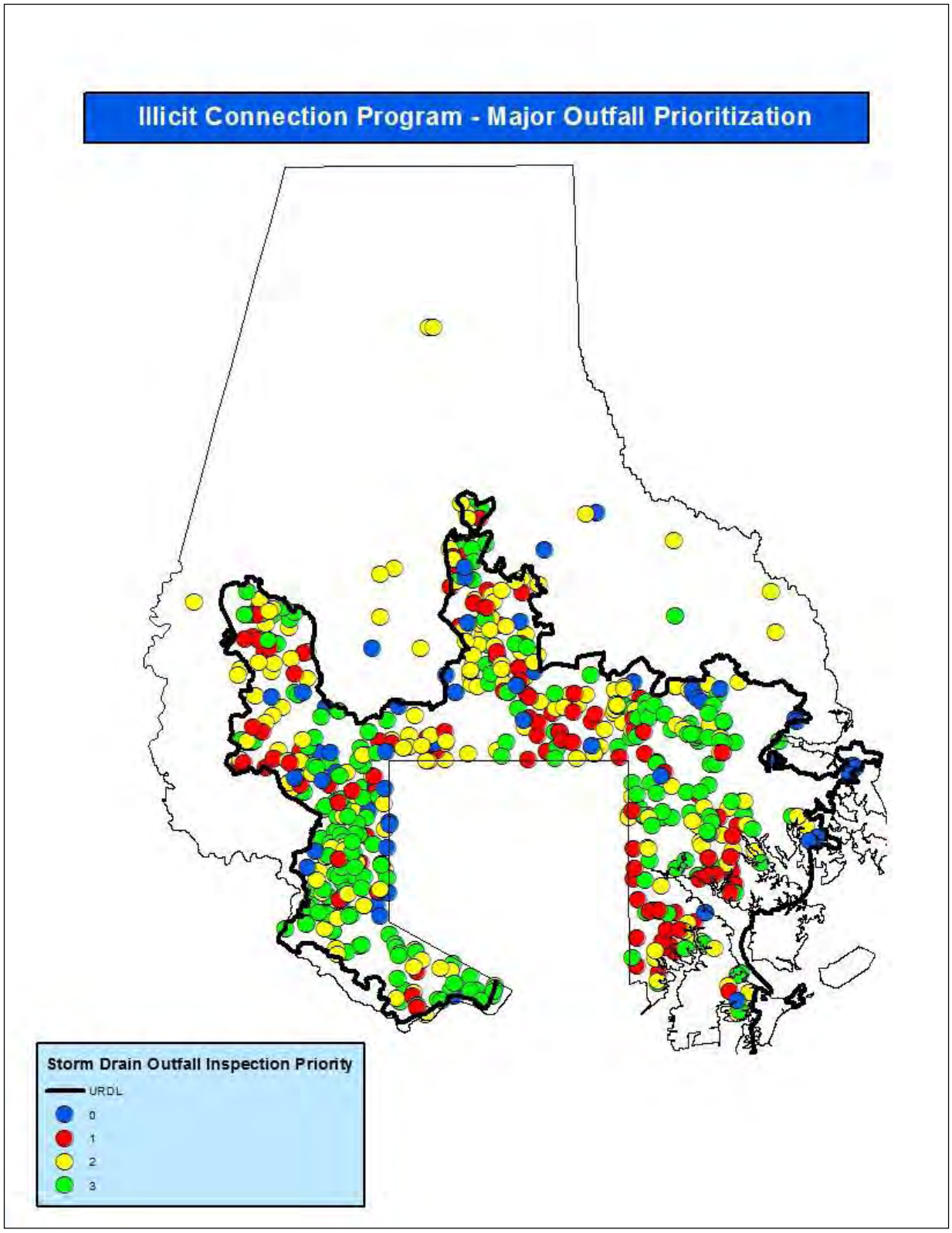


Figure 5-1a: Major Outfall Prioritization. Note most outfalls are inside the Urban-Rural Demarcation Line (URDL).

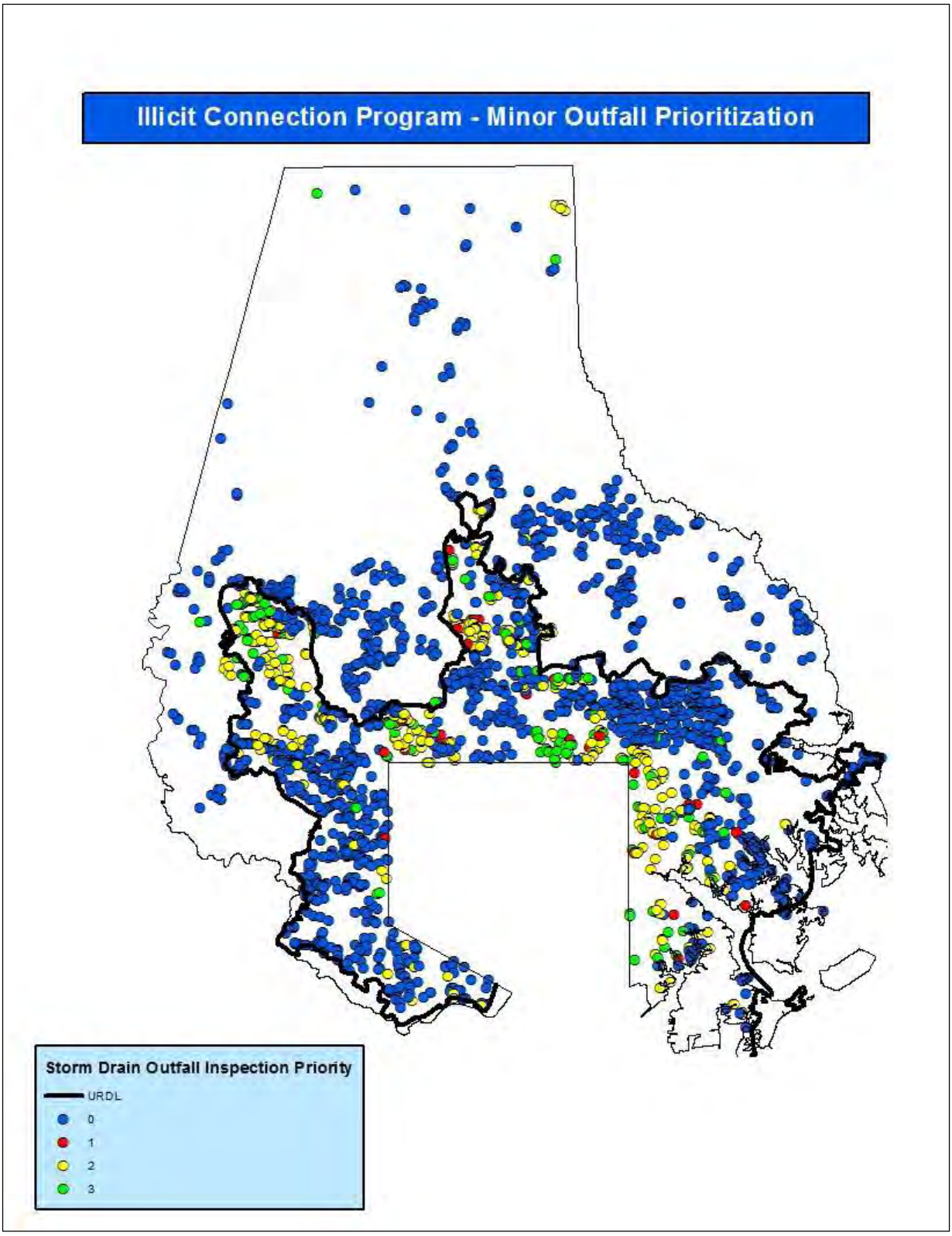


Figure 5-1b: Minor Outfall Prioritization. Note most outfalls are inside the Urban-Rural Demarcation Line (URDL).

The percentages of the 1,023 outfalls, which have been given a rating, are shown in Figures 5-2a and 5-2b.

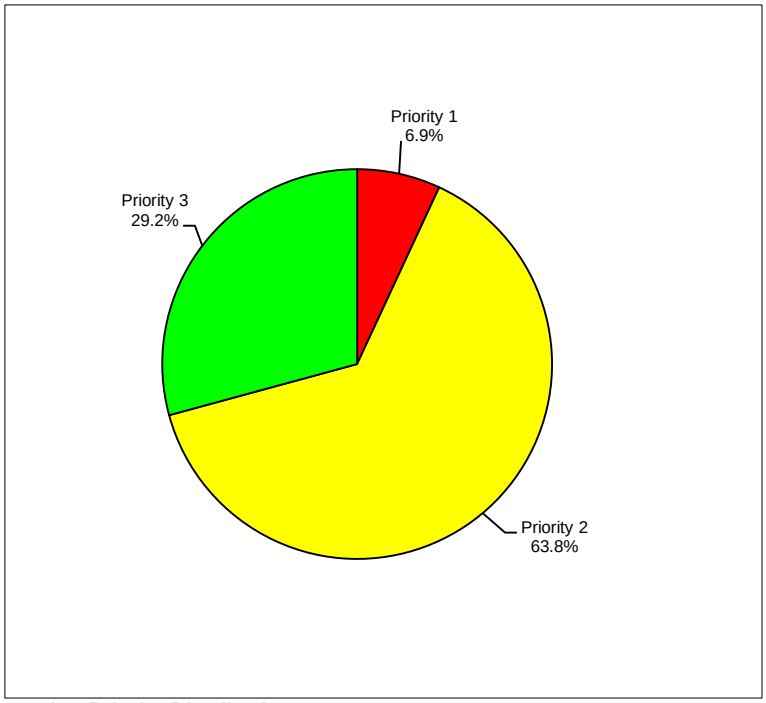


Figure 5-2a: Minor Outfall Screening Priority Distribution

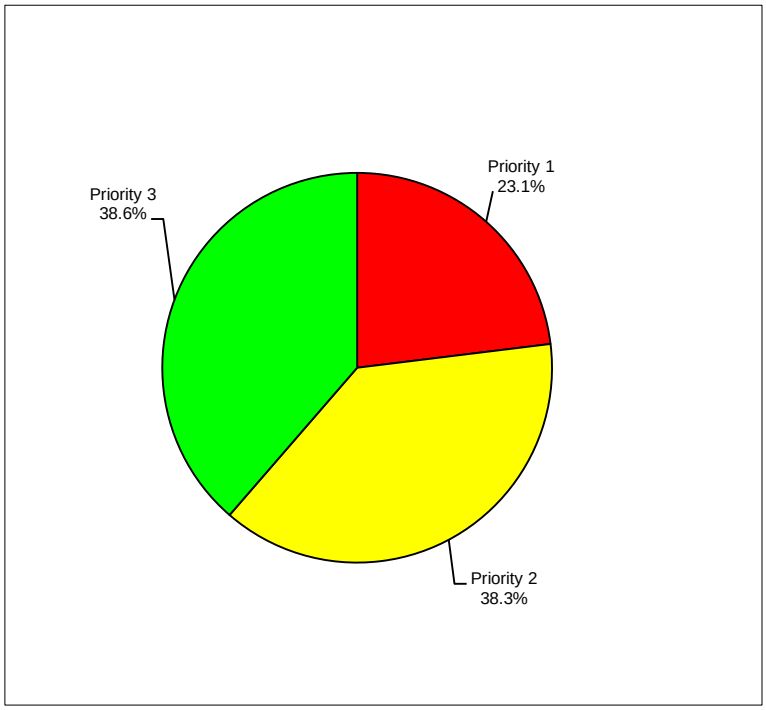


Figure 5-2b: Major Outfall Screening Priority Distribution

Of the 141 outfalls screened during January 2014 to December 2014, 36 were major outfalls and 105 were minor outfalls. They were selected from the newly prioritized database based on the following criteria:

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

Figures 5-3a and 5-3b shows the quantitative problems and Figures 5-4a and 5-4b shows the qualitative problems found. As indicated in Figures 5-3a and 5-3b, by the bar labeled "*none detected*", 122 out of the 141 routine outfall screenings had no detectable quantitative problems. Phenol, chlorine, copper, ammonia and boron are considered as indicators if they are above 0.17 mg/L, 0.4 mg/L, 0.21mg/L and 0.3 mg/L, 0.35 mg/L respectively. Temperature is considered a potential problem if it exceeds 75 degrees F (23.9 degrees C), which occurred in one outfall. The criteria used to determine if pH is out of range is if it is under 6.0 or above 9.0, and a problem was detected at four outfalls. Copper was detected at three outfalls and phenol was detected at 14 outfalls. Chlorine was detected at one outfalls and ammonia was detected at one. Boron was detected at one outfall. There were a total of 25 quantitative problems, table 5-3 shows which outfalls had those problems. Twenty-five percent of the major and about ten percent of the minor outfalls had a quantitative problem.

When an outfall has a quantitative problem detected, meaning the parameter was above the allowable threshold, it is automatically changed to a higher priority and investigated. The qualitative problems are more subjective and depend on the particular problem and severity.

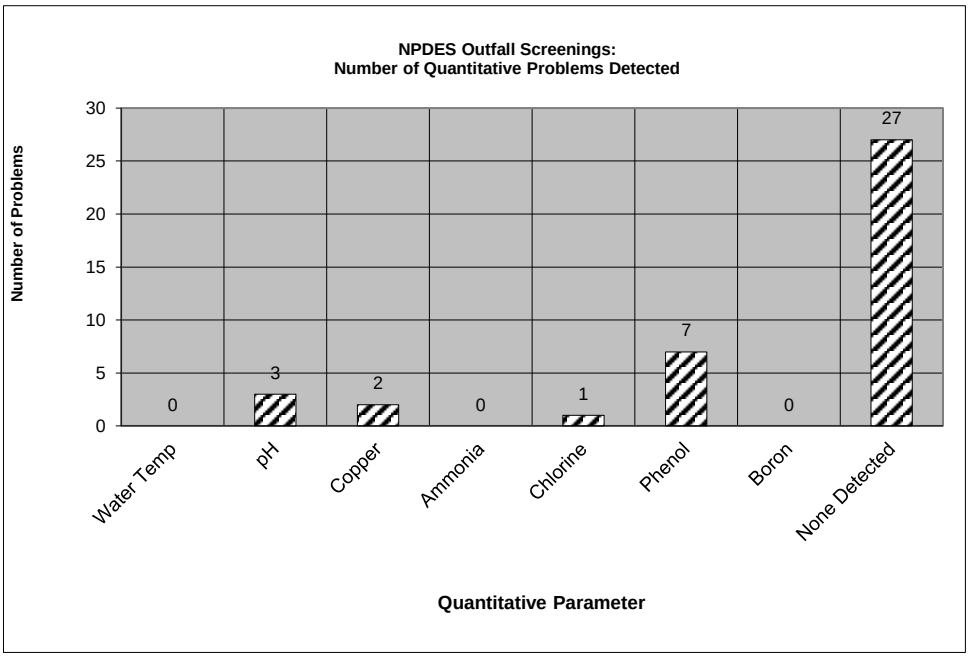


Figure 5-3a: Major Outfalls Number of *quantitative* problems detected.

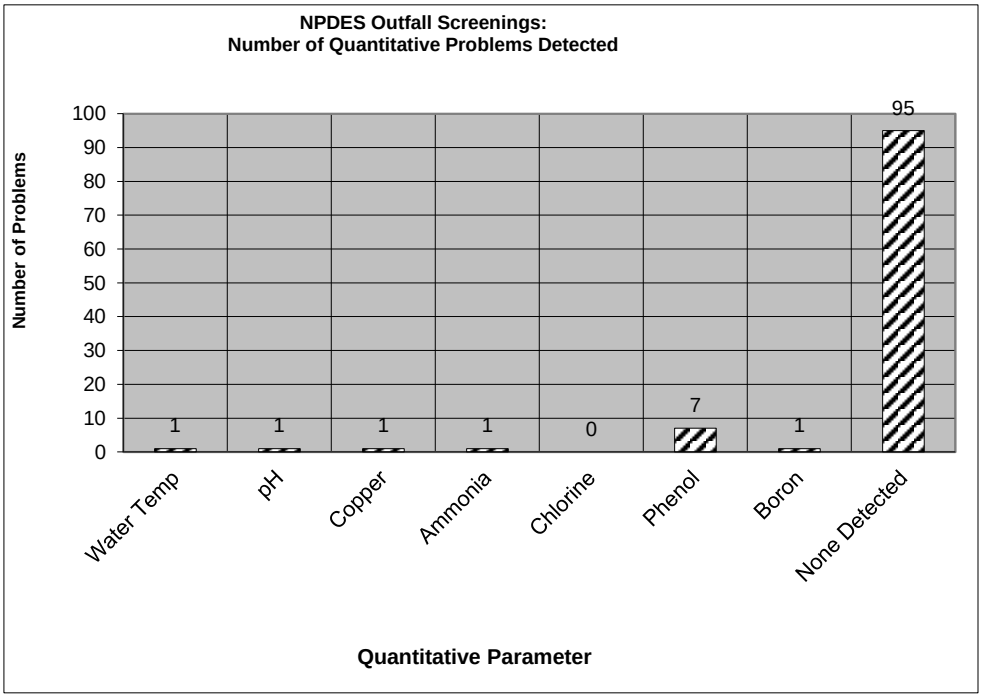


Figure 5-3b: Minor Outfalls Number of *quantitative* problems detected.

Table 5-3: Summary of 2014 Outfalls above Water Quality Threshold

Outfall	Parameter Exceeded	Source	Status
So-461	Phenols, chlorine, water temp.	Traced to water line break	14-045 on-going
So-1033	Phenols	Probably due to pool of water backed into pipe even though outfall had flow	Outfall is priority 1 to keep an eye on
So-1736	Phenols	Probably due to outfall being 90% submerged even though there was flow	Will investigate
So-2657	Phenols	Probably due to sampling plunge pool	Outfall is priority 1 to keep an eye on in case of intermittent issue
So-2447	Phenols	Probably due to sampling plunge pool	Outfall is priority 1 to keep an eye on in case of intermittent issue
So-1776	Ammonia	Probably due to large debris jam of leaves in pipe	Outfall is priority 1 to keep an eye on
So-3230	pH	Probably due to sampling plunge pool	Outfall is priority 1 to keep an eye on in case of intermittent issue
So-3138	Phenols	Undetermined	To be investigated
So-1251	Phenols	Probably due to pool of water backed into pipe even though outfall had flow	Outfall is priority 1 to keep an eye on
So-312	Copper	Probably due to sampling plunge pool	Outfall is priority 1 to keep an eye on in case of intermittent issue
So-2659	Boron	Probably due to sampling plunge pool	Outfall is priority 1 to keep an eye on in case of intermittent issue
502	Copper	Probably due to iron bacteria interference	Outfall is priority 1 to keep an eye on
349	Phenols	Undetermined	To be investigated
329	Phenols	Could have been due to dumped mattresses	14-081, will rescreen to be sure
314	Phenols	Retested and phenols were under threshold	Outfall is priority 1 to keep an eye on

Outfall	Parameter Exceeded	Source	Status
243	Phenols, Copper, pH	Probably due to sampling plunge pool	Outfall is priority 1 to keep an eye on in case of intermittent issue
021	Phenols	TV'ing of line showed no leaks or cross connections, may be from wildlife	14-093 Outfall is priority 1 to keep an eye on
823	Phenols, pH	Probably due to sampling plunge pool	Outfall is priority 1 to keep an eye on in case of intermittent issue
003	pH	May be due to school bus washing	15-072, will rescreen to be sure
319	Phenols	Undetermined	Investigation started

Figures 5-4a and 5-4b illustrates incidences of problems observed during *qualitative* assessments such as; visual evidence of sewage, oil, and structural problems. Qualitative and "visual problems" which were those most frequently encountered included observations regarding color, odor, clarity, and receiving water characteristics and sediment deposition immediately at and below each outfall. Trash, erosion, and sediment deposition were observed at 105, 19, and 71 outfalls, respectively. Sewage was not observed at any outfalls. Oil was found at one, structural issues at 21 and odor at two. Of the total 141 outfalls screened, there were a total of 219 qualitatively assessed problems, however, 18 had no problems. Many of the outfalls screened had more than one problem. Ninety-two percent of the major and 86% of the minor outfalls had a quantitative problem.

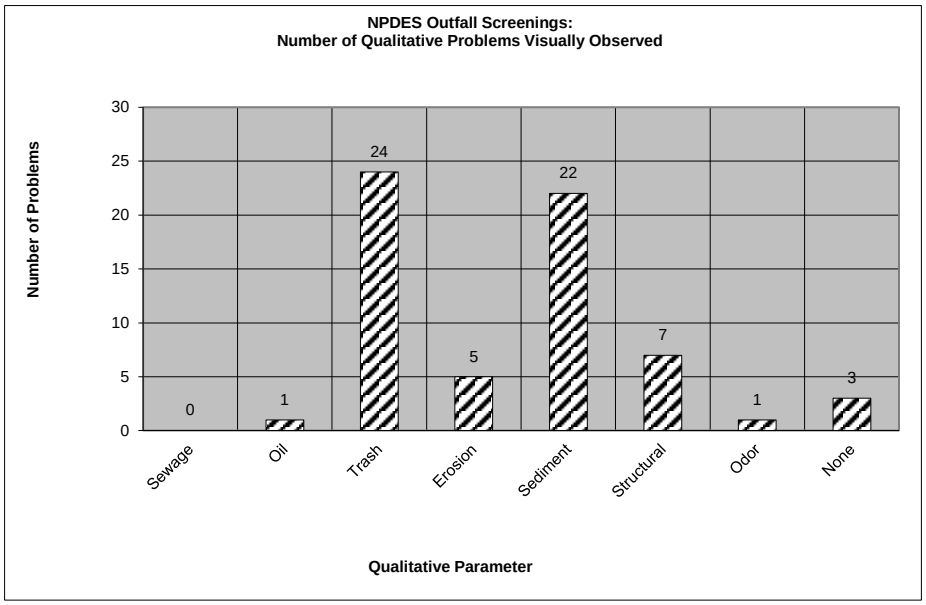


Figure 5-4a: Major Outfalls Number of *qualitative* problems visually observed.

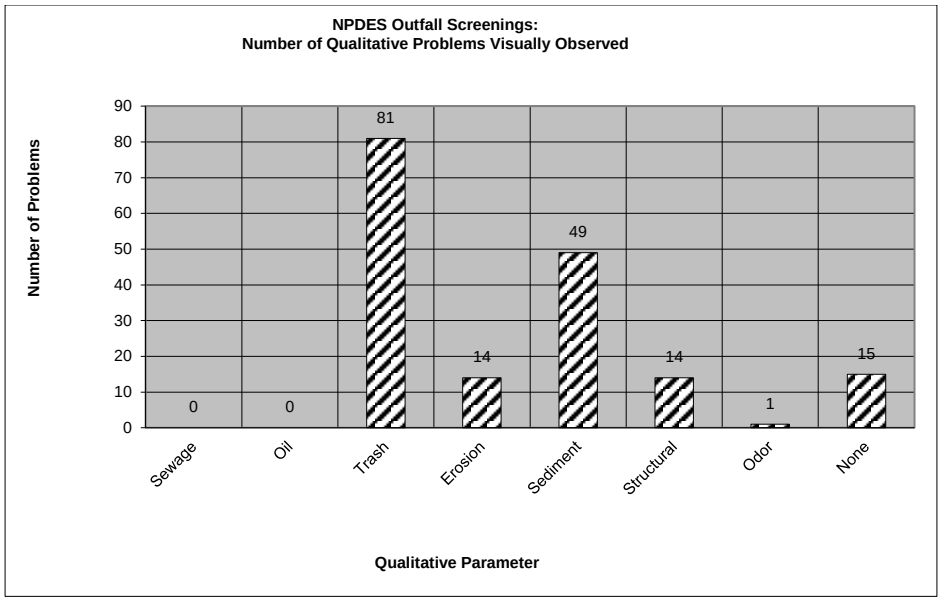


Figure 5-4b: Minor Outfalls Number of *qualitative* problems visually observed.

As described above, routine outfall screenings include a quantitative analysis, a qualitative assessment and a visual inspection. Based on these three procedures, a total of 244 problems were encountered during the 141 routine outfall screenings during this reporting period. Many of the outfalls had more than one problem. Observations regarding the receiving channel within the immediate vicinity of the outfall were also included.

During the reporting period, outfall screening was distributed among eight watersheds as follows: Gwynns Falls (74), Back River (26), Baltimore Harbor (2), Bird River (1), Loch Raven (24), and Jones Falls (11), and Patapsco (3).

5.4 Enforcement

The Illicit Connection Program was developed by identifying existing programs that address the requirements of the illicit connection program and incorporating those programs and their procedures by reference into the overall illicit connection program. These existing programs include:

- **Baltimore Metropolitan Water District** has responsibility for correction of problems in the water distribution system. Baltimore City administers this portion of the Baltimore Metropolitan Water District program. Only those problems associated with the water distribution system will be routed to the City via their complaint procedure.
- **Department of Public Works - Bureau of Utilities** has responsibility for maintenance of the County sanitary sewer system and the below ground portion of the County storm water sewer system. Any sanitary sewer problems encountered will be referred to this Bureau. This program also has the equipment, training and expertise to conduct below ground investigations to locate illicit connections.
- **Department of Public Works - Bureau of Highways** has responsibility for maintenance of the above ground portions of the storm water sewer system. All outfall structural problems will be routed to this Bureau for correction. The

determination of corrective action will be on a priority basis within the limits of the County's capital improvement budget.

- **Department of Environmental Protection and Sustainability - Groundwater Management Section** has the authority to order correction of failing septic systems and the expertise to facilitate the correction of these systems if they require innovative technology for permanent correction. Any septic system failing to the storm water sewer system will be referred to this Section.
- **Department of Health Environmental Services Section** - Baltimore County Health inspectors investigate some complaints that are now categorized as potential illicit connections. These complaints include septic systems, leaky refuse and grease containers, the dumping of used motor oil, leaky engines, and industrial maintenance activities among others. Because these investigations are only a small percentage of the thousands of complaints received each year by the regional programs, it was difficult to separate complaints with a potential illicit connection from the rest of the caseload. These thousands of complaints were analyzed and broken down into the categories seen in Figure 5-5. After looking at the data from 2005-2009, it was determined that the breakdown into categories is approximately the same each year and we can assume these numbers will continue to be the same in the future.

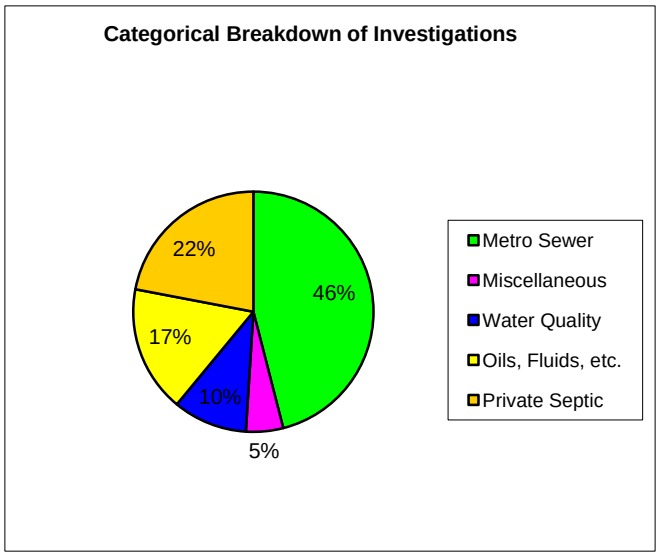


Figure 5-5: Involvement of the Regional Programs in the Investigation of Illicit Connections. This is the approximate breakdown of cases based on past data.

- **Maryland Department of the Environment (MDE)** has responsibility for the permitting of industrial discharges under the NPDES Industrial Permit program and the NPDES Industrial Stormwater Permit program. Any discharges that are industrial in nature and for which the source has been identified will be routed to MDE.

The Watershed Monitoring Section of Environmental Protection and Sustainability will provide overall coordination, record keeping and tracking of the Illicit Connection Program. This section will perform the outfall screening and initial field investigations if an illicit connection is detected as a result of the screening. This section will also be responsible for directing the removal of illicit connections that do not fall under the responsibility of an existing program.

5.5 Illicit Connections Investigations and Corrections

During the reporting period, the Watershed Monitoring section handled 99 investigations, of which 44 were citizen complaints. The citizen complaints include participants in the Stream Watch Program through various watershed associations. Four citizen complaints were received through our report pollution web form, although it is important to note citizens are still emailing as well. The remainder of the investigations listed as complaints in table 5-3 came from other sections of EPS or other agencies. Table 5-4 lists a summary of cases referred to other agencies and those handled by EPS as well as the status of the investigations. Complaints that are still open will be investigated until resolution. These complaints and their status are detailed in Table 5-5. Open complaints or complaints from 2013 that had a change in status are listed at the beginning of the table. Case numbers from 2013 in italics were added after prior report was written.

Table 5-4: Summary of Complaint Status

	On-going	Case Closed	**Total**
Referred to other agencies	17	49	**66**
Handled by EPS	3	30	**33**
Total	**20**	**79**	**99**

Table 5-5: Open/Change in Status Complaints 2013 and Complaints Processed from January 1, 2014 through December 31, 2014

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
13-002	1/22/13	Water bubbling next to road.	Complaint	***Update: Baltimore City says this is a Baltimore County issue. Working on resolution with Baltimore County DPW.***	**On-going**	9755 Matzon Rd. 37 G2
13-007	2/26/13	Abandoned vehicles on public property.	SWAP Hotspot	Referred to Police Department. Requested update twice, no response.	**On-going**	1202 Middle River Road. 37 E1
13-012	3/28/13	Property owner clear cutting their land.	Complaint	Referred to EIR.	**On-going**	080. 45 A3
13-015	4/18/13	Submerged outfalls.	Outfall	Inlet in street was almost full of water. Referred to Rec and Parks. No response after two update requests.	**On-going**	So-1550. 19 B9

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
13-025	5/21/13	Oil sheen covering stream.	Complaint	MDE is investigating when time allows. It is not oil but food grade material. ***Update: Site still being monitored monthly, problem has not been seen again.***	**Case closed**	So-2694. 16 E10
13-041	6/27/13	Staining around fuel tanks.	SWAP Hotspot	Referred to MDE Oil Control Program. MDE never answered requests for investigation result.	**On-going**	595. 16 D11
13-042	6/27/13	Staining around fuel tanks.	SWAP Hotspot	Referred to MDE Oil Control Program. MDE never answered requests for investigation result.	**On-going**	So-1731. 27 C2
13-043	6/27/13	Staining on fuel pumps, drums stored outside.	SWAP Hotspot	Referred to MDE Oil Control Program. MDE never answered requests for investigation result.	**On-going**	080. 45 A3
13-058	10/23/13	Spilled gasoline washed into storm drain by gas station employee.	Complaint	Complaint was also given to MDE by citizen. Contacted MDE to find out who is investigating so I can follow up with them. After two requests never received answer back.	**On-going**	Essex Road bridge. 33 E3
13-061	3/11/13	Outfall broken at joint.	Outfall	Referred to DPW Storm Drain Engineering. Haven't heard back about status.	**On-going**	111 W. Chesapeake Avenue. 27 C6

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
13-065	4/11/13	Outfall broken at joint and apron damage.	Outfall	Referred to DPW Storm Drain Engineering. Requested updated and never received one.	**On-going**	7 Jerusalem Mill Court. 22 D9
13-073	4/23/13	Landscape dumping at outfall, cracked apron.	Outfall	Apron cracked by large metal roll-off container. Doorhangered for landscape dumping. Referred to DPW Storm Drain Engineering.	**On-going**	So-1731. 27 C2
13-080	2013	High e. coli level in outfall.	Outfall	Returned to site and retested outfall several times, e. coli level has been low and high, still investigating possible sources. Excessive dog waste may be responsible. Doorhangered to educate residents.	**On-going**	So-928. 36 H6
13-082	8/21/13	High flow at outfall.	Outfall	Chlorine level was low. Contacted Baltimore City to see if pumping station construction was responsible, never heard back.	**On-going**	Lakeside Blvd. at Owings Run Apt. entrance. 24 E7
13-094	7/5/13	Outfall separated at joint.	Outfall	Referred to DPW Storm Drain Design.	**On-going**	Philadelphia Road over culvert. 29 J9
13-096	5/30/13	Outfall blocked by vegetation and landscape dumping.	Outfall	Referred to State Fairgrounds Management. Never received request for update.	**On-going**	7 Jerusalem Mill Court. 22 D9

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
13-098	11/4/13	Eroding storm drain manhole.	Upland	Referred to DPW Utilities.	**On-going**	3001 Eastern Blvd. 38 B5
13-099	11/4/13	Outfall broken at multiple joints.	Outfall	Referred to SD Design. ***Update: This was repaired with Stormwater fee FY 2014 funds.***	**Case closed**	9813 Philadelphia Road. 29 F13
13-102	8/27/13	Outfall pipe separated at joint.	Outfall	Referred to SD Design. They never responded to request for update.	**On-going**	1717 Reisterstown Rd. 25 E9
13-103	8/15/13	Swampy odor in area.	Complaint	No smell during visit.	**Case closed**	595. 16 D11
13-104	8/28/13	Yard waste being dumped in stream.	Complaint	Doorhangered neighborhood to educate on proper disposal.	**Case closed**	So-1731. 27 C2
13-105	3/28/13	Leaves being dumped at outfall.	Outfall	Doorhangered neighborhood to educate on proper disposal.	**Case closed**	080. 45 A3
13-106	10/17/13	Yard waste dumped in storm drain.	Upland	Doorhangered neighborhood to educate on proper disposal.	**Case closed**	Outfall 560. 28 G11

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
13-107	4/22/13	Foam and high phenols at outfall.	Outfall	Traced to car dealer who was dumping mop buckets into storm drain. They have been informed on proper procedures.	**Case closed**	Outfall 315. 27 E7
13-108	3/11/13	Pet waste and yard waste dumping.	Upland	Doorhangered to educate about proper disposal.	**Case closed**	So-1550. 19 B9
13-109	10/22/13	High e. coli at outfall.	Outfall	High bacteria was due to raccoons living in storm drain. Line was tv'ed and flushed.	**Case closed**	So-1805. 18 J10
13-110	11/7/13	New outfall with high chlorine.	Outfall	Revisited outfall, was dry. Has been added to database for future monitoring.	**Case closed**	Behind 6719 Fordcrest. 36 K4
13-111	10/4/13	Unusually high flow at USGS gage during dry weather.	Complaint	Screened outfalls in area, walked stream found no issues. Was probably due to a water leak that has since been repaired.	**Case closed**	So-928. 36 H6
13-112	2013	High ammonia and fluoride at outfall.	Outfall	Traced to inlet in parking lot of Teledyne. Referred to Plumbing.	**On-going**	So-1289. 25 H7
13-113	2013	Water running in inlet.	Complaint	May have been the leaking fountain which has been turned off. No water currently running.	**Case closed**	Lakeside Blvd. at Owings Run Apt. entrance. 24 E7

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
14-001	3/17/14	Mobile car washing business discharging to storm drain.	Upland	MDE visited site and informed them of how to properly handle discharge to stay in compliance.	**Case closed**	8716 Liberty Road. 24 G13
14-002	01/17/14	Garage floor covered with oil.	Complaint	May be running auto shop out of home. PAI has placed a lien since owner failed to show for hearing.	**Case closed**	5650 Carville Ave. 42 A9
14-003	03/17/14	Piles of sediment and gravel in street.	Complaint	Sediment control investigated and found no violations.	**Case closed**	St. Agnes and Masefield. 33 G12
14-004	3/5/14	Cloudy water at outfall.	Complaint	No issues found. Citizen will let us know if they see it again.	**Case closed**	Outfall so-3227. 33 G10
14-005	1/8/14	Excessive dog feces found while doing SWM pond inspection.	Complaint	Doorhangered twenty houses to educate about proper disposal.	**Case closed**	Valles Court. 28 E5
14-006	3/17/14	Yard waste dumping in woods.	Upland	Doorhangered four houses to educate about proper disposal.	**Case closed**	Clifmar. 24 K13
14-007	1/8/14	Excessive dog feces found while doing SWM pond inspection.	Complaint	Doorhangered twenty-four houses to educate about proper disposal.	**Case closed**	Minte Dr. 29 B6

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
14-008	3/2014	Trash along road.	Complaint	Site had normal roadside litter, not excessive. Heavy equipment tire present, referred to DPW Highways. Highways would not clean up tire because it wasn't blocking water flow. Added to potential project list for citizen clean-ups.	**Case closed**	Next to 8900 Reisterstown Rd. 25 C8
14-009	5/27/14	Grass blown in street.	Complaint	Notified company this practice is illegal. DPW street swept.	**Case closed**	1919 Church Road. 44 J5
14-010	06/07/14	Overflowing dumpster and dumping at business.	Complaint	Referred to PAI. Inspector found no violations.	**Case closed**	30 Balfred Rd. 40 K5
14-011	04/25/14	Oil Sheen in stream caused by nearby facility.	Complaint	Visited facility found no evidence of spills. No sheen in stream. Gas pump has spill kit and UST is below size requiring a SPCC.	**Case closed**	4100 Maple Avenue. 42 B8
14-012	4/25/14	Sanitary manhole cover not on properly.	Complaint	Referred to DPW Utilities who found all covers on properly.	**Case closed**	Spyglass Ct. 18 G12
14-013	3/21/14	Report of septic leak and trash dumping.	Complaint	Bacteria results found no evidence of septic leak. PAI found no trash violations.	**Case closed**	1104 Freeland. 3 B3
14-014	6/5/14	Sediment from illegal ditches going into stream.	Complaint	The ditches are an allowable part of the agricultural operation on property.	**Case closed**	4830 Trenton Mill Rd. 5 C13

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
14-015	7/16/14	Trash outside of SWM pond.	Complaint	Property Management and Highways cleaned the trash.	**Case closed**	8537 Brest Rd. 24 H10
14-016	07/11/14	Sludgy water dumped into storm drain.	Complaint	Crew was working for Baltimore City cleaning water valve vaults. They have been informed on proper disposal procedures.	**Case closed**	Wise Avenue and North Point Road. 45 E6
14-017	8/29/14	Stream clogged with down trees and trash.	Complaint	DPW Highways cleaned several bags of trash and removed tree.	**Case closed**	7323 Prince George Street. 33 D1
14-018	6/17/14	Grease draining to stream.	Complaint	Source of foul water was grocery store compactor discharging to storm drain. EH had them correct the issue.	**Case closed**	7309 McClean Blvd. 27 J11
14-019	7/22/14	Paint chipping off outfall.	Complaint	The material chipping is no longer used in outfalls. This is not a safety issue, so it will be monitored and fixed if it becomes worse.	**Case closed**	Dutton Avenue. 41 B3
14-020	11/10/14	Oil spilled in intersection.	Complaint	Fire department responded but oil was dry, they can't do anything with dry oil.	**Case closed**	Sagamore Forest Lane. 16 E5
14-021	8/4/14	Building power washing going into storm drain.	Complaint	Sent management company letter on compliance options for future power washing activities.	**Case closed**	20 Lambourne Road. 27 D6

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
14-022	10/28/14	Trash in stream.	Complaint	Metro parking lot, dumpster, trash cans were clean. Source is litter from bus stop. Suggested to Blue Water Baltimore as a volunteer clean-up site.	**Case closed**	4300 Old Court Road.
14-023	4/24/14	Pool being discharged to street.	Complaint	No discharge at time of visit. Doorhangered to educate on better disposal. Homeowner let us know it was rainwater from top of cover.	**Case closed**	17004 Sunswept Lane. 6 K11
14-024	Mar-14	Salt piles stored near storm drain.	Complaint	No salt piles observed. Sent email to educate on proper procedure for this winter.	**Case closed**	9901 York Road. 18 J8
14-025	7/2/14	Gray Discharge at outfall.	Outfall	Source was sidewalks being redone. Doorhangered to educate.	**Case closed**	245 Linden Avenue. 27 E7
14-026	8/20/14	48 tires stored in yard.	Complaint	PAI issued correction notice to remove.	**Case closed**	41 Fullerton Heights Avenue. 28 E13
14-027	9/24/14	Trash being thrown outside of trash cans.	Complaint	PAI found no violations.	**Case closed**	1314 3rd Road. 38 A8
14-028	8/11/14	Fish kill.	Complaint	Naturally occurring due to fish being trapped in pool.	**Case closed**	11 Farwell Court. 29 D8

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
14-029	07/07/14	Area G Hot Spots found various sediment, grease, trash, car washing issues.	SWAP Hotspot	Various violations and no violations found.	**Case closed**	Area G (Jones Falls).
14-030	12/09/14	Approximately 10 bags of leaves dumped.	Upland	Baltimore City has removed bags of leaves.	**Case closed**	Glen Falls at railroad tracks. 15 E2
14-031	11/26/14	Leaky oil drums, vehicle washing.	SWAP Hotspot	Asked MDE twice for update and got no response.	**On-going**	3403 East Joppa Road. 28 H7
14-032	11/26/14	Trash and grease around dumpsters.	SWAP Hotspot	EH spoke to owner, they will remove items.	**Case closed**	4140 East Joppa Road. 29 B6
14-033	11/26/14	Messy grease dumpster, stains around inlet and back door from wash water.	SWAP Hotspot	EH told business to clean up grease. No wash water was observed being thrown out back door.	**Case closed**	8810 Waltham Woods Road. 28 C6
14-034	11/26/14	Grease spilled on and around dumpster.	SWAP Hotspot	EH told business to clean up grease.	**Case closed**	8816 Waltham Wood Road. 28 C6
14-035	11/26/14	Cars being worked on in parking lot, resulting in spilled fluids.	SWAP Hotspot	EH did not find any cars being worked on but asked manager to call to discuss. Emailed photos taken to show this activity and asked if manager had called inspector. Never got a response back from EH.	**On-going**	2105 E. Joppa Road. 28 C7
14-036	11/26/14	Wash water dumped behind building	SWAP Hotspot	EH instructed business how to properly dispose of wastewater.	**Case closed**	4136 E. Joppa Road. 29 B6

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
14-037	10/8/14	Inlet collapsing and causing erosion.	Complaint	Utilities raised and repaired inlet. CPO put stream on potential project list.	**Case closed**	1007 Chestnut Ridge Drive. 18 C11
14-038	11/26/14	Car washing discharge going to storm drain.	SWAP Hotspot	Sent violation letter and then elevated complaint to MDE. Enterprise is no longer washing cars at this facility.	**Case closed**	2031 E. Joppa Road. 28 C7
14-039	11/21/14	Car leaking oil.	Complaint	EH did not observe car and found no significant oil spots.	**Case closed**	8600 block Oakleigh Road. 28 A7
14-040	05/27/14	Excessive trash in stream from business.	Complaint	Dumpsters were clean, no excessive trash. Some litter from upstream.	**Case closed**	6501 B Baltimore National Pike. 41 A1
14-041	11/12/14	Sediment/road debris pile dumped near culvert.	Complaint	Highways removed pile, but complaintant said some still remains. Highways reported remaining rubble is providing barrier to keep debris out of culvert.	**Case closed**	Francis Avenue at 195. 41 J10
14-042	11/22/14	Burning materials on bulkhead, adding construction debris to bulkhead, pipe draining to water.	Complaint	Sediment Control and EIR had already received complaint, except burning. Fire Department found no violations.	**Case closed**	13116 Cherwin Avenue. 30 K10
14-043	06/09/14	Trash dumping.	Complaint	Complaintant got license plate. Police knocked on residence with no answer. Asked them to pursue a clean-up action. Police never responded to request for update.	**On-going**	933 Hillside Drive. 26C4

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
14-044	06/06/14	Evidence of sewer overflow.	Complaint	Utilities verified there were no ongoing issue.	**Case closed**	Patapsco State Park east of Halethorpe Farms Road. 42 A12
14-045	04/28/14	Chlorine found at outfall.	Complaint	Referred to Baltimore City.	**On-going**	Outfall so-461. 33 A11
14-046	06/05/14	Car wash business is being run out of home.	Upland	Doorhangered to educate on proper disposal of car wash discharge.	**Case closed**	3938 Rolling Road. 25 A12
14-047	04/29/14	Trash and sofa clogging stream.	Complaint	WMM found no sofa. Highways cleaned litter.	**Case closed**	8122 Streamwood Drive. 25 B11
14-048	05/08/14	Outfall 100% submerged.	Outfall	SWM reported this is on the list to be fixed.	**Case closed**	Outfall so-1054. 26 D9
14-049	05/08/14	Fluoride found in outfall.	Outfall	Leak has been repaired.	**Case closed**	Outfall so-1270. 26 D8
14-050	10/24/14	Bus washing, overflowing salt pile and overflowing dumpsters.	SWAP Hotspot	Referred to MDE.	**On-going**	1524 E. Joppa Road. 27 J7
14-051	05/05/14	Outfall blocked by sediment and trash.	Outfall	SWM cleaned pond.	**Case closed**	so-1383. 24 J10
14-052	03/25/14	Optical brighteners found in outfall.	Complaint	MDE issued violation. King Motors has ceased car washing activities.	**Case closed**	Outfall 822. 33 H5
14-053	12/2014	Buried outfall.	Outfall	DPW Highways will unbury outfall.	**Case closed**	Outfall so-1344. 25 A6

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
14-054	05/07/14	Excessive trash in ditch, 100s of bottles.	Outfall	Highways is doing a right of way search to see who is responsible for cleaning. If it's them it will be cleaned in 90 days.	**Case closed**	Outfall 130. 37 E6
14-055	05/15/14	Trash going into stream. White PVC pipe draining to stream.	Complaint	Trash was mostly from upstream litter not business. EH found pvc pipe only drained rainwater.	**Case closed**	1817 Frederick Road. 41 B4.
14-056	05/21/14	Various complaints from Randallstown trash listening session.	Complaint	SHA put sites on rotating maintenance schedule. Requested update from MTA and one SHA site and never heard back. SWM cleaned SWM pond trash. WMM removed large trash item. One site added to potential project list for volunteer cleanup.	**On-going**	Various. 24 K13
14-057	03/28/14	Grey discharge at outfall.	Complaint	Sent grease issue to EH. Will investigate high e. coli.	**On-going**	Outfall 289. 32 H1
14-058	08/13/14	Trash tour problem sites.	Complaint	Sent to EH, PAI, SHA, DPW Highways. Issues have been corrected, when enforceable issues found by inspectors.	**Case closed**	Various. 42 A6
14-059	05/28/14	Outfall 95% submerged.	Outfall	Highways will correct this.	**Case closed**	Outfall so-191. 37 H6

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
14-060	03/20/14	Outfall with sudsy discharge.	Complaint	Rescreened outfall, no suds all parameters within range, added to our database. SD Design said outfall damage is not affected flow, will keep an eye on to make sure damage doesn't get worse.	**Case closed**	Outfall so-3223. 33 H6
14-061	05/28/14	Various complaints from Ag Center trash listening session.	Complaint	Added some trash cleanups and an invasive removal to potential project list. Referred to SHA (completed some, never heard back on others), PAI (complete),EH (complete), Highways (never heard back) and SD Design (never heard back).	**On-going**	Various. 29 A6
14-062	10/2014	Sediment issues at residential construction project.	SWAP Hotspot	Referred to Sediment Control. Asked twice for update, they hadn't investigated yet.	**On-going**	W. Joppa Road and Meadowridge Court. 27 G7
14-063	05/05/14	Residential yard waste dumping in swm pond.	Outfall	Doorhangered 11 houses to educate. While out homeowner notified us of clogged stormdrain, DPW cleaned.	**Case closed**	Outfall so-1382. 24 J10
14-064	04/21/14	High bacteria.	Outfall	Narrowed down storm drain line, requested Utilities TV line.	**On-going**	Outfall 599. 16 D10
14-065	07/22/14	Leaking water meter.	Complaint	Baltimore City repaired leak.	**Case closed**	3010 Bender Ridge Court. 20 G5
14-066	03/16/14	Outfall with high ammonia.	Complaint	Couldn't locate. Asked BWB for help and they said they probably couldn't find it again.	**Case closed**	Gwynndale and Gwynnmore. 33 H6

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
14-067	03/20/14	Outfall with high ammonia.	Complaint	Baltimore City corrected sewer leak.	**Case closed**	4806 Seton Drive. 33 H3
14-068	06/04/14	Various complaints from Dundalk trash listening session.	Complaint	Prologue did homeless outreach, PAI issued violation, Rec and Parks will keep an eye on litter at park, clean when necessary.	**Case closed**	Various. 44 K5
14-069	11/06/14	High fluoride at outfall.	Complaint	Traced to water leak in sidewalk. Referred to Baltimore City.	**On-going**	Cedar Drive. 33 G7
14-070	07/10/14	Leaking sewer pipe.	Complaint	Will return to site to take more bacteria samples.	**On-going**	Wycliffe Road. 28 A11
14-071	04/18/14	Car wash discharging to storm drain. Reopened due to another complaint.	Complaint	MDE and DPW spoke to car wash about proper procedure. Will revisit with DPW.	**On-going**	955 Essex Avenue. 37 E8
14-072	2014	Pipe crossing stream is discharging ugly material.	Complaint	Only pipe present is USGS gage pipe.	**Case closed**	Regester Avenue. 27 G11
14-073	08/07/14	Liquid dripping from spent grain silo.	Complaint	Referred to EH.	**On-going**	8901 Yellow Brick Road. 37 B4
14-074	07/17/14	High E.coli at outfall.	Outfall	Traced to a flood control pit in storm drain manhole, will test above this in future as this may be tidal water.	**Case closed**	Outfall so-111. 45 C5

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
14-075	03/17/14	Soapy discharge in stormwater pond.	Complaint	No discharge at time of visit. From pictures, appears source was a sanitary sewer. No evidence of recent overflows.	**Case closed**	7101 Rolling Mill Road. 36 F11
14-076	12/22/14	Outfall 100% submerged.	Outfall	Referred to Highways.	**On-going**	Outfall so-2085. 24 J3
14-077	12/22/14	Outfalls filled with sediment, neighbor complained about trash in pond.	Outfall	SWM put this on maintenance list.	**Case closed**	Outfalls so-3148 and so-3149.
14-078	12/22/14	Couch dumped in BGE right-of-way.	Upland	BGE removed couch.	**Case closed**	Ritters Lane. 24 G3
14-079	12/22/14	Outfall buried by woody debris.	Outfall	Highways cleared outfall.	**Case closed**	Outfall so-2441. 24 F3
14-080	03/20/14	Elevated ammonia at outfall.	Complaint	Did full screen on outfall, all tests were low including ammonia which was <0.1 ppm. Will change outfall to higher priority in case there is an intermittent issue.	**Case closed**	Outfall 676. 33 G2
14-081	12/08/14	Mattresses dumped on side of road.	Outfall	Highways removed mattress.	**Case closed**	Outfall 329. 24 G2
14-082	12/18/14	Stream erosion.	Outfall	DPW is investigating improving the culvert.	**Case closed**	Outfall so-1042. 27 E9
14-083	12/19/14	Excessive trash in SWM pond.	Outfall	SWM will put on the list to be cleaned.	**Case closed**	Outfall 590. 24 E1
14-084	12/19/14	Lawn chairs dumped at outfall.	Outfall	Highways removed chairs.	**Case closed**	Outfall so-2466. 24 E1
14-085	12/19/14	Yard waste and residential dumping in SWM pond.	Outfall	Distributed door hangers to educate.	**Case closed**	Outfall so-3118. 16 E13.

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
14-086	12/19/14	Residential trash dumping.	Outfall	Distributed litter fact sheets.	**Case closed**	Outfall so-2463. 24 G1
14-087	12/19/14	Yard waste at outfall.	Outfall	Will doorhanger to educate.	**On-going**	Outfall so-1362. 25 A7
14-088	12/30/14	Outfall 60% full of sediment.	Outfall	Highways will clear outfall.	**Case closed**	Outfalls so-2683. 16 G10
14-089	12/30/14	Residential dumping in SWM pond.	Outfall	Distributed litter fact sheets.	**Case closed**	Outfall so-2681. 16 F10
14-090	12/30/14	Outfall 99% submerged.	Outfall	SWM inspected and the facility failed. It is on list for repair.	**Case closed**	Outfall so-2684. 16 F10
14-091	12/30/14	Yardwaste dumping.	Outfall	Distributed litter fact sheets.	**Case closed**	Outfall so-2687. 16 G10
14-092	04/22/14	Outfall damage causing erosion.	Complaint	Storm Drain Design has placed this on the low priority project list.	**Case closed**	Outfall so-1539. 19 C10
14-093	05/09/14	High phenols at outfall.	Outfall	Referred to Utilities.	**On-going**	Outfall 021. 18 J6
07-084	11/13/14	Chlorine found at outfall. Reopened case.	Complaint	Chlorine appears to be irrigation water from nearby school.	**Case closed**	Outfall so-1115. 25 K10.
14-094	10/01/14	Concern about illicit discharge in outfalls.	Complaint	Found one outfall, screened but it was dry. Stream was fine. Referred outfall erosion to SD Design.	**On-going**	Outfall so-2024. 26 J2.
14-095	10/30/14	Soapy discharge in stormwater pond.	Complaint	Visited outfall and it was dry. Will make high priority to keep an eye on in case of intermittent issue.	**Case closed**	Outfall so-1850. 18 H12
12-094	12/18/14	Orange material and sheen at outfall. Reopened case.	Complaint	No sheen or orange material but did find high fluoride, chlorine, phenols.	**On-going**	Outfall 144. 27 A4

Case No.	DATE	COMPLAINT	TYPE	ACTION TAKEN	STATUS	LOCATION
14-096	07/08/14	High surfactants and optical brighteners in outfall.	Complaint	Was actually a culvert, dry during screening. Pipe damage and erosion reported to SD Design.	**On-going**	7911 Beverly Avenue. 28 A10
14-097	07/15/14	Concern for water quality in stream.	Complaint	Tested stream and screened outfalls. No water quality issues present. One outfall had high phenols suspect from landscaping company runoff.	**Case closed**	8349 Tally Ho Road. 26 G2

5.6 Commercial/ Industrial Pollution Surveys (Hotspots)

Commercial and industrial pollution surveys have been conducted for years as part of the SWAP process, referred to as Hotspot Site Investigations (HSIs). A ramped up hotspot program was initiated in the 2015 fiscal year.

5.6.1 Hotspot Site Investigations

For many years, commercial and industrial sites (private and public) were selected for HSIs by looking for sites that seemed likely to be actual stormwater pollution hotspots. During the 2015 fiscal year, a total of 46 sites were assessed in this way in the following SWAP areas: Area A (5), Area N (23), and Area S (18). The Area A HSIs were re-visits of previously identified hotspots, in which 80% of these assessments were “confirmed hotspots”. Confirmed hotspots are written up as complaints and tracked until resolution. Table 5-6 lists the hotspot complaints handled during the 2015 fiscal year. The 2014 hotspot complaints have also been included above in Table 5-4, which are all the complaints the IDDE program investigated in 2014.

Consultants and staff doing fieldwork have been instructed to immediately report suspected illicit connections found. Hotspots were found both in hot spot assessments and while doing other fieldwork related to the SWAP. Complaints are also received at stakeholder meetings. Participants are asked to fill out cards with issues in the area and any illicit connections identified are investigated.

Table 5-6: SWAP Complaints Processed from July 1, 2014 through June 30, 2015

Case No.	DATE	COMPLAINT	ACTION TAKEN	STATUS	LOCATION
14-029	07/07/14	Area G Hot Spots found various sediment, grease, trash, car washing issues.	Various violations and no violations found.	**Case closed**	Area G (Jones Falls).
14-031	11/26/14	Leaky oil drums, vehicle washing.	Asked MDE twice for update and got no response.	**On-going**	3403 East Joppa Road. 28 H7
14-032	11/26/14	Trash and grease around dumpsters.	EH spoke to owner, they will remove items.	**Case closed**	4140 East Joppa Road. 29 B6
11-025	05/04/11	Revisited site, dumpster area is leaking juice and surrounded by trash. Reopened case.	EH inspector found the area clean, no violation.	**Case closed**	6300 Baltimore National Pike. 41 B1
14-033	11/26/14	Messy grease dumpster, stains around inlet and back door from wash water.	EH told business to clean up grease. No wash water was observed being thrown out back door.	**Case closed**	8810 Waltham Woods Road. 28 C6
14-034	11/26/14	Grease spilled on and around dumpster.	EH told business to clean up grease.	**Case closed**	8816 Waltham Wood Road. 28 C6
14-035	11/26/14	Cars being worked on in parking lot, resulting in spilled fluids.	EH did not find any cars being worked on but asked manager to call to discuss. Emailed photos taken to show this activity and asked if manager had called inspector. Never got a response back from EH.	**On-going**	2105 E. Joppa Road. 28 C7
14-036	11/26/14	Wash water dumped behind building	EH instructed business how to properly dispose of wastewater.	**Case closed**	4136 E. Joppa Road. 29 B6

Case No.	DATE	COMPLAINT	ACTION TAKEN	STATUS	LOCATION
14-038	11/26/14	Car washing discharge going to storm drain.	Sent violation letter and then elevated complaint to MDE. Enterprise is no longer washing cars at this facility.	**Case closed**	2031 E. Joppa Road. 28 C7
14-050	10/24/14	Bus washing, overflowing salt pile and overflowing dumpsters.	Referred to MDE.	**On-going**	1524 E. Joppa Road. 27 J7
14-062	10/2014	Sediment issues at residential construction project.	Referred to Sediment Control. Asked twice for update, they hadn't investigated yet.	**On-going**	W. Joppa Road and Meadowridge Court. 27 G7
15-008	01/16/15	At SHA facility sediment staining on outfall riprap, erosion on another outfall	Haybales have been replaced by boom around inlet.	**Case closed**	306 Mount Carmel Rd. 7 D10
15-027	03/30/15	Storage tank leaking, working on trucks outdoors.	MDE is having business correct some housekeeping issue. EH found trucks are washed over oil/grease separator and not repaired outside.	**Case closed**	3206 Hammonds Ferry Road. 42 E10
15-028	03/30/15	Leaking and overflowing dumpsters.	PAI found no violations. EH had them clean dumpster area and close lids.	**Case closed**	40 West Shopping Center, N. Rolling Road.
15-030	03/30/15	Cars leaking fluids, dumpster missing lid, discharge going to storm drain.	EH found discharge was water coming from an overflow device inside building, was corrected. PAI issued correction notice for junk/debris.	**Case closed**	4615 Hollins Ferry Road. 42 C11
15-065	04/22/15	Rusty, oily drums without lids.	Referred to EH.	**On-going**	1 Beaver Court. 18 G6.

Case No.	DATE	COMPLAINT	ACTION TAKEN	STATUS	LOCATION
15-066	04/22/15	Uncovered drums, trash, tires, untagged truck.	PAI found no violations.	**Case closed**	105 Beaver Court. 18 G5
15-075	04/22/15	Junk piles and untagged vehicles.	Referred to PAI.	**On-going**	200 Cockeysville Road. 18 G5
15-112	04/22/15	Pile of trash in woods behind house.	PAI didn't find trash issue, but issued correction notice for abandoned vehicle.	**Case closed**	5213 Pembroke Avenue. 33 H6
15-058	04/27/15	Junky conditions, salt stored on pallets outside.	Referred to PAI.	**On-going**	10822 Williamson Lane. 18 H4
15-059	04/27/15	Untagged vehicles	Referred to PAI.	**On-going**	10840F Williamson Lane. 18 G4
15-060	04/27/15	Untagged vehicles	Referred to PAI.	**On-going**	10823 Veneer Lane #4. 18 G4
15-061	04/27/15	Untagged vehicles	Referred to PAI.	**On-going**	10823 Veneer Lane, #C. 18 G4
15-062	04/27/15	Overflowing dumpster of dirt, piles have been started around dumpster because it's full.	Referred to PAI.	**On-going**	10819 Williamson Lane. 18 G4
15-063	04/27/15	Piles of metal, old gas tank, untagged vehicle.	Referred to PAI.	**On-going**	10817 Williamson Lane. 18 G4
15-064	04/27/15	Many untagged vehicles, at least one truck leaking fluids.	Referred to PAI.	**On-going**	10823 Williamson Lane. 18 G4.
15-076	04/27/15	At least 6 untagged vehicles on property.	Referred to PAI.	**On-going**	10820 Williamson Lane. 18 G4

Case No.	DATE	COMPLAINT	ACTION TAKEN	STATUS	LOCATION
15-077	04/27/15	Piles of brush, junk piled against building.	Referred to PAI.	**On-going**	10838 Williamson Lane. 18 G4
15-078	04/30/15	At least 6 untagged vehicles on property.	PAI issued correction notice.	**Case closed**	10901 McCormick Road. 18 F5
15-071	05/21/15	Fish/plant tanks being drained to parking lot.	Referred to EH.	**On-going**	11035 York Road. 18 H3
15-072	05/21/15	Bus washing in parking lot.	Bus lot was contacted to let them know this activity was not allowed and the EPA fined us for this during our audit.	**Case closed**	103 Wight Avenue. 18 F4
15-073	05/21/15	Grease on ground around used oil dumpster.	When EH visited, business was already taking care of issue. Absorbent was on ground and top of container had been cleaned.	**Case closed**	10752 York Road. 18 H5
12-037	05/21/15	At least 10 untagged vehicles on property, reopened case.	Referred to PAI.	**On-going**	10926 York Road. 18 H4
15-074	05/21/15	Washing vehicles in parking lot.	MDE issued notice of corrective action.	**Case closed**	10300 York Road. 18 H6
15-093	05/29/15	Untagged vehicles, working on vehicles outside.	Referred to PAI.	**On-going**	11013 York Road. 18 H4

5.6.2 HSI Pilot Study

A pilot study was conducted in which 158 commercial and industrial sites were assessed without any sort of pre-screening. Efforts were concentrated along the York Road corridor in the Timonium and Cockeysville area (SWAP Area O). The percentage of sites found to have issues was lower using this approach (12% “confirmed hotspots”). The vast majority (88%) were “not a hotspot”. Revisions to the field data sheet, prior to the pilot study, included removal of the option to identify a site as “potential hotspot”. This accounts for the difference in the data between

Areas A and O, and Areas N and S. See Table 5-7 for HSIs by SWAP Area and Figures 5-6 through 5-9 for maps showing locations of HSIs.

Table 5-7: Hotspot Investigations Conducted from July 1, 2014 through June 30, 2015

SWAP Area	Total # HSIs Assessed	# Confirmed Hotspots	# Potential Hotspots	# Not a Hotspot	% Confirmed Hotspots
A Lower Patapsco	5	4	n/a	1	80%
N Urban Gunpowder	23	9 (includes 2 "severe")	7	7	39%
S Liberty Reservoir	18	1	13	4	5%
O Loch Raven South (Pilot)	158	19	n/a	139	12%
TOTAL	**204**	**33**	**20**	**151**	**16%**

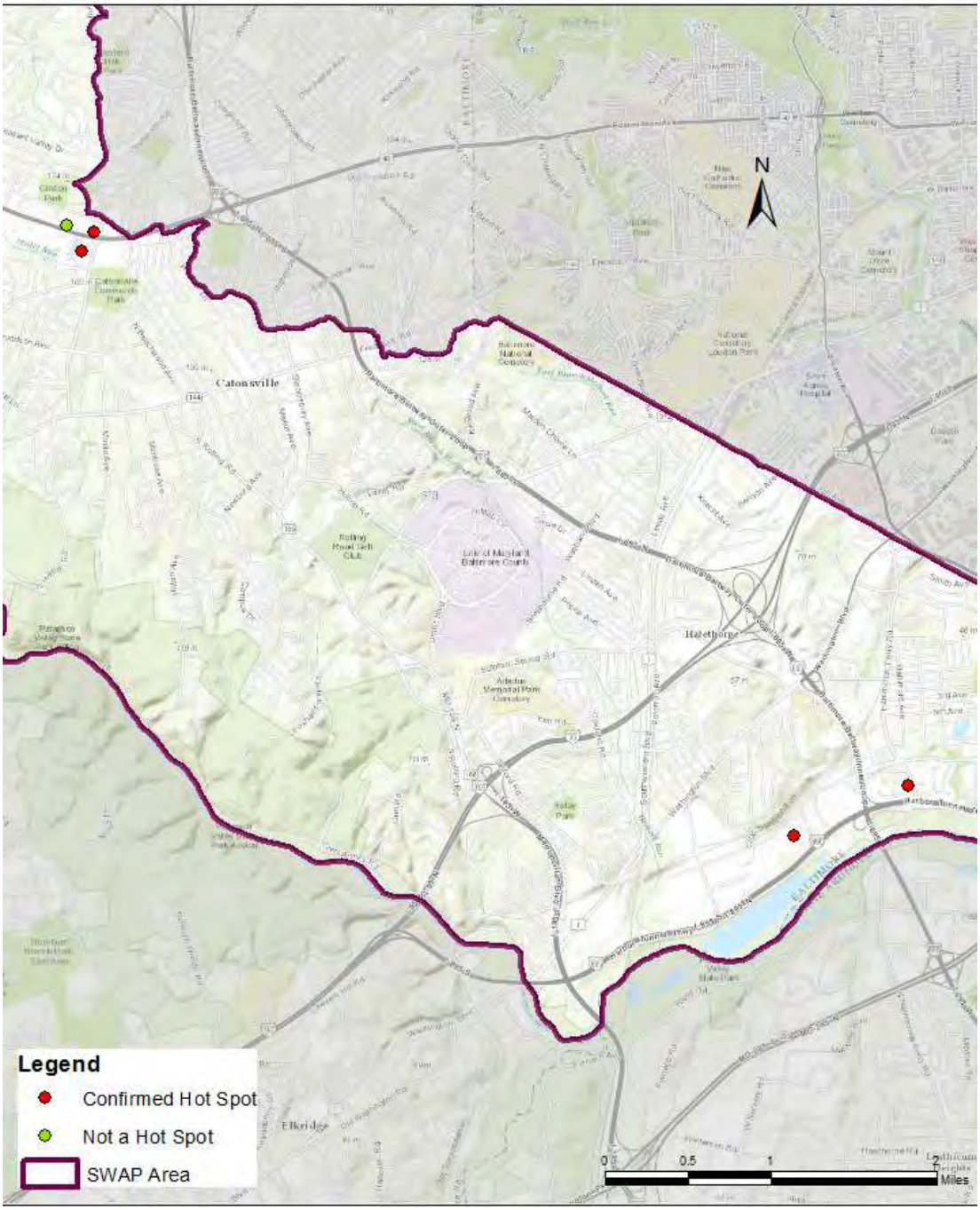


Figure 5-6: HSI Locations in Area A

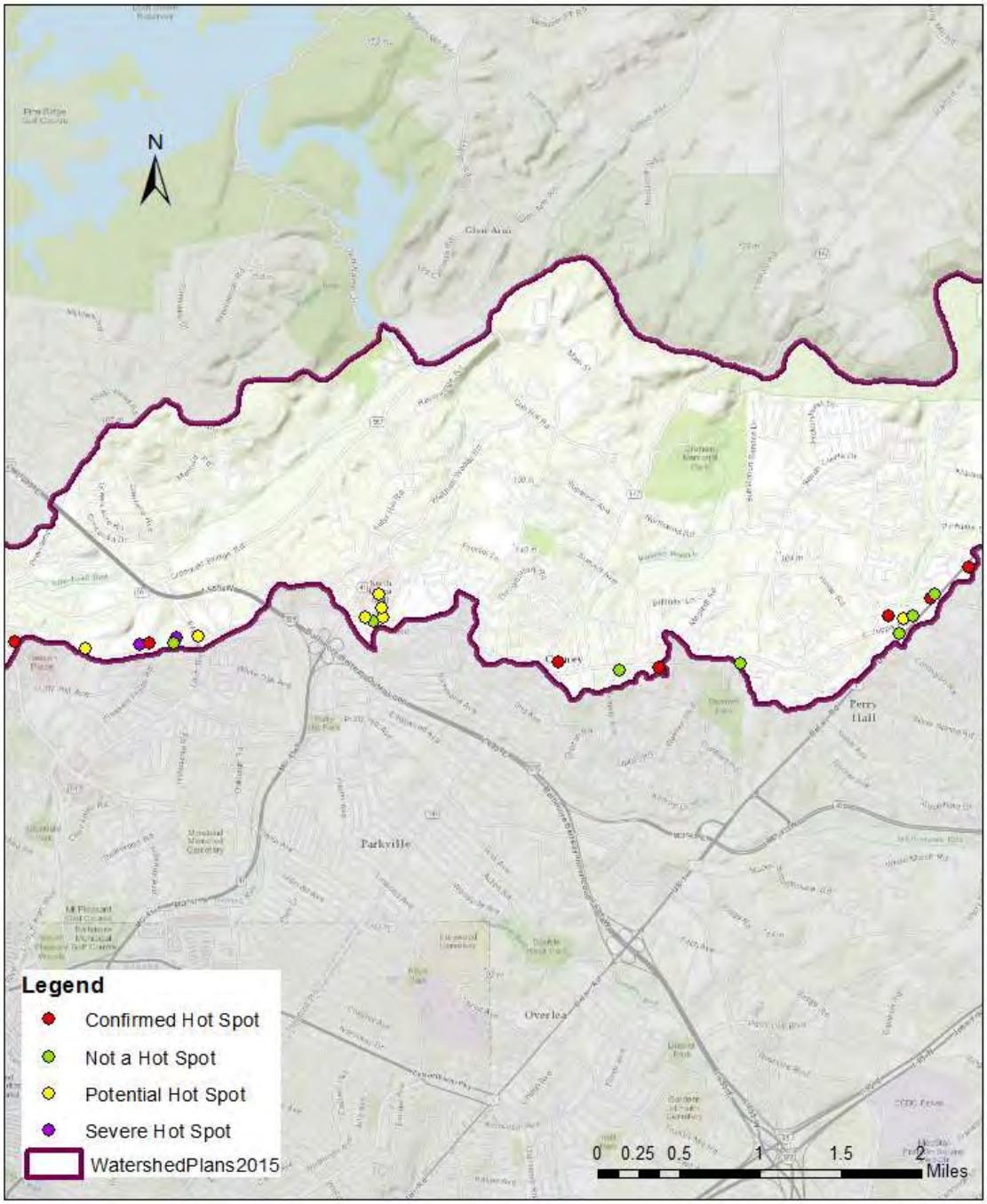


Figure 5-7: HSI Locations in Area N

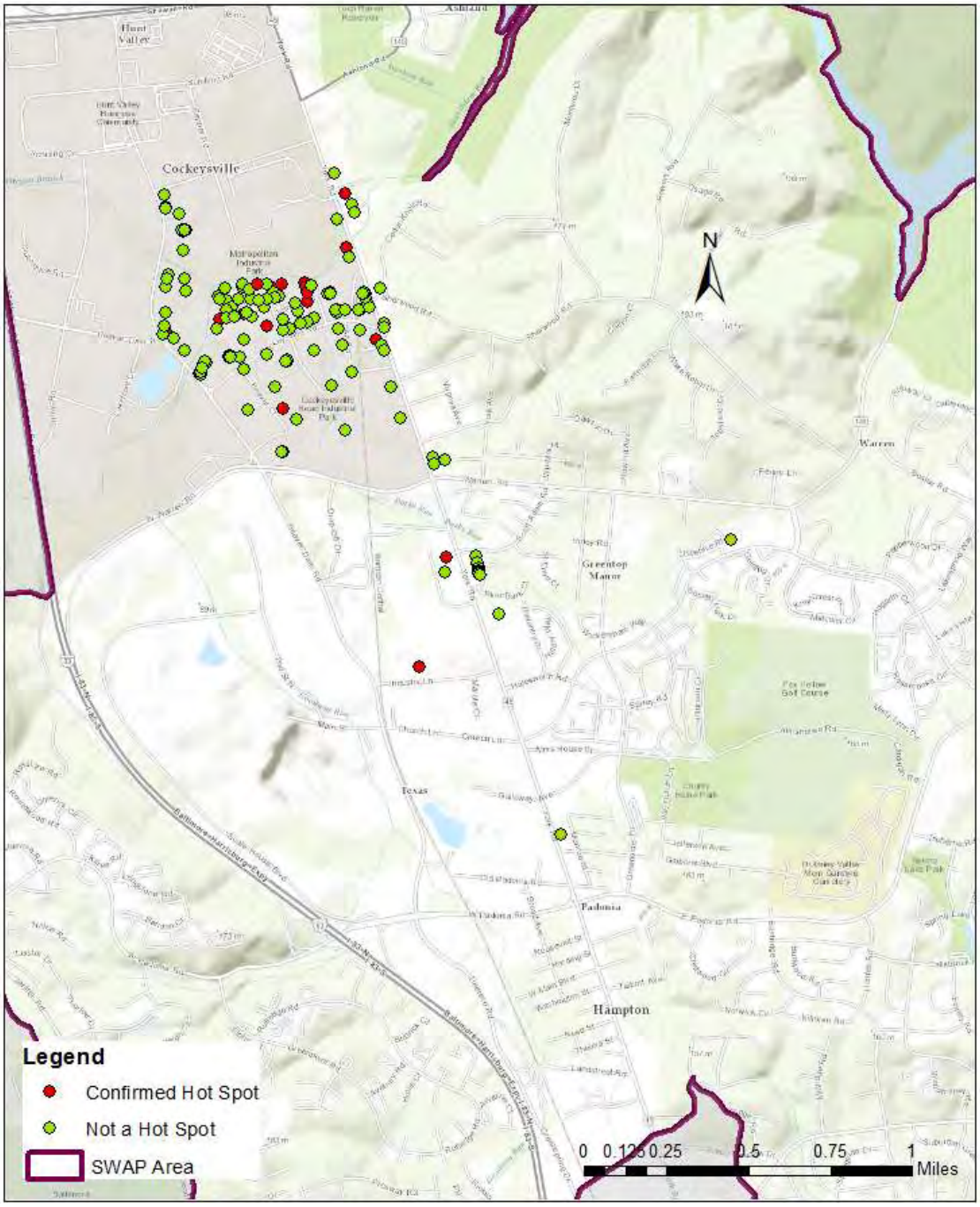


Figure 5-8: HSI Locations in Area O

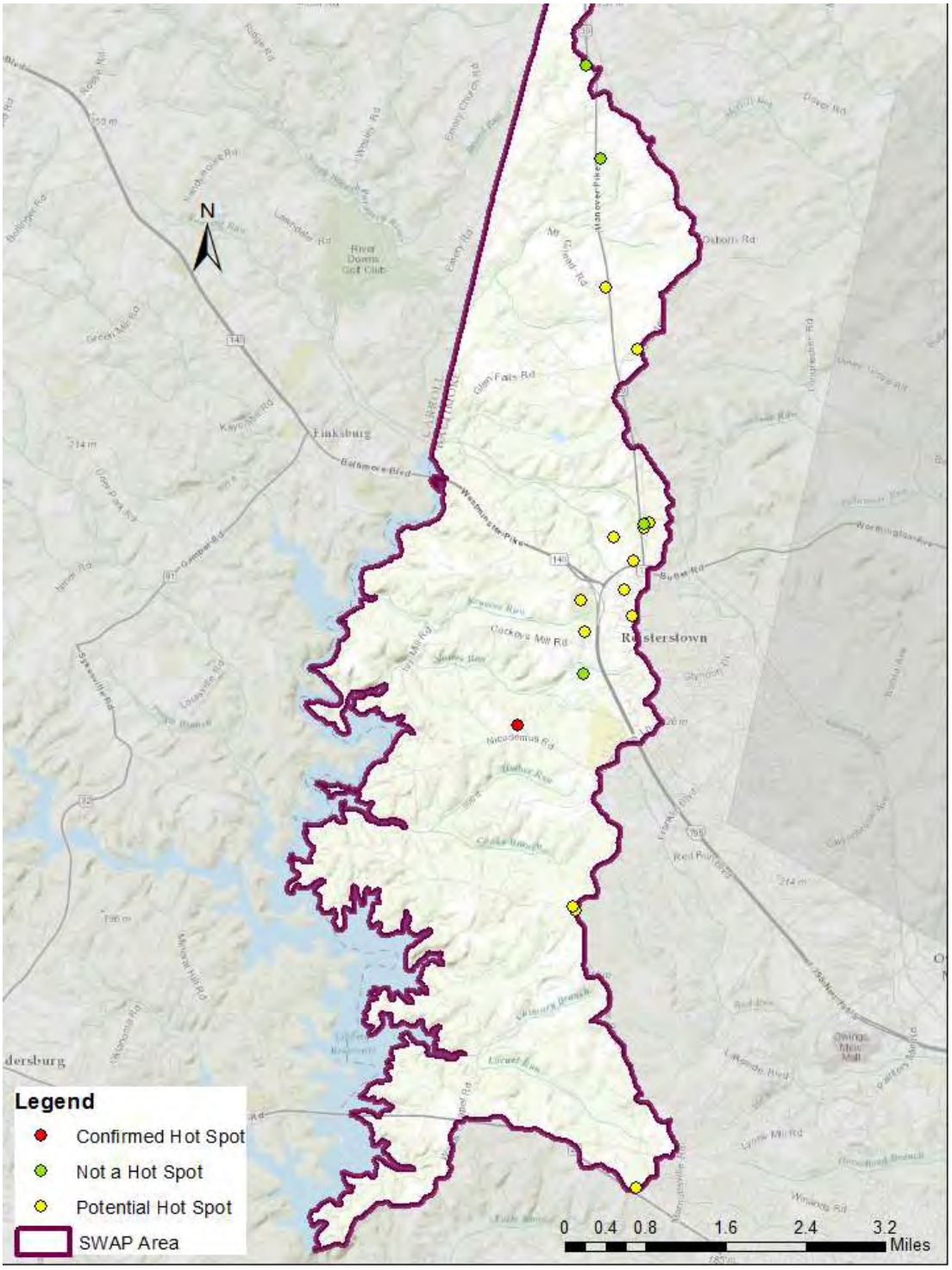


Figure 5-9: HSI Locations in Area S

5.6.2 Future Hotspot Site Investigations

EPS staff will refine the program to make more efficient use of field time. In the current year, we plan to analyze the data further and look for patterns that would allow us to identify problem sites more readily without being slowed down by assessing sites that are rather unlikely to contaminate stormwater runoff, such as office buildings. We feel that by identifying the categories of commercial and industrial sites that tend to have issues, that we can better use our time and allow more pollution problems to be addressed. The plan will include a method for prioritizing hotspots for future re-checks. A Standard Operating Procedure (SOP) for hotspot assessments will be included in the 2016 report.

5.7 Outreach

Not all complaints investigated, even if an issue is found, result in an enforcement action. Some problems, such as litter, are not severe enough or cannot be attributed to one source. Or we may have a report of dumping into a storm drain, but no evidence is found when we visit the site. WMM has developed a door-hanger to be used in such instances. The door-hanger was based on one developed by MDE. Staff can check off the particular issue found from the list on the door-hanger. There is also educational information on the reverse side, letting them know storm drains are connected to streams and the proper disposal of materials.

A brochure on the illicit connection program has also been developed. It is distributed at events and stakeholder meetings to educate and advertise the program. A form is now available on our website to report pollution complaints. Previously complainants could send an email to watersheds@baltimorecountymd.gov, but sometimes information about the problem was missing. The web form will eliminate the problem of missing data and hopefully increase the number of complaints submitted by making the process easier.

5.8 IDDE Research

In 2011, Baltimore County participated in the Illicit Discharge Detection and Elimination in Baltimore Project organized by The Center for Watershed Protection (CWP). This was a one-year grant project that looked at both major and minor outfalls and investigated illicit connections on a subwatershed scale in Baltimore County and City.

CWP found fluoride in four samples, which was not in the presence of chlorine. As a result, they recommend fluoride as an indicator of potable water instead of chlorine. Baltimore County does not use fluoride as an indicator because it is too sensitive to discharges that are not regulated under the NPDES permit, such as residential car washing. Baltimore County has found that using chlorine instead of fluoride saves time and effort expended on investigations where no illicit discharges are occurring. Results from the study found minor outfalls (<36”) to be a significant contributor to pollutant loadings. Baltimore County has not found this to be the case.

Due to some question about how applicable the results are to Baltimore County, a research project was launched in February 2012. The study is looking at pollutant loadings from county outfalls. One task of the study will be to compare the current NPDES illicit connection parameters (chlorine, copper, phenols, ammonia, pH and temperature) with the parameters used by CWP. The additional CWP parameters (boron, fluoride and E. coli) will be used in conjunction with the current tests, to see if we are missing illicit discharges. The results will also be examined to see if small outfalls are a significant contributor to pollutant loadings. In previous years, most of the Baltimore County small outfalls have been found to be dry.

The study is concentrated in six SWAP areas, which contains 1,224 outfalls; we will complete all the outfalls both major and minor in the six areas. Lab samples will be taken at each outfall where a discharge measurement can be taken and nutrient loadings will be calculated. We have completed screenings for 854 outfalls and 370 remained to be screened. The goal is complete these outfall screenings and analyze the data for the 2016 report.

5.9 Illicit Discharge Elimination – Program Credit

An Expert Panel evaluated infrastructure-related nutrient discharges against 5 technical criteria and identified 8 discharge types to be recommended for an annual nutrient reduction credit. The Panel recommended a phased approach whereby the credit would be granted in the Phase 5.3.2 Model for localities that go above and beyond the following minimum requirements set forth under the MS4 permit. The programmatic credit is available beginning 2015 and extending through 2017. The program credit is not cumulative year over year, (i.e., the maximum allowable reduction is capped at 1% of all qualifying pervious acres in each community). The specific acres subject to the program credit lapse 5 years after the first year in which they are reported to the appropriate state regulatory authority. Additional qualified acres may be reported in succeeding years but those additional acres also expire after 5 years. At the end of the 5 years the community is encouraged to report load reductions based on the elimination of individual nutrient discharges.

The Panel defined the annual credit as being equivalent to a maximum of 1% of the dry weather nutrient load within the jurisdiction, which is defined as 20% of the total annual N and P load discharged from the urban pervious land in which advanced nutrient reduction programs are targeted. Credit is contingent on documentation that they possess advanced program elements to target, screen, detect and correct the nutrient discharges with the highest nutrient loading risks.

Two of the following additional criteria are required:

1. GIS assessment of storm and sanitary network to identify high risk segments for cross-connections of exfiltration.
2. Dry weather stream monitoring to prioritize segments with the highest nutrient and bacteria levels that warrant further investigation.
3. Methods to investigate for sewer leaks in problem storm drain systems (e.g., CCTV, dye testing, etc).
4. Targeted inspection outreach of facilities subject to high risk for illicit discharges of sewer clogging.
5. Detailed field assessments to identify sanitary segments with high risk of exfiltration or dry weather overflows.

Baltimore County is eligible to begin taking program credit for the program credit based on its IDDE program which goes beyond the requirements of the MS4 permit. Advanced nutrient reduction programs in effect during FY 2015 are listed in Table 5-8. Figure 5-10 shows the locations in Baltimore County which qualify for program credit.

Table 5-8: Advanced Nutrient Reduction Programs in fiscal year 2015

Project	Qualifying Criteria	Watershed or Area	Duration

Bacteria Subwatershed Prioritization	2	PB, LR, JF, GW, PA, LI	2015
SWAP Hotspot Site Inspections	4	SWAP Areas A, C, D, E, F, G, H, I, K, L, M, N, O, R, S, T, V, X	2015

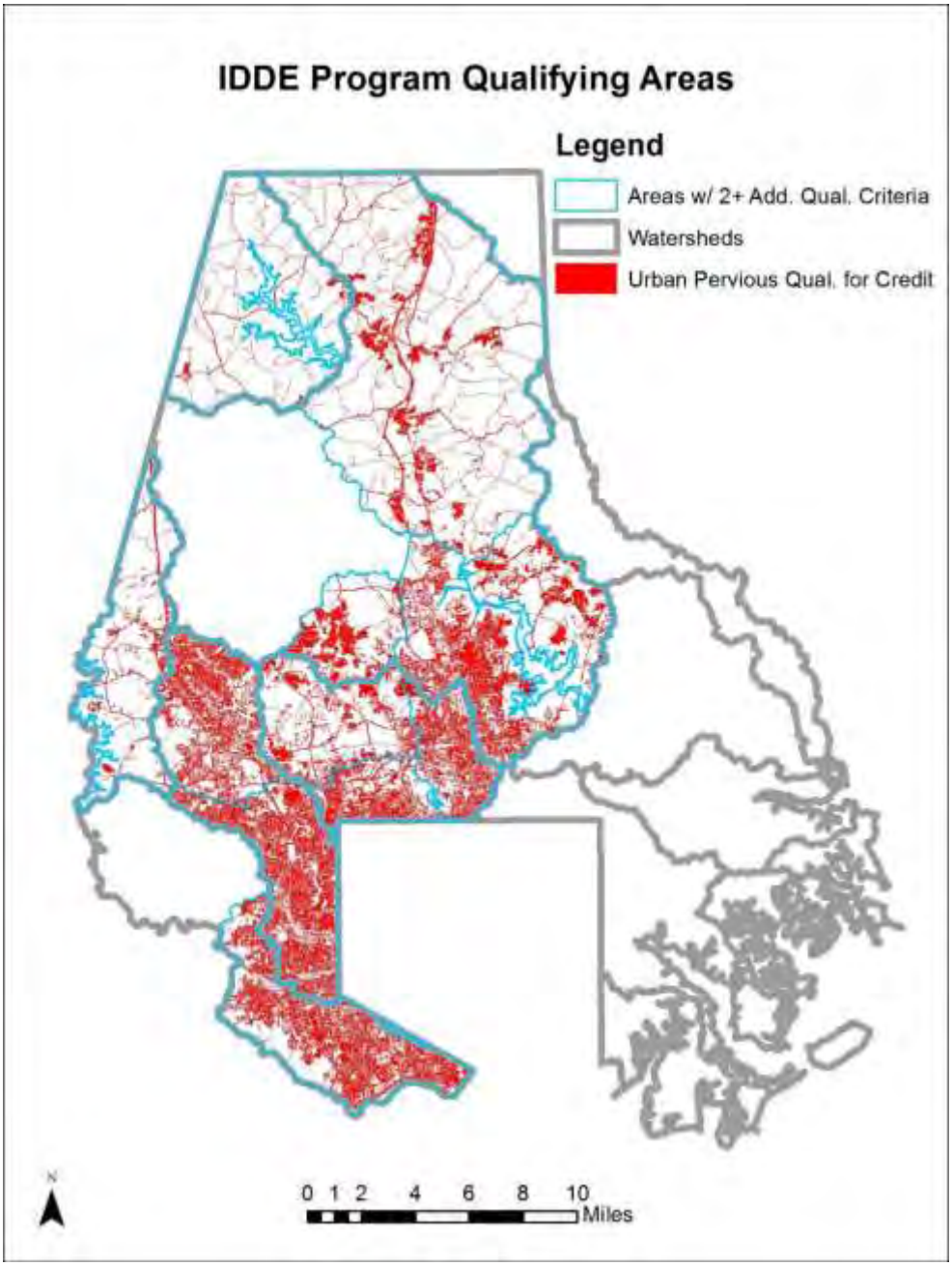


Figure 5-10: Locations in Baltimore County which qualify for program credit

Table 5-9 presents the qualifying acreage, the nitrogen and phosphorus loads they produce, and the resultant advanced IDDE program credit. The calculation method is documented in the expert panel report (CSN and CWP 2014) and in Baltimore County's standard operating procedures (Baltimore County, 2015). An example calculation is shown below.

$$TN_i = 0.01 \times 0.20 \times A_{q,i} \times R_{TN,i}$$

where TN_i = total nitrogen credit for watershed i,
QA_i = urban pervious acres in qualifying area in watershed i, and
$R_{TN,i}$ = urban pervious nitrogen loading rate for watershed i

Table 5-9: Advance Program Credit taken for fiscal year 2015

Watershed	Acres	Landuse	TN loading rate	TN Load	TN Credit	TP loading rate	TP Load	TP Credit
Gwynns Falls	14,594	Urban Pervious	11.55	168,560.70	337.12	0.3	4,378.20	8.76
Jones Falls	9,734	Urban Pervious	11.55	112,427.70	224.86	0.3	2,920.20	5.84
Liberty Reservoir	1,791	Urban Pervious	11.56	20,703.96	41.41	0.3	537.30	1.07
Loch Raven Reservoir	19,078	Urban Pervious	11.55	220,350.90	440.70	0.3	5,723.40	11.45
Patapsco River	8,181	Urban Pervious	9.73	79,601.13	159.20	0.25	2,045.25	4.09
Prettyboy Reservoir	1,424	Urban Pervious	11.55	16,447.20	32.89	0.3	427.20	0.85
Total	**54,802**			**618,092**	**1,236**		**16,032**	**32**

5.10 Summary

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

6.0 Permit Requirements

D. Management Programs

4. Trash and Litter

Baltimore County drains to at least two major water bodies (the Middle Branch and Northwest Branch of the Patapsco River) determined to be impaired by trash. The trash and litter section of this permit is to assist in efforts to address water quality improvements. Increases in trash discharges to receiving water have become a growing concern both nationally and within Maryland. This section requires Baltimore County to evaluate current trash and litter control efforts; develop strategies to reduce trash, floatables, and debris within those areas draining to the Middle Branch and Northwest Branch of the Patapsco River; and bolster public education.

a. Within one year of permit issuance, the County shall inventory and evaluate all current trash and recycling pick-up operations, litter control programs, and public outreach efforts. The analysis shall identify opportunities for improving overall efficiency, especially in the Middle Branch and Northwest Branch of the Patapsco River.

b. Within one year of permit issuance, develop and implement a public education and outreach strategy with specific performance goals, and corresponding deadlines to initiate or increase residential and commercial recycling rates, improve trash management, and reduce littering. The strategy shall include:

i. Educating the public on the importance of reducing, reusing, and recycling:

ii. Disseminating information by using signs, articles, and other media outlets;

iii. Promoting educational programs in schools, businesses, community associations, etc.; and

iv. Providing the strategy to interested parties upon request.

c. Evaluating annually the effectiveness of the education program.

d. Within one year of the Environmental Protection Agency's (EPA) approval of a trash total maximum daily load (TMDL) for the Middle Branch and Northwest Branch of the Patapsco River, implement those program improvements identified in Part III.D.4.a above and any additional programs needed to address the TMDL.

e. Submit an annual report that details progress toward implementing the trash reduction strategies. The report shall describe the status of trash elimination

efforts including resources (e.g., personnel and financial) expended and the effectiveness of all program components.

6.1 Introduction

The 2008 Integrated Report indicated that the mesohaline portion of the Patapsco River basin was listed for impairment of aquatic life by debris/floatables/trash. This listing only applies to the Middle Branch from the mouth (Ferry Bar Park to Harbor Hospital Center) extending westward and the Northwest Branch from the Hull Street Pier to Canton Waterfront Park, which includes the Inner Harbor at the base of Gwynns Falls and Jones Falls. In October 2010 Baltimore County initiated a monitoring program to collect data for development of a trash TMDL, which was completed in November 2011. Following this yearlong study, a long-term trend monitoring program was initiated in March 2012 with a fixed and random site study design. The draft TMDL report was made public on September 11, 2012. The public comment period ended on October 29, 2012. An informational briefing was held prior to the closing on September 21, 2012. Comments were addressed and the trash TMDL was submitted to EPA in August of 2014 for approval. In January 2015, the EPA approved the trash TMDL for the Harbor.

Baltimore County is developing a Trash TMDL Implementation Plan to outline how the County plans to meet the Trash TMDL requirements in the impaired waterbody. The TMDL Implementation Plan is on track to be completed by January 2016. To target areas of high trash accumulation, an upland trash assessment monitoring plan was developed in 2015 to determine the sources of trash within the Gwynns Falls and Jones Falls.

A county-wide Trash and Litter Reduction Strategy has also been developed to address the trash issue throughout the county in response to a requirement in the county's 2013 MS4 permit. The Trash and Litter Reduction Strategy was submitted to MDE in 2014. This section will describe the progress of the Trash and Litter Reduction Strategy and include any monitoring data collected as part of strategy implementation and tracking. In future NPDES Annual Reports, this section will also include progress and monitoring relating to the Trash TMDL Implementation Plan.

6.2 TMDL Compliance

This section describes the key assessment, outreach and progress tracking components of the Trash TMDL Implementation Plan and the Trash Reduction Strategy. The Trash and Litter Reduction Strategy outlines a County wide program to reduce litter pollution and addresses a requirement in part IV.D.4 of the current MS4 permit. The Trash TMDL Implementation Plan addresses the requirement to develop a plan to meet TMDL reductions in Baltimore County within one year of approval of the TMDL.

6.2.1 Trash TMDL Implementation Plan

A Trash TMDL Implementation Plan is being developed to outline the County's strategy for compliance with the Trash and Debris TMDL reduction requirements by 2036. This implementation plan will be submitted to MDE by January 5th of 2016.

The implementation plan is a two phase plan. Much like the Trash and Litter Reduction Strategy, The first phase of the plan is to focus on education and outreach, incentives and enforcement actions to meet the reduction requirements. These are the actions that will stop the trash pollution

at its source. Baltimore County will first try to reach the requirements set forth by MDE using these source reduction actions alone. An evaluation of phase I success will be performed after 10 years. At this time, the County will determine if the contingent phase II is necessary or if the reductions can be reached with phase I actions.

Phase II is the implementation of trash trapping devices. These devices trap trash after it has already been littered in the environment. This phase will be more costly than phase I of the plan. It is contingent only on a determination that the TMDL requirements cannot be met with phase I alone.

There is limited available data on the pathways of trash pollution to fresh water bodies and on the efficiency of best management practices to reduce trash pollution. For this reason, this TMDL Implementation Plan emphasizes an adaptive management strategy with emphasis on gathering data to improve our understanding of these uncertainties throughout the implementation process.

6.2.2 Trash and Litter Reduction Strategy

Baltimore County EPS has created a Trash and Litter Reduction Strategy. This plan introduces actions to reduce trash, enhance public education, and ensure that Baltimore County meets the compliance requirements of the TMDL.

The strategy addresses MS4 permit requirements as stated in Part IV.D.4 of the current permit. This strategy was developed by Baltimore County's Department of Environmental Protection & Sustainability (EPS) in close partnership with various county agencies, public stake holders, local watershed associations, and with input from Trash Free Maryland. Suggestions from the public, via community input events held throughout the county, are the main driver of the actions within this plan. Suggestions for litter reduction actions, made by individual citizens, were compiled into a report in the initial phase of strategy development. Those suggestions were then evaluated for their feasibility and potential effectiveness. This plan is the result of that evaluation.

6.2.2.3 Inventory and Evaluation of Operations and Outreach

Baltimore County EPS worked closely with Baltimore County Department of Public Works' (DPW) Bureau of Solid Waste Management, Baltimore County Department of Permits, Approvals, and Inspections (PAI), Baltimore County Police Department and the Department of Health in an effort to identify opportunities for improving efficiency within programs pertaining to trash and recycling pickup, litter control, and public outreach.

In 2009, MDE approved a Ten Year Solid Waste Management Plan covering the years 2009-2018. The goals of this plan are to promote waste prevention, increase recycling, increase resource recovery, and decrease the quantity of solid waste requiring use of the landfills. The use of this plan will allow for identifying effective ways to improve waste management efforts.

Enforcement of trash regulations is conducted by PAI and by the Baltimore County Police Department. The Baltimore County Bureau of Solid Waste Management has a comprehensive education and outreach program to improve county recycling rates and reduce the amount of trash generated. The Bureau of Solid Waste also has a Community Clean Up Program and Recycle Bin Loan Program. The Baltimore County Bureau of Highways runs several litter reduction programs including county street sweeping, Adopt-A-Road, Inmate Litter Crew Highway Cleanup, District Litter Removal, and Neighborhood Dumpster Clean-Ups.

Collaboration with these departments will ensure effective litter control and trash reduction programs.

Existing programmatic and municipal trash reduction actions that have associated measurable load reductions have been inventoried in Section 9 of the Trash TMDL Implementation Plan. Those actions with calculable load reductions are street sweeping, storm drain cleaning, SWM facilities, Clean Green 15, Community Clean Ups, Project Clean Stream, and Enforcement programs. Calculated reductions are based on the best available data. This section will serve as the means for reporting any reduction calculation changes based on future data.

A gap analysis is also available in Section 9 of the Trash TMDL Implementation Plan, which shows the remaining reductions needed to meet the TMDL requirements for trash and the process of analysis used to select opportunities for program enhancements. The program enhancements are projected to achieve the remaining reductions. This section will also serve to report progress of program enhancements and the status of Phase I and II of the Trash TMDL Implementation Plan.

6.2.2.4 Public Education and Outreach

To provide outreach to schools, businesses, community associations, etc., collaboration will be required with the Baltimore County School System, as well as community and watershed groups. Trash activities with high citizen involvement and publicity, such as Project Clean Stream, and watershed group clean-ups, will be beneficial in reaching the targeted audiences.

A county wide litter reduction media campaign is being developed as part of the Trash and Litter Reduction strategy and Trash TMDL Implementation Plan. The media campaign is intended to reach as many Baltimore County Citizens as possible with the message to stop littering in Baltimore County. A request for proposal has been issued to retain the services a consultant(s) to develop this campaign and to develop a methodology for tracking the effectiveness and related trash reduction efficiencies of the campaign. This is one of several education and outreach actions described in the Trash and Litter Reduction Strategy. Other potential actions outlined in the Trash and Litter Reduction Strategy include: development of a county based trash treaty, promoting service learning opportunities, school litter awareness programs, anti-littering signage, and continued support of cleanups by watershed groups and faith based institutions.

Baltimore County EPS has developed an educational door-hanger that can be used as an alternative to a citation, as a means to educate communities with high trash accumulation. The use of websites, e-newsletters, local newspaper, etc. will also provide a valuable tool in promoting information. Many departments within Baltimore County have media programs already established that can be built upon to cater to specific trash and recycling information needs.

6.2.2.5 Program Effectiveness

The effectiveness of the education and outreach programs can be evaluated annually through the NPDES report. Information will be compiled from all responsible agencies with education materials. DPW Bureau of Solid Waste Management analyzes the annual recycling rate throughout communities in Baltimore County on its website http://www.bcrecycles.com. This is an example of how EPS can deliver information to the public while promoting trash and recycling activities.

Baltimore County EPS will also track the effectiveness of its Trash and Litter Reduction Strategy and Trash TMDL Implementation Plan as part of the initial phase of implementation. The Trash TMDL Implementation Plan requires that the need for the contingent structural phase be evaluated after 10 years. The Trash and Litter Reduction Strategy has a similar contingent structural phase, but at a County wide level. This too will be addressed in this section of future NPDES reports. The data collected from the initial phase can also be used to better target actions to areas where they will be most beneficial.

6.3 Monitoring

Following the TMDL development study, the trash monitoring program has developed into a long-term trend monitoring program for stream sites only. Trash from both fixed and random sampling sites will be collected on an annual basis to document trends and identify problem areas. Results of this program will help to target improvement efforts.

6.3.1 Fixed and Random Study

The twenty stream sites from the previous trash survey were defined as fixed sites, and were randomly selected to be alternately sampled in groups of ten during odd and even years. Each year, twenty additional randomly selected sites (ten in Gwynns Falls, ten in Jones Falls) are added to the survey along with the ten fixed sites. The random sites will not be repeated in the survey during the following years. Figure 6-1 below shows the locations of the fixed and random sites for 2014 throughout the Gwynns Falls and Jones Falls.

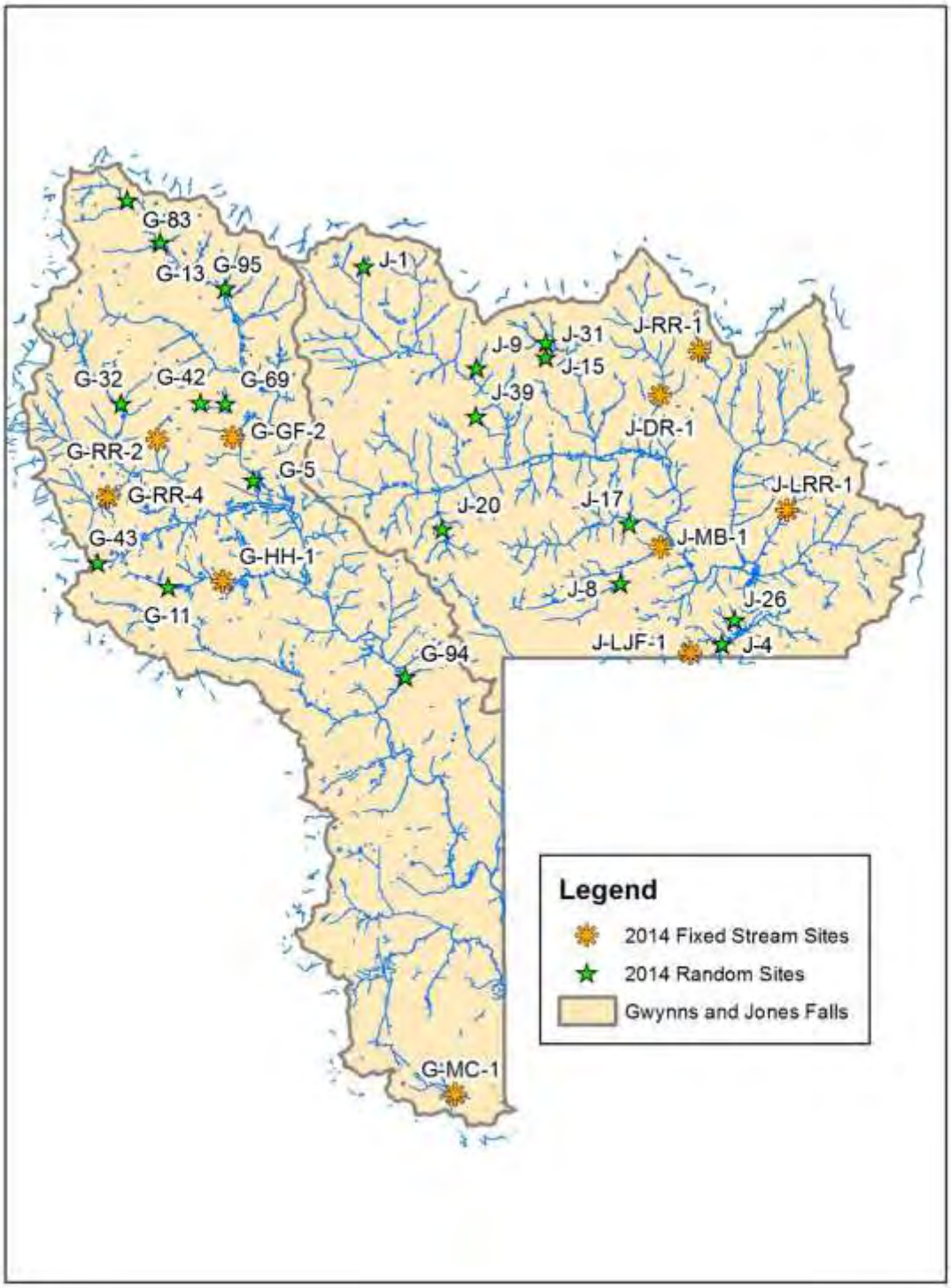


Figure 6-1: Map of 2014 Fixed and Random Monitoring Locations

6.3.1.1 Results

The results from the 2014 fixed/random survey are presented below. The data is broken into total pounds of trash collected per site, count of bottles/cans per site, and the loading rates with and without dumping (lbs/acre) per site. As opposed to the survey of random sites in 2012, there was not a significant amount of dumping in 2014. Table 6-1 displays the site-specific information, grouped by watershed.

Table 6-1: 2014 Fixed and Random Site Information

Stream Site	Fixed/ Random	Stream Name	Watershed	Major Designation Land Use*	Drainage Area (acres)	Trash Total (lbs)	Trash (lbs/acre)	Trash w/o dumping (lbs/acre)
G-GF-2	Fixed	Trib to Gwynns Falls	Gwynns Falls	MDR	150.26	120.82	0.8040	0.5112
G-HH-1	Fixed	Horsehead Branch	Gwynns Falls	MDR	508.47	0.88	0.0017	0.0017
G-MC-1	Fixed	Trib to Maiden's Choice Run	Gwynns Falls	MDR	414.40	60.79	0.1467	0.0984
G-RR-2	Fixed	Trib to Red Run	Gwynns Falls	Forest	112.82	0.58	0.0051	0.0051
G-RR-4	Fixed	Trib to Red Run	Gwynns Falls	Forest	522.83	10.06	0.0192	0.0192
J-DR-1	Fixed	Mainstem Deep Run	Jones Falls	LDR	1,149.03	22.15	0.0193	0.0158
J-LJF-1	Fixed	Lower Jones Falls	Jones Falls	HDR	48.77	29.99	0.6149	0.6149
J-LRR-1	Fixed	Trib to Roland Run	Jones Falls	Institutional	180.29	14.50	0.0804	0.0804
J-MB-1	Fixed	Moores Branch	Jones Falls	LDR	1,315.70	4.08	0.0031	0.0031
J-RR-1	Fixed	Roland Run	Jones Falls	OU	221.48	2.00	0.0090	0.0090
G-13	Random	Trib to Gwynns Falls	Gwynns Falls	MDR	1,254.64	172.63	0.1376	0.0404
G-32	Random	Trib to Red Run	Gwynns Falls	MDR	143.50	6.207	0.0433	0.0433
G-83	Random	Gwynns Falls	Gwynns Falls	MDR	506.46	31.28	0.0618	0.0618
G-5	Random	Gwynns Falls Mainstem	Gwynns Falls	MDR	6,328.11	158.07	0.0250	0.0115
G-69	Random	Trib to Gwynns Falls	Gwynns Falls	HDR	27.96	11.78	0.4212	0.0635
G-94	Random	Trib to Gwynns Falls	Gwynns Falls	MDR	164.10	6.53	0.0398	0.0398
G-11	Random	Horsehead Branch	Gwynns Falls	MDR	201.64	20.93	0.1038	0.1038
G-42	Random	Trib to Gwynns Falls	Gwynns Falls	MDR	52.20	53.60	1.0268	0.4521
G-43	Random	Red Run	Gwynns Falls	MDR	16.82	30.58	1.8174	1.8174

Stream Site	Fixed/ Random	Stream Name	Watershed	Major Designation Land Use*	Drainage Area (acres)	Trash Total (lbs)	Trash (lbs/acre)	Trash w/o dumping (lbs/acre)
G-95	Random	Trib to Gwynns Falls	Gwynns Falls	MDR	244.69	26.21	0.1071	0.1071
J-15	Random	Dipping Pond Run	Jones Falls	Forest	269.93	0.50	0.0019	0.0019
J-17	Random	Slaughterhouse Branch	Jones Falls	LDR	1,060.17	11.00	0.0104	0.0104
J-8	Random	Moores Branch	Jones Falls	MDR	915.19	2.58	0.0028	0.0028
J-20	Random	Trib to Jones Falls	Jones Falls	LDR	335.28	52.93	0.1579	0.0535
J-1	Random	Trib to North Branch Jones Falls	Jones Falls	LDR	95.50	7.00	0.0733	0.0366
J-31	Random	Trib to Dipping Pond Run	Jones Falls	LDR	49.48	14.75	0.2981	0.0960
J-9	Random	Trib to North Branch Jones Falls	Jones Falls	LDR	113.81	5.73	0.0503	0.0503
J-26	Random	Trib to Jones Falls	Jones Falls	Forest	36.86	11.12	0.3017	0.0304
J-4	Random	Trib to Jones Falls	Jones Falls	Forest	99.96	21.00	0.2101	0.0100
J-39	Random	Trib to North Branch Jones Falls	Jones Falls	LDR	39.59	0.25	0.0063	0.0063

***-Note: The abbreviations used in the Land Use column are as follows: LDR – Low Density Residential, MDR – Medium Density Residential, HDR – High Density Residential, OU – Open Urban.**

In order to analyze the trend of trash loading at random sites between 2012 and 2013, a 1-way analysis of variance was performed between the two datasets. Since there was a substantial amount of dumping at the random sites from 2012, the two years were compared based on the loading rates without dumping. The results in table 6-2 show that there is not a significant difference between the loading rates of the last two years, based on the P-value of 0.6. This indicates that a similar amount of trash can be expected at random locations throughout Baltimore County streams.

Table 6-2: Results of 1-way ANOVA

Year	Average Loading Rate w/o Dumping	P-value
2012	0.19	
2013	0.14	
Between Years		0.6

An additional ANOVA was performed between data from random sites analyzed in 2013 and 2014, to ensure that the assumption that random sites have a similar amount of trash remains valid. The results of this ANOVA are shown in Table 6-3, which shows that, not only does the assumption remain valid, the random sites between 2013 and 2014 are more similar than those between 2013 and 2012.

Table 6-3: Results of 1-way ANOVA

Year	Average Loading Rate w/o Dumping	P-value
2013	0.14	
2014	0.15	
Between Years		0.9

A two-tailed, paired t-test was also performed on data from fixed sites analyzed in 2012 and 2014, to ensure that the trash loading rates remained consistent. The results of this test indicate that, with a p-value of 0.12, loading rates between 2012 and 2014 did not change significantly at the fixed sites.

Table 6-4: Comparison of Fixed Site Results 2012-2014 (#s/Acre)

Site	Loading Rate 2012	Loading Rate 2014	Difference
G-GF-2	0.1538	0.5112	+0.3574
G-HH-1	0.0001	0.0017	+0.0016
G-MC-1	0.0841	0.0984	+0.0143
G-RR-2	0.0000	0.0051	+0.0051
G-RR-4	0.0138	0.0192	+0.0054
J-DR-1	0.0115	0.0158	+0.0043
J-LJF-1	0.1430	0.6149	+0.4719
J-LRR-1	0.0174	0.0804	+0.0630
J-MB-1	0.0024	0.0031	+0.0007
J-RR-1	0.0009	0.0090	+0.0081
Mean	0.0427	0.1359	+0.0932

As can be seen in tables 6-5 and 6-6 below, the total pounds of trash per sorting category and total count of bottles and cans were moderately higher at the random sites than at the fixed sites. This may be due to the fact that the fixed sites had been previously monitored 5 times during the course of the TMDL development study, which removed a significant amount of trash from prior years. Trash collected from the random monitoring sites could include items that have been there for many years, in addition to any trash dumping that may have occurred. The amount of trash collected during the survey was most likely higher due to the land use, which was predominately medium density residential at both the fixed and random sites.

Table 6-5: Pounds of Trash Collected by Sorting Category

Sorting Category	Fixed (lbs)	Random (lbs)	Project Total (lbs)
Plastic Bottles	6.35	12.67	19.02
Glass Bottles	3.82	6.54	10.36
Aluminum Cans	3.18	2.96	6.14
Other	184.50	297.00	481.50
Dumping	68.00	325.50	393.50
Total	265.84	644.66	910.50

Table 6-6: Count of Bottles and Cans Collected

Bottle Counts	Fixed	Random	Project Total
Plastic Bottles	82.5	164.5	247
Glass Bottles	7	12	19
Aluminum Cans	43.5	40.5	84

The results of the loading rate analysis, displayed in figures 6-2 and 6-4 show that the loading rates for several of the random stream sites are skewed higher due to moderate amounts of trash found at streams with small drainage areas. For example, at random site G-43, had 30 pounds of trash, the average amount of trash for all 2014 random sites, but a drainage area of only 16 acres. This resulted in a loading rate of 1.82 pounds per acre, by far the highest loading rate amongst the random sites. Large item dumping was again a large source of trash for the random sites, with just over half of the trash by weight accounted for by large items.

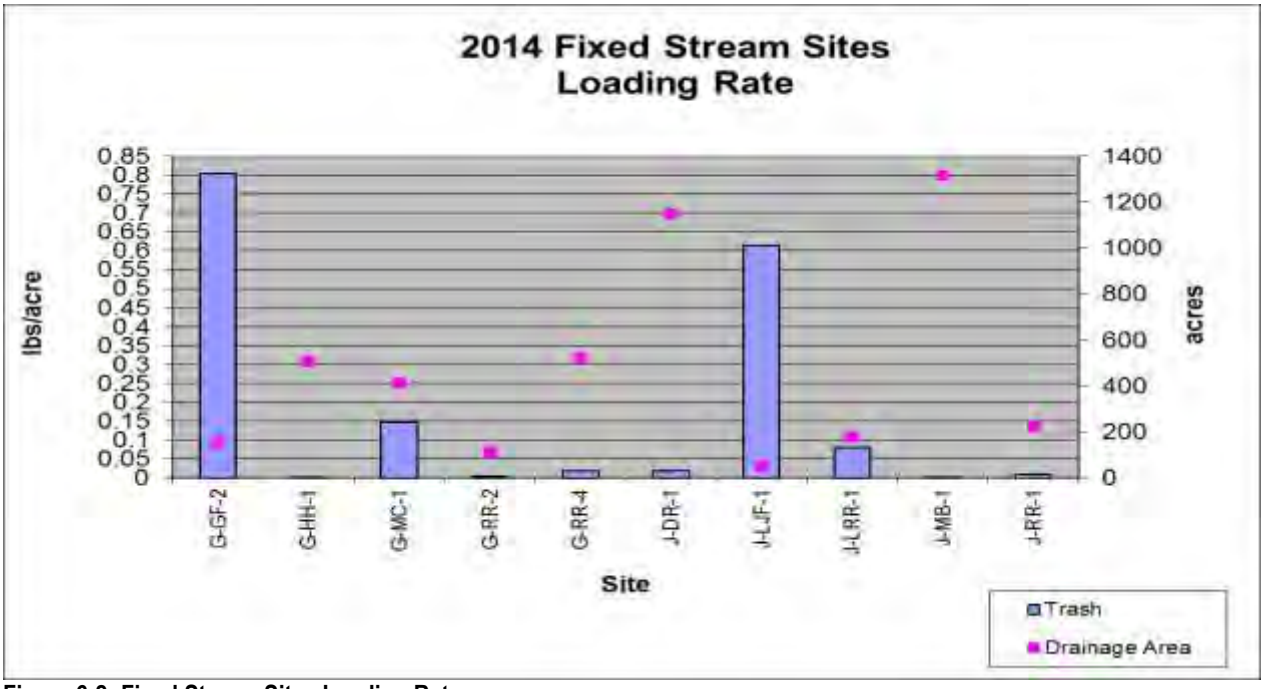


Figure 6-2: Fixed Stream Sites Loading Rates

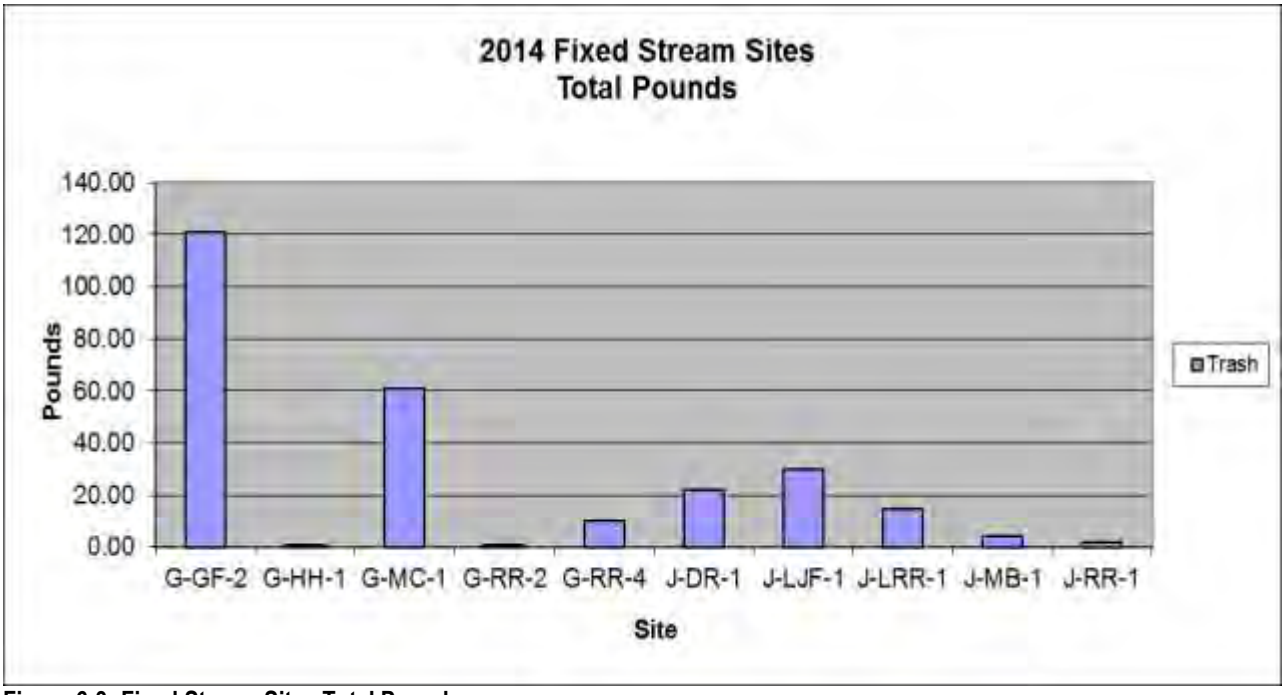


Figure 6-3: Fixed Stream Sites Total Pounds

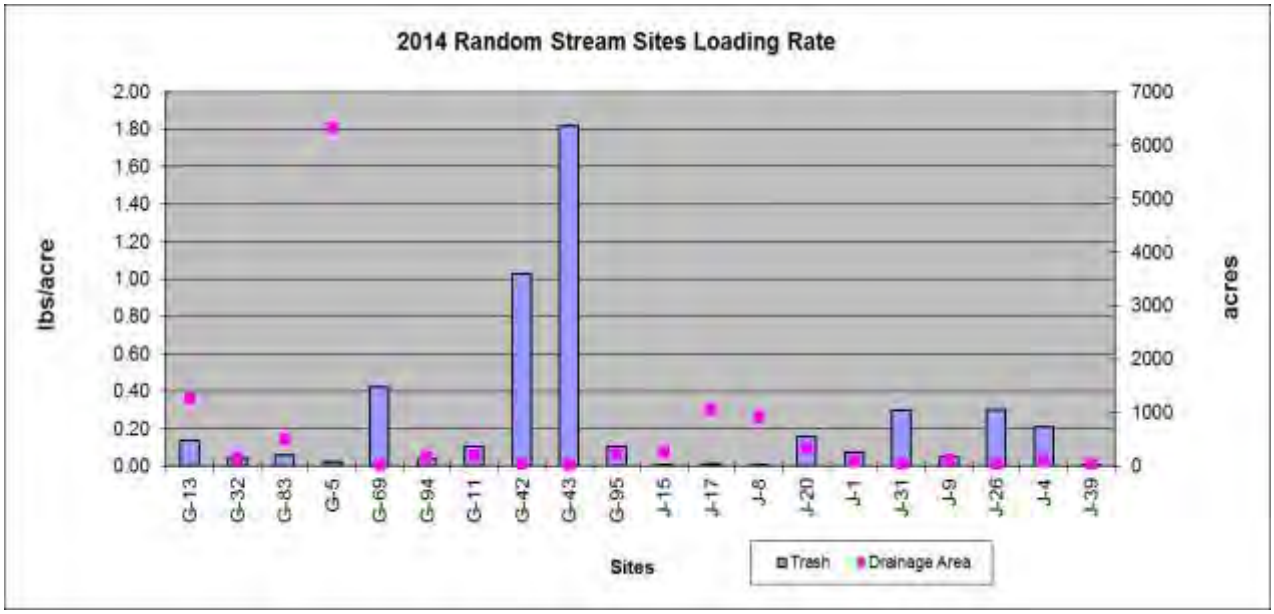


Figure 6-4: Random Stream Sites Loading Rates

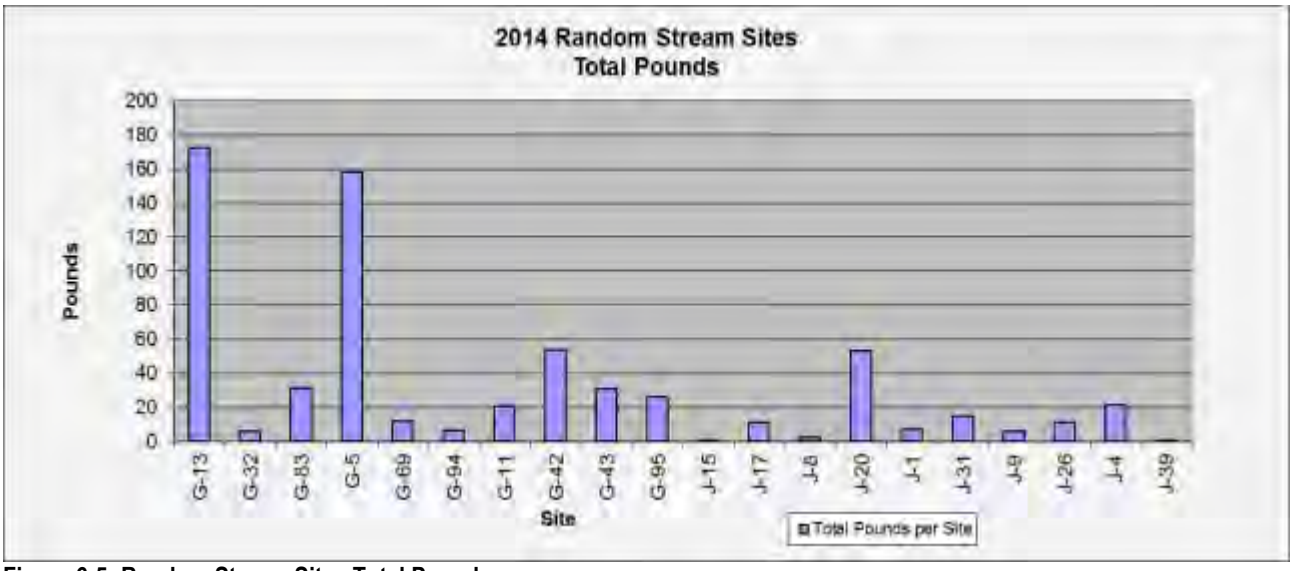


Figure 6-5: Random Stream Sites Total Pounds

6.3.3 Upland Trash Assessment

In order to assess the sources of trash throughout the study area, an upland assessment has been developed. Upland trash monitoring will be used as a tool to track the sources of trash in watersheds. Specifically, this program will be used in the watersheds draining to the Middle Branch and Northwest Branch of the Patapsco River to address the trash TMDL. The results of this assessment may be a valuable resource for targeting trash reduction actions in order to meet the TMDL requirements.

Methodology from Small Watershed Action Plans (SWAPs) will provide a baseline on how to best identify trash hotspots throughout watersheds. SWAPs have been completed for the Lower Jones Falls, the Northeastern Jones Falls and the Upper and Middle Gwynns Falls. The final SWAP for the remaining Baltimore County areas in the Jones Falls watershed is now in progress. Upland assessments for the SWAPs identify areas in need of improved trash management, providing the data needed to target citizen awareness efforts and additional street sweepingAn Upland Trash Assessment Quality Assurance Project Plan has been developed for this program and can be found electronically in the Miscellaneous Documents folder of the accompanying CD.

An initial pilot of this Upland Trash Assessment took place in 2015. The data collected from the initial pilot can be found in figure 6-6 and table 6-6. Baltimore County plans to implement the full version of the program beginning in 2016. As was done in the Anacostia watershed (and presented in the Anacostia Watershed Trash Reduction Plan), “windshield” surveys are used to survey upland trash on the streets that might enter the water bodies. This consists of a survey where a vehicle is driven throughout a segment of streets, and the amount of visible trash that can be seen is assigned a litter index score based on the level of pollution. This type of survey will be useful in targeting areas for education and for trash removal or street sweeping.

This type of assessment will be beneficial in investigating why sites such as G-PM-1 from the trash survey have significantly large amounts of trash.

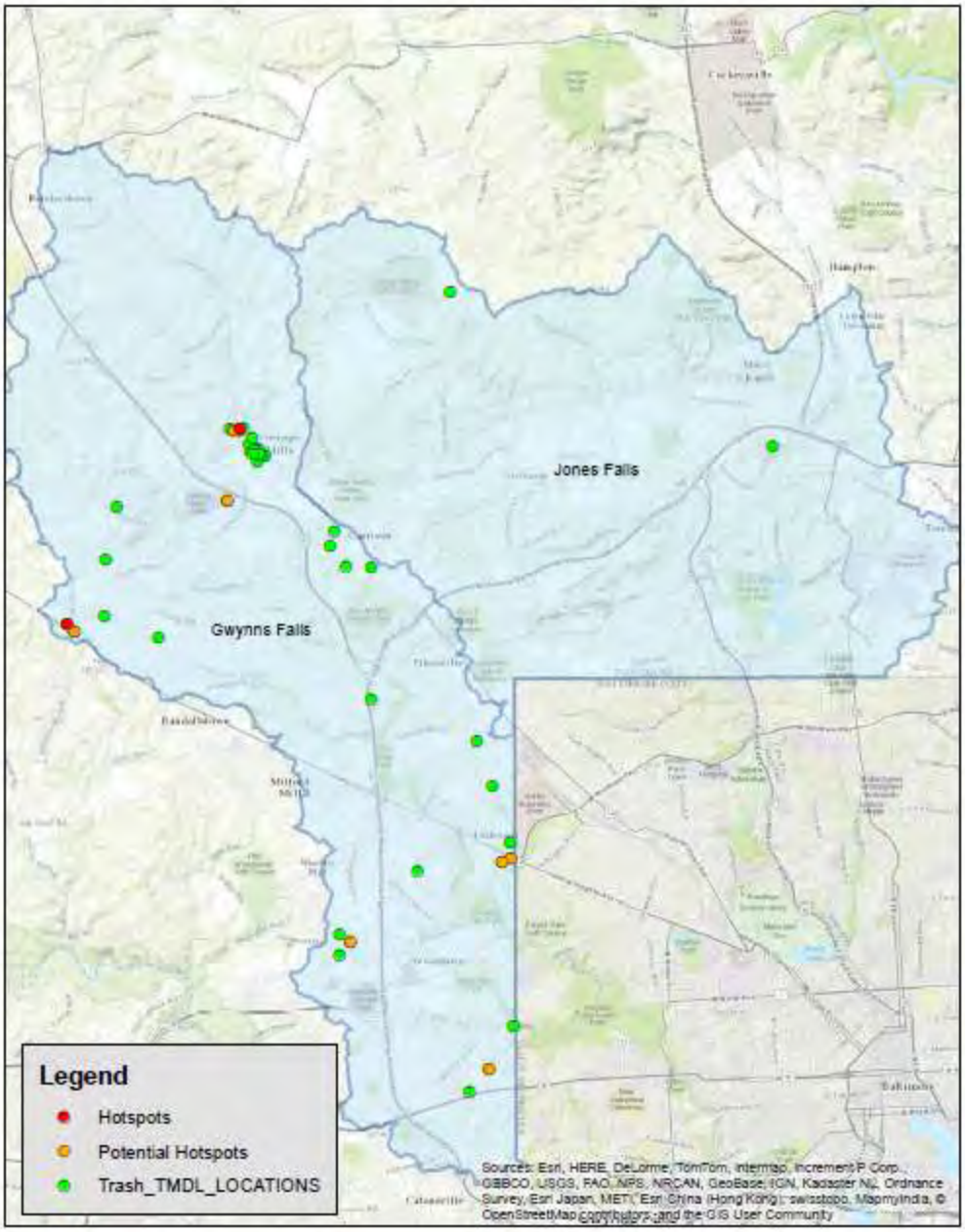


Figure 6-6: Map of 2015 Upland Trash Assessment Pilot Sites

Table 6-7: Trash Assessment Results

Assessment Site	Hotspot Classification	Site Type	Highest Index Score
GF-15-5-8	Potential Hotspot	Business	3
GF-15-5-23	Potential Hotspot	Business	3
GF-15-5-19	Potential Hotspot	Shopping Center	3
GF-15-5-1	Potential Hotspot	Residential	3
GF-15-5-3	Potential Hotspot	Residential	3
GF-15-5-9	Potential Hotspot	Residential	3
GF-15-7-14	Potential Hotspot	Business	3
GF-15-7-16	Potential Hotspot	Business	3
GF-15-5-20	Hotspot	Business	4
GF-15-7-15	Hotspot	Business	4

Of the 42 sites surveyed in the pilot study, 8 of the sites were potential hotspots and 2 of the sites were hotspots. Potential hotspots have at least one index score of 3. Hotspots have at least one index score of 4 or 5. Of all of the sites assessed, no sites were determined to have a score of 5. The majority of sites that were classified as potential hotspots or hotspots were business sites and none of them had stenciled storm drains. Two of the littered sites did have anti-litter signage present.

6.4 Watershed Trash Loading Calculations

While the Trash TMDL developed trash loading rates for the Gwynns Falls and the Jones Falls, there were no calculations for the trash loading rates for the rest of the watersheds in Baltimore County. In order to provide the trash loadings on a county-wide basis, EPS has used the information in the Baltimore Harbor Trash TMDL to develop trash loading rates for all 14 watersheds in Baltimore County. The trash TMDL is based on loading rates attributable to the differing land uses in the county (Table 6-8). These land use loading rates plus a 0.5% margin of safety were used to estimate the trash loads in each of the 14 major watersheds in Baltimore County (Table 6-9). Based on the Baltimore County data, it is estimated that 0.57 pounds of trash per acre are dumped each year, in addition to the land use derived trash load.

Table 6-8: Trash Loading Rates by Land Use

Land Use	Land Use Code	Trash Loading rate Lbs/acre/year
Low Density Residential	11, 191, 192	0.9
Medium Density Residential	12	2.45
High Density Residential	13	4.01
Commercial	14	7.91
Industrial	15	7.91
Extractive	17	7.91
Institutional	16	1.99
Open Urban	18	2.15
Roadways	80	2.06
Agriculture	21,22,23,241,242	2.15
Forest	41,42,43,44	0.02
Construction	73	7.91

Table 6-9: Baltimore County Watersheds - Annual Trash Loading Rates

Watershed	Acres	Pounds of Trash per Year
Deer Creek	7,152	14,084
Prettyboy Reservoir	25,551	38,761
Loch Raven Reservoir	139,568	266,591
Lower Gunpowder Falls	29,468	62,516
Little Gunpowder Falls	17,276	30,801
Bird River	16,408	50,460
Gunpowder River	5,859	11,669
Middle River	6,466	23,468
Liberty Reservoir	17,597	27,366
Patapsco River	33,579	82,411
Gwynns Falls	28,654	99,563
Jones Falls	25,933	64,051
Back River	23,115	84,816
Baltimore Harbor	11,406	57,236
	388,032	913,793

The trash load calculated for each watershed will be used as the target load for removal each year to reach a goal of zero trash in our waterways.

7.0 Permit Requirements

D. Management Programs

5. Property Management and Maintenance

a. Baltimore County shall ensure that a Notice of Intent (NOI) has been submitted to MDE and a pollution prevention plan developed for each County-owned municipal facility requiring NPDES stormwater general permit coverage. The status of pollution prevention plan development and implementation for each County-owned facility shall be reviewed, documented, and submitted to MDE annually.

b. The County shall implement a program to reduce pollutants associated with maintenance activities at County-owned facilities including parks, roadways, and parking lots. The maintenance program shall include these or MDE approved alternative activities:

i. Street sweeping;

ii. Inlet inspection and cleaning;

iii. Reducing the use of pesticides, herbicides, fertilizers, and other pollutants associated with vegetation management through the use of integrated pest management;

iv. Reducing the use of winter weather deicing materials through research, continual testing and improvement of materials, equipment calibration, employee training, and effective decision-making; and

v. Ensuring that all County staff receive adequate training in pollution prevention and good housekeeping practices.

The County shall report annually on the changes in any of the maintenance practices and the overall pollutant reductions resulting from the maintenance program. Within one year of permit issuance, an alternative maintenance program may be submitted for MDE approval indicating the activities to be undertaken and associated pollutant reductions.

7.1 Introduction

Baltimore County has a number of county owned facilities that are required to have NPDES stormwater general permit coverage (Section 7.2). The Department of Environmental Protection and Sustainability (EPS) has identified these sites and is assisting various departments in developing their stormwater pollution prevention plans, which includes good housekeeping and best management practices to prevent contaminants from leaving the site during rainstorms or a spill.

Baltimore County has established programs to reduce the amount of pollution that reaches the stream systems. Both the Storm Drain Cleaning Program (Section 7.3.1) and the Street Sweeping Program (Section 7.3.2) are the responsibility of the Baltimore County Department of Public Works (DPW) (Section 7.3). The Storm Drain Cleaning Program was originally created to remove the sediment from the storm drain systems in the watersheds of dredged tidal creeks,

thereby increasing the longevity of the original dredging. The program has since been expanded to clean the county's entire storm drain system, including the drain inlets, connecting pipes and outfalls. Debris, sediment, and pollutants can also be taken off the streets before they enter the storm drain system. This is accomplished with the Street Sweeping Program.

The County tracks its use of chemicals involved in vegetation maintenance (herbicides, pesticides, fertilizers) and deicing materials for winter weather conditions (Section 7.3), as well as Household Hazardous Waste (Section 7.4).

EPS coordinates with other county agencies through the NPDES Management Committee (Section 7.5).

7.2 General Permit for Stormwater Discharges Associated with Industrial Activity - Compliance of County Facilities with the General Industrial Stormwater Discharge Permit

The State of Maryland's current General Permit for Stormwater Discharges Associated with Industrial Activities went into effect on January 1, 2014. It is also referred to as the General Discharge Permit No. 12-SW, or simply "12-SW". It is administered by Maryland Department of Environment (MDE).

7.2.1 Regulated County Facilities - Status of NOIs and SWPPPs

County-owned industrial facilities requiring NPDES stormwater general permit coverage include general government sites such as highway shops, utility yards, vehicle/equipment maintenance and fueling facilities. Other public industrial sites, such as school bus yards and college campus maintenance facilities are also covered under this permit. These municipal industrial operations fall under various county agencies, including Public Works, Property Management, Public Schools, and the Baltimore County Community College.

7.2.1.1 Status of General Government Sites

The Department of Public Works (DPW) has assumed responsibility for ensuring that regulated general government facilities comply with the new permit requirements. Consultants conducted stormwater assessments on industrial sites, developed Stormwater Pollution Prevention Plans (SWPPPs), and designed restoration plans to address untreated impervious surface area as required by the county's NPDES-MS4 permit.

Table 7-1 shows the status of county facility compliance with the General Permit for Industrial Stormwater Discharge (12-SW) by agency or bureau. In FY 2015, there were a total of 26 permits in effect for general government industrial activities. A few sites have multiple permits due to multiple industrial uses on a shared site. Each industrial operator is responsible for maintaining their own permit and related requirements.

At the time of this report preparation, there were five new permits pending: three Property Management maintenance sites (Texas, Sparrows Point, and Inwood), Fullerton Utilities, and Fullerton EOM. A Notice of Termination (NOT) was issued in June 2015 for the Gilroy Utilities/EOM site. It was moved to the Fullerton Utilities site.

EPS provides guidance to county agencies on preparation of the Notice of Intent (NOI) or No Exposure Certification (NEC), and the Stormwater Pollution Prevention Plan (SWPPP) as needed. In accordance with the requirements of the 12-SW permit, NOIs and SWPPPs have been prepared and submitted to MDE for all regulated general government sites. A Letter of Coverage

from MDE states that all of these sites are covered, effective October 1, 2014. All Baltimore County municipal sites are in compliance.

DPW has contracted with the Maryland Environmental Service (MES) to conduct monitoring, maintenance, and updating of SWPPPs, handling of corrective actions, maintenance of data, tracking and reporting data, and training of staff at the regulated general government sites. MES has developed a customized database for tracking the data, and for generating notifications and work orders to established contacts when issues arise.

7.2.1.2 Status of Other County Agencies

This group includes public sites managed separately by Baltimore County Public Schools (13 sites) and the Community College of Baltimore County (3 campuses). All BSPS and CCBC sites are in compliance. These sites are also included in Table 7-1.

Table 7-1: General SW Discharge Permit (12-SW) – FY 2015 Compliance Status of Baltimore County Industrial Sites

County Department	Facilities	Notice of Intent (NOI) & Stormwater Pollution Prevention Plan (SWPPP) Established
Department of Public Works - Highways (includes Equipment Operation and Maintenance, and the DPW Training Academy)	16 Shops/Salt Domes: Bosley Avenue (Shop 5) Brady Avenue (Shop 1) Clarks Lane (Shop 3) Emala Ave (Shop 8) Glen Arm (EOM) Hydes Road (Shop 7-2) Industry Lane (Salt Dome) Longview (Shop 6) Middletown Road (Shop 4-2) Perry Road (Shop 7-1) Pikesville (Salt Dome) Ridge Road (Shop 4-1) Sparrows Point (Shop 9) Training Academy White Hall (Shop 4-3) Windsor Mill (Shop 2)	Yes
Department of Public Works - Utilities	3 Shops: Brady Avenue Essex Pikesville	Yes
Department of Public Works - Traffic Engineering	1 Site: Glen Arm	Yes
Office of Budget and Finance - Vehicle Operations and Maintenance	3 Maintenance Shops: Essex Gilroy (moved in June 2015) Randallstown	Yes
Office of Budget and Finance - Property Management	3 Maintenance Shops: Chesterwood Park Double Rock Park Special Forces	Yes
Baltimore County Public Schools - Transportation and Grounds	13 Facilities: Arbutus Bus and Grounds Cockeysville Transportation and Grounds Hopkins Creek Bus	Yes

	Inwood Transportation Kenwood Larchmont Grounds Loch Raven Grounds North Point Transportation, Bus and Grounds Parkton Bus Providence Road Bus Rosedale Bus Wabash Bus Windsor Mill Bus	
Community College of Baltimore County	3 Campuses: Catonsville Dundalk Essex	Yes

7.2.2 Restoration Plans for Permitted Sites (General Government)

Phase One restoration projects to assist towards meeting the impervious surface area treatment requirement of the NPDES-MS4 permit were completed in 2014. Phase Two sites are underway at some of the county's industrial sites. MES is under contract to maintain the BMPs implemented at the general government sites. See Section 10 for the list of restoration projects, the pollutant load reductions, and impervious surface credit calculations.

7.2.3 Employee Training

Training of on-site employees is an essential part of compliance with the 12-SW permit. All county industrial sites are required to conduct regular training and to keep a record of the training with their SWPPP at the site.

7.2.3.1 Department of Public Works (DPW)

At DPW's Mid-Level Managers' Meeting in October 2014, a presentation was given on Stormwater Pollution Prevention to approximately 90 supervisors from all DPW bureaus.

DPW conducted two staff training sessions on compliance of the General Stormwater Discharge Permit for general government sites. The first training was held at the county's Brady Avenue facility (southern county) on November 20, 2014. The second was held at the county's Safety and Training Academy in Phoenix (northern county) on December 10, 2014. Each training was held from 7:30 a.m. to 12:00 p.m., and each was attended by about 55 personnel. Sign in sheets for each facility represented are stored at the facility as required. Training was conducted by Maryland Environmental Service (MES) with support from DPW. The PowerPoint presentation given is included in the "Miscellaneous Documents" folder, submitted to MDE electronically with this report. Future staff trainings will take place on site, facility by facility.

7.2.3.2 Baltimore County Public Schools (BCPS)

BCPS employs over 1,000 bus drivers that work at various sites around the county. At the end of the school year, bus drivers have annual meetings. The BCPS Department of Facilities developed a Power Point presentation to train bus drivers on permit requirements and their role in maintaining a clean site. The presentation was given at all the bus driver meetings in June 2015. The presentation is included in the "Miscellaneous Documents" folder, submitted to MDE electronically with this report.

7.2.4 Site Inspections by MDE

MDE inspected 18 county facilities for 12-SW permit compliance in the 2015 fiscal year. Adjustments to the new record keeping requirements posed the greatest challenge. Four of eight Highway shops inspected were found to be noncompliant due to lack of proper record keeping; documentation was completed and put in place at the sites. One VOM and two Utilities sites were inspected and found to be compliant. Seven BCPS Transportation and Grounds sites were inspected; five were compliant; the other two had issues that were addressed and passed follow up inspections.

7.3 Pollution Reduction Due to County Maintenance Programs

7.3.1 Storm Drain Cleaning

The Baltimore County DPW stormdrain geodatabase is still being compiled, and will be updated via field investigations, quality control, and compilation from recent storm drain drawings. A copy of this geodatabase accompanies this report. Below are totals from DPW's stormdrain geodatabase as of 9/18/2015.

The Baltimore County storm drain system consists of approximately 1,591 miles of storm drain pipes, channels, and swales, 53,107 inlets, 29,091 manholes, 20,061 in-network structures, and 8,367 outfalls. This is a conservative estimate from DPW's storm drain geodatabase (included in this report, see Section 2), which continues to grow as field investigations, quality control, and compilation of recent storm drain drawings continue.

In order to keep the entire storm drain system clean of trash, debris, and sediment, the Department of Public Works Bureau of Utilities maintains three storm drain cleaning vehicles and employs three crews of two men each on a daily basis to clean the storm drains and pipes. Removing the material from the storm drain system reduces street flooding, a potential safety hazard, reduces the amount of trash and sediment from entering streams, and aids in the detection of illicit connections.

Each time a crew cleans an inlet or pipe the amount of debris removed is recorded on a data sheet that typically contains all cleaning records for that particular location. Completed data sheets are sent to EPS, where the data is entered into a database. The database facilitates reporting for NPDES purposes.

The DPW Bureau of Highways also has three inlet cleaning trucks that cover the eastern, western, and central county. The Bureau of Highways purchased three Elgin Megawind Sewer Catch Basin trucks and operator training was conducted on October 9, 2014 with several operator meetings after the training. The material collected from the inlets is dumped in the street sweeping debris dumpster and weighed at the landfill. That data is included with the Street Sweeping Program and not with the inlet cleaning data in this section.

7.3.1.1 Storm Drain Cleaning Data Analysis

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

The removal rates for 1993 through 2015 are presented in Table 7-2. Inlet data are reported as the average annual cubic feet of material removed per inlet, and pipe data are reported in cubic

feet of material removed per linear foot of pipe. Figure 7-1 shows a yearly comparison of the number of inlets cleaned and the total volume of material removed. Figure 7-2 shows the mean volume of debris removed per inlet. Figure 7-3 shows a yearly comparison of the length of pipe cleaned and the amount of material removed, and Figure 7-4 shows the mean volume of debris removed per linear foot of pipe.

Table 7-2: Removal Rates of Inlet and Pipe Cleaning by Year

Year	Inlet Vol. Cu. Yd.	# Inlets	Vol. / Inlet Cu. Yd	Pipe Vol. Cu. Yd.	Length in feet	Vol. / Ft. Cu. Yd.
1993	760	8,955	0.08	1,186	68,830	0.0172
1994	769	2,615	0.29	347	21,193	0.0164
1995	642	1,532	0.42	306	14,491	0.0211
1996	1,536	1,347	1.14	1,558	67,676	0.0230
1997	1,731	1,485	1.17	2,822	119,900	0.0235
1998	2,059	1,178	1.75	988	93,918	0.0105
1999	662	462	1.43	446	38,451	0.0116
2000	689	580	1.19	672	89,145	0.0075
2001	902	746	1.21	585	46,319	0.0126
2002	919	602	1.53	409	34,384	0.0118
2003	660	428	1.54	519	30,374	0.0171
2004	898	653	1.37	1,169	54,795	0.0213
2005	1,385	888	1.56	1,001	53,069	0.0189
2006	950	659	1.44	538	30,891	0.0174
2007	429	223	1.92	179	10,257	0.0175
2008	664	377	1.76	238	16,572	0.0144
2009	591	373	1.58	288	19,450	0.0148
2010	354	313	1.13	172	13,310	0.0129
2011	466	605	0.77	441	28,069	0.0157
FY 2012*	407	619	0.66	434	25,761	0.0168
FY 2013	221	286	0.77	229	14,342	0.0160
FY 2014	260	209	1.24	439	19,372	0.0226
FY 2015	407	854	0.48	645	42,615	0.0151
Totals	**18,361**	**25,989**	**0.706**	**15,611**	**953,184**	**0.0164**

* The analysis for 2012 was projected in terms of the 2012 fiscal year using data from January-June 2012, which was added to the ½ the value of the 2011 data.

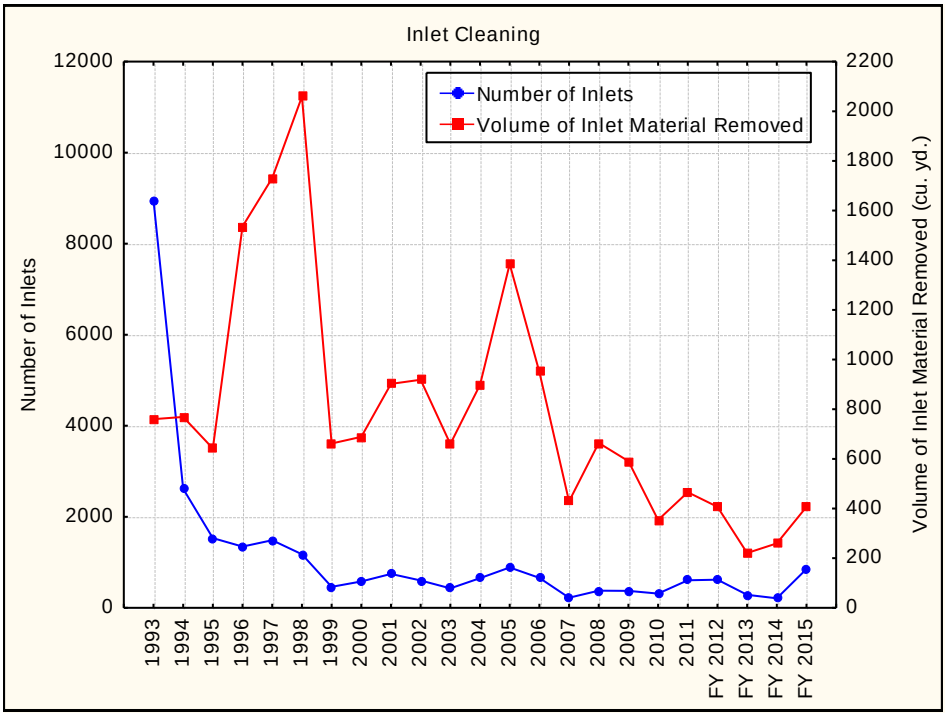


Figure 7-1: Inlets Cleaned and Volume of Material Removed per Year

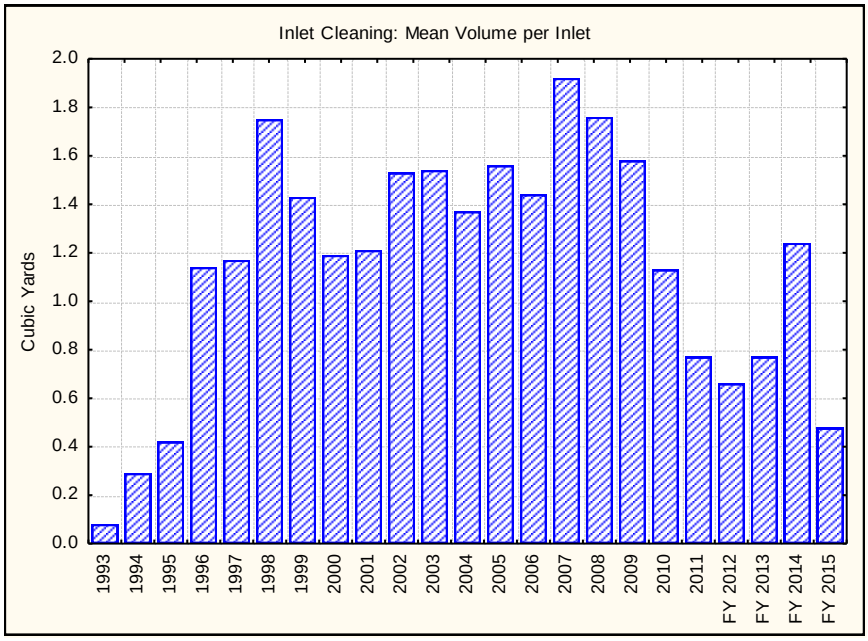


Figure 7-2: Annual Inlet Debris Removal Rates

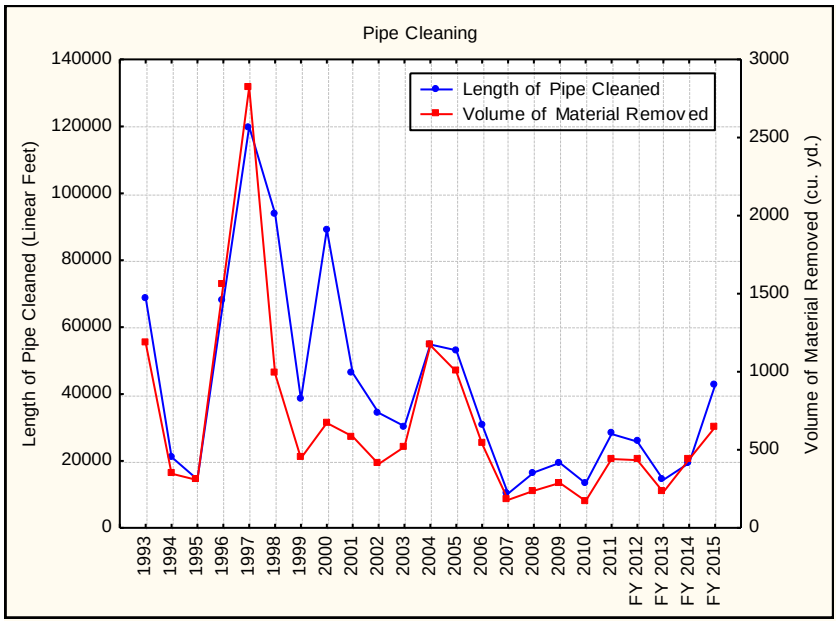


Figure 7-3: Length of Pipe Cleaned and Volume of Material Removed per Year

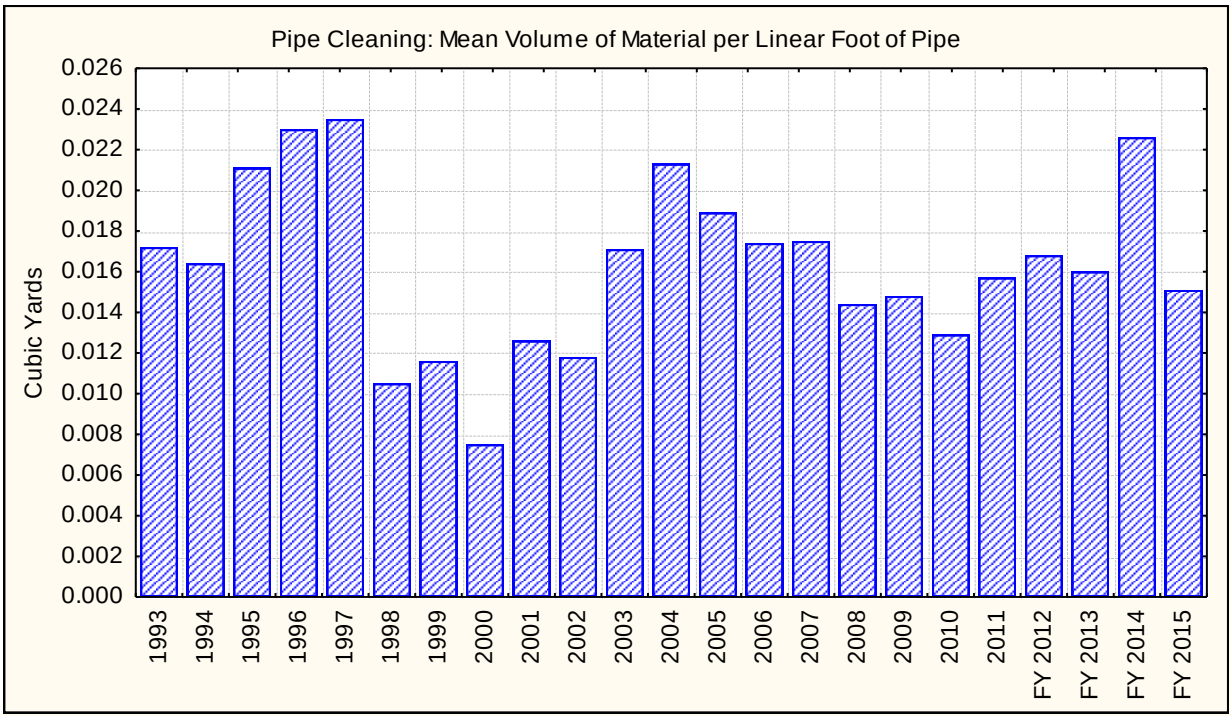


Figure 7-4: Annual Pipe Debris Removal Rates

The number of inlets cleaned remained fairly steady between 1999 and 2006, with a decrease between 2007 and 2010. While the 2011 and 2012 data showed an increase in the number of inlets cleaned, data for the 2013 and 2014 fiscal years shows a slight decrease. The number of inlets cleaned increased significantly in FY 2015 to 854. For the period from 1993 through 1998, the average number of inlets cleaned was ~2,850 per year in contrast to ~627 per year in the 1999-2006, ~418 in the 2007-2012 time periods, and ~240 during 2013-2014. The volume of

material removed per inlet has also been variable throughout the years. The average amount of material removed per inlet increased from ~0.8 cubic yards per inlet to ~1.4 cubic yards per inlet between 1998 and 2006, decreased slightly to ~1.3 cubic yards per inlet between 2006 and 2010, declined further to ~0.86 cubic yards per inlet between 2011 and FY 2014, and decreased again to ~0.48 cubic yards per inlet in FY 2015. In the early years of the program (1993-1995), all inlets within the county were cleaned, some with little or no accumulation of material.

This resulted in low volumes of material removed per inlet cleaned. This method was changed after 1995. The current storm drain cleaning program includes routine cleaning as budget permits of storm drains with known problems, in addition to responding to comments or complaints received via phone and web requests from citizens. There are also emergency based cleanings due to pipes or inlets being clogged. During the winter months (November – March), the Department of Public Works responds only to emergencies when the temperature is below freezing. Therefore, the numbers of pipes and inlets cleaned after 1995 varies each year, depending in part on the temperature.

The volume of material removed from inlets grew beginning in 1993 and peaked in 1998, at over 2,000 cubic yards of material removed (Figure 7-1). The total amount of material removed was lower for the years 1999 through 2003. There was an upward trend in 2004 and 2005 after which the volume of material removed has been consistently lower except in FY 12 when it rose slightly. However in the 2014 and 2015 Fiscal Years the amount of inlets cleaned and material removed rose substantially, although the removal of material per inlet decreased.

The largest amount of material removed from pipes was in 1997. This was also the greatest length of pipe cleaned (see Figure 7-4). The volume of material removed from pipes has steadily declined from an average of ~1,200 cubic yards between 1993 and 1998, ~667 cu. yd. between 1999 and 2006, and down to ~365 cu. yd. between 2007 and 2015. The average volume of material removed from pipes cleaned in these time periods has also declined with ~64,500 linear ft. from 1993 to 1998, ~47,000 ft. from 1999 through 2006, and ~21,000 ft. from 2007 to 2015. The volume removed per linear foot decreased from 0.019 cubic yards between 1993 and 1999 to 0.015 cu. yd. for 1999-2009, but increased to 0.17 cubic yards for FY2009-2015. Over the years the assumption of how full the pipe was before cleaning has been revised. In FY 2015 it was assumed the pipe was 50% full before cleaning and then the volume of debris was determined. In previous years, 100% and 75% assumptions have been used.

It should also be noted that drought conditions from 1999 through 2002 might have resulted in less material being washed into the storm drain system. That material was likely removed by street sweeping. Conversely, the increase in removal rates in the 2003 to 2005 period was probably due to above average levels of precipitation. In general, it's typically smaller diameter pipes that get clogged and need cleaning whereas larger pipes receive more volume of water and are able to flush the debris more easily.

7.3.1.2 Storm Drain Cleaning Data by Watershed

The Storm Drain Cleaning data for the 2015 fiscal year, showing the total number of inlets and lengths of pipe cleaned for each of Baltimore County's fourteen (14) major watersheds, are displayed in Table 7-3.

Table 7-3: FY 2015 Material Removed in Cubic Yards by Watershed

Watershed	Inlets Cleaned	Inlet Volume Cleaned (Cu. yd.)	Length of Pipe Cleaned (Ft.)	Pipe Volume Cleaned (Cu. yd.)	Total Volume (Cu. yd.)
Upper Western Shore					
Deer Creek	0	0.0	0	0.0	0.0
Prettyboy Reservoir	0	0.0	0	0.0	0.0
Loch Raven Reservoir	57	21.2	2,085	29.4	50.6
Lower Gunpowder Falls	52	22.6	2,858	31.7	54.3
Little Gunpowder Falls	3	0	295	4.5	4.5
Bird River	27	25.5	1,035	8.8	34.4
Gunpowder River	7	2.1	1,189	35.3	37.4
Middle River	58	19.4	2,112	31.1	50.5
Upper Western Shore Totals	**204**	**90.9**	**9,574**	**140.8**	**231.7**
Patapsco/Back River					
Liberty Reservoir	2	0.6	0	0	0.6
Patapsco River	84	55.1	3,289	75.4	130.6
Gwynns Falls	181	102.3	7,010	102.5	204.8
Jones Falls	125	45.6	8,311	70.3	115.9
Back River	171	75.3	9,670	187.1	262.5
Baltimore Harbor	87	37.6	4,761	68.4	106.0
Patapsco/Back River Totals	**650**	**316.6**	**33,041**	**503.7**	**820.3**
County Totals	**854**	**407.4**	**42,615**	**644.6**	**1,052.0**

Around 78% of the material removed from the storm drain system was removed from the heavily urbanized Patapsco/Back River Basin, with Gwynns Falls, Jones Falls, and Back River having the highest amounts removed.

In the fall of 2005, a study was initiated on the pollutant removal effectiveness of street sweeping and storm drain cleaning. This study was funded by the Chesapeake Bay Program and led by the Center for Watershed Protection and UMBC. Both Baltimore County and Baltimore City were partners in this research effort. Baltimore County specifically looked at the storm drain cleaning portion of the study by measuring monthly accumulation rates for 100 inlets in coastal plain commercial/industrial and residential, and piedmont commercial/industrial and residential. Baltimore County conducted sampling and chemical analysis of the material from a subset of the inlets. The results from this study are used to estimate pollutant load reductions from street sweeping and storm drain cleaning activities. The study, entitled "Deriving Reliable Pollutant Removal Rates for Municipal Street Sweeping and Storm Drain Cleanout Programs in the Chesapeake Bay Basin", is available for free download at http://www.worldsweeper.com/Street/Studies/CWPStudy/CBStreetSweeping.pdf

The composition of 16 inlets sampled in spring and fall of 2006 was divided into three categories: sediment, leaves (organic matter), and trash. The weight and volume of each component was determined for each inlet sampled. Materials were not dried before weighing, and were collected from a mix of wet and dry inlets. The study found that trash accounted for 8.9% of the weight of debris from inlets, while sediment and organic material made up 91.1% of the weight of debris. Trash debris is not eligible for nutrient and sediment reductions. An ANOVA based on a 2 x 2 x 2 factorial design (land use, physiographic province, and sampling round) was conducted. This analysis found no significant differences between the design factors. The average bulk density for the spring was 330.7 pounds/cubic yard of material and for the fall

331.4 pounds/cubic yard of material. The following formula was used to determine tons of material per cubic yard:

331 pounds/cubic yard x 0.0005 tons/pound = 0.166 tons/cubic yard

The derived tons/cubic yard was then multiplied by the total cubic yards of material removed from each watershed in FY 2013 to determine the total tons of material removed. We conservatively assume that the tons of material represents wet weight, and therefore estimate the dry weight by multiplying the tons by 70%, as per the document *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* (MDE, 2014).

The pollutant load reduction was then calculated using the following figures, from MDE (2014): pounds of pollutant per ton of collected dry material are 5 lbs/ton total nitrogen, 2 lbs/ton total phosphorus, and 600 lbs/ton total suspended solids. Weight of wet material can be converted to dry weight by multiplying by 70% (MDE 2014, 46).

The amount of each pollutant removed and urban impervious area treated from each major watershed in the county during the 2015 Fiscal Year is shown in Table 7-4. Impervious Urban Area Treated was calculated by multiplying the tons of material removed by 0.40 as per MDE (2014). The pollutants removed from the Patapsco/Back River Basin watersheds were about five times the amounts removed from the Upper Western Shore watersheds.

Table 7-4: FY 2015 Storm Drain Cleaning Program Pollutant Removal (Pounds) and Impervious Urban Acres Treated

Watershed	Debris (Cu. yd.)	Debris, non-trash (Tons)	TN Pounds	TP Pounds	TSS Pounds	EIUA[1]
Deer Creek	0.00	0.00	0.00	0.00	0.00	0.00
Prettyboy Reservoir	0.00	0.00	0.00	0.00	0.00	0.00
Loch Raven Reservoir	50.63	7.66	26.80	10.72	3,215.50	2.14
Lower Gunpowder River	54.27	8.21	28.73	11.49	3,447.20	2.30
Little Gunpowder Falls	4.46	0.67	2.36	0.94	283.49	0.19
Bird River	34.37	5.20	18.19	7.28	2,183.19	1.46
Gunpowder River	37.43	5.66	19.81	7.93	2,377.63	1.59
Middle River	50.53	7.64	26.75	10.70	3,209.57	2.14
UWS Totals	**231.70**	**35.04**	**122.64**	**49.06**	**14,716.57**	**9.81**
Liberty Reservoir	0.63	0.10	0.33	0.13	40.02	0.03
Patapsco River	130.57	19.75	69.11	27.64	8,293.02	5.53
Gwynns Falls	204.75	30.96	108.37	43.35	13,004.70	8.67
Jones Falls	115.88	17.52	61.34	24.53	7,360.26	4.91
Back River	262.49	39.70	138.93	55.57	16,672.07	11.11
Baltimore Harbor	105.98	16.03	56.09	22.44	6,731.17	4.49
Patapsco/Back River Totals	**820.30**	**124.05**	**434.18**	**173.67**	**52,101.24**	**34.73**
County Totals	**1,052.00**	**159.09**	**556.82**	**222.73**	**66,817.81**	**44.55**

[1]EIUA = Equivalent Impervious Urban Acres

7.3.1.3 Program Summary – Storm Drain Cleaning

Over the past twenty-two years, the storm drain cleaning program has removed ~33,972 cubic yards of material from the Baltimore County storm drain system. At 331 pounds per cubic yard, that amounts to approximately 11.2 million pounds. Without intervention, this material would have eventually entered our waterways.

7.3.2 Street Sweeping Overview

Removing materials such as trash, sediment, and debris, from public streets also results in a reduction of the pollutant load (toxins and nutrients) that could have entered waterways. Baltimore County removes these materials by utilizing a mechanical street sweepers managed by the Bureau of Highways. A significant increase in street sweeping occurred near the end of FY 2014 and continued into FY 2015. Using Stormwater Remediation Fee funds, the county increased its fleet of street sweepers to nine. An additional contracted sweeper started working full time in the Essex and Dundalk area after new equipment started arriving in May 2014.

The data on how many street miles are swept and tonnage collected is recorded by the Department of Public Works and submitted to EPS on an annual basis. Table 7-5 shows this data for each year from 1991-2015. Figure 7-5 provides graphic displays of the information contained in Table 7-5. The removal rates or productivity is also expressed in a tons-per-mile ratio for each year in the table. Approximately 0.5 tons of material was collected each mile from 1991 through 1995, with a spike to 0.88 in 1994. In 1994, during a particularly severe winter, the county experienced a salt shortage and found it necessary to utilize slag to provide traction on the icy roads. Subsequently, the material removed per mile spiked to the highest-ever that year. In 1996, the 0.5 tons/mile average began to decrease, reaching its lowest point of 0.112 tons/mile in 1998. The decreasing trend began in 1996 and leveled off between 1998 and 2001 at approximately 0.11 tons/mile. Since then the efficiency has been stable at about 0.30 tons/mile. The analysis for 2012 only reflects data collected between January and June 2012. The data for this time period is significantly lower than previous years, and was not extrapolated to represent the full fiscal year. This could be due to variations in street sweeping activities throughout the seasons. Note: Revised data was provided by the Bureau of Highways for street sweeping in 2012 and 2013.

Table 7-5: Annual Street Sweeping Summary

Year	Miles Swept	Tons Collected	Tons/Mile
1991	7,566	3,792	0.50
1992	6,663	3,161	0.47
1993	6,300	3,108	0.49
1994	8,532	7,473	0.88
1995	5,333	2,990	0.56
1996	8,605	2,990	0.35
1997	14,785	3,177	0.21
1998	24,863	2,792	0.11
1999	24,968	2,880	0.12
2000	21,949	2,491	0.11
2001	12,147	1,395	0.12
2002	7,800	2,364	0.30
2003	8,640	2,592	0.30
2004	6,617	1,985	0.29
2005	6,126	1,838	0.30
2006	6,306	1,892	0.30
2007	5,133	1,540	0.30
2008	4,110	1,233	0.30
2009	3,972	1,192	0.30
2010	3,937	1,181	0.30
2011	3,107	932	0.30
*2012	3,638	1,091	0.30
FY 2013	2,569	771	0.30

Year	Miles Swept	Tons Collected	Tons/Mile
FY 2014	N/A	2,166	N/A
FY 2015	N/A	1,854.4	N/A

Prior to April 2015, data was provided as miles swept and tons collected and productivity could be determined as tons per mile swept. Productivity of tons swept per mile showed a decline of about two-thirds of the rate in later years compared to the first five years of the program. The decline in productivity does not necessarily indicate a serious problem. It may simply indicate that the bulk of sediment and debris accumulated over many years was removed during the early years of the program, as might be expected. Without any major sediment influx (e.g. more cinders used for snow removal), street sweeping efficiency may have reached a maintenance level where it is simply keeping up with the average annual loading. Optimizing the program's performance may now depend mostly on fine-tuning the interrelated activities, for example a route analysis could lead to prioritizing and redefining the sweeping routes, and concentrating efforts more on the commercial areas. Please note data is now provided as tons collected per highway shop as described in 7.3.2.1 and we can no longer calculate a rate of tons per mile.

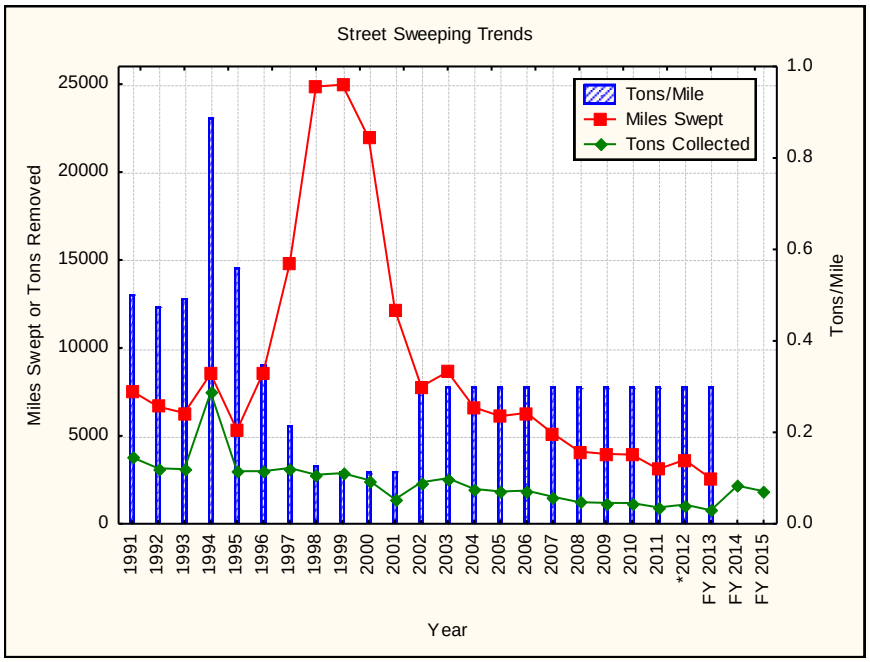


Figure 7-5: Miles of Street Swept, Tons of Material Removed, and Tons/Mile Swept

7.3.2.1 Street Sweeping by Watershed

Street sweeping data is reported as tons collected per highway shop. There are 11 highway shops in Baltimore County. Street sweeping is conducted only on roads with curb and gutters. Some alleys, County parking lots, and open roadways (without curb and gutter) are swept when requested. State Routes such as S.R. 45 (York Road) are not handled by the County; State Highway Administration is responsible those roads.

According to DPW, areas serviced by highway shops 8 and 9 (Essex area) are swept approximately three times a year where there's a dedicated, contracted street sweeper: all other areas are swept one to one and a half times per year. Street sweeping does not occur when the

temperature is below freezing, when there's snow on the ground, or during heavy rain. However, it is done year round when possible.

Tonnage of debris collected is reported as tons per highway shop (debris weighed at landfill). An assumption is made that the street sweeping is distributed evenly across the eligible road miles in each highway shop's territory. The percent of highway shop road miles in each watershed is used to distribute the street sweeping debris collections among watersheds. The miles per watershed per highway shop are displayed in Table 7-6.

Table 7-6: Street Sweeping Program – Proportion of Swept Miles by Highway Shop

Highway Shop	1		2		3		4-2		4-3	
Watershed	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%
Back R.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Balt. Harbor	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Bird R.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Gunpowder R.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Gwynns Falls	40.4	14.0%	345.0	71.9%	339.4	62.6%	0.0	0.0%	0.0	0.0%
Jones Falls	0.0	0.0%	9.6	2.0%	172.1	31.8%	0.0	0.0%	0.0	0.0%
Liberty	0.0	0.0%	0.0	0.0%	13.7	2.5%	0.0	0.0%	0.0	0.0%
Little Gun. F.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Loch Raven	0.0	0.0%	0.0	0.0%	10.3	1.9%	0.0	0.0%	5.4	100.0%
Lower Gun. F.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Middle R.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Patapsco R.	247.3	86.0%	125.2	26.1%	6.4	1.2%	0.0	0.0%	0.0	0.0%
Prettyboy	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.4	100.0%	0.0	0.0%
Grand Total	287.6	100.0%	479.8	100.0%	541.9	100.0%	0.4	100.0%	5.4	100.0%

Highway Shop	5		6		7-1		7-2		8		9	
Watershed	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%
Back R.	170.9	38.6%	0.0	0.0%	163.3	51.9%	0.0	0.0%	135.8	53.4%	50.3	20.4%
Balt. Harbor	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	196.4	79.6%
Bird R.	19.8	4.5%	0.0	0.0%	143.5	45.6%	37.8	18.0%	22.4	8.8%	0.0	0.0%
Gunpowder R.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	25.4	10.0%	0.0	0.0%
Gwynns Falls	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Jones Falls	106.1	24.0%	71.9	17.7%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Liberty	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Little Gun. F.	0.0	0.0%	0.4	0.1%	0.0	0.0%	26.8	12.8%	0.0	0.0%	0.0	0.0%
Loch Raven	52.9	12.0%	333.3	82.2%	0.0	0.0%	28.7	13.7%	0.0	0.0%	0.0	0.0%
Lower Gun. F.	92.7	20.9%	0.0	0.0%	7.7	2.5%	116.8	55.6%	0.1	0.0%	0.0	0.0%
Middle R.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	70.6	27.8%	0.0	0.0%
Patapsco R.	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Prettyboy	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Grand Total	442.5	100.0%	405.5	100.0%	314.5	100.0%	210.1	100.0%	254.2	100.0%	246.6	100.0%

Utilizing the same methodology used to calculate Storm Drain Cleaning Program pollutant removal rates, the reduction in pollutant loading attributable to the Street Sweeping Program was quantified. Street sweeping materials are not dried before weighing, so MDE's wet weight to dry weight conversion is applied (MDE 2014). Using pollutant concentrations from MDE (2014),

the distribution of pounds of pollutants removed and Impervious Urban Acres Treated in the 2013 Fiscal Year from each of the major watersheds in the county was calculated and is shown in Table 7-7. Impervious Urban Area Treated was calculated by multiplying the tons of material removed by 0.40 as per MDE (2014).

Table 7-7: FY 2015 Street Sweeping Program Pollutant Removal (Pounds) and Impervious Urban Acres Treated

Watershed	Debris (Tons)	TSS Pounds	TN Pounds	TP Pounds	EIUA[1]
Deer Creek	0.0	0.0	0.0	0.0	0.0
Prettyboy Reservoir	0.0	0.0	0.0	0.0	0.0
Loch Raven Reservoir	201.2	84,517.0	704.3	281.7	56.3
Lower Gunpowder Falls	117.1	49,201.5	410.0	164.0	32.8
Little Gunpowder Falls	17.8	7,485.3	62.4	25.0	5.0
Bird River	159.77	67,093.4	559.1	223.6	44.7
Gunpowder River	35.9	15,074.9	125.6	50.2	10.0
Middle River	99.8	41,931.6	349.4	139.8	28.0
UWS Totals	**631.7**	**265,303.6**	**2,210.9**	**884.3**	**176.9**
Liberty Reservoir	4.4	1,839.0	15.3	6.1	1.2
Patapsco River	123.77	51,957.2	433.0	173.2	34.6
Gwynns Falls	257.5	108,162.4	901.4	360.5	72.1
Jones Falls	133.22	55,943.1	466.2	186.5	37.3
Back River	434.55	182,485.3	1,520.7	608.3	121.7
Baltimore Harbor	269.44	113,165.9	943.0	377.2	75.4
P/Back River Totals	**1,222.7**	**513,553.0**	**4,279.6**	**1,711.8**	**342.4**
Annual County Totals	**1,854.2**	**778,856.6**	**6,490.5**	**2,596.2**	**519.2**

[1]EIUA = Equivalent Impervious Urban Acres

7.3.2.2 Program Summary - Street Sweeping

From 1991 to June of 2015, the Street Sweeping program removed 58,880 tons of debris from Baltimore County streets (Table 7-5). Without this program, this debris would have entered waterways.

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

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

7.3.3 Fertilizer, Pesticide, and Deicing Statistics

Members of the Baltimore County NPDES Management Committee have submitted statistics for usage of fertilizers, pesticides and deicing materials. Quantities of fertilizers and pesticides are reported in pounds, tons, gallons, and ounces. All results have been converted to pounds for this report. Fluid measure is assumed to have a density of 7.0 pounds per gallon. The statistics for FY 2015 (July 1, 2014 – June 30, 2015) by individual agencies are presented in Table 7-8. The

amounts used by the entire county annually since 1999 are presented in Table 7-9, along with number of winter storms and snowfall in inches.

Table 7-8: July 1, 2014 – June 30, 2015 County Agency Fertilizer, Pesticide and Deicing Materials Use (in Pounds)

Golf Courses	Fertilizer	Pesticide	Deicing
Diamond Ridge	23,929	5,638	375
Greystone	11,100	5,052	500
Rocky Point	25,994	9,684	175
Fox Hollow	28,420	5,387	350
Woodlands	33,586	7,962	375
Golf Course Total	**123,029**	**33,723**	**1,775**
Agency	**Fertilizer**	**Pesticide**	**Deicing**
Catonsville Community College	0	0	471,900
Essex Community College	10	2	140,140
Dundalk Community College	0	5	106,800
County Public Schools	3,500	261	356,900
DPW - Bureau of Utilities	0	24	0
DPW - Bureau of Highways	0	1,164	203,786,000
DPW – Bureau of Solid Waste[1]	6,000	21	80,000
Environmental Protection and Sustainability[1]	400	118	0
Property Management (athletic fields)	131,950	1,602	381,500
Non-Golf Course Total	**141,860**	**3,197**	**205,323,240**
Total County Pounds	**264,889**	**36,920**	**205,325,015**

[1]Data included for the first time in FY 2015.

A few additional sources of chemical treatments by the county are included for the first time in this report, namely DPW – Solid Waste (landfill grounds), and Environmental Protection and Sustainability (reforestation nursery operations, reforestation site maintenance, stormwater management facility maintenance, and in restoration projects to control invasive plants and establish new plantings for stabilization). It was also confirmed that all Recreation and Parks sites are maintained by Property Maintenance, and that DPW's forestry practices are included under the reporting for the Bureau of Highways.

7.3.3.1 Fertilizer

In 1998, the Maryland Legislature passed the Water Quality Improvement Act, also known as the nutrient management law. This law requires farms to develop and implement nutrient management plans for application of fertilizer, animal manure and sludge. Non-agricultural nutrient applicators, including commercial lawn care companies, landscapers, golf course managers and public groundskeepers, are required by law to follow Maryland Cooperative Extension guidelines when applying nutrients to lawns, athletic fields or other landscapes ten acres or greater in size. Nutrient management plans were required to be developed by December 31, 2001 and implemented by December 31, 2002. Since implementation of the Water Quality Improvement Act, there has been an overall downward trend in fertilizer use by county agencies, with the recent exception of Property Management as it is enhancing its athletic fields (described below). In 1999, the first year that data was reported and just prior to the start of implementation

of the Water Quality Improvement Act, a total of over 275,000 pounds of fertilizer was applied. From 2005 through 2011, the average amount of fertilizer used annually was about 150,000 pounds, which is 44% less than the 1999 high point, Baltimore County's data generally reflects the decrease in fertilizer use expected by this law.

In 2011, Maryland passed the Fertilizer Use Act of 2011, an environmental law designed to reduce the amount of nutrients washing into the Chesapeake Bay from lawns, recreation areas, golf courses, parks, and other non-agricultural areas. The law limits the amount of phosphorus contained in lawn fertilizer products sold to the public, establishes a training, certification and licensing program for people who are hired to apply fertilizer to non-agricultural landscapes, limits fertilizer amounts applied to turf, and requires the implementation of a homeowner education program about best management practices to be followed when using fertilizers. While certain restrictions on fertilizer use and application have been in place for farmers since 2001, only limited restrictions applied to commercial lawn care applicators and no restrictions applied to homeowners prior to the Fertilizer Use Act. The law was fully implemented by October 1, 2013. The Act contains new content requirements and labeling instructions for all lawn fertilizer products sold in Maryland. These changes are designed to help homeowners maintain healthy lawns without applying unnecessary amounts of certain nutrients. (From the Maryland Department of Agriculture, Fact Sheet: Fertilizer Use Act of 2011) For the full fact sheet: http://mda.maryland.gov/resource_conservation/Documents/fertilizerwebpage.pdf

In addition to the effects of the Water Quality Improvement Act of 1998, a number of factors have contributed to the highs and lows of fertilizer application, such as the number of county golf courses in operation (either five or six depending on the year) and whether agency data was reported. Among the county agencies that apply fertilizer products, golf courses were consistently the biggest users of these materials until FY 2015 when they lost the title to Property Management who tends the county's athletic fields. The 2015 fiscal year has also brought a new milestone, the highest overall fertilizer use since 1999, exceeding the past high in 2004 by over 37,000 pounds. The all-time high year for fertilizer application remains 1999 at 275,400 pounds. It was in 2004, that the Department of Recreation and Parks reported using an unusually high quantity of fertilizer, over 68,000 pounds. There were also six county golf courses in operation in 2004. The greatest amount of fertilizer used by a single golf course in a year was documented in FY 2013 at 53,078 pounds by Woodlands; the second highest of 50,000 was in 2004. The average amount of fertilizer used by a county golf course is roughly 30,000 pounds per year, however it was 24,600 pounds on average for 2015. In 2005 and 2006, there were five golf courses in operation, but also of note is that there was no data reported by the Department of Recreation and Parks in each of those years. From 2007 through FY 2013, Recreation and Parks (sites now maintained by Baltimore County Property Management) reported using from 550 pounds (2013) to over 10,000 pounds (2009) of fertilizer, a small fraction of the 68,000 pounds used in 2004. However, due to a turf enhancement program begun in FY 2014 by Property Management, a significantly higher amount of fertilizer has been applied. Over 69,000 pounds of fertilizer was applied to improve the condition of the county athletic fields in 2014, and nearly 132,000 pounds in 2015 (exceeding the 2015 golf course total by 8,900 pounds). Property Management follows MDA guidelines and University of Maryland fertilizer specifications. In 2015, golf courses applied 123,029 pounds of fertilizer, and the county total was 264,889 pounds. This is about 118,000 pounds higher than the average annual county total from 2005 to the 2013 (January – June 2012 data excluded) of 146,353 pounds, prior to the athletic field enhancement program. In contrast, the average quantity of fertilizer used in the six previous

years (1999-2004) was 221,536 pounds. The average annual county total from the past two years since the athletic field enhancement program began is 231,889 pounds of fertilizer applied. In FY 2015, Property Management was responsible for applying 50% of the total amount of fertilizer used by the county.

7.3.3.2 Pesticides

The chemicals that make up the category known here as "pesticides" include herbicides, insecticides, and fungicides. Golf courses are the largest users of pesticides. There is not a distinct trend in pesticide use. Over the years, reported pesticide use by county agencies has ranged from 21,000 to nearly 39,000 pounds, with 2014 topping the charts at 38,979 pounds. Of that total amount, golf courses have reported collectively using from 19,000 to 36,000 pounds. In 2004, when the Gunpowder Falls Golf Course opened, an unusually high amount of pesticide was applied to that site (13,000 pounds), which accounts for the spike in pesticide use that year. Otherwise, there does not appear to be a relationship between the number of golf courses in operation and the amount of pesticide used. From 1999 to 2015, non-golf course use of pesticide ranges from 1,735 to 4,373 pounds per year. The spike of 2006 is due to the Dundalk campus of CCBC applying 1,200 pounds of pesticide. This is an unusually high amount for this campus, where the second highest year was only 120 pounds, and all other years did not exceed 48 pounds (2013). In 2015, the non-golf course total was 3,197 pounds. Golf courses reported higher than average pesticide application in 2009, 2010, 2013, 2014, and 2015 (all between 32,000 and 36,000 pounds) contributing to the high totals for those years. In 2015, golf courses applied 33,723 pounds of pesticide, followed by 1,602 pounds by Property Management, and 1,164 pounds by the Bureau of Highways.

7.3.3.3 Deicing

Deicing materials (road salts) are used by several county agencies. As expected, because of its responsibility to clear roads, the DPW Bureau of Highways remains the biggest user of deicing materials. In 2015, the Bureau of Highways applied 203,786,000 pounds, or 99.3% of the road salt applied by the county. Efforts will continue to be made to reduce the amount of deicing materials used through research, testing, equipment calibration, employee training, and effective decision making. *The analysis for 2012 only reflects data collected between January and June 2012.

The amount of deicing materials used depends not only on accumulation of snow, but also the number of winter weather events. 2014 broke the record on the amount of deicing material used with 249,938,000 pounds applied. A total of 39 inches of snow fell in 20 separate storms that winter. Icy road conditions are not tracked at this time. The January – June 2012 deicing data was included in the graph; although not a full year, autumn snow is uncommon in Baltimore County.

Table 7-9 shows the annual usage of fertilizer, pesticides and deicing material from 1999 through June 2015. Snowfall data is obtained from NOAA's online preliminary monthly weather data archive. The number of winter weather events is attributable to the events with measurable snowfall ("heavy snow" and "snow" categories); the number of winter storms does not include "freezing rain" events, although road salt may be applied for these storms as well. Figure 7-6 shows data for Fertilizer and Pesticide Trends and Figure 7-7 shows the data for Deicer and Snowfall. The analysis for 2012 only reflects data collected between January and June 2012; this

data was intentionally not included in the graph, as it does not represent an entire growing season. Since 2013, data is reported by the fiscal year (July 1 – June 30), not the calendar year.

Table 7-9: Annual Fertilizer, Pesticide and Deicing Materials Used By County Agencies (in Pounds)

Year	Fertilizer	Pesticide	Deicing Mat.	Snowfall (in.)	Number of Winter Weather Events
1999	275,400	34,320	83,978,000	12.4	8
2000	213,114	21,028	94,467,750	27.2	7
2001	221,609	21,509	48,566,400	7.4	5
2002	200,060	21,229	100,437,859	12.0	7
2003	191,726	22,137	205,164,341	58.0	8
2004	227,309	34,762	147,537,040	8.7	5
2005	133,881	20,899	185,118,740	24.5	7
2006	166,870	29,607	23,888,950	13.1	1
2007	131,191	26,362	156,690,026	14.4	11
2008	113,435	32,059	65,456,420	4.3	15
2009	170,175	35,279	151,208,045	28.6	9
2010	181,573	38,587	162,724,620	58.1	7
2011	158,866	29,778	133,892,760	13.2	7
2012*	90,546	14,878	23,162,196	1.8	3
2013 FY	170,644	37,244	65,614,500	8.0	3
2014 FY	198,889	56,325	251,133,425	39.0	20
2015 FY	264,889	36,920	205,325,015	28.7	20
Totals					

*2012 data is for January – June only

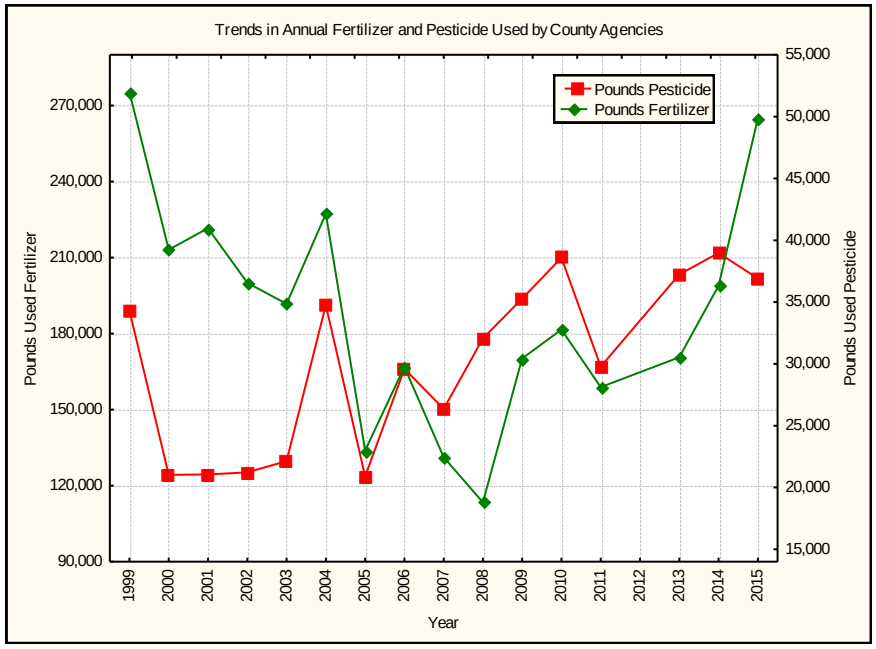


Figure 7-6: Trends in Annual Fertilizer and Pesticide Used by County Agencies

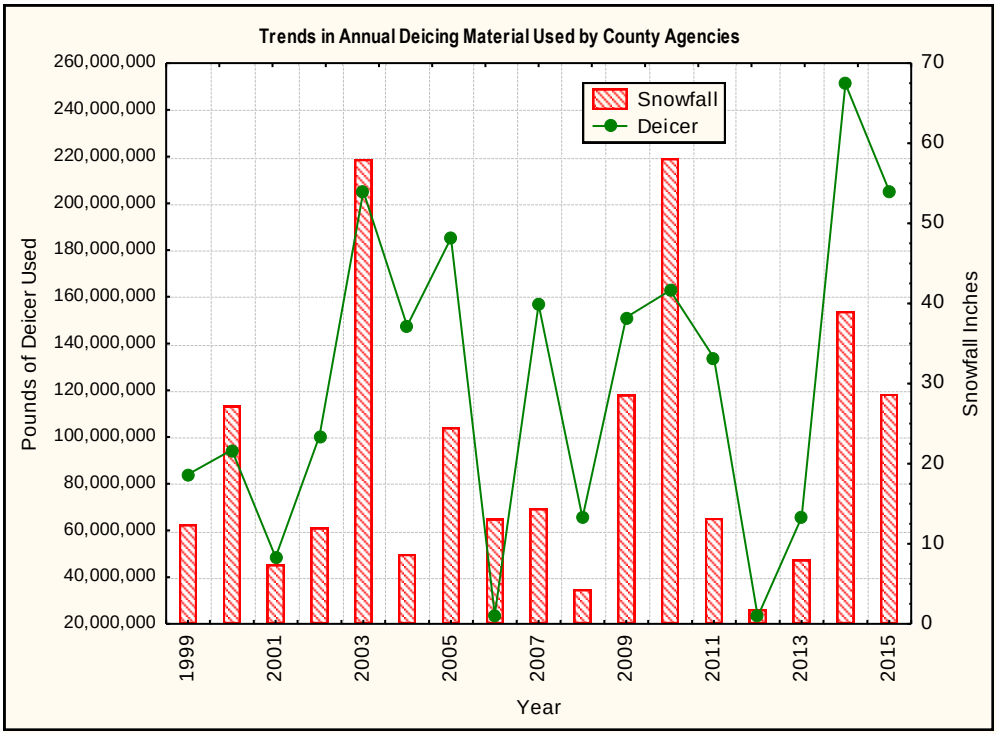


Figure 7-7: Trends in Annual Deicing Material Used by County Agencies

7.4 Household Hazardous Waste

There is one permanent drop off center at the Eastern Sanitary Landfill Solid Waste Management Facility, where Baltimore County citizens can drop off all household hazardous waste (HHW) materials year round (paints, automotive fluids, solvents, pesticides and herbicides, swimming pool chemicals, corrosive materials, rechargeable batteries, fluorescent light bulbs, mercury thermometers and thermostats, etc.). The landfill and on-site HHW collection facility is operated by the Department of Public Works (DPW).

There are also two permanent satellite collection facilities at the Central Acceptance Facility (CAF) in Cockeysville, and Western Acceptance Facility (WAF) in Halethorpe that accept some household hazardous waste materials year round (motor oil, anti-freeze, rechargeable batteries, fluorescent light bulbs, mercury thermometers and thermostats). Recently, gasoline collection year round was added at the CAF, and one day a year we collect all household hazardous waste materials at each of these two facilities. The spring collection day is at CAF, and the fall collection day is at WAF. These satellite locations are operated by MES, under contract with DPW. EPS oversees all three facilities, pays for the contractors, equipment and supplies. Table 7-10 provides a listing of material collected from all the facilities, including the one-day events, over the past eight years (2008-2015). Older reports have data from prior years.

Table 7-10 was modified in 2015 to more closely follow the reporting of materials collected as it comes to EPS. A number of the category names have been changed to more accurately reflect the materials in that category. The listing has been alphabetized. There are a few entities (agencies and contractors) responsible for reporting amounts of materials collected. It is common for significant lag times occur between collection of materials and reporting of data to the EPS. Ultimately, over 25 different vendors are engaged in the recycling and disposal of household

hazardous waste materials. To avoid data gaps, amounts have been estimated in some cases as indicated.

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

Table 7-10: Household Hazardous Waste Recycled (2008-2015)

Material Type	2008	2009	2010	2011	2012*	2013 FY	2014 FY	2015 FY
Liquid Materials (gallons)								
Ammonia	****	****	****	****	****	****	****	****
Antifreeze	5,926	4,548	6,906	3,238	2,876	5,752	4,546	4,500
Gasoline	2,884	3,607	4,235	4,663	1,912	4,158	6,240	5,340
Motor oil	75,676	81,353	113,166	55,108	56,602	113,204	103,143	100,000
Paint (Latex)	11,555	13,560	13,690	18,905	9,303	12,793	14,130	20,454
Solvents/Oil Based Paint	5,885	7,260	7,975	9,460	4,305	6,340	9,400	6,215
Liquid Totals (gallons)	101,926	110,328	145,972	91,374	74,998	142,247	137,459	136,509
Solid and Liquid Materials (pounds)								
Asbestos Waste	***	***	111,180	119,940	63,000	126,000	81,380	69,240
Batteries (auto)	91,840	176,320	131,800	80,220	37,920	75,840	68,160**	72,460
Batteries (rechargeable)	6,372	1,238	2,089	2,169	2,453	5,253	5,433	4,471
Corrosives, combined	8,698	11,681	7,400	7,200	3,550	6,201	15,300	*****
Corrosives/acid								5,700
Corrosives/base								9,900
Electronics	***	2,386,580	4,488,940	3,496,060	1,843,590	3,687,180	425,640	800,000
Explosives/ Fireworks								6
Freon (white goods)	773	742	863	1,018	392	784	1,224**	877
Medicines (Pharmaceuticals)	***	***	***	***	120	240	1,735	520
Mercury	22	42	54	51	95	120	102	50
Oxidizers	1,747	1,796	500	1,370	500	731	1,262	1,124
PCB Oil	5	1	1,690	2,310	1,836	2,081	2,298	1,100
Pesticides	13,685	11,031	6,870	10,400	5,275	9,987	27,135	19,600
Propane Cylinders	23,820	14,560	11,460	14,400	4,000	8,000	7,160**	6,000
Reactives	18	21	1	5	25	25	42	30
Toxics	257	12	61	0	36	41	86	20
Solid/Liquid Totals (pounds)	147,237	2,604,024	4,762,908	3,735,143	1,962,792	3,922,483	560,413**	991,098
Number of Items								
Ammunition, Rounds	400	815	2,779	2,026	1,015	2,029	125	1,033
Flares, Road/ Marine								55
Fluorescent Light Bulbs	7,945	22,449	46,767	69,615	30,388	50,102	59,289	69,153
Number Totals	**8,345**	**23,264**	**49,546**	**71,641**	**31,403**	**52,131**	**59,414**	**70,241**

* 2012 data is only for Jan. – June, due to transition to fiscal year reporting
** Updated or newly added data from a previous year; data was not available at the time of the previous report
*** Not recorded for these years
**** Ammonia is now being included with the corrosives – base
***** Corrosives are reported separately as acid or base, as of 2015
Numbers in red are estimates based on past collection results; data was not available at the time of the report

7.4.1 Materials Reported in Gallons

In addition to the liquid materials described in this section, there are other liquids reported in pounds due to methods of collection and transport, such as corrosives and pesticides.

7.4.1.1 Ammonia

Starting in 2008, ammonia was combined with corrosive liquids (base). It is disposed through the waste water treatment system.

7.4.1.2 Antifreeze

Collection of antifreeze has ranged from about 3,000 to 7,000 gallons over the past ten years. An estimate was made for antifreeze for FY 2015 (4,500 gallons), since data was not available. Antifreeze is recycled throughout the county at drop-off facilities operated by DPW, in cooperation with the Maryland Environmental Service (MES). Over 100,000 gallons of anti-freeze have been recycled in Baltimore County since 1991.

7.4.1.3 Gasoline

The amount of recycled gasoline had remained relatively steady in a range of 2,000 to 3,000 gallons per year, until 2009 when over 3,600 gallons were collected. With the exception of 2012 (half year data), over 4,000 gallons of gasoline has been collected each year since 2010 with an all-time high of 6,240 gallons (2014). 5,340 gallons were reported for 2015.

7.4.1.4 Motor Oil

Motor oil remains the most frequently recycled household hazardous waste. Motor oil is recycled throughout the county at drop-off facilities operated by DPW, in cooperation with the Maryland Environmental Service (MES). Statistics for recycled motor oil for all participating collection facilities have been reported since 1991. Oil and antifreeze recycling is reported through MES, local government, and private facility partnership efforts. Additional unreported recycling of oil and anti-freeze occurs through a network of 65 private sector collection centers across the county, most of which are neighborhood gas/service stations. EPS provided assistance in establishing the motor oil and antifreeze recycling program at the DPW facilities. County drop-off sites include landfills, transfer stations, two rural DPW Highways shops, and the Bowley's Quarters Marina.

As can be seen in Figure 7-8, the recycling of motor oil was typically between 90,000 and 100,000 gallons from 1998 to 2005. It was between 75,000 and 85,000 for the following four years. In 2010 and FY 2013, motor oil collection reached a high of over 110,000 gallons. A total of over 2,000,000 gallons of motor oil has been collected for recycling since 1991. Since data was not yet available, an estimate of 100,000 gallons was made for the quantity of motor oil collected in 2015.

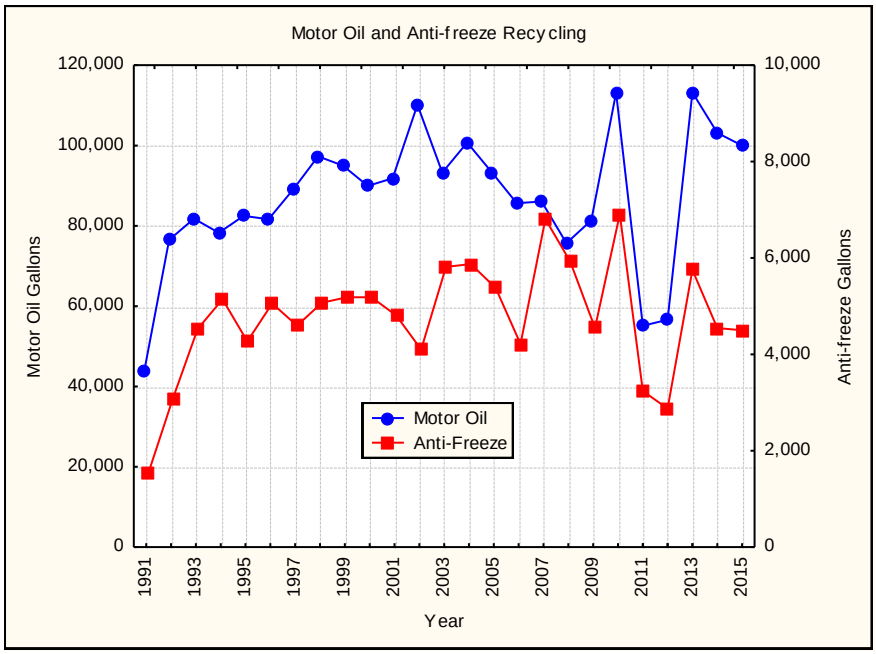


Figure 7-8: Motor Oil and Anti-freeze Recycled from 1991 through FY 2015
* 2012 data reflects on January – June of that year

7.4.1.5 Paint (Latex)

Collected water-based paints are distributed for re-use through the Loading Dock in Baltimore City, a non-profit building materials re-use facility. An all-time high was reached in 2015 of over 20,000 gallons.

7.4.1.6 Solvents/Oil Based Paint (includes flammables)

In previous reports this category was reported as "flammables". The materials in this category are all combustible, however they are not all flammable, as determined by a substance's flash point temperature. Paint sludge is now bulked together into the same drums with other combustible material (solvents). Over the past ten years, the amount of solvents collected has ranged between about 4,000 and 9,000 gallons per year. In 2015, 6,215 gallons were collected.

7.4.2 Materials Reported in Pounds

7.4.2.1 Asbestos

Asbestos waste has been handled appropriately since the 1980's, however it was not reported as household hazardous waste until 2010. From 2010 to 2013, over 110,000 pounds of asbestos were collected each year (data for the 2012 column is only half the year). In 2014, the quantity dropped considerably to 81,000 pounds, then again in 2015 to 69,000 pounds.

7.4.2.2 Batteries – Auto

There was a decrease in auto batteries recycled in 2008 likely due to the sluggish economy. People may have sold their batteries to salvage yards, instead of dropping them off at the landfill. Also in 2008, auto batteries were being stolen from the landfill, and as a result the area was fenced and locked. In 2009, the quantity of batteries collected returned to a more typical level, but there has been a sharp decline since then with only 75,000 pounds collected in FY 2013. Data was not available in time for the 2014 report, but has been added in for this report (68,160 pounds). In 2015, 72,460 pounds were collected.

7.4.2.3 Batteries – Rechargeable

Generally, there has been an increase in rechargeable batteries collected for recycling with over 5,200 pounds collected in 2013 and 2014. In 2015, the amount was somewhat less at 4,500 pounds.

7.4.2.4 Corrosives

There are acid and base corrosives. These are liquid materials, but they are reported in pounds due to collection and transport methods, including partially filled containers. As of this report, the acid and base corrosives are shown separately, instead of being combined. Acid corrosives are stabilized and disposed of in the landfill (5,700 pounds in 2015). Base corrosives, which includes ammonia, are disposed through the waste water treatment system (9,900 pounds in 2015).

7.4.2.5 Electronics

Beginning in October 2009, it became illegal in Baltimore County for residents to dispose of household electronics as trash. Collection of unwanted electronics for recycling began that year and very quickly became a major source of material to be diverted from the waste stream. Electronics contain mercury, lead, cadmium, and arsenic which should not go into a landfill or waste-to-energy facilities. Types of electronics collected for recycling include computer equipment, VCRs, DVD players, telephones, stereos, fax machines, and video display devices. Televisions were excluded from the collection in 2015, due to market factors. In 2010, the quantity of electronics collected was 4,488,940 pounds, a near doubling of the amount collected in the fall of 2009. Roughly, 3,500,000 pounds per year were collected from 2011 through 2013, however only 435,000 pounds were reported for FY2014. Since data was not available in time for the report, an estimate of 800,000 pounds was included for electronics. Three drop off centers accept electronics throughout the year.

7.4.2.6 Explosives/Fireworks

Only 6 pounds were collected in 2015. Explosives and fireworks are destroyed by the Baltimore County Police Bomb Squad.

7.4.2.7 Freon from White Goods

All refrigerators and air conditioners are separated out at the landfill and transfer stations for the Freon to be removed for recycling. Over the past nine years since Freon was collected, between 400 and 1,000 pounds have been recycled per year. Data was not available in time for the 2014 report, but has been added in for this report (1,224 pounds). In 2015, 877 pounds of Freon were collected.

7.4.2.8 Medicines (Pharmaceuticals)

Beginning in 2009, expired and un-wanted medicines were collected for proper disposal by the Police Department at one-day events. Initially, approximate weights of the materials collected were included in the “toxics” category. In 2012, medicines were shifted to a separate category for tracking. As of September 2013, unwanted/expired medicines were accepted at police stations in outdoor locked drop-off boxes, which has resulted in a big jump in the amount of material collected. Approximately 1,735 pounds of medicines were collected in FY 2014, several times more than were collected the two years before. In 2015, 520 pounds were collected for incineration.

7.4.2.9 Mercury

Mercury TMDLs are in effect for the Prettyboy and Loch Raven Reservoirs in fish tissue. Liberty Reservoir has been de-listed for mercury due to an adequate reduction of mercury in fish tissue samples, so the Liberty mercury TMDL is no longer in effect. Future fish tissue sampling may also lead to de-listing in Prettyboy and Loch Raven. Although mercury contamination is mainly attributed to atmospheric deposition, the Household Hazardous Waste Program helps to meet the reduction of mercury that could potentially end up in our waterways. Mercury was added to the list of household hazardous wastes in 2001, when 168 pounds were collected. Since then, collected amounts have ranged from 22 to 125 pounds per year. In FY 2015, 50 pounds were collected for recycling.

7.4.2.10 Oxidizers

Between 500 and 1,800 pounds of oxidizers have been collected per year over the past ten years. In 2015, 1,124 pounds of oxidizers were collected. This material is stabilized and landfilled.

7.4.2.11 Polychlorinated Biphenyl Oil (PCBs)

TMDLs are in effect for PCBs in the Jones Falls, Back River and Baltimore Harbor watersheds. There is PCB oil and PCB ballasts from fluorescent bulbs. Variation from year to year for PCB ballasts is in part due to the limited collection amount and timing of shipping a drum to the recycler/disposer. A drum is only shipped out when it is full. In 2015, there were no PCB ballasts collected, and 1,100 pounds of PCB oil. From 2010 to 2014, there were from 1,700 to 2,300 pounds collected each year, so this year's collected amount is comparatively low. Ballasts are recycled, and oil is incinerated.

7.4.2.12 Pesticides

TMDLs for chlordane, a pesticide banned since 1988, are in effect for the Back River and Baltimore Harbor watersheds. The Jones Falls has been de-listed for chlordane, so its chlordane TMDL is no longer in effect. The quantity of pesticides collected has varied greatly over time with a high of 27,000 pounds collected in 2014. The previous high was 18,256 pounds in 2007. In 2010, just 6,870 pounds of pesticides were collected. In 2015, 19,600 pounds of pesticide were collected. Solid and liquid pesticides are collected, but both are reported in pounds. There is no differentiation of types of pesticides collected. These chemicals are disposed by incineration.

Figure 7-9 displays the estimated statistics for recycled flammables, gasoline and pesticides.

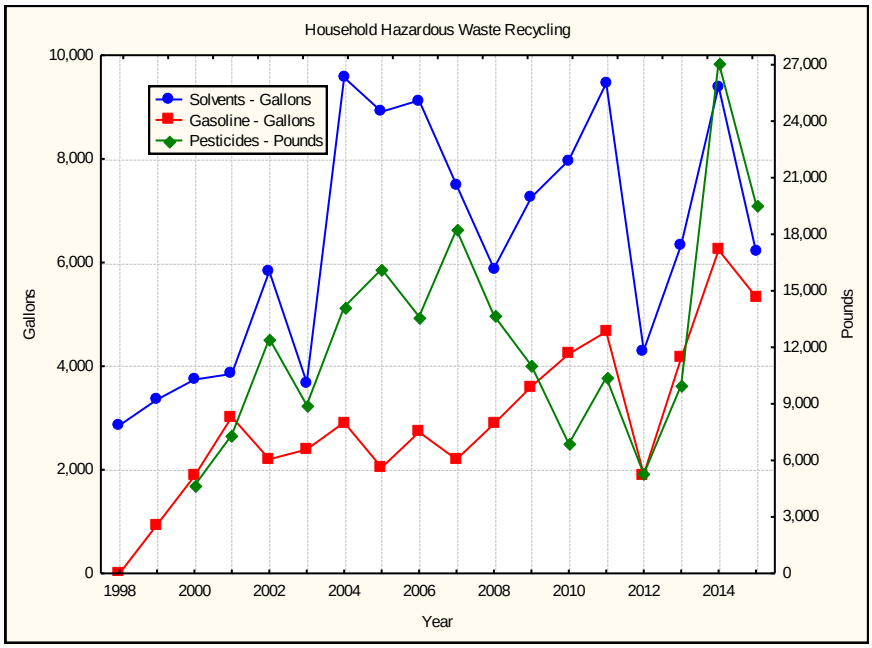


Figure 7-9: Household Hazardous Waste Recycling of Solvents, Gasoline, and Pesticides from 1998 to FY 2015
* Only one collection event held in 2003; fall collection was cancelled due to a hurricane.
** 2012 data reflects on January – June of that year

7.4.2.13 Propane Cylinders

Between 4,000 and 42,000 pounds of propane cylinders have been collected per year over the past ten years. Data was not available in time for the 2014 report, but has been added in for this report (7,160 pounds). In 2015, 6,000 pounds were collected. The cylinders are recycled.

7.4.2.14 Reactives

Between one and 42 pounds of reactive materials have been collected per year over the past ten years. Thirty pounds were collected in 2015 for incineration.

7.4.2.15 Toxics

Up to 257 pounds of toxic materials have been collected in a year. In 2015, 20 pounds were collected for incineration.

7.4.3 Materials Reported by Number

7.4.3.1 Ammunition Rounds

The Baltimore County Police Department Bomb Squad destroys ammunition that is brought to the Household Hazardous Waste collections. Over the past ten years, from about 100 to 2,800 rounds of ammunition were collected. In 2015, there were 1,033 rounds of ammo collected.

7.4.3.2 Flares, Roadside/Marine

Various types of flares are destroyed either at the Eastern Sanitary Landfill, or by the Bomb Squad (one day events). Fifty-five flares were collected in 2015. There is no data on flares prior to this year. It was either combined with explosives (by weight) or flares were not collected.

7.4.3.3 Fluorescent Light Bulbs

In 2010, fluorescent light bulbs from county buildings were included in the Household Hazardous Waste tallies, which more than doubled the quantity of the previous year. The highest collection of these bulbs was in 2011 at 69,615. Over 69,000 fluorescent bulbs were collected in FY 2015 for recycling.

7.5 NPDES Management Committee

This committee is composed of representatives from several county agencies with responsibility for property management and maintenance of county facilities. The committee meets periodically to discuss issues related to NPDES-MS4 compliance. In the upcoming year, it is our intent to meet with the committee to discuss regulation of fertilizer and pesticide use, and potential ways to reduce the amount used.

There was not a general committee meeting in FY 2015, however the Department of Environmental Protection and Sustainability was in close contact with other agencies throughout the development of over twenty-two Total Maximum Daily Load Implementation Plans, which were submitted to MDE at the end of 2014.

7.6 Sanitary Sewer Repair Tracking

In Baltimore County the population that lives inside the metropolitan district is primarily supported by the sanitary sewer system. The county has been making repairs to the sewer system, and these are expected to reduce bacteria entering our waterways. This section outlines the sanitary sewer repairs and our method of tracking these repairs.

7.6.1 Data Sources and Methodology

Bacteria monitoring locations were used as reference points to summarize the records of sewer repairs. Drainage areas for these locations were digitized in GIS using ArcHydro and manual delineation using topography and county and city digital elevation model (DEM) data. Map 7-1 below shows the locations of the bacteria monitoring points used to summarize the data in this section. Monitoring locations that have drainage areas entirely outside the metropolitan district are not included in this section as well as areas that do not have any sewer repair data. These areas include the following watersheds: Prettyboy Reservoir, Liberty Reservoir, Little Gunpowder Falls, Lower Gunpowder Falls, Bird River, Gunpowder River, Middle River and Baltimore Harbor and portions of the Loch Raven Reservoir, Jones Falls and Gwynns Falls.

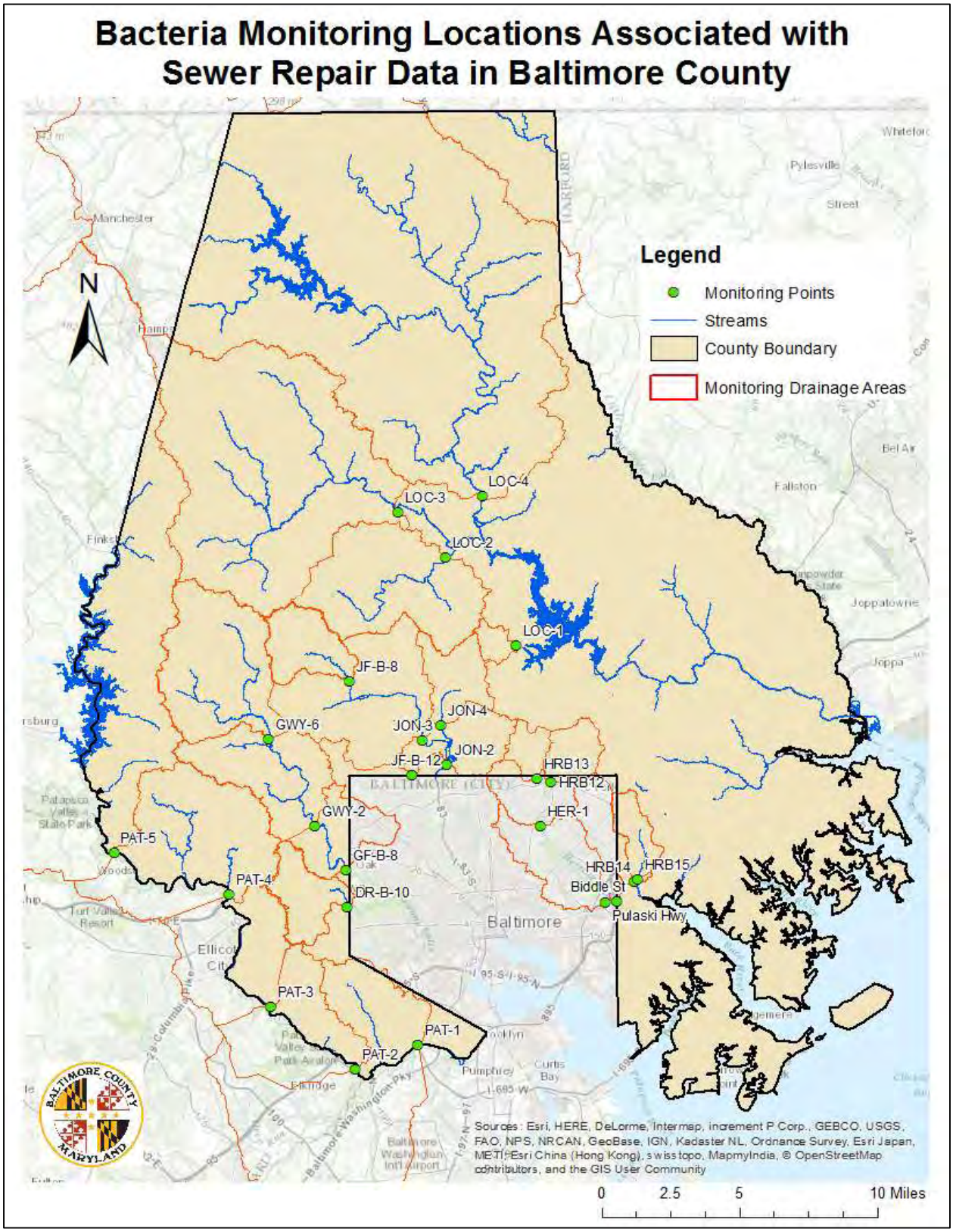


Figure 7-10: Baltimore County Bacteria Monitoring Locations with Sewer Repair Data

The consent decree mandated in 2005 by the EPA and MDE requires the county to complete repairs to sanitary sewer overflow structures (SSOs) and pump station structures. Using data compiled from the Department of Public Works and consent decree appendices we summarized the progress of these repairs. We completed an overlay analysis of the SSO repairs to each of our bacteria monitoring drainage areas to get the count and status of repairs. SSOs were either substantially completed with the overflow pipe plugged (completed) or substantially complete with the overflow pipe open (to be completed). Pumping stations labeled as substantially complete were tallied for the complete 'pump station repairs' column of the tables below. There were no incomplete pump station repairs in the consent decree appendices.

The development and implementation of sewer replacement, repair, and rehabilitation (SRRR) plans is also required as a part of the consent decree. SRRR plan information was taken from the consent decree monthly report from June 2015 and assigned to the corresponding sewershed in order to associate each SRRR plan with an area in the county, creating a SRRR plan feature class. Using the bacteria monitoring drainage areas and sewer SRRR plan feature class, an implementation date for each drainage area was recorded and is shown in the tables below. Multiple sewersheds can fall within a monitoring drainage area, and therefore multiple SRRR plans with varying implementation dates can be associated with the same drainage area. The 'SRRR Plan Imp. Date' is the last implementation date of the SRRR plans that fall within that drainage area.

The CAPs geodatabase developed by the Bureau of Utilities is a compilation of sewer line and manhole repairs specified by the SRRR plans including: repair type, status of repair, and repair location. This data was used to derive the total number of sewer line and manhole repairs completed and proposed (to be completed) within the drainage areas of each of the county's bacteria monitoring locations. The types of sewer repairs tallied for the 'sewer pipe repair' column in the tables below include the following: grout, grout lateral, pipe replacement, open cut point repair, segmental liners, t- liner, upsize 6" to 8" PVC, lining, and pipe bursting. 'Manhole repairs' include: frame seal, cementitious lining, chimney seal, rebuild bench and channel, replace, reset frame and cover and replace frame and cover. These repairs were intersected to drainage areas using overlay analysis in GIS. From this analysis we were able to get a count of manhole and sewer line repairs in each bacteria monitoring drainage area shown in Table 7-11 through 7-20 below.

7.6.2 Summary of Sewer Repairs Associated with Bacteria Monitoring

The status of sanitary sewer system repairs and plans is presented in this section, organized by watershed.

7.6.2.1 Lower North Branch Patapsco Watershed

The Lower North Branch Patapsco watershed has five sampling locations for the bacteria monitoring program. The drainage areas for these monitoring points are all nested meaning they fall within each other and there is an overlap in repairs for each area. PAT-1 has the largest drainage area and includes the area of PAT -5 through PAT-2 and areas downstream of PAT-2. Repairs in PAT-1 include all repairs in PAT-2 through PAT-5, repairs in PAT-2 include all repairs in PAT-3 through PAT-5, and so on. All pump stations and SSO repairs in the Lower North Branch Patapsco watershed set out by the consent decree have been completed. As shown in Table 7-11 and 7-12 all the pumping stations and the SSO's required by the consent decree have been repaired and all SRRR plans should be implemented by September 6, 2021.

Table 7-11: Lower North Branch Patapsco River – Completed Sanitary Sewer Repairs

Monitoring Stations					Overflow Pipe Plugged	Pumping Station Repairs	Manhole Repairs	Sewer Pipe Repairs	SRRR Plan Imp. Date
Downstream	Nested 1	Nested 2	Nested 3	Nested 4					
PAT-1					3	7	0	0	9/6/2021
	PAT-2				3	6	0	0	9/6/2021
		PAT-3			2	2	0	0	9/6/2021
			PAT-4		1	2	0	0	9/6/2021
				PAT-5	0	0	0	0	9/6/2018

Table 7-12: Lower North Branch Patapsco River – To Be Completed Sanitary Sewer Repairs

Monitoring Stations					Overflow Pipe Plugged	Pumping Station Repairs	Manhole Repairs	Sewer Pipe Repairs
Downstream	Nested 1	Nested 2	Nested 3	Nested 4				
PAT-1					0	0	186	922
	PAT-2				0	0	118	506
		PAT-3			0	0	80	281
			PAT-4		0	0	1	0
				PAT-5	0	0	0	0

7.6.2.2 Jones Falls Watershed

The Jones Falls watershed has five bacteria monitoring locations that fall within the county boundaries. Monitoring site JON-2 has the largest drainage area which encompasses the drainage areas for JON 3-4 and JF-B-8. The drainage area for JF-B-12 does not overlap with the other Jones Falls monitoring drainage areas. Tables 7-13 and 7-14 show that six SSO's detailed in the consent decree still need to be plugged and 137 manhole repairs and 97 sewer pipe repairs still need to be completed in the Jones Falls.

Table 7-13: Jones Falls – Completed Sanitary Sewer Repairs

Monitoring Stations				Overflow Pipe Plugged	Pumping Station Repairs	Manhole Repairs	Sewer Pipe Repairs	SRRR Plan Imp. Date
Downstream	Nested 1	Nested 2	Nested 3					
JON-2				3	2	0	22	*
	JON-3			0	2	0	0	*
		JON-4		1	0	0	0	*
			JF-B-8	0	0	0	0	9/6/2019
JF-B-12				0	0	0	0	9/6/2019

* The SRRR plan for this area is still being developed and an implementation date has not been set yet.

Table 7-14: Jones Falls – To Be Completed Sanitary Sewer Repairs

Monitoring Stations				Overflow Pipe Plugged	Pumping Station Repairs	Manhole Repairs	Sewer Pipe Repairs
Downstream	Nested 1	Nested 2	Nested 3				
JON-2				0	0	137	97
	JON-3			0	0	66	12
		JON-4		0	0	0	13
			JF-B-8	0	0	0	0
JF-B-12				0	0	0	3

7.6.2.3 Gwynns Falls Watershed

There are four bacteria monitoring locations in the Gwynns Falls watershed in the county. Two additional locations for Gwynns Falls fall in the city potion of the watershed and are not included

in our data for this section. The most downstream and largest drainage area is GF-B-8, the two other monitoring drainage areas GWY-2 and GWY 6 fall within its area. The DR-B-10 drainage area is not nested with the other areas. Six overflow pipes still need to be plugged for the GF-B-8 drainage area and 149 sewer pipe repairs need to be completed for DR-B-10 as shown in Tables 7-15 and 7-16.

Table 7-15: Gwynns Falls –Completed Sanitary Sewer Repairs

Monitoring Stations				Overflow Pipe Plugged	Pumping Station Repairs	Manhole Repairs	Sewer Pipe Repairs	SRRR Plan Imp. Date
Downstream	Nested 1	Nested 2	Nested 3					
GF-B-8				5	1	0	6	9/6/2019
	GWY-2			4	1	0	0	9/6/2019
		GWY-6		0	1	0	0	9/6/2018
DR-B-10				2	0	62	5	9/6/2021

* The SRRR plan for this area is still being developed and an implementation date has not been set yet.

Table 7-16: Gwynns Falls –To Be Completed Sanitary Sewer Repairs

Monitoring Stations				Overflow Pipe Plugged	Pumping Station Repairs	Manhole Repairs	Sewer Pipe Repairs
Downstream	Nested 1	Nested 2	Nested 3				
GF-B-8				6	0	0	0
	GWY-2			2	0	0	0
		GWY-6		0	0	0	0
DR-B-10				0	0	0	149

7.6.2.4 Loch Raven Reservoir Watershed

In the Loch Raven Reservoir watershed the county has seven bacteria monitoring locations. Four of these (LOC 1- 4) include area that is served by the sewer system and are included in the table below, the other 3 (LOC 5-7) are served by septic systems and are not included. The drainage areas for these four areas that are served by the sewer system are not nested. As shown in Tables 7-17 and 7-18 Loch Raven has two manhole repairs to be completed in LOC-2.

Table 7-17: Loch Raven Reservoir –Completed Sanitary Sewer Repairs

Monitoring Stations				Overflow Pipe Plugged	Pumping Station Repairs	Manhole Repairs	Sewer Pipe Repairs	SRRR Plan Imp. Date
Downstream	Nested 1	Nested 2	Nested 3					
LOC-1				0	0	0	0	*
LOC-2				0	0	0	0	*
LOC-3				0	0	0	0	9/6/2018
LOC-4				0	0	0	0	*

* The SRRR plan for this area is still being developed and an implementation date has not been set yet.

Table 7-18: Loch Raven Reservoir – To Be Completed Sanitary Sewer Repairs

Monitoring Stations				Overflow Pipe Plugged	Pumping Station Repairs	Manhole Repairs	Sewer Pipe Repairs
Downstream	Nested 1	Nested 2	Nested 3				
LOC-1				0	0	0	0
LOC-2				0	0	2	0
LOC-3				0	0	0	0
LOC-4				0	0	0	0

7.6.2.5 Back River Watershed

The Back River watershed has seven bacteria monitoring locations. The HER-1 monitoring location is downstream of HRB-12 & 13 and is nested within the Pulaski Hwy monitoring drainage area that is the farthest downstream. The monitoring location for HRB 14 is located downstream of the HRB 15 monitoring location and therefore its drainage area is nested within HRB 14. Biddle Street monitoring location is not nested within any other monitoring drainage areas. Tables 7-19 and 7-20 below show that two pump station repairs have been completed and four overflow pipes still need to be plugged in Back River.

Table 7-19: Back River –Completed Sanitary Sewer Repairs

Monitoring Stations				Overflow Pipe Plugged	Pumping Station Repairs	Manhole Repairs	Sewer Pipe Repairs	SRRR Plan Imp. Date
Downstream	Nested 1	Nested 2	Nested 3					
Pulaski Hwy				2	0	0	0	*
	HER 1			2	0	0	0	*
		HRB 12		2	0	0	0	9/6/2024
			HRB 13	0	0	0	0	*
HRB-14				0	0	0	0	*
	HRB 15			0	0	0	0	*
Biddle St				0	0	0	0	*

* The SRRR plan for this area is still being developed and an implementation date has not been set yet.

Table 7-20: Back River –To Be Completed Sanitary Sewer Repairs

Monitoring Stations				Overflow Pipe Plugged	Pumping Station Repairs	Manhole Repairs	Sewer Pipe Repairs
Downstream	Nested 1	Nested 2	Nested 3				
Pulaski Hwy				4	0	29	245
	HER- 1			4	0	29	236
		HRB-12		2	0	18	104
			HRB-13	0	0	11	130
HRB-14				0	0	0	0
	HRB-15			0	0	0	0
Biddle St				0	0	0	2

8.0 Permit Requirements

Permit Conditions

D. <u>Management Programs</u>

6. <u>Public Education</u>

Baltimore County shall continue to implement a public education and outreach program to reduce stormwater pollutants. Outreach efforts may be integrated with other aspects of the County's activities. These efforts are to be documented and summarized in each annual report. The County shall continue to implement a public outreach and education campaign with the specific performance goals and deadlines to:

a. Maintain a compliance hotline or similar mechanism for public reporting of water quality complaints, including suspected illicit discharges, illegal dumping, and spills.

b. Provide information to inform the general public about the benefits of:

i. Increasing water conservation;

ii. Residential and community stormwater management implementation and facility maintenance;

iii. Proper erosion and sediment control practices;

iv. Increasing proper disposal of household hazardous waste;

v. Improving lawn care and landscape management (e.g., the proper use of herbicides, pesticides, and fertilizers, ice control and snow removal, cash for clippers, etc.);

vi. Residential car care and washing; and

vii. Proper pet waste management.

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

i. NPDES permitting requirements;

ii. Pollution prevention plan development;

iii. Proper housekeeping; and

iv. Spill prevention and response.

8.1 Introduction

Baltimore County continues to view environmental education, outreach, action, and stewardship through community partnerships as a high priority in its suite of services to citizens, particularly in an effort to reduce stormwater pollutants and address the Municipal Separate Storm Sewer System (MS4) permit requirements. The County's integrated watershed approach to resource management and its intention to work with and support local citizens and watershed

organizations offers opportunities for effective community partnerships. These involve a broad constituency of citizens, families, schools, organizations, faith communities, and businesses.

To continue our mission of community involvement, the Department of Environmental Protection and Sustainability (EPS) advertised for and accepted, public comments on departmental publications on two occasions. The Total Maximum Daily Load (TMDL) Implementation Plans (IPs) and the county-wide Trash & Litter Reduction Strategy (TLRS) developed by EPS had a public comment period in late 2014, while two Small Watershed Action Plans (SWAPs) and another TMDL IP had a joint comment period which began in March 2015. The County also worked towards the development of a Request for Proposals for Education & Outreach consulting. This RFP is meant to acquire services of a professional team with the ability to develop and pilot a concentrated campaign to implement and assess public education and behavioral change.

This 2015 Annual Report covers the fiscal year of July 1, 2014 to June 30, 2015 for reporting. The purpose of the fiscal year reporting is to dovetail with the milestone requirements of the Chesapeake Bay TMDL, now in effect.

8.2 Public Reporting of Water Quality Complaints

EPS has an online form to "report pollution" of illegal connections to and/or dumping into the storm drain system. The online form to report pollution can be found at www.baltimorecountymd.gov\Agencies\environment\reportpollution.html as well as an email link to the Watershed section. In FY15, eleven complaints were logged using the form, and six came in through the Watershed email. The reporting page also explains the difference between an emergency and a concern (non-emergency), giving phone numbers for those agencies that provide a 24-hour service line. Instances that are not an emergency will be investigated by staff of EPS Watershed Monitoring within 48-business hours. A door hanger became available for staff use in FY14 to inform citizens that pollutants have been found in the local storm drain, as well as, informing the resident that substances put into the storm drain system flow into the nearby stream and then to the Chesapeake Bay. A full description of the Illicit Discharge Detection & Elimination program is found in Section 5.

Chemical spills can pose a public health threat as well as an environmental risk. These events are considered an emergency situation and are handled by MDE Emergency Response Division.

8.3 Public Outreach and Education

Many county departments and agencies continue efforts to inform the public and student population about various aspects of environmental education and practices, community activities and individual resident activities. Since 1994, Baltimore County has carried its message in over 18,000 environmental presentations, outreach events and a variety of media outlets. In FY2015, the County sponsored a variety of outreach events including informational displays, business events, neighborhood and stakeholder meetings, and interactive events for citizens and families, reaching over 3,000 people.

The majority of the audiences were located at county-wide events, the result of several large events (e.g. watershed appreciation days) and the E-News Stream newsletter. Presentations were made to a wide variety of groups. Table 8-1 reports presentation events by type of audience.

Table 8-1: Education Presentations, Distributions and Events by Type of Audience*, FY2015

Type of Group/Audience	# Interactions/events for each audience
Citizens, Community Groups or Associations	87
Environmental Career Education	1 event (80 students)
Government Agency, Facility, Group	200
EPS Lobby, Duty Room	2,600
Festivals	90
Cable TV/County blog/E-News Stream	~3,500
Flyers/Doorhangers	45

*Notes: Career education includes school career fairs and internship opportunities. Access to lobby displays is estimated to be approximately 10 people/day for 50 weeks (250 days). Some presentations and events addressed audiences that included several of the groups listed above and thus were entered in more than one category. Where appropriate, audience size is estimated (e.g. Cable TV viewership).

Much of the support material is available on many of the county web pages, or in hard copy by request. It is recognized that in order for any public outreach and education program to be successful, public stewardship is essential for the program to maintain its effectiveness. Specific strategies to effectively reach and engage the public, performance goals and deadlines shall continue to be implemented.

8.3.1 Outreach

EPS continues to provide information to the public on a variety of topics. Fact sheets are available in the office lobby and online. Online links to sister agencies, organizations, and additional publications are also provided on the EPS webpage. The outreach efforts described in previous NPDES Annual Reports continue to be implemented.

8.3.1.1 Water conservation: The Baltimore County Public Works - Bureau of Utilities offers tips on their web pages regarding water issues and water conservation. These websites are: http://www.baltimorecountymd.gov/Agencies/publicworks/utilities/waterissues.html and http://www.baltimorecountymd.gov/Agencies/publicworks/utilities/waterconserv.html

8.3.1.2 Residential and community stormwater management: The Rain Barrel sale held annually in spring of the year is announced on several of the county media sites. FY2014's event distributed 751 barrels. The Sustainability Resources for Residents web page offers guidance about rain barrels, green and renewable power in Maryland, electricity use, home energy audit, green-cleaning around the home, fertilizer use and application and many other topics: http://www.baltimorecountymd.gov/Agencies/environment/sustainability/residents.html

8.3.1.3 Erosion and sediment control practices: The EPS Environment at Home web page found at http://www.baltimorecountymd.gov/Agencies/environment/education/house.html provides a link to the Maryland Department of Agriculture – Education and Homeowner Tips web page found at http://mda.maryland.gov/resource_conservation/Pages/environmental_education.aspx. Residents will find a brochure entitled "Soil Erosion and Rainwater Runoff Harm the Chesapeake Bay" at http://mda.maryland.gov/resource_conservation/Documents/tip3.pdf.

8.3.1.4 Household hazardous waste disposal: This program was developed to educate residents regarding the environmental and human health threat imposed by the improper disposal of chemicals that are stored in a home and to provide for proper disposal. Baltimore County citizens can drop off household hazardous waste (HHW) materials for recycling or proper disposal at a permanent processing facility located at the Eastern Sanitary Landfill Solid Waste Management Facility from April 1 - November 30 each year. Materials dropped off for

processing include: unwanted household chemicals, paint, flammable cleaning solvents, automotive fluids, pesticides, pool chemicals, acids, mercury thermometers, gasoline, corrosive material, etc. In addition, EPS holds two (2) one-day collection events annually, in the spring and fall, at different locations around Baltimore County. Event dates and details can be found at: http://www.baltimorecountymd.gov/Agencies/environment/groundwatermgt/hazwaste.html Details on materials collected is located in Section 7.

8.3.1.5 Greening Baltimore County operations: The County continues to expand its efforts to reduce waste, encourage recycling, and decrease costs for operations via several programs. The following website highlights and details those efforts: http://www.baltimorecountymd.gov/Agencies/environment/sustainability/countyactions.html. The county's Forest Sustainability Program provides information about the county's Big Trees Sale, Tree-Mendous Maryland, forest workshops and forums and multiple other forest topics at http://www.baltimorecountymd.gov/Agencies/environment/forestsandtrees/index.html. The Increased tree planting efforts on county owned property are being guided by EPS with participation of many county departments. Efforts include establishing urban and rural reforestation and buffers, as well as single-tree planting. *The Policy and Guidelines for Community Tree Planting Projects,* found online through the forest and trees web page noted above, helps to ensure that planting projects are designed, installed, and maintained for long-term success and tree health. These guidelines will help assure that the county can address its obligations for reforestation on all land owned by Baltimore County.

8.3.1.6 Conservation landscaping: Citizens and communities that wish to reduce pollution and enhance their properties will find several informative guidance brochures at this website: http://www.baltimorecountymd.gov/Agencies/environment/education/house.html

8.3.1.7 Residential car care and washing: Following a few simple steps and tips can protect the water quality in nearby streams and reduce water consumption. Visit the MDE website at: http://www.mde.maryland.gov/programs/water/waterconservation/pages/programs/waterprograms/water_conservation/household_tips/carwashing.aspx

8.3.1.8 Composting: This website gives how-to information about composting yard materials as well as food scraps. It also includes the proper technique to grasscycle and leafcycle at: http://www.baltimorecountymd.gov/Agencies/publicworks/recycling/composting/index.html

8.3.1.9 Re-use and recycle: The first web link details such topics as the single stream recycling, electronics recycling, managing organic materials, waste prevention, publications and downloads, and the county's Ten Year Solid Waste Management Plan. The second link is an interactive monitoring site allowing viewers to observe the amounts of recycled items within neighborhoods of the county. This site was activated in spring 2012: http://www.baltimorecountymd.gov/agencies/publicworks/recycling/ and http://bcrecycles.com/

8.3.1.10 Proper pet waste management: A fact sheet about pet waste and water quality is displayed in the lobby of EPS. This fact sheet is also used at events/festivals regularly.

8.3.1.11 Additional media:

Baltimore County Now is the newly established blog to communicate county events and information. All county departments are encouraged to contribute pieces. These may include events, observations, tips, ideas, technical information, etc. Find Baltimore County Now at: http://www.baltimorecountymd.gov/News/BaltimoreCountyNow

The Big Trees Program features major deciduous trees native to Maryland. The sale of young trees is held in the spring and fall of the calendar year for planting on private residential properties. Additional information regarding The Big Trees Program can be found at: http://www.baltimorecountymd.gov/Agencies/environment/forestsandtrees/bigtrees.html.

8.3.2 Education

As of 2011the Maryland State Board of Education requires high school graduates to be environmentally literate per the Maryland Environmental Literacy Standards. Each local school system can shape its own program, but it must align with the MEL Curriculum Standards, which consists of eight state standards. As a resource, Maryland Green Schools provide examples of lessons that combine environmental learning with the Science, Technology, Engineering and Math (STEM) education. Since the loss of the EPS outreach and education position, Maryland Green Schools coordination is now referred to Maryland Association for Environmental and Outdoor Education (MAEOE) as of spring 2012.

Promotion and support for stewardship projects: include conservation landscaping principles, planting trees, stream clean-ups, impervious reduction, rain barrels, rain gardens and residential water audits.

Community and agency partnerships: Local watershed associations, partially funded by county grants, partner with EPS to implement pollution reduction initiatives outlined by the county's Small Watershed Action Plans (SWAPs), and Total Maximum Daily Load (TMDL) goals. These goals include educational components which are meant to build awareness about issues of pollution and extend the reach of our message of stewardship into the local communities. Some activities taken on by the watershed associations include Adopt-a-Stream, Stream Watch, Project Clean Stream, downspout disconnections, rain barrel and rain garden sales and installations, native plant sales, tree plantings, invasive plant removal, and storm drain marking. Through outreach networks, festivals, events, sales, workshops, and websites, the watershed groups address trash and litter issues, conservation landscaping techniques, watershed restoration and preservation (including stormwater management), and the importance of reporting sewage spills/overflows and other evidence of waterway pollution. Each quarter the watershed organizations submit a report to EPS that includes events, dates and number of participants for educational activities. Increasingly, county agencies cooperate to expand awareness of programs and services to citizens.

Table 8-2: Watershed Group Events and Participation, FY2015

Group Name	# of Events	# of Participants
Back River Restoration Committee (BRRC)	39	2,517
Blue Water Baltimore (BWB)	21	773
Dundalk Renaissance Corporation (DRC)	14	302
Gunpowder Valley Conservancy (GVC)	48	806
Patapsco Heritage Greenway (PHG)	13	438
Prettyboy Watershed Alliance (PWA)	6	780
Totals:	141	5,616

8.4 Information Regarding Water Quality Issues to the Regulated Community

8.4.1 NPDES Permitting Requirements

Upon request, EPS provides explanation and materials to public and private entities about NPDES permitting requirements. EPS shares fact sheets, templates, and other resources to help the regulated community comply. An NPDES Resources web page was created to benefit the NPDES Management Committee as well as the community. This can be found at: http://www.baltimorecountymd.gov/Agencies/environment/npdes/npdesresources.html

See Section 7.2 for details on the status of compliance with the NPDES - MS4 (Municipal Separate Storm Sewer System) requirements for Baltimore County agencies.

8.4.2 Pollution Prevention Plan Development

EPS meets with department representatives and offers assistance to those entities required to prepare a SWPPP for a Maryland General Permit for Discharges from Stormwater Associated with Industrial Activities on an as-needed basis. See MDE's website for details of the permit, which became effective on January 1, 2014, and related resources.
http://www.mde.state.md.us/programs/Permits/WaterManagementPermits/WaterDischargePermitApplications/Pages/Permits/watermanagementpermits/water_applications/stormwater.aspx

8.4.3 Proper Housekeeping

Proper, or good, housekeeping establishes control measures for actions to reduce the potential for water pollution for MS4 entities. Actions include covering materials in secure containers, prompt cleanup of spilled materials, covering storm drains temporarily to reduce the chance of material from getting into it, etc. Record keeping of inspections, maintenance, spills, and staff training is essential for audit purposes.

8.4.4 Spill prevention and response

An NPDES – MS4 regulated entity must have a spill prevention plan. Most facilities will already have preventative maintenance programs (PMP) which should also include regular inspection of containers, as well as, spill prevention and response procedures. See link above to the permit for more information.

8.5 Continuing public outreach related to TMDL Implementation Plans and Trash & Litter Reduction Strategy

Throughout CY2014 Baltimore County developed a county-wide Trash & Litter Reduction Strategy (TLRS), as well as Implementation Plans for 22 local water quality impairments. Work on TMDL Implementation Plans for trash in the Gwynns and Jones Falls continued into this reporting year. As part of all Implementation Plans, continuing public outreach will be used to engage the general population in the implementation and restorative process. Since the short timeframe between submittal of the plans and the ending of the fiscal year, there has been plenty of planning and advancement towards certain goals detailed in last year's documents.

8.5.1 NPDES Management Committee

The NPDES Management Committee is composed of representative agencies that are involved in meeting the NPDES – MS4 Permit requirements. This committee has met irregularly in the past, generally to review information on permit requirements and other upcoming regulatory requirements, such as, the General Industrial Stormwater Discharge Permit. These meetings will

be useful platforms to coordinating public outreach and education messages which may benefit from consistent messaging. Additional information regarding the NPDES Management Committee responsibilities may be found in Section 1 of this Annual Report.

8.5.2 Local Watershed Associations

Baltimore County continues to rely heavily on its partnerships with local not-for-profit environmental organizations to reach many of its goals of education and outreach to the general public. Through the County's *Watershed Association Restoration Planning and Implementation Grants*, funding is provided to these organizations working towards implementation of Total Maximum Daily Load and Small Watershed Action Plan pollution reduction goals. Many of the projects which are undertaken by these groups include public awareness/outreach and education programmatic actions, such as storm drain marking.

8.5.3 Business Community Outreach

The Small Watershed Action Plan (SWAP) process includes an upland assessment of potential pollution hotspots. Often, these potential hotspots are commercial or industrial sites. The information derived from this assessment will be used to target outreach and education to businesses specific to the issue(s) at the location identified in each SWAP. These actions will be tracked and reported in the annual NPDES – MS4 Report. Baltimore County plans on engaging the business community through various business forums, targeted outreach and education efforts on specific topics, and hosting workshops on specific topics as necessary. Outreach to the business community will be a large part of the County's partnership with education and marketing consultants that we hope to begin early 2016.

8.5.4 Trash and Litter Reduction Outreach

The County's Trash and Litter Reduction Strategy details many plans for us to consider during our outreach and education phase of the strategy. These possibilities may include:

- Development of a local "Trash Treaty"
- Promotion of trash clean-ups as service-learning opportunities
- Improvement of anti-littering/dumping signage
- Support of local not-for-profit's litter education programs
- Develop a business and/or neighborhood recognition/incentive program for "clean" businesses/neighborhoods

8.5.5 Continuing Public Outreach

In order to engage the public in the TMDL implementation process each TMDL IP includes a continuing public outreach plan will be implemented upon MDE's approval of each IP. The outreach plan is applicable to all TMDL Implementation Plans that are currently being developed and those developed in the future, as well as the Trash & Litter Reduction Strategy. The continuing public outreach plan is meant to engage county agencies, environmental groups, the business community, and the general public. Section 11 of each IP contains an outline of the Continuing Public Outreach plan.

The general public will be engaged through a number of mechanisms, including:

- WIP Team meetings
- Targeted outreach and education efforts on specific topics

- Steering Committee and Stakeholder Meetings in the development of Small Watershed Action Plans
- Meetings of the Implementation Committee for completed Small Watershed Action Plans
- Displays at various events
- Annual progress reports posted on the county website and placed in our libraries
- A biennial "State of Our Watersheds" conference

In addition to these County initiatives, EPS has worked with the Office of Budget and Finance to develop a Request for Proposals to retain the services of an on-call environmental consulting firm. Our goal is to use this consultant to help build our public education and outreach campaigns. We hope to evaluate these campaigns by measurement of behavioral change in the community.

8.6 Summary

Baltimore County implements its public awareness and education programs to aid in the reduction of stormwater pollutants. The initiatives and programs are multi-faceted, and developed for flexibility so that the message may be easily adapted to a variety of educational settings involving homeowners, community groups, school administration and staff, facility managers, students, watershed coalitions, faith communities, and businesses in various geographic settings around the county and region.

A number of important new components and materials have been developed or enhanced in order to better reach certain target audiences. The County's sustainability initiatives provide recommendations and Green@Work initiatives in the increasing effort to model best practices. Through changes to county operating protocols, employees are engaged in the workplace, and measurable progress is expected. Through local initiatives by individual watershed organizations and special ground maintenance projects for county properties, new emphasis has been placed on institutional landscape design, maintenance, and conservation landscaping concepts such as the benefits of native plants, integrated pest management (IPM), and removal of impervious surfaces. Pet waste, grass clippings, and other sources of nutrients and bacteria in urban and suburban neighborhoods were highlighted at community events. The Clean Green 15 initiative encourages citizens to take 15 minutes and pick up a bag of trash in the neighborhood, athletic field, etc. and report on the web page to help the county meet the Chesapeake Bay restoration goals and improve the community.

Partnerships with other Baltimore County offices and agencies enhance the level of communication, avoid duplication of services, and increase overall effectiveness and efficiency. Supporting materials developed by the department and by outside organizations are available online. Volunteer citizen participation in pollution prevention and environmental stewardship is promoted in all components of the program.

9.0 Permit Requirements

F. Discharge Characterization

Baltimore County and 10 other municipalities in Maryland have been conducting discharge characterization monitoring since the early 1990's. From this expansive monitoring, a statewide database has been developed that includes hundreds of storms across numerous land uses. Analyses of this dataset and other research performed nationally effectively characterize stormwater runoff in Maryland for NPDES municipal stormwater purposes. To build on the existing information and to better track progress toward meeting TMDLs, better data are needed on ESD performance and BMP efficiencies and effectiveness.

Assessment of controls is critical for determining the effectiveness of the NPDES stormwater management program and progress toward improving water quality. The County shall use chemical, biological, and physical monitoring to document work toward meeting applicable WLAs developed under EPA approved TMDLs. Additionally, the County shall continue physical stream monitoring in the Windlass Run to assess the implementation of latest version of the *2000 Maryland Stormwater Design Manual*. Specific monitoring requirements are described below.

1. Watershed Restoration Assessment

Baltimore County shall monitor the Scotts Level Branch, or, select and submit for MDE's approval a new watershed restoration project for monitoring. Monitoring activities shall occur where the cumulative effects of watershed restoration activities can be assessed. One outfall and associated in-stream station, or other locations based on a study design approved by MDE, shall be monitored. The criteria for chemical, biological, physical monitoring are as follows:

a. Chemical Monitoring

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

ii. Discrete samples of stormwater flow shall be collected at the monitoring stations using automated or manual sampling methods. Measurements of pH and water temperature shall be taken;

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

Biochemical Oxygen demand (BOD_5)	Total Lead
Total Kjeldahl Nitrogen (TKN)	Total Copper
Nitrate plus Nitrite	Total Zinc
Total Suspended Solids	Total Phosphorus
Total Petroleum Hydrocarbons (TPH)	Hardness
E. coli or enterococcus	

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

b. Biological Monitoring

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

ii. The County shall use EPA Rapid Bioassessment Protocols (RBP), Maryland Biological Stream Survey (MBSS), or other similar method approved by MDE.

c. Physical Monitoring

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

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

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

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

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

ii. Chemical, biological, and physical monitoring results and a combined analysis for the approved monitoring locations; and

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

2. Stormwater Management Assessment

The County shall continue monitoring the Windlass Run for determining the effectiveness of stormwater management practices for stream channel protection. Physical stream monitoring protocols shall include:

a. An annual stream profile and survey of permanently monumented cross-sections in the Windlass Run to evaluate channel stability in conjunction with surrounding and on-going commercial development;

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

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

9.1 Introduction

Baltimore County is required to maintain a long-term monitoring location in an approved watershed to determine the effectiveness of stormwater management practices for stream channel protection. Additionally, chemical, biological, and physical monitoring is required to assess the cumulative effects of watershed restoration activities. The permit requires the County to conduct a systematic assessment of water quality for each watershed. These watershed assessments are to include detailed water quality analyses, identifying water quality improvement opportunities, and developing and implementing restoration plans to control stormwater discharges.

Assessment of controls is critical to determine the effectiveness of the NPDES stormwater management program. Therefore, chemical, biological, and physical monitoring is required to document progress toward improving water quality and meeting applicable stormwater WLAs developed under EPA approved TMDLs. This report will present the research design and monitoring data for Scotts Level Branch (9.2), Windlass Run (9.3), and Countywide monitoring locations (9.4). The monitoring results reporting is on a calendar year basis. This report covers monitoring conducted during calendar year 2014.

9.2 Scotts Level Branch Long-Term Monitoring

Scotts Level Branch is located in the Gwynns Falls watershed in the Patapsco/Back River Basin. The Gwynns Falls has a TMDL for sediment that requires a 36.5% reduction. On December 29, 2010, the U.S. Environmental Protection Agency established the Chesapeake Bay TMDL. The Chesapeake Bay TMDL requires 29% nitrogen and 45.1% phosphorus load reductions. The Gwynns Falls TMDL for bacteria has identified a ~98% reduction for human and domestic pet sources.

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

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

In order to assess restoration progress in the Scotts Level Branch subwatershed, a before-after design concept will be used. Restoration work in the Scotts Level Branch was started in 2014 with the completion of the McDonogh Road site. Pre restoration monitoring data has been collected since 2005 and post restoration monitoring data was started in the fall of 2014. Figure 9-1 shows the location of the three monitoring sites for the McDonogh Road restoration project. All three sites are outside the restoration project, with SL-05 being the Allenswood tributary site along with SL-12 (Meadow Heights) and SL-13 (McDonogh) being the main stem sites above

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

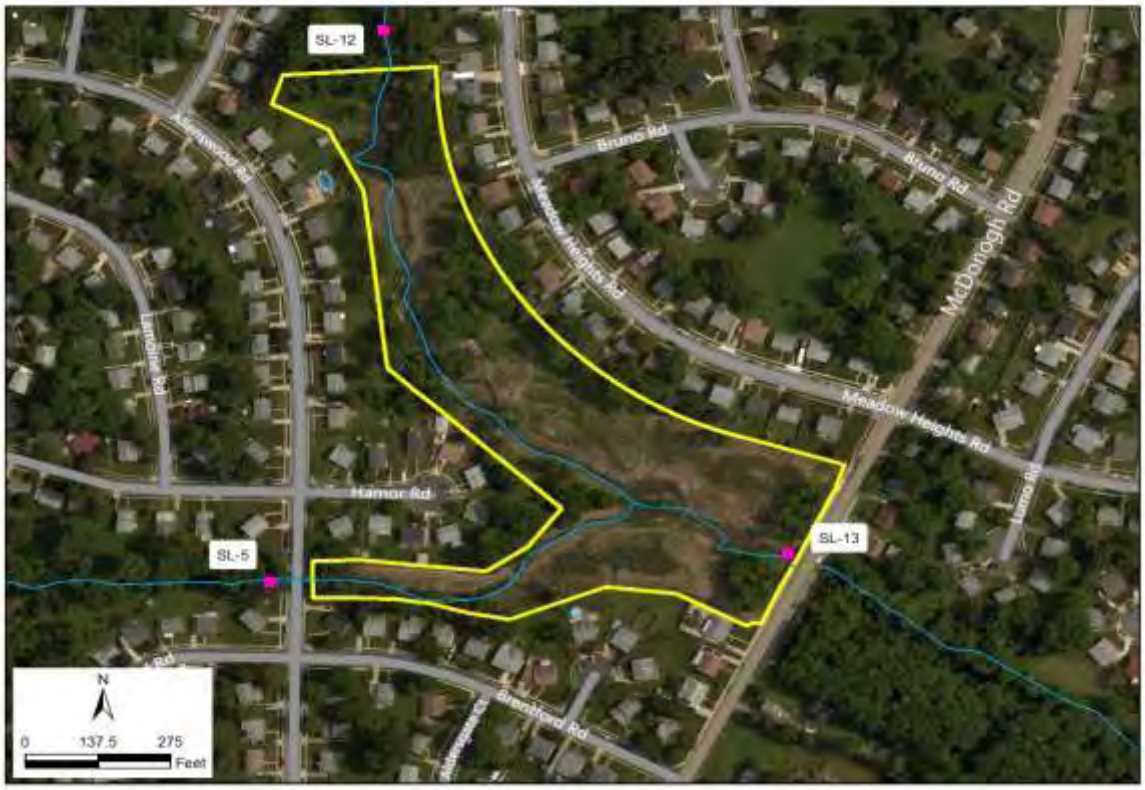


Figure 9-1: Scotts Level Branch McDonogh Road Restoration Monitoring Locations

9.2.1 Monitoring Design

9.2.1.1 Flow Monitoring

Scotts Level Branch has a gage installed and operated by the US Geological Survey (SL-01) (Figure 9-2). USGS provides the rating curve and annual data for the gage. A 36" outfall near the headwater of Scotts Level Branch is being monitored for discharge and chemistry (SL-09). A weir was installed to permit continuous flow monitoring with a water level sensor installed and operated by Baltimore County. This outfall has a drainage area of 15.0 acres with ~35% impervious cover. The land use is ~88% medium residential and therefore representative of the major land use in each of the subwatersheds.

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

9.2.1.2 Chemical Monitoring

The chemical monitoring will include both storm event and baseflow monitoring components. The standard list of chemicals detailed in the permit requirements will be analyzed. Figure 9-2 displays the location of the chemical monitoring sites in Scotts Level Branch by type.

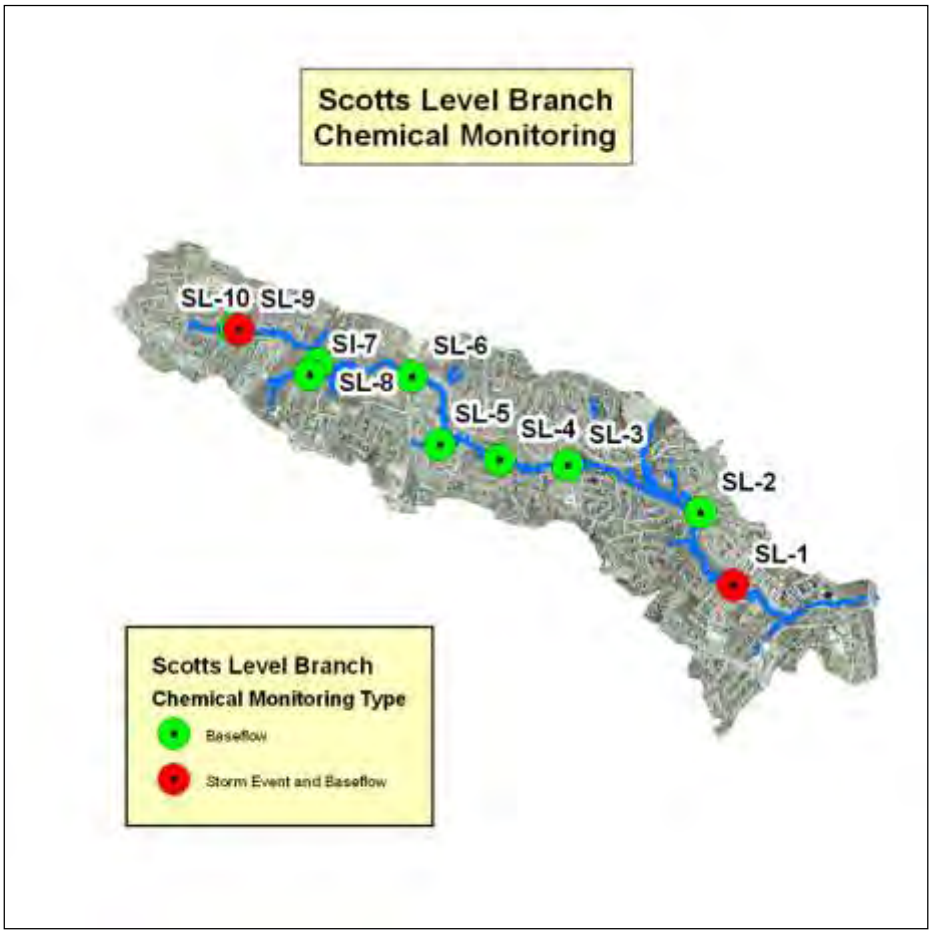


Figure 9-2: Scotts Level Branch Chemical Monitoring Locations

9.2.1.3 Storm Event Monitoring

Storm event monitoring occurs at the USGS gage site and at the outfall. The two Scotts Level Branch storm event monitoring sites (SL-1 in-stream, and SL-9 outfall) will be monitored for 12 storms each calendar year seeking to acquire samples for the entire hydrograph. The data will be analyzed using regression analysis to determine the relationship between discharge and pollutant concentration. These relationships will then be used in conjunction with the flow data collected from the USGS operated gage and the water level sensor operated by EPS. The results and subsequent analysis following restoration will be used to determine annual loads and any load reductions due to restoration activities.

The pollutant load data collected from the Scotts Level Branch outfall will be used to estimate the wash load (the load derived from the land surface). The pollutant load estimate derived from the Scotts Level Branch in-stream site will estimate the watershed load, which includes both the wash load and the load derived from stream bank erosion. The geomorphological analysis (see below) will attempt to determine the stream channel erosion component via changes in the channel cross-section and analysis of the pollutant concentration of the stream bank and bed. Thus the wash load (derived from the outfall data) plus the stream erosion load (derived from the geomorphological data) should equal the watershed load (derived from the in-stream monitoring data). These data should provide an estimate of the relative proportions of pollutants derived from the land surface and the stream corridor. This will have important implications for

restoration efforts in urban settings. If, as the literature suggests, a large component of the sediment and total phosphorus load is derived from the stream channel, then in order to meet sediment and phosphorus load reduction requirements for TMDLs and the Chesapeake Bay Program additional effort will need to be focused on stream restoration.

9.2.1.4 Baseflow Monitoring

Scotts Level Branch baseflow monitoring will occur at the outfall (SL-9), two tributary locations, and six mainstem locations for a total of 10 baseflow monitoring sites (Figure 9-2). The baseflow sites in Scotts Level Branch will be monitored quarterly during baseflow conditions (preceded by a minimum of 72 hours dry weather).

Analysis of baseflow pollutants is especially important in relation to nitrogen. Research work conducted by the County, indicates that ~50% of the nitrogen load occurs during dry weather. The baseflow sampling will be used in conjunction with the storm event sampling to partition the annual discharge and pollutant load between baseflow (dry weather) conditions and storm event conditions.

9.2.1.5 Geomorphic Monitoring

The geomorphic monitoring is intended to provide an estimate of stream erosion and deposition rates, and an estimate of the pollutant load derived from stream channel erosion. In addition, it is intended over time to provide an estimate of the effects of restoration on stream stability on both a project basis and over the entire subwatershed.

In order to assure unbiased selection of cross-section locations, Scotts Level Branch and Powder Mill Run were divided into 30 equal length stream segments, 20 in Scotts Level Branch (Figure 9-3) and 10 in Powder Mill Run (Figures 9-4). Within each segment a point was randomly selected, using a GIS subroutine, for location of permanent cross sections. These cross sections are monitored annually, usually in the fall or winter seasons with the results overlaid to provide an assessment of the amount of channel change. Two longitudinal profile reaches were selected in Scotts Level Branch for annual assessment.

In 2007 stream bank and bed core samples were collected in the vicinity of the permanent cross sections for laboratory analysis of bulk density, particle size distribution, total nitrogen, and total phosphorus. These were one-time sample collections, however a second round of sample collections are needed to provide an analysis of annual variability. Based on the annual and long term change, and the results of the core samples, the estimated annual sediment, total nitrogen, and total phosphorus loads will be calculated for comparison with the chemical monitoring results derived from the in-stream monitoring site. New stream bank and bed samples will be collected in 2016.

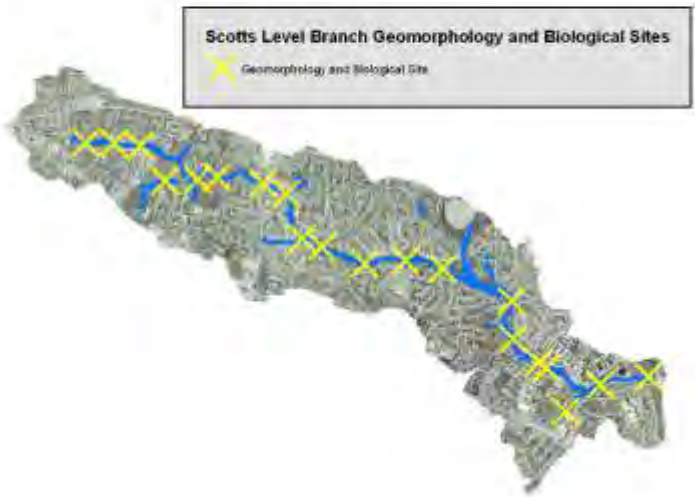


Figure 9-3: Scotts Level Branch Geomorphic and Biological Monitoring Site Locations

Figure 9-4: Powder Mill Run Chemical, Geomorphic and Biological Monitoring Sites

9.2.1.6 Biological Monitoring

Benthic macroinvertebrate and fish sampling is conducted annually at ten fixed stations on Scotts Level Branch and two fixed stations on Powder Mill Run, during the appropriate index periods

(March-April for macroinvertebrates, June-September for fish). Maryland Biological Stream Survey (MBSS) methods are followed. Macroinvertebrate identification is to the Genus taxonomic level or the lowest practical identification level. At the time of sample collection, the appropriate MBSS stream habitat assessment is conducted.

The biological monitoring data are integrated with the cross sectional and habitat data to produce an overall assessment of conditions in the subwatersheds. In addition, the results will be compared between the two subwatersheds and to reference sites within Baltimore County. Inter-annual comparisons and changes in the biological community will be related to restoration progress within Scotts Level Branch.

9.2.2 Scotts Level Branch Long-Term Site Monitoring Results

9.2.2.1 Chemical Monitoring Results

The data analysis for chemical monitoring includes three components, storm event monitoring, baseflow monitoring, and the calculation of pollutant loads.

9.2.2.1.1 Storm Event Monitoring Results

The chemical results from the storm event monitoring at the Scotts Level Branch in-stream (SL-01) and outfall (SL-09) monitoring sites were analyzed in conjunction with the discharge data. Twelve storms were monitored for the instream site and eleven were monitored at the outfall site in 2014. Both the chemical and the discharge data were $\log_{10}$ transformed before regression analysis and all available data were used to determine the regression equations. The data for the regression equations was censored by removing any chemical data that was below the detection limit for any constituent. The regression equations were used to calculate the chemical concentrations for each 15-minute interval for recorded discharge. Regression equations were determined for Total Suspended Solids, TKN, Nitrate/Nitrite, Total Nitrogen, and Total Phosphorus. The results are displayed in Table 9-1 and an example regression graph is shown in Appendix 9-3.

Table 9-1a: SL-01 Regression Equations Relationship Between Discharge (CFS) and Pollutant Concentrations

Parameter	Regression Equation
Total Suspended Solids	0.87504+0.50864*(log cfs)
Total Kjeldahl Nitrogen	-0.5290+0.29277*(log cfs)
Nitrate/Nitrite	-0.1638-0.1191*(log cfs)
Total Nitrogen	-0.002+0.10319*(log cfs)
Total Phosphorus	-1.233+0.25753*(log cfs)

Table 9-1b: SL-09 Regression Equations Relationship Between Discharge (CFS) and Pollutant Concentrations

Parameter	Regression Equation
Total Suspended Solids	1.3053+0.20798*(log cfs)
Total Kjeldahl Nitrogen	-0.0373+0.06689*(log cfs)
Nitrate/Nitrite	-0.4060-0.1729*(log cfs)
Total Nitrogen	0.17601-0.0690*(log cfs)
Total Phosphorus	-0.8521+0.01154*(log cfs)

For SL-01, Total Suspended Solids, TKN, TP, and Total Nitrogen (TKN+Nitrate/Nitrite Nitrogen) exhibited strong positive relationships with discharge. The Nitrate/Nitrite relationship with discharge was moderately weak and negative.

For SL-09, the total suspended solids exhibited a moderately positive relationship with discharge, while nitrate/nitrite displayed a moderately negative relationship. The TKN and TP

relationship with discharge was relatively weak and positive. TN displayed a weak and negative relationship.

9.2.2.1.2 Baseflow Monitoring Results

Scotts Level Branch baseflow monitoring occurred at the outfall (SL-9), two tributary locations, and six mainstem locations for a total of 10 baseflow monitoring sites (Figure 9-2). Within Powder Mill Run baseflow monitoring will take place at the USGS gage and two up-stream sites that are representative of each major branch (one in the County and one in the City). Baseflow monitoring in Upper Gwynns Falls will occur only at the USGS gage site. The baseflow sites in Scotts Level Branch, Powder Mill Run, and Upper Gwynns Falls will be monitored quarterly during baseflow conditions (preceded by a minimum of 72 hours dry weather).

Analysis of baseflow pollutants is especially important in relation to nitrogen. Research conducted by the County indicates that ~50% of the nitrogen load occurs during dry weather conditions. The baseflow sampling will be used in conjunction with the storm event sampling to partition the annual discharge and pollutant load between baseflow (dry weather) conditions and storm event conditions.

Pollutant loads were examined for each of the baseflow sites. Total Suspended solids were excluded from the baseflow analyses because limited conclusions can be drawn from this parameter during a baseflow sample. Many factors can affect the total suspended solids including small construction projects and car washing. These factors may only affect the stream for the limited time the sample is taken and can be misleading if extrapolated for a longer period of time. The results obtained were standardized to both daily pollutant load for drainage area and a daily load per acre and are shown in table 9-2.

Table 9-2: 2014 Mean Daily Baseflow Pollutant Loads for Scott's Level Branch Sites

Site	Acres	TKN (mg/L)	TKN Daily Load (#s)	TKN Daily Load (#s per acre)	NO_2/NO_3 (mg/L)	NO_2/NO_3 Daily Load (#s)	NO_2/NO_3 Daily load (#s per acre)
SL-01	2,186	0.2	1.294	0.0006	1.21	7.831	0.004
SL-02	1,908	0.44	2.060	0.0011	1.19	5.571	0.003
SL-03	1,434	0.24	1.148	0.0008	1.25	5.980	0.004
SL-04	1,167	0.3	1.087	0.0009	1.16	4.204	0.004
SL-05 – Trib.	202	0.1*	n/a	n/a	3.39	n/a	n/a
SL-06	742	0.1*	0.273	0.0004	1.06	2.898	0.004
SL-07 – Trib.	62	0.1*	0.013	0.0002	1.21	0.163	0.003
SL-08	451	0.1*	0.166	0.0004	1.23	2.037	0.005
SL-09 -outfall	15	0.1*	0.064	0.0043	4.36	2.798	0.187
SL-10	265	0.24	0.114	0.0004	1.45	0.688	0.003
Site	**Acres**	**TN (mg/L)**	**TN Daily Load (#s)**	**TN Daily Load (#s per acre)**	**TP (mg/L)**	**TP Daily Load (#s)**	**TP Daily Load (#s per acre)**
SL-01	2,186	1.41	9.125	0.0042	0.025*	0.162	0.00007
SL-02	1,908	1.63	7.630	0.0040	0.025*	0.117	0.00006
SL-03	1,434	1.49	7.128	0.0050	0.025*	0.120	0.00008
SL-04	1,167	1.46	5.291	0.0045	0.025*	0.091	0.00008
SL-05 Trib.	202	3.49	n/a	n/a	0.025*	n/a	n/a
SL-06	742	1.16	3.172	0.0043	0.025*	0.068	0.00009
SL-07 Trib.	62	1.31	0.177	0.0028	0.025*	0.003	0.00005
SL-08	451	1.33	2.202	0.0049	0.025*	0.041	0.00009
SL-09 -outfall	15	4.46	2.862	0.1908	0.025*	0.016	0.001
SL-10	265	1.69	0.802	0.0030	0.025*	0.012	0.00005

*- denotes values below detection limit,

9.2.2.1.3 Pollutant Load Calculations

Data from the USGS gage was recorded at 15-minute intervals from October 1, 2005 through December 31, 2014. Starting June 5, 2013 the intervals were changed to 5 minute. There were 492,153 individual discharge readings. Discharge data from the Win-situ probe installed at the outfall recorded 175,013 15-minute intervals from January 1, 2010 December 31, 2014. The regression equations determined above from the storm event samples, relating pollutant concentration to discharge, were used to determine the pollutant concentration for each 15-minute interval. From this data the load was calculated for each 15-minute interval using the following formula:

$P_L = (P_C*.000008345)*(CFS*448.8*I)$, where

P_L = Pollutant Load,
P_C = Pollutant Concentration,
.000008345 = Conversion factor to convert mg/L to pounds per gallon,
CFS = Cubic feet per second,
448.8 = Conversion factor to convert cubic feet per second to gallons per minute
I = number of minutes in the interval (5 or 15).

The results obtained by the above formula were standardized to both an annual pollutant load for the drainage area and an annual pollutant load per acre (Table 9-3).

Table 9-3a: Pollutant Load Characteristics for USGS gaged in-stream site (SL-01) calendar year 2014

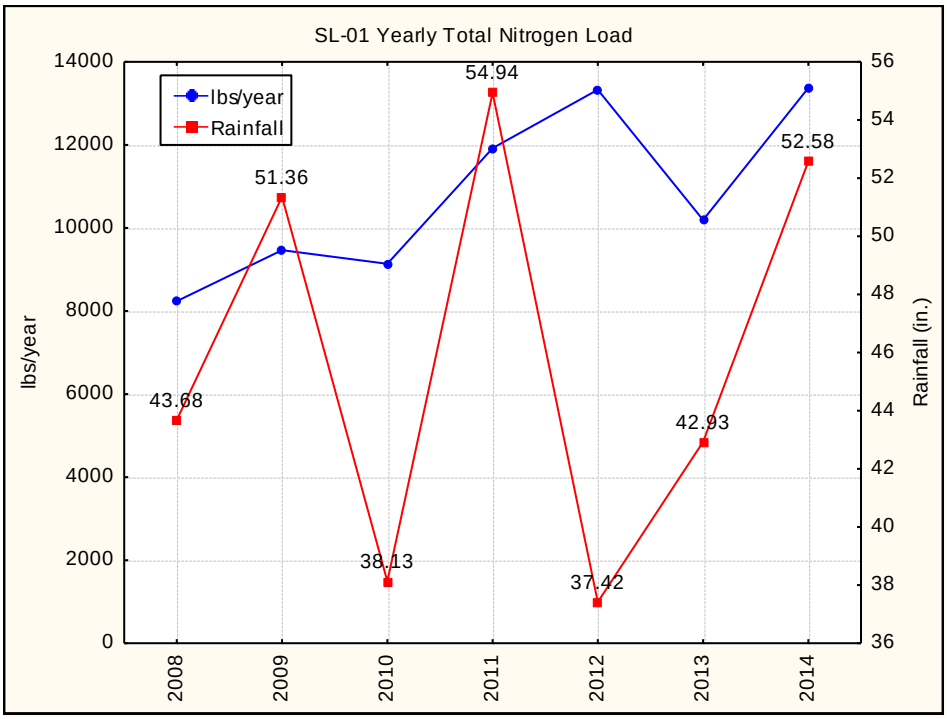
Parameter	Pounds/ Year	Pounds/year Standardized by average rainfall	Pound/Acre Standardized by average rainfall	% by Season	Storm Event lbs.	% Load as Storm Flow	Baseflow lbs.	% Load as Baseflow
TSS								
Fall	59,998	45,464	20.80	6.3%	51,081	89.6%	5,917	10.4%
Winter	99,614	79,456	36.35	11.0%	95,630	96.0%	3,984	4.0%
Spring	705,404	562,660	257.39	77.6%	699,324	99.1%	6,080	0.9%
Summer	47,159	37,616	17.21	5.2%	44,251	93.8%	2,908	6.2%
Total	**909,175**	**725,196**	**331.75**		**890,285**	**97.9%**	**18,890**	**2.1%**
TKN								
Fall	1,181	942	0.43	10.2%	991	83.9%	190	16.1%
Winter	1,838	1,466	0.67	15.9%	1,708	92.9%	130	7.1%
Spring	7,688	6,132	2.81	66.7%	7,487	97.4%	201	2.6%
Summer	820	654	0.30	7.1%	5718	87.6%	102	12.4%
Total	**11,526**	**9,194**	**4.21**		**10,904**	**94.6%**	**622**	**5.4%**
NO_2/NO_3								
Fall	1,014	809	0.89	19.2%	703	69.3%	312	30.7%
Winter	1,267	1,010	1.24	23.9%	1,056	83.4%	211	16.6%
Spring	2,379	1,897	3.43	44.9%	2,041	85.8%	338	14.2%
Summer	637	508	0.56	12.0%	424	66.7%	212	33.3%
Total	**5,296**	**4,224**	**6.12**		**4,224**	**79.8%**	**1,072**	**20.2%**
TN								
Fall	2,426	1,935	0.89	14.5%	1,883	77.6%	542	22.4%
Winter	3,410	2,420	1.24	20.3%	3,039	89.1%	372	10.9%
Spring	9,392	7,492	3.43	56.0%	8,808	93.8%	584	6.2%
Summer	1,538	1,227	0.56	9.2%	1,215	79.0%	323	21.0%
Total	**16,767**	**13,374**	**6.12**		**14,946**	**89.1%**	**1,821**	**10.9%**
TP								
Fall	212	169	0.08	11.0%	175	82.9%	36	17.1%
Winter	323	258	0.12	16.8%	299	92.3%	25	7.7%
Spring	1,246	994	0.45	64.7%	1,208	96.9%	39	3.1%
Summer	144	125	0.05	7.5%	124	86.2%	20	13.8%
Total	**1,925**	**1,116**	**0.70**		**1,805**	**93.8%**	**120**	**6.2%**

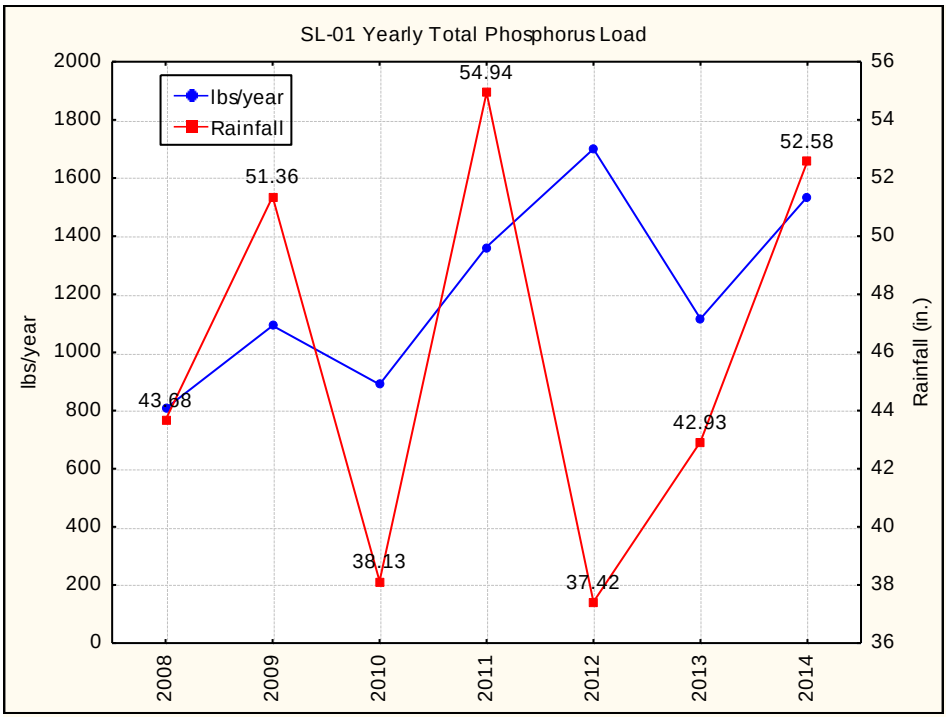
Table 9-3b: Pollutant Load Characteristics for Outfall site (SL-09) calendar year 2014

Parameter	Pounds/ Year	Pounds/year Standardized by average rainfall	Pound/Acre Standardized by average rainfall	% by Season	Storm Event lbs.	% Load as Storm Flow	Baseflow lbs.	% Load as Baseflow
TSS								
Fall	1,489	1,188	79.18	20.9%	988	66.4%	501	33.6%
Winter	1,842	1,469	97.95	25.8%	1,322	71.8%	520	28.2%
Spring	3,029	2,416	161.07	42.5%	2,522	83.3%	507	16.7%
Summer	771	615	40.99	10.8%	461	59.8%	310	40.2%
Total	**7,131**	**5,688**	**379.19**		**5,293**	**74.2%**	**1,837**	**25.8%**
TKN								
Fall	74	59	3.92	22.6%	42	57.6%	31	42.4%
Winter	92	74	4.90	28.2%	61	65.7%	32	34.3%
Spring	123	98	6.54	37.6%	91	74.1%	32	25.9%
Summer	38	30	2.01	11.6%	17	44.8%	21	55.2%
Total	**327**	**260**	**17.36**		**211**	**64.6%**	**116**	**35.4%**
NO_2/NO_3								
Fall	41	33	2.18	24.5%	18	44.1%	23	55.9%
Winter	50	40	2.68	30.1%	28	55.9%	22	44.1%
Spring	53	42	2.81	31.6%	29	55.2%	24	44.8%
Summer	23	18	1.23	13.8%	6	24.3%	18	75.7%
Total	**168**	**134**	**8.91**		**81**	48.4%	**86**	**51.6%**
TN								
Fall	137	110	7.31	23.8%	68	49.6%	69	50.4%
Winter	171	137	9.11	29.7%	103	60.0%	68	40.0%
Spring	195	156	10.39	33.8%	124	63.6%	71	36.4%
Summer	73	59	3.90	12.7%	24	32.0%	50	68.0%
Total	**578**	**461**	**30.72**		**319**	**55.2%**	**259**	**44.8%**
TP								
Fall	12	9	0.63	23.1%	6.43	54.3%	5.42	45.7%
Winter	15	12	0.79	28.9%	9	63.4%	5	36.6%
Spring	18	15	0.98	36.0%	13	70.0%	6	30.0%
Summer	6	5	0.33	12.0%	2	39.3%	4	60.7%
Total	**51**	**41**	**2.72**		**31**	**60.7%**	**20**	**39.3%**

There are distinct seasonal differences in the delivery of nutrient and total suspended solids pollutant loads at SL-01, with summer being the season of reduced load delivery for all pollutants analyzed. SL-09 showed the loads per season were more evenly distributed. A severe storm occurred between April 29 and May 1, 2014, with major flooding throughout Maryland. This major flooding event is clearly reflected in the data for both SL-01 and SL-09, as the data is skewed heavily toward the spring season. For example, of the 705,404 pounds observed during the spring season, 476,306 pounds occurred during the period between April 29 and May 3.

Figure 9-5 shows pollutant loads for TN, TP and TSS at the SL-01 gage throughout the year. This data is adjusted for average annual rainfall. In 2014, the total annual rainfall was 52.58 inches, compared to the average annual rainfall of 41.94 inches. As can be seen from the graphs, rainfall loosely follows pollutant load. However, factors such as intensity of rainfall and length of storm event may account for the variability.


SL-01 Yearly Total Nitrogen Load
lbs/year
Rainfall
lbs/year
Rainfall (in.)
14000
12000
10000
8000
6000
4000
2000
0
56
54
52
50
48
46
44
42
40
38
36
43.68
51.36
38.13
54.94
37.42
42.93
52.58
2008
2009
2010
2011
2012
2013
2014


SL-01 Yearly Total Phosphorus Load
lbs/year
Rainfall
lbs/year
Rainfall (in.)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
56
54
52
50
48
46
44
42
40
38
36
43.68
51.36
38.13
54.94
37.42
42.93
52.58
2008
2009
2010
2011
2012
2013
2014

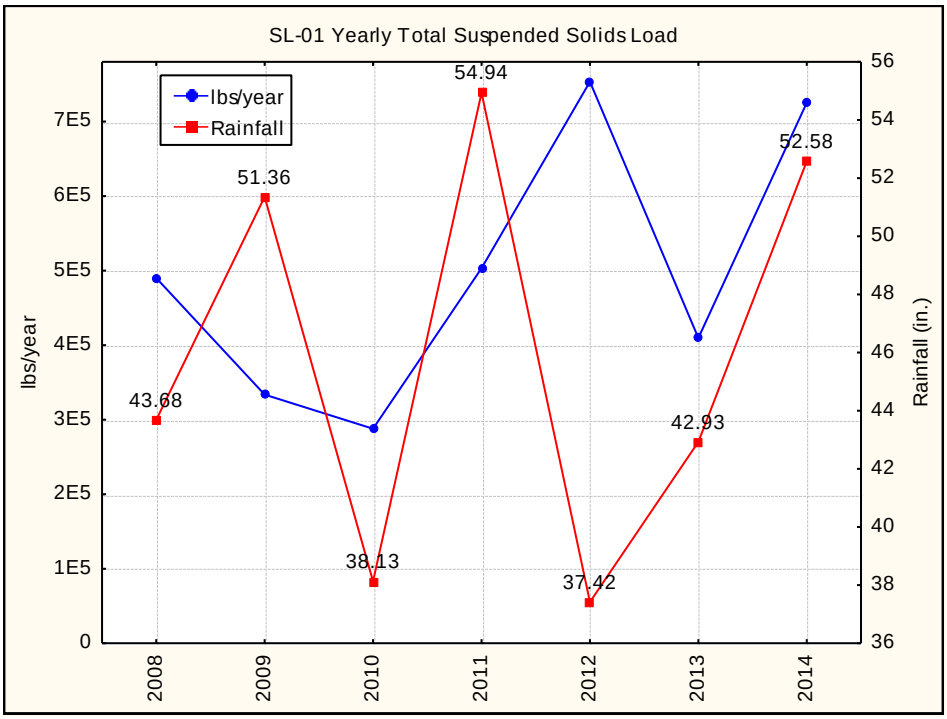


Figure 9-5: Scotts Level Branch pollutant loads at SL-01 gage from 2007-2014 (adjusted for average annual rainfall)

9.2.2.2 Geomorphic Monitoring Results

Streambank Soil Sampling: Nine sets (3 Powder Mill, 6 Scott's Level) of stream bank and bed core samples were collected in 2007 in the vicinity of the permanent cross sections for laboratory analysis of bulk density, particle size distribution, total nitrogen, and total phosphorus and other constituents. There will be new soil samples taken in 2016, and those samples will be analyzed by an independent lab. The data from each cross section will allow either positive or negative loading estimates to be made for the cross sections. These estimates, if extended to represent their respective stream segments, may provide information helpful in understanding the sediment and chemical flux of the stream system. Based on the annual and long term change, and the results of the core samples, the estimated annual sediment, total nitrogen, and total phosphorus loads will be calculated for comparison with the chemical monitoring results derived from the in-stream monitoring site.

9.2.2.2.1 Scotts Level Branch Geomorphic Monitoring Results

The morphology of 16 cross sections was examined to show changes that occurred in fall and winter of 2014/2015 and the changes over the period of 2006 through 2015. Figure 9-6 shows an overlay of CX #1 for 2014 and 2015. Table 9-4 presents the amount of aggradation (filling) or degradation (cutting) within the active channel, and Table 9-5 (listed from upstream to downstream) summarizes Table 9-4. Data in Table 9-4 were annualized to standardize aggradation and degradation estimates. The data files and plots are included on the CD accompanying this report. SL-18, SL-12, SL-4, and SL-3 cross sections were not sampled. Both left and right bank pins for SL-18 could not be located. The pins for SL-12 were removed during stream restoration construction. The contractor, EA Engineering Science, will take future cross sectional data within the restoration site. SL-4 is lacking property owner permission, so this

cross section was not sampled. SL-3 was not sampled. Most reaches showed minor adjustments in channel morphology between 2013 and 2014, although SL-19, SL-16, SL-14, SL-13, SL-10, SL-9, SL-7, SL-2, and SL-1 were more active (cut/fill > ± 4.0 cubic feet). SL-1 is on a straight, low-gradient reach following a series of high-gradient, alternating riffles and short pools. As the stream slows at the gradient break, it deposits sands and silts along the stream banks.

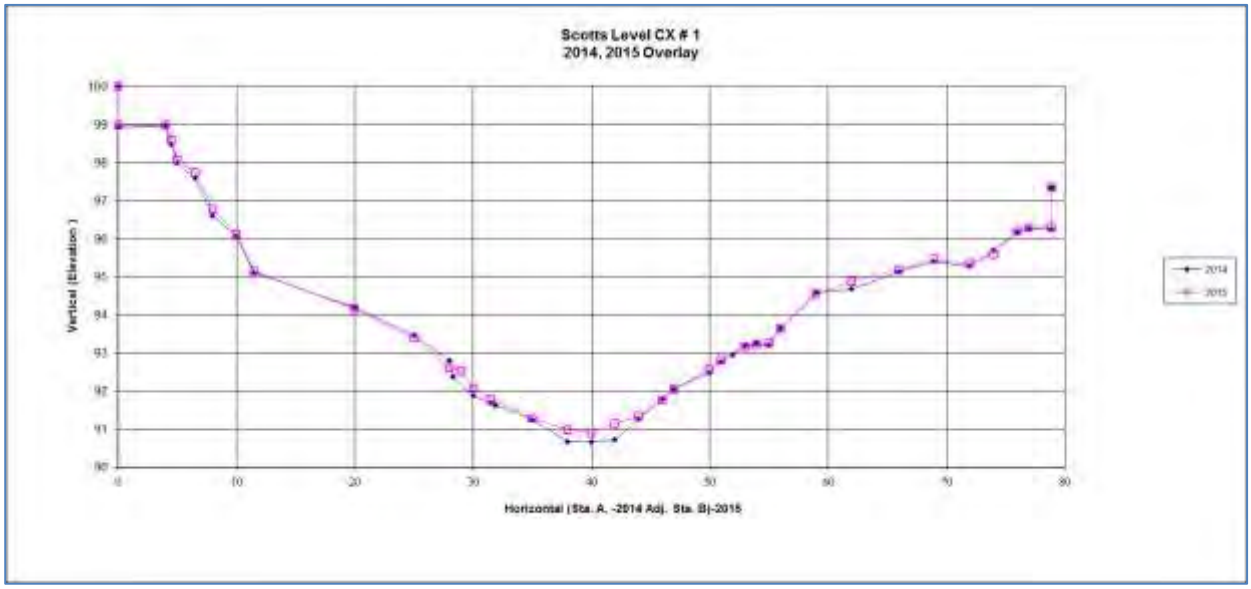


Figure 9-6: Scotts Level Branch Geomorphic Cross Section 1 Overlay showing differences in channel morphology between the 2014 and 2015 surveys.

Impervious land cover influences the majority of the Scotts Level Branch hydrology. Therefore the sediment fluxes within the stream channel are most likely part of the process of the stream reworking its surrounding legacy flood plain sediments and ultimately transporting them into the Gwynns Falls mainstem and beyond. The baseline data will be useful in evaluating the stream restoration project at McDonogh Road. The project will stabilize the stream channel and reconnect the stream to the floodplain.

Table 9-4: Scotts Level Branch Cross Sections - Annualized Cut and Fill Amounts

SL20: Change (cu ft)	**Period: 2014-2015**	**Period: 2006-2015**	**SL10: Change (cu ft)**	**Period: 2014-2015**	**Period: 2006-2015**
Total Cut	-0.8	-0.2	Total Cut	-0.7	-1.0
Total Fill	2.8	0.3	Total Fill	6.2	0.6
Total Change	3.6	0.5	Total Change	6.9	1.6
Net Change	2.0	0.0	Net Change	5.6	-0.4
SL19: Change (cu ft)	**Period: 2014-2015**	**Period: 2006-2015**	**SL9: Change (cu ft)**	**Period: 2014-2015**	**Period: 2006-2015**
Total Cut	-0.4	-0.3	Total Cut	-9.1	-0.5
Total Fill	4.4	1.7	Total Fill	0.4	0.3
Total Change	4.8	2.0	Total Change	9.5	0.8
Net Change	4.0	1.4	Net Change	-8.8	-0.3
SL18: Change (cu ft)*	**Period: 2014-2015**	**Period: 2006-2015**	**SL8: Change (cu ft)**	**Period: 2014-2015**	**Period: 2006-2015**

Total Cut	NA	NA	Total Cut	-0.3	-0.2
Total Fill	NA	NA	Total Fill	2.5	0.1
Total Change	NA	NA	Total Change	2.8	0.3
Net Change	NA	NA	Net Change	2.2	-0.1
SL17: Change (cu ft)	**Period: 2014-2015**	**Period: 2012-2015**	**SL7: Change (cu ft)**	**Period: 2014-2015**	**Period: 2006-2015**
Total Cut	-3.3	-0.9	Total Cut	-7.0	-0.4
Total Fill	2.1	0.1	Total Fill	0.1	0.9
Total Change	5.4	0.9	Total Change	7.1	1.3
Net Change	-1.2	-0.8	Net Change	-6.9	0.5
SL16: Change (cu ft)	**Period: 2014-2015**	**Period: 2006-2015**	**SL6: Change (cu ft)**	**Period: 2014-2015**	**Period: 2006-2015**
Total Cut	-11.9	-0.8	Total Cut	-3.3	-0.2
Total Fill	0.4	0.2	Total Fill	3.7	0.9
Total Change	12.4	1.0	Total Change	7.1	1.1
Net Change	-11.5	-0.6	Net Change	0.4	0.7
SL15: Change (cu ft)	**Period: 2014-2015**	**Period: 2006-2015**	**SL5: Change (cu ft)**	**Period: 2014-2015**	**Period: 2006-2015**
Total Cut	-3.8	-0.1	Total Cut	-4.1	NA
Total Fill	2.8	0.5	Total Fill	1.8	NA
Total Change	6.6	0.6	Total Change	5.9	NA
Net Change	-1.0	0.4	Net Change	-2.3	NA
SL14: Change (cu ft)	**Period: 2014-2015**	**Period: 2006-2015**	**SL4: Change (cu ft) ****	**Period: 2014-2015**	**Period: 2006-2015**
Total Cut	-5.0	-1.7	Total Cut	NA	NA
Total Fill	0.7	0.5	Total Fill	NA	NA
Total Change	5.7	2.2	Total Change	NA	NA
Net Change	-5.0	-1.2	Net Change	NA	NA
SL13: Change (cu ft)	**Period: 2014-2015**	**Period: 2006-2015**	**SL3: Change (cu ft) *****	**Period: 2014-2015**	**Period: 2006-2015**
Total Cut	-12.7	-1.2	Total Cut	NA	NA
Total Fill	7.6	0.0	Total Fill	NA	NA
Total Change	20.3	1.2	Total Change	NA	NA
Net Change	-5.0	-1.1	Net Change	NA	NA
SL12: Change (cu ft)****	**Period: 2014-2015**	**Period: 2006-2015**	**SL2: Change (cu ft)**	**Period: 2014-2015**	**Period: 2006-2015**
Total Cut	NA	NA	Total Cut	-4.3	-0.9
Total Fill	NA	NA	Total Fill	2.2	0.2
Total Change	NA	NA	Total Change	-2.1	-0.7
Net Change	NA	NA	Net Change	6.6	1.1
SL11: Change (cu ft)	**Period: 2014-2015**	**Period: 2006-2015**	**SL1: Change (cu ft)**	**Period: 2014-2015**	**Period: 2006-2015**
Total Cut	-1.4	-0.4	Total Cut	-0.9	-0.5

Total Fill	2.0	0.4	Total Fill	5.8	2.8
Total Change	3.4	0.8	Total Change	6.7	3.3
Net Change	0.6	0.0	Net Change	4.9	2.3

*SL-18 Right pin could not be located. New set of pins will be set in 2016
** SL-4 was not sampled in 2014. Permission from private property owners for SL 4 has not been obtained and will not be sampled.
*** SL-3 is a stable concrete channel, and was not sampled in 2014
**** SL-12 was not sampled in 2014 and was removed during stream restoration construction.

Table 9-5: Scotts Level Branch Stream Channel Changes Over Time.

SL #	CX 2014-2015	CX 2006-2015
20	a	nc
19	a	a
18	*	*
17 (Trib.)	d	d^
16	d	d
15	d	a
14	d	d
13	d	d
12	**	**
11	a	nc
10	a	d
9	d	d
8	a	d
7	d	a
6	a	a
5	d	^^
4	***	***
3	****	****
2	a	a
1	a	a

Symbols: a: aggradation, d: degradation, nc: no change

* The right pin monument for SL 18 could not be located. Annual and historic comparisons could not be made. New pins were set, and both comparisons will continue in the 2015 report.
** SL-4 was not sampled in 2014. Permission from private property owners for SL 4 has not been obtained and will not be sampled.
*** SL-3 is a stable concrete channel, and was not sampled in 2014
**** SL-12 was not sampled in 2014 and was removed during stream restoration construction.
^ SL-17 historically compared from 2012-2015 due resetting of pin
^^ There is not enough data for SL-5 to historically compare 2006-2015

9.2.2.2.2 Powder Mill Run Geomorphic Monitoring Results

Cross-sectional measurements for the fall and winter of 2014/2015, and the period of 2006 through 2015, were compared to determine changes in bedload movement. The data files and plots are included on the CD accompanying this report. Table 9-6 presents cubic feet of aggradation (filling) and degradation (cutting) within the active channel of each cross section. Table 9-7 summarizes Table 9-6. The Powder Mill Run channel remained active. Similar to Scotts Level Branch, this most downstream station is on a relatively low-gradient reach, just downstream of a high-gradient riffle-pool section. The imperviousness of the upstream channel likely concentrates high flows and causes downstream channel instability.

Table 9-6: Powder Mill Run Cross Sections - Cut and Fill Amounts

PM 10:Change (cu ft)	Period:2014-2015	Period: 2006-2015		PM 5:Change (cu ft)	Period: 2014-2015	Period: 2006-2015
Total Cut	-3.0	-0.3		Total Cut	-12.6	-2.1
Total Fill	3.4	0.7		Total Fill	1.8	0.4
Total Change	6.3	1.0		Total Change	14.4	2.4
Net Change	0.4	0.4		Net Change	-10.7	-1.7
PM 9:Change (cu ft)	**Period: 2014-2015**	**Period: 2006-2015**		**PM 4:Change (cu ft)**	**Period: 2014-2015**	**Period: 2006-2015**
Total Cut	-3.8	-0.3		Total Cut	-9.2	-1.2
Total Fill	5.3	0.9		Total Fill	4.1	1.3
Total Change	9.0	1.3		Total Change	13.3	2.5
Net Change	1.5	0.4		Net Change	-5.1	0.0
PM 8:Change (cu ft)	**Period: 2014-2015**	**Period: 2006-2015**		**PM 3:Change (cu ft)**	**Period: 2014-2015**	**Period: 2006-2015**
Total Cut	-6.3	-0.7		Total Cut	-0.5	-0.4
Total Fill	2.1	0.1		Total Fill	0.9	0.2
Total Change	8.4	0.8		Total Change	1.4	0.5
Net Change	-4.1	-0.7		Net Change	0.4	-0.2
PM 7:Change (cu ft)	**Period: 2014-2015**	**Period: 2006-2015**		**PM 2:Change (cu ft)**	**Period: 2014-2015**	**Period: 2006-2015**
Total Cut	-21.6	-0.3		Total Cut	-2.7	-0.4
Total Fill	0.0	0.4		Total Fill	8.3	0.8
Total Change	21.6	0.7		Total Change	10.9	1.2
Net Change	-21.6	0.1		Net Change	5.6	0.4
PM 6:Change (cu ft)	**Period: 2014-2015**	**Period: 2006-2014**		**PM 1:Change (cu ft)**	**Period: 2014-2015**	**Period: 2006-2015**
Total Cut	-1.6	-0.4		Total Cut	-4.9	-1.5
Total Fill	5.4	0.7		Total Fill	5.4	1.6
Total Change	6.9	1.1		Total Change	10.4	3.1
Net Change	3.8	0.3		Net Change	0.5	0.1

Table 9-7: Powder Mill Run, 2014-2015 and 2006-2015 Stream Channel Changes

PM #	CX 2014-2015	CX 2006-2015
10	a	a
9	a	a
8	d	d
7	d	a
6	a	a
5	d	d
4	d	nc
3	a	d
2	a	a
1	a	a

Symbols: a: aggradation, d: degradation, nc: no change

9.2.2.3 Biological Monitoring Results

Benthic macroinvertebrate and fish sampling were conducted as per MBSS protocols. Benthic macroinvertebrates were sampled between March 3rd and April 30th, 2014 and fish were sampled between June 2nd and September 30th, 2014. Scotts Level Branch was sampled for fish at SL-1 SL-6, SL-9, SL-11, SL-11a, SL-12, SL-12a, SL-13, SL-14, and SL-18. Powder Mill Run was sampled at PM-1 and PM-4. The Benthic Index of Biotic Integrity (BIBI) and Fish Index of Biotic Integrity (FIBI) were calculated using metrics developed by MBSS for Piedmont streams. The BIBI and FIBI scoring criteria are: 1.00-1.99 (Very Poor), 2.00-2.99 (Poor), 3.00-3.99 (Fair), and 4.00-5.00 (Good). Stream physical habitat was assessed when macroinvertebrates and fish were collected using the MBSS Physical Habitat Index. The protocol measured components of stream physical habitat, including fish habitat quality, macroinvertebrate habitat quality, stream depth and velocity diversity, riffle quality, pool quality, the percentage of sediment surrounding stream bottom substrates, and the percentage of shading in the stream reach. Each parameter was estimated on a scale of 0-20, except for sediment and shading, which were percentage estimates. Physical habitat data were converted to physical habitat index (PHI) scores and rated using criteria from Southerland et al (2005). Minimally degraded stations had PHI scores of 81-100, partially degraded stations had PHI scores of 66-80, degraded stations had PHI scores of 51-65, and severely degraded stations had PHI scores of 0-50.

The IBI scores are shown in Figure 9-7. All Scotts Level and Powder Mill BIBIs were in the Very Poor or Poor condition category. The FIBI scores for all sites in Scotts Level and Powdermill were Poor or Very Poor. The following sites sampled for fish will be discussed in the McDonogh Road restoration section: SL-11, SL-11a, SL-12, SL-12a, and SL-13. Fish in Scotts Level Branch are able to survive the acute and chronic water quality problems within both streams than benthic macroinvertebrates. The mobility of fish likely allows them to better exploit good habitat and avoid such episodic events as high storm flows. The PHI scores are shown in Figure 9-8. Scotts Level Branch physical habitat condition was degraded at SL-6. SL-9, SL-14, and SL-18 were all severely degraded. SL-1 was partially degraded.

The benthic and fish communities of Scotts Level Branch and Powder Mill Run show the effects of environmental stress. Both are low in diversity and are primarily composed of pollution tolerant organisms. The stream habitat is degraded and provides poor living space for both benthos and fish. As reported in previous Baltimore County NPDES reports, these results have been consistent since monitoring began in 2005, i.e., BIBI and FIBI ratings of Poor or Very Poor annually. The biological community of Scotts Level Branch is so impaired that it does not respond to fluctuations in precipitation and water temperature the way healthy streams do.

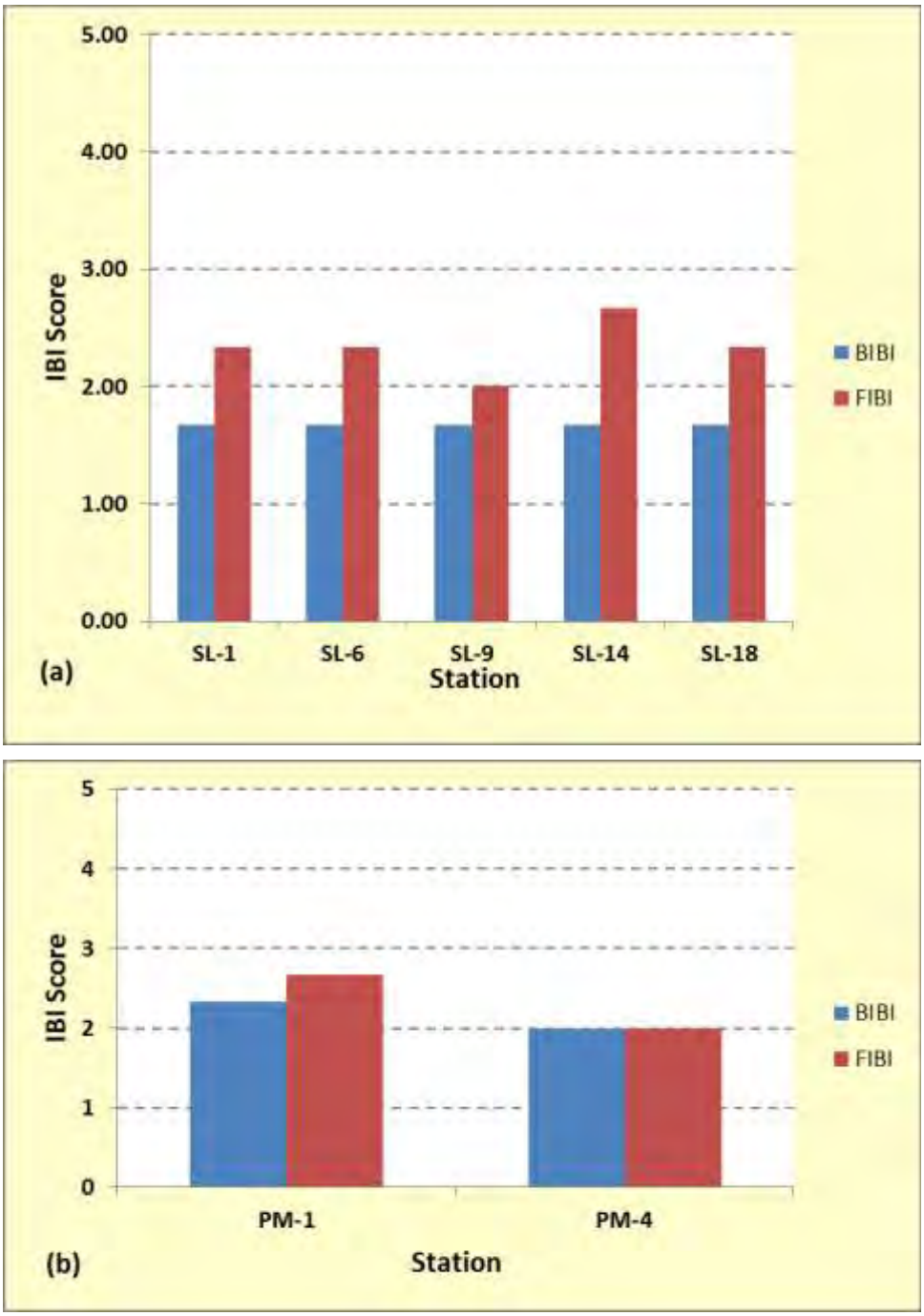
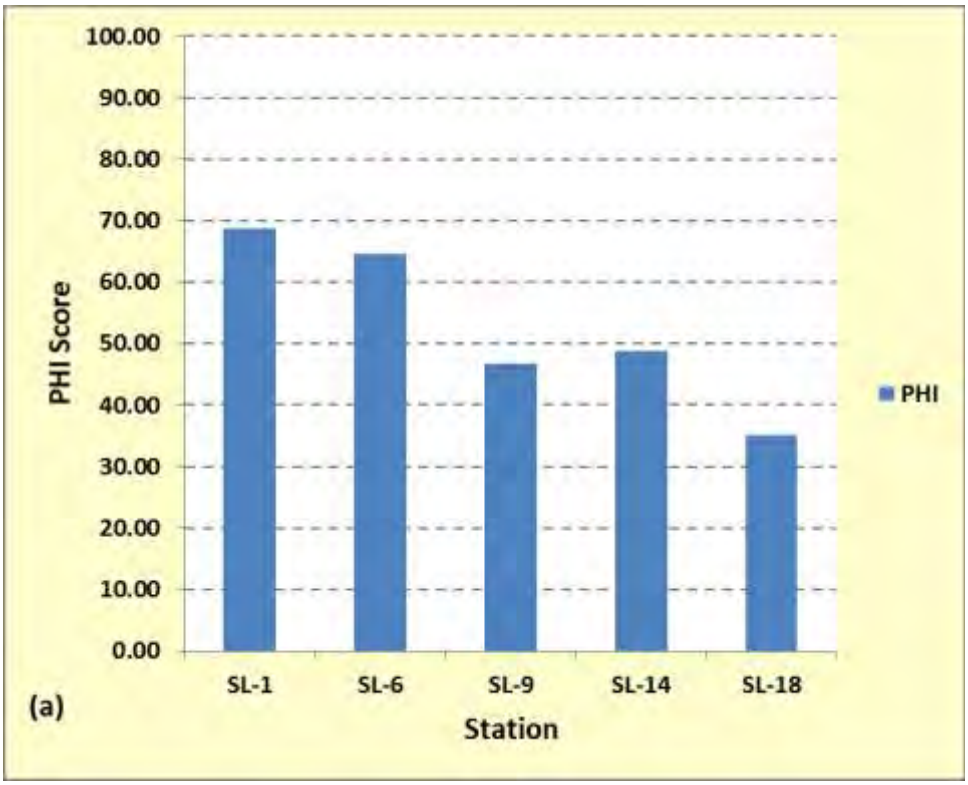


Figure 9-7: (a) Scotts Level Branch and (b) Powder Mill Run IBI Scores, 2014.



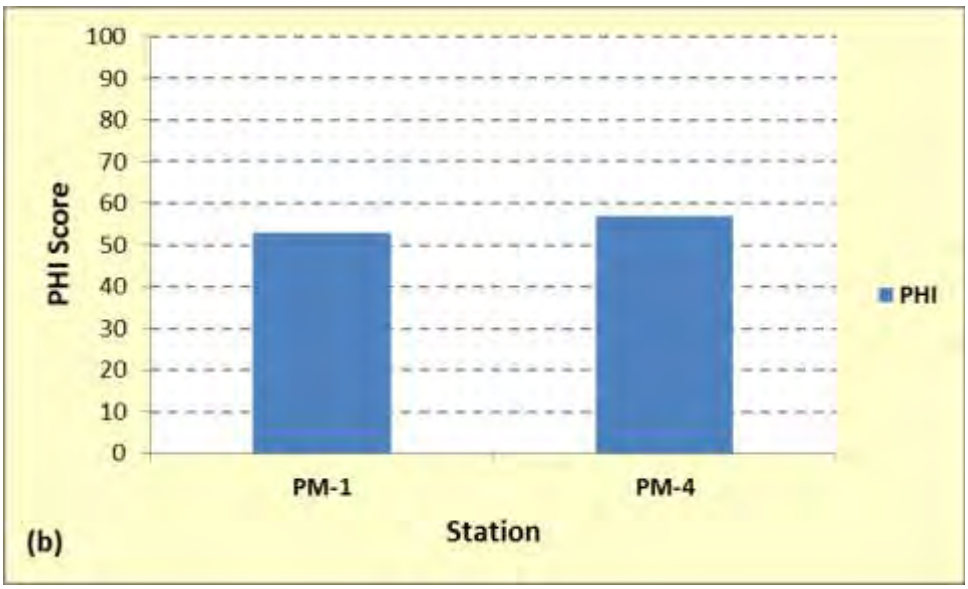


Figure 9-8: (a) Scotts Level Branch and (b) Powder Mill Run Physical Habitat Index 2014.

9.2.2.4 Scotts Level Branch Pollutant Load Calculations

Integrating geomorphology, stream bank soil chemistry, and water chemistry data, allows examination of pollutant loads for various components of the Scotts Level Branch watershed. The three components of the field model are in-stream water quality loads measured at SL-01, stream bank soil loads measured at the geomorphology cross-sections, and watershed wash-off

loads measured at outfall SL-09. The model expectation is that in-stream water quality estimates are equal to the sum of stream bank and watershed wash-off estimates.

9.2.2.4.1 Stream Erosion Loads

The calculations for the stream erosion loads are based on the stream channel changes measured by the annual cross-sections and the mean concentration of TKN, NO_3, and TP determined by stream bank and bed chemical analysis. The net change at a particular cross-section was applied to a stream length based on the midpoints between cross-sections to determine the cubic feet of change for the stream reach. The load for each reach was then calculated based on the average bulk density of stream bank and bed samples, the chemical concentrations of nitrogen species, and total phosphorus. The numbers used in this analysis were:

- Mean Bulk Density = 64.9 lbs/ft^3
- Mean TKN Concentration = 0.002254 lbs/lb sediment
- Mean NO_3 Concentration = 0.000005 lbs/lb sediment
- Mean TP Concentration = 0.000705 lbs/lb sediment

The following formulas were applied to determine the stream channel erosion loads for sediment, TKN, TP, NO_3, and TN

Sediment Load = Net Change Cross-section (ft^2) x reach length (ft) x Bulk Density (lbs/ft^3) (9.2)

Total TKN Load = Sediment Weight (lbs) x Mean TKN Concentration (9.3)

Total NO_3 Load = Sediment Weight (lbs) x Mean NO_3 Concentration (9.4)

Total TP Load = Sediment Weight (lbs) x Mean TP Concentration (9.5)

Total TN Load = Total TKN Load + Total NO_3 Load (9.6)

Table 9-8 shows load calculations derived from the geomorphology measurements for the calendar year 2014.

Table 9-8: 2014 Pollutant Load Estimates and Calculations for Stream Bank Soil Sediment and Nutrients

Site	Stream Length (ft)	Distance Between Sites	Adjusted Stream Length[1]	Net Cut/Fill at Site (cu ft)[2]	Cut/Fill Adjusted for Stream Length (cu ft)[3]	Sediment Weight (lbs)[4]	TKN (lbs)[5]	TP (lbs)[6]	NO_3 (lbs)[7]	TN (lbs)[8]
20	885	* [9]	1,643	2	3286.7	213,307	480.8	150.4	1.07	481.9
19	2,402	1,517	1,351	4	5,404	350,720	790.5	247.2	1.75	792.3
18	3,587	1,185	3,434	0	0	0	0	0	0	0
17	2,782	* [10]	3,662	-1.2	-4,394	-285,197	-642.8	-201	-1.42	-644
16	12,932	5,683	3,918	1.3	5,093	330,570	745	233	1.65	746.7
15	15,085	2,153	2,269	-1	-2,269	-147,258	-331.9	-104	-0.74	-332.6
14	17,470	2,385	1,738	-4.4	-7,645	-496,160	-1,118	-350	-2.48	-1,120
13	18,560	1,090	3,070	-5	-15,347	-996,053	-2,245	-702	-4.98	-2,250
12	1,575	* [10]	1,601	0	0	0	0	0	0	0
11	25,210	5,049	3,764	0.6	2,258	146,551	330	103	0.73	331

Site	Stream Length (ft)	Distance Between Sites	Adjusted Stream Length[1]	Net Cut/Fill at Site (cu ft)[2]	Cut/Fill Adjusted for Stream Length (cu ft)[3]	Sediment Weight (lbs)[4]	TKN (lbs)[5]	TP (lbs)[6]	NO_3 (lbs)[7]	TN (lbs)[8]
10	27,688	2,478	2,400	5.6	13,440	872,256	1,966	615	4.36	1,970
9	30,010	2,322	2,562	-8.8	-22,545	-1,463,209	-3,298	-1031	-7.31	-3,305
8	32,812	2,802	6,845	2.2	15,057	977,258	2,202	689	4.88	2,207
7	43,699	10,887	6,922	-6.9	-47,758	-3,099,517	-6,986	-2185	-15.5	-7,002
6	46,655	2,956	2,612	0.4	1,044	67,807	152.8	47.8	0.33	153.2
5	48,923	2,268	1,318	-2.3	-3,031	-196,738	-443.4	-139	-0.98	-444
Total Load (lbs)	--	--	--	--	--	-3,725,664		-2627		-8416
Total Load, Normalized for Rainfall (lbs)	--	--	--	--	--	**-2,971,745**		**-2095**		**-6713**

[1] Stream length upstream of cross-section plus one-half the distance between cross-sections
[2] As calculated from geomorphic cross-section measurements
[3] Geomorphic cut/fill multiplied by adjusted stream length
[4] Cut/fill adjusted for stream length multiplied by 64.9 lb/cu ft (mean bulk density of Scotts Level soils)
[5] Weight of sediment in lbs multiplied by 0.002254 (mean soil TKN in lb/lb sediment)
[6] Weight of sediment in lbs multiplied by 0.000705 (mean soil TP in lb/lb sediment)
[7] Weight of sediment in lbs multiplied by 0.000005 (mean soil NO_3 in lb/lb sediment)
[8] TKN (lbs) plus NO_3 (lbs)
[9] Upstream limit of study. "Distance between sites" does not apply.
[10] Tributary. "Distance between sites" does not apply.

9.2.2.4.2 Watershed Load

The land surface pollutant load was calculated for 2014 using water chemistry data and discharge measurements from the outfall (SL-09). A flow-rating curve developed by the United States Geological Survey aided in calculating watershed wash-off loads at the SL-09 outfall. The calculated per acre loading rates from the outfall SL-09 were used to calculate the watershed load. The load was determined by placing the watershed acreage (watershed determined by drainage area to SL-01) into four categories:

- Acreage of urban land draining untreated to outfalls,
- Acreage of urban land draining to stormwater management facilities and receiving some treatment,
- Acreage of urban land that did not flow to a storm drain system (considered sheet flow to buffer), and
- Acreage in forest cover based on MDP 2007 land use and CBP Watershed Model 5.3 loading from forest.

Using the pollutant loading information provided in Table 9-3b on the standardized per acre loading rates (standardization based on average annual rainfall), the watershed per acre loads for

Total Nitrogen, Total Phosphorus, and Total Suspended Solids were calculated. The respective loading rates were:

- 30.72 lbs/acre Total Nitrogen
- 2.72 lbs/acre Total Phosphorus
- 379.19 lbs/acre Total Suspended Solids

The acreages, nutrient loads, and sediment load by landscape category are shown in Table 9-9.

Table 9-9: Calculated Watershed Loads Delivered Based on SL-09 Monitoring Data

Landscape Category	Acres	TN Load	TP Load	Sediment Load
Untreated Outfalls	1,510.9	46,415	4,110	572,918
Stormwater Management	249.4	1,791	287	18,518
Sheet Flow to Buffer	127.1	184	19	820
Forest Cover	298.3	829	12	24,511
Total	**2,185.7**	**49,219**	**4,427**	**616,767**

The bulk of the nutrient and sediment loads from the watershed are delivered untreated directly to the stream through storm drain outfalls, and a smaller portion of the drainage receives some treatment from stormwater management facilities.

The calculated watershed loads (Table 9-9) were combined with estimated stream erosion loads (Table 9-8) to provide an estimate of the total load delivered to the in-stream monitoring site SL-01. The estimated total load was compared to the calculated (based on discharge and pollutant concentration) load from the monitoring data at SL-01 for 2014. The differences between the two loads were then calculated on both a pound and percentage basis. All loads are standardized to an average precipitation year. The results are displayed in Table 9-10.

Table 9-10: 2014 Watershed Pollutant Load Estimates Compared to Water Quality Monitoring at SL-01

Year	Component	Parameter		
		TN	TP	Sediment
2014	**Geomorphology Pollutant Load (lbs/yr)**	6,713	2,095	2,971,745
	Land Surface Pollutant Load (lbs/yr)	49,219	4,427	616,767
	Total Estimated Watershed Load to SL-01	**55,932**	**6,523**	**3,588,512**
	In-stream Water Quality Pollutant Load (lbs/yr) SL-01 – Measured	13,374	1,536	725,196
	Difference Between Estimated Load and Measured	42,558	4,987	2,863,316
	Percent Underestimate by In-stream Monitoring	**76%**	**76%**	**80%**

The in-stream monitoring site SL-01 measured pollutant loads were 76% - 80% less than the calculated loads based on the geomorphological and the outfall monitoring, site SL-09.

Several explanations may account for why the in-stream monitoring, and stream erosion estimates and land surface (based on outfall SL-09 monitoring) pollutant loads are out of balance. Suggestions for future avenues of investigation are provided for several of the points below.

- The estimates may not be accurate due to inadequate data. The estimates should become more refined as more data are collected annually. This is the fifth year for the pollutant

load estimates and with additional soil analysis, along with additional water chemistry data we should get closer to a better estimate of the in-stream pollutant load.

- The outfall is not representative of each outfall in the watershed. This outfall has groundwater input whereas many of the other outfalls are dry. There are 18 major outfalls upstream from SL-01, which have 4.98 acres of drainage. Additional outfalls have been selected for comparative sampling to determine if the data is adequate.
- Geomorphology estimates are based on once-annual cross-sectional measurements. Although the loads are annualized, they are point-in-time estimates and may not accurately characterize the amount of material being moved through the channel in each study reach over the entire year. In future, more frequent cross-sectional measurements should be made to determine what, if any, effect this has on sediment and nutrient loads originating from the Scotts Level Branch stream banks.
- New soil samples will be collected in 2015 at fifteen cross sections. The current soil data is an incomplete data set that may not be representative of actual pollutant concentrations along the length of Scotts Level Branch. The new soil samples will give us a complete data set from fifteen cross-sections and will be used in next year's report.
- Randomly selected cross-sections may not accurately reflect nutrient and sediment fluxes within the Scotts Level Branch watershed. Targeted cross-sections should be considered, in areas where stream bank and floodplain indicators suggest frequent shaping of the active channel by storm events.
- Field-measured pollutant loads do not fully integrate stormwater management reductions. Samples for this analysis are collected during storm-flow. Stormwater management facilities retain water for treatment, so that the water wouldn't be released and flow past the gage until several days after sampling.
- The field-collected data may underestimate the in-stream pollutant loads, or the land surface pollutant loads may be overestimated. There may be a component of the in-stream load that our current monitoring is missing. For example, we may not be getting enough peak flow water quality data or we may be missing bed load, or large organic matter. The land surface loads may be overestimated because the SL-09 outfall is not representative of all outfalls in the watershed, as explained above.
- Scotts Level Branch benthic and fish communities are impaired, as shown in past EPS NPDES reports. Nutrient uptake by stream organisms is probably less than in a healthy, functional stream. However, it is likely that some ecosystem function such as, denitrification, floodplain deposition and in-stream biological uptake is maintained and may account for some of the difference between the in-stream measured loads and the estimated loads.
- The ISCO sampler at the in-stream site may not be collecting the entire sediment load. Therefore, the bank- and bedloads may be undersampled. We will do a comparison study between the ISCO sampler and manual grab samples to determine the validity of this statement.

9.2.2.4.3 Comparison of Scotts Level Pollutant Loads with the Chesapeake Bay Watershed Model Computed Loads

To aid in understanding the field-collected data, pollutant loads were calculated using a Chesapeake Bay model which incorporates loading rates for urban pervious, urban impervious, crop, pasture, and forested land use. The model also considers load reductions due to stormwater management measures. Table 9-11 shows the loading rates and acreages for each land use and the results of the computations for nitrogen, phosphorus, and sediment. These results are compared to the estimated watershed load for Scotts Level Branch. As can be seen from Table 9-11, the CBP Watershed Model underestimates the nitrogen, sediment and phosphorus loads in comparison to the data collected in Scotts Level Branch (Table 9-10). It should be noted that the in-stream measurements at SL-01 are closer to the CBP Watershed Model numbers than the estimated loads calculated for Scotts Level Branch.

Table 9-11: Land Use and CBP Watershed Model 5.3 Loading Rates for SL-01 Drainage Area and Calculated Loads

Land Use	Acres	Loading Rate N (lbs/ac/yr)	N Load (lbs/yr)	Loading Rate P (lbs/ac/yr)	P Load (lbs/yr)	Loading Rate TSS (lbs/ac/yr)	Sed Load (lbs/yr)
Urban Pervious	1,360.5	11.55	15,714	0.30	408	280.43	381,525
Urban Impervious	526.0	17.34	9,121	1.51	794	2,056.95	1,081,956
Crop	0.56	23.07	13	1.32	1	1,422.32	796
Pasture	0.37	7.97	3	0.74	0	307.45	114
Forest	298.3	2.78	829	0.04	12	82.17	24,511
CBP Total Load	**2,185.7**		**25,680**		**1,215**		**1,488,902**
In-stream SL-01 Measured Load			**13,374**		**1,536**		**725,196**
Scotts Level Estimated Load			**55,932**		**6,523**		**3,588,512**

9.2.2.4.4 Summary

This analysis has begun to show patterns of nutrient and sediment loading to Scotts Level Branch. Continued water quality and stream bank soil sampling, along with estimates of loads from the outfall, should provide more refined estimates of the relative contribution of each of these components to the pollutant loads within the watershed, as well as estimates of export from the watershed. These data will allow EPS to more accurately determine the contribution of the various flow components to overall pollutant load estimates, and will form the basis for more accurate determination of benefits from future stream restoration.

9.2.3 McDonogh Road Stream Restoration

Stream restoration and riparian enhancement began in December 2013 on approximately 1600 linear feet of stream channel and 4 acres of land surface in Scotts Level Branch, upstream of McDonogh Road. To investigate potential gains in water quality resulting from the restoration, EPS will complete pre- and post-restoration monitoring. Pre-restoration monitoring began in 2011. Stream restoration was completed in late spring 2014. Stream chemistry is monitored at three stations within the project reach. Both baseflow (quarterly) and stormflow (12 storms per year) will be sampled. A rating curve will be constructed to determine the relationship between discharge and pollutant loads. Benthos and fish are monitored at five stations within the reach. Changes in biological stream condition will be determined using the Maryland Benthic and Fish IBIs. Changes in fish species composition and biomass will also be examined. Pre-Restoration geomorphic monitoring has concluded. The cross section monuments were removed during the construction of the Restoration project. Baltimore County EPS will receive cross-sectional, longitudinal profiles, and pebble count data at each station within the restoration project from a

consultant for the next 3 years. Post-Restoration cross section monuments were replaced within the restoration near the old Pre-Restoration monuments. For each monitoring component, there are stations upstream, within, and downstream of the restoration reach. Currently, Baltimore County EPS is expecting the consultant to provide the geomorphic data after this report is published. The geomorphic data will be compared in next year's report.

9.2.3.1 McDonogh Road Geomorphic Monitoring Results

Pre-Restoration monitoring consisted of three existing cross-sections (SL-11, SL-12, and SL-13) in Scotts Level Branch near McDonogh Road. A cross-section that was within the reach to be restored (CS 5) was added. Longitudinal profiles (20 bankfull widths long) and pebble counts were completed in each reach. SL-11 is downstream of the restoration, SL-13 is upstream of the restoration, CS 5 is within the restoration, and SL-12 is located on a tributary to Scotts Level Branch. A consultant will be monitoring geomorphic sites within the restoration. Baltimore County will monitor sites that are upstream and downstream of the restoration.

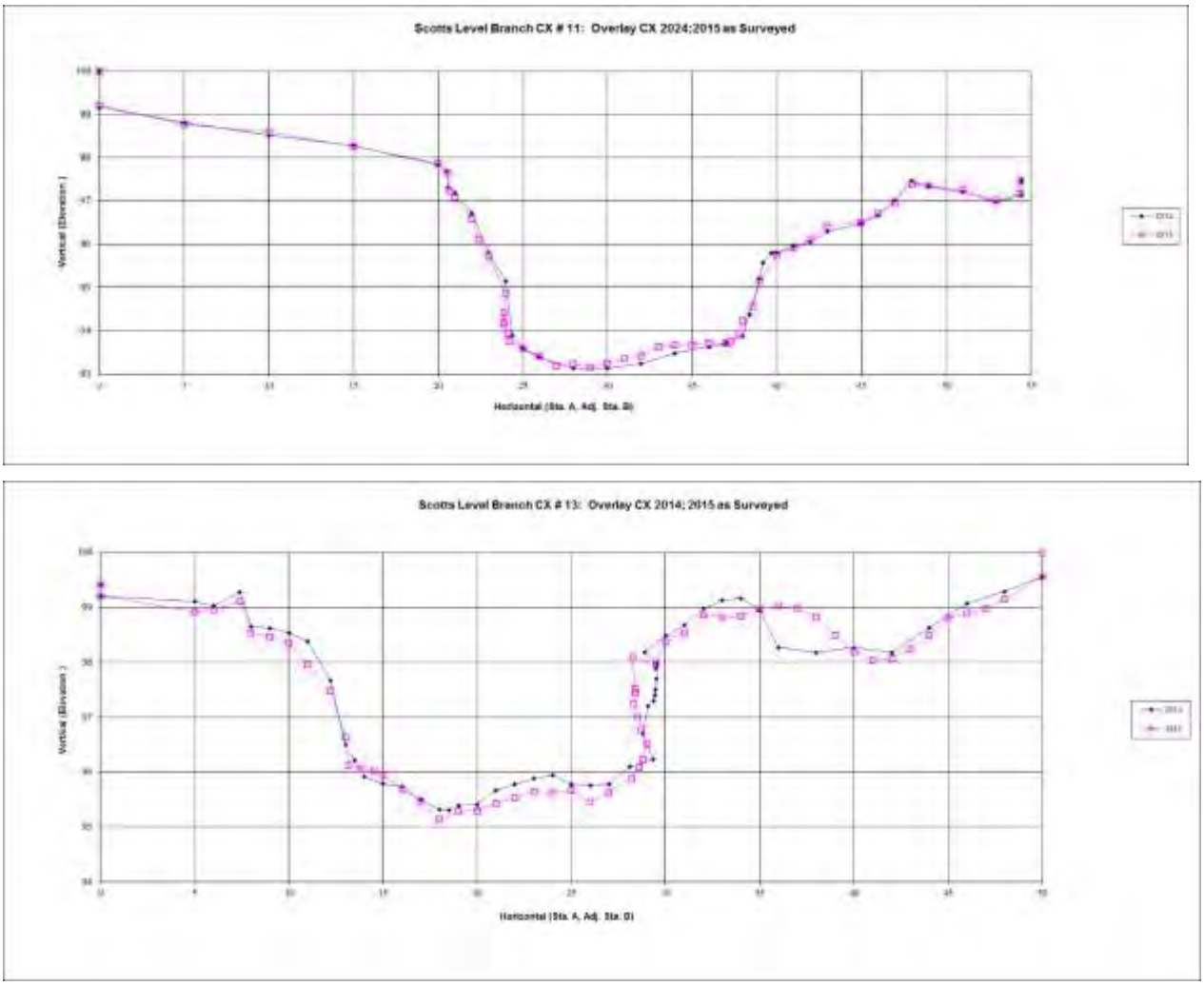


Figure 9-9: McDonogh Road 2014 and 2015 cross-section overlays.

Cross sectional data was collected in the early winter of 2014 and early winter of 2015. The data collected each year, represents the previous year's addition or subtraction of sediment from the cross section. ie. 2014 represents 2013. The 2014-2015 cross-section overlays for (Figure 9-9) show that each reach is typical of urbanized streams: incised and widened channels, and perched floodplains. The cross section upstream of the restoration (SL-13) saw more changes than the downstream cross section (SL-11). The channel continued to lose sediment from the cross section. From 2014-2015 it saw a net change of -5.0 cubic feet of sediment moving out of the cross section. SL 11, which is downstream of the restoration, saw some only a net change of +0.6 cubic feet of being added to the cross section. This may suggest that the McDonogh Restoration is effective at reducing the energy of the high storm flows coming downstream. However, only one year worth of data is not enough to come to the final evaluation of the potential benefit of the Scotts Level restoration on stream channel stabilization.

9.2.3.2 McDonogh Road Biological Monitoring Results

Scotts Level Branch was sampled for benthos and fish at SL-11, SL-11a, SL-12, SL-12a, and SL-13. Five stations were monitored to establish pre-restoration biological condition: SL-11 (downstream of restoration), SL-11a (on main stem within restoration), SL-12 (tributary upstream of confluence to main stem, within restoration), SL-12a (tributary, upstream of restoration and SL-12), and SL-13 (Scotts Level Branch, upstream of restoration). Table 9-12 shows FIBI and PHI values for 2013(pre-restoration) and 2014 (post restoration). All stations had biological communities' characteristic of urban streams. All sites' BIBI scores, except for SL-12 and SL-13, scores improved, but all remained in the Poor Category (Figure 9-10). The BIBI scores tend to remain in the Very Poor and Poor Category prior to restoration. Post restoration resulted in each site's BIBI, except for SL-13 (Upstream of Restoration), scores increased from Very Poor to Poor. All sites' FIBI scores, except for SL-11a and SL-12a, improved, but all remained in the Poor category. The stream restoration has provided more fish habitat resulting in an increase in the FIBI scores. Taxonomic diversity was low, and the organisms present were pollution tolerant. Habitat was degraded or severely degraded.

Table 9-12: FIBI and PHI values for McDonogh Road restoration biological monitoring stations

Station	Year	FIBI	PHI
SL-11	2013	1.67	59
	2014	2.00	57
SL-11a	2013	2.00	58
	2014	2.00	57
SL-12	2013	1.33	56
	2014	2.00	47
SL-12a	2013	1.33	43
	2014	1.33	44

SL-13	2013	1.67	66
	2014	2.00	45

*Unable to sample benthos due to stream restoration construction

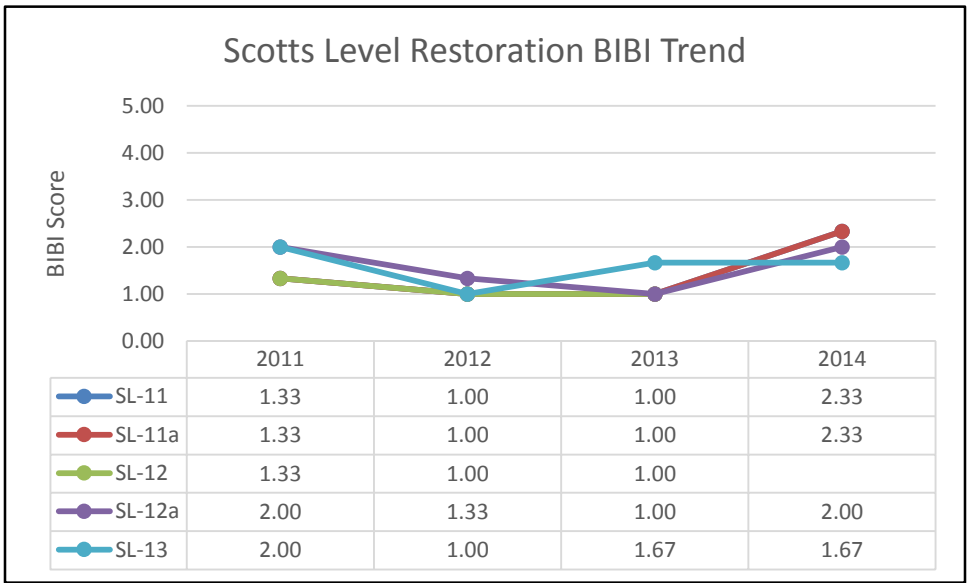


Figure 9-10: BIBI trend Pre and Post Restoration Scores

9.3 Windlass Run Monitoring – Stormwater Management Assessment

Baltimore County's National Pollutant Discharge Elimination System (NPDES) permit requires the monitoring of a subwatershed for geomorphologic impacts resulting from development under the revised Stormwater Management Design Manual (year 2000). In order to comply with this component of the permit, Baltimore County conducted a comprehensive review of the available land for development. An analysis using geographic information systems (GIS) was used for selection of the monitoring subwatershed. The characteristics for determination of the selected subwatershed were:

- 1) an area of open undeveloped land, and
- 2) an area with a zoning category that would lead to development.

Nearly all new development and redevelopment will be affected by the guidelines in the new stormwater design manual, but the denser developments are expected to show a more dramatic change to the stream system. Therefore the study area must have a zoning category of sufficient density to affect the stability of the stream system. The results of a countywide screening, followed by field verification led to the selection of Windlass Run as the monitoring subwatershed.

The Windlass Run subwatershed is 1,926 acres, and has the potential for a large amount of future development. The level of imperviousness in the subwatershed at the beginning of the study was about 3 % and is expected to increase to well over 20%. Much of the undeveloped land is zoned for manufacturing. The development in this subwatershed began after the extension of MD route

43 was completed. This roadway is the primary access to these new properties and is needed for the intense level of development expected in this subwatershed. If this high-density development is not controlled, it is expected to have a severe impact on the water quality and stability of Windlass Run. The protection provided by the new stormwater management regulations should be easily visible through monitoring of the stream conditions.

Windlass Run is a Coastal Plain stream system typified by a stable, low gradient, sinuous, unconfined, silt and sand channel within well-developed floodplains. Average Rosgen bankfull width and corresponding bankfull depths are 10 and 2 feet, respectively. The Windlass Run system is very stable, and there are no areas of moderate or severe streambank erosion. One year of stream gage data was recorded by U.S.G.S. in 1992 – 1993. Well-vegetated stream buffers surround the stream. The upper portion exhibits multiple channels, which are stable and meander through non-tidal wetlands. These conditions are reflective of those described in the Bird River watershed plan that was completed in 1995.

Monitoring in the Windlass Run watershed includes stream geomorphology and biology. The Baltimore County NPDES Municipal Stormwater Discharge Permit only requires the stream stability geomorphic monitoring.

9.3.1 Stream Geomorphic Monitoring

Six (6) monitoring sites in the Windlass Run subwatershed are shown in Figure 9-11 below. The site selection process took into consideration the location of future development and the extension of MD Route 43. Three sites are located along the mainstem: two above (WR-3, WR-5) and one below (WR-2) the crossing of MD Route 43. WR-2 has experienced additional flow of water when a nearby SWM pond is drained into a forest buffer prior to entering the mainstem. This was observed in 2015. One site (WR-4) is on a tributary within the area of proposed industrial and high-density development, and downstream of Route 43. Another cross section (WR-6) is on a tributary within the area of under current residential development. The last cross section (WR1) is a reference site on a tributary near the bottom of the subwatershed. This tributary is within an area zoned for agricultural uses and should not be affected by the other development activities in the watershed.

The geomorphic monitoring consists of a monumented channel cross-section measurement, a channel slope/profile measurement, and a Wolman pebble count. Cross sections were selected on the reach between meander bends and where the conditions best represented confined flow. Profiles were also surveyed at all of the cross section reaches and include the cross sections. The procedures outlined by D. Rosgen (1996) were used for channel classification and stability assessment. The seven cross sections and six profiles have been surveyed annually since 2002. WR-6 is located on a tributary to Windlass Run. Its forest buffer has been cleared away for future development and impervious cover has increased. .

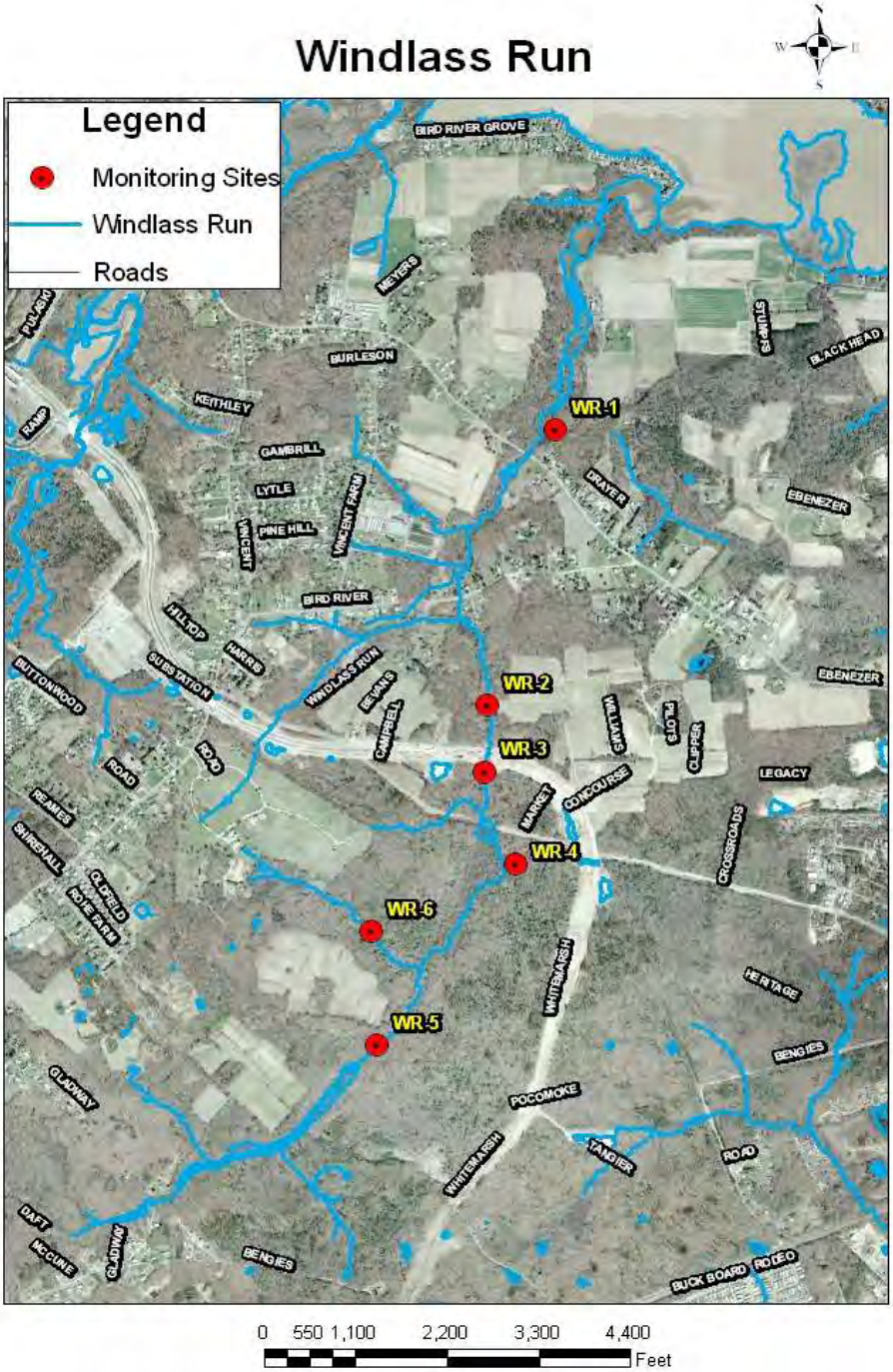


Figure 9-11: Windlass Run Aerial Photograph Showing Monitoring Station Locations.

Figure 9-12 shows the percentage of impervious land cover at each station in 2001, 2005, 2008, and 2011. Figures 9-13 through 9-18 show the progression of development in Windlass Run, from 1995-2014, in years for which orthophotographs were available. Development occurring in the interval between years is summarized below. Changes in geomorphology and biology related

to the land disturbance caused by development are discussed in the results for each monitoring component.

1995 – 2002:

- A small housing development was built 2,850 feet northwest of WR-5.
- Two driveways were cleared 1,520 feet west of WR-2.

2002 – 2005:

- The roadbed for the Route 43 extension was cleared.

2005 – 2008:

- The Route 43 extension was paved.
- A roadway was cleared 2,470 feet southwest of WR-5.
- Land clearing and grading for commercial/industrial complexes occurred 1,330 feet east of WR-6, 95 feet east of WR-2, WR-3, and WR-4, and 380 feet west of WR-1.

2008 – 2011:

- A housing development was graded and built 95 feet west of WR-2.
- A convenience store was built on the previously cleared and graded area south of WR-4. Additional land was cleared and graded in this area.

2011-2014:

- Land was cleared and graded for a housing development west of WR-4.
- Land was cleared and graded for a housing development west of WR-5.

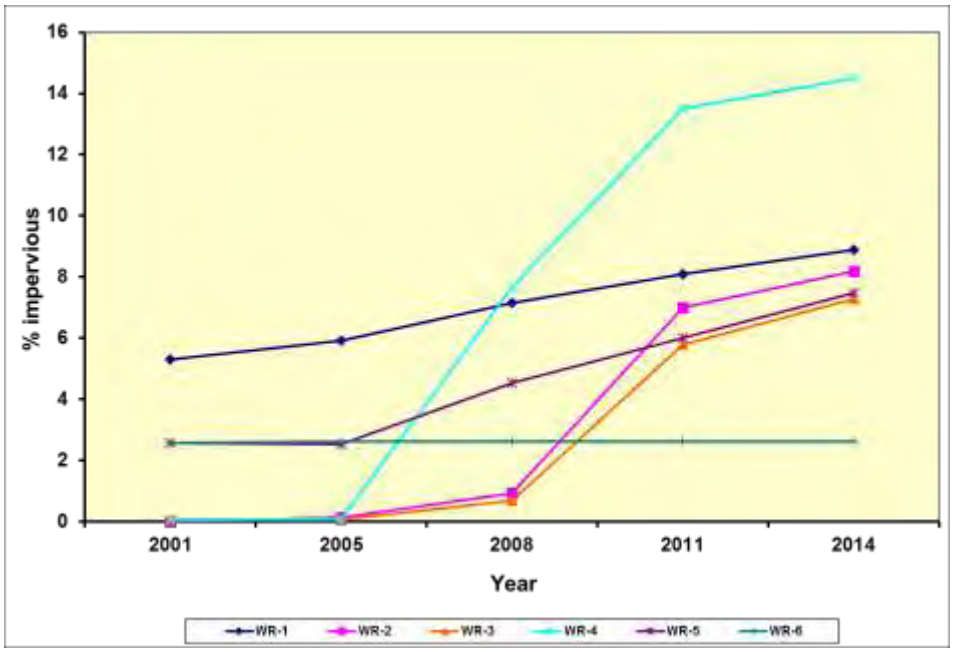


Figure 9-12: Percentage impervious cover in Windlass Run watershed 2001 through 2014

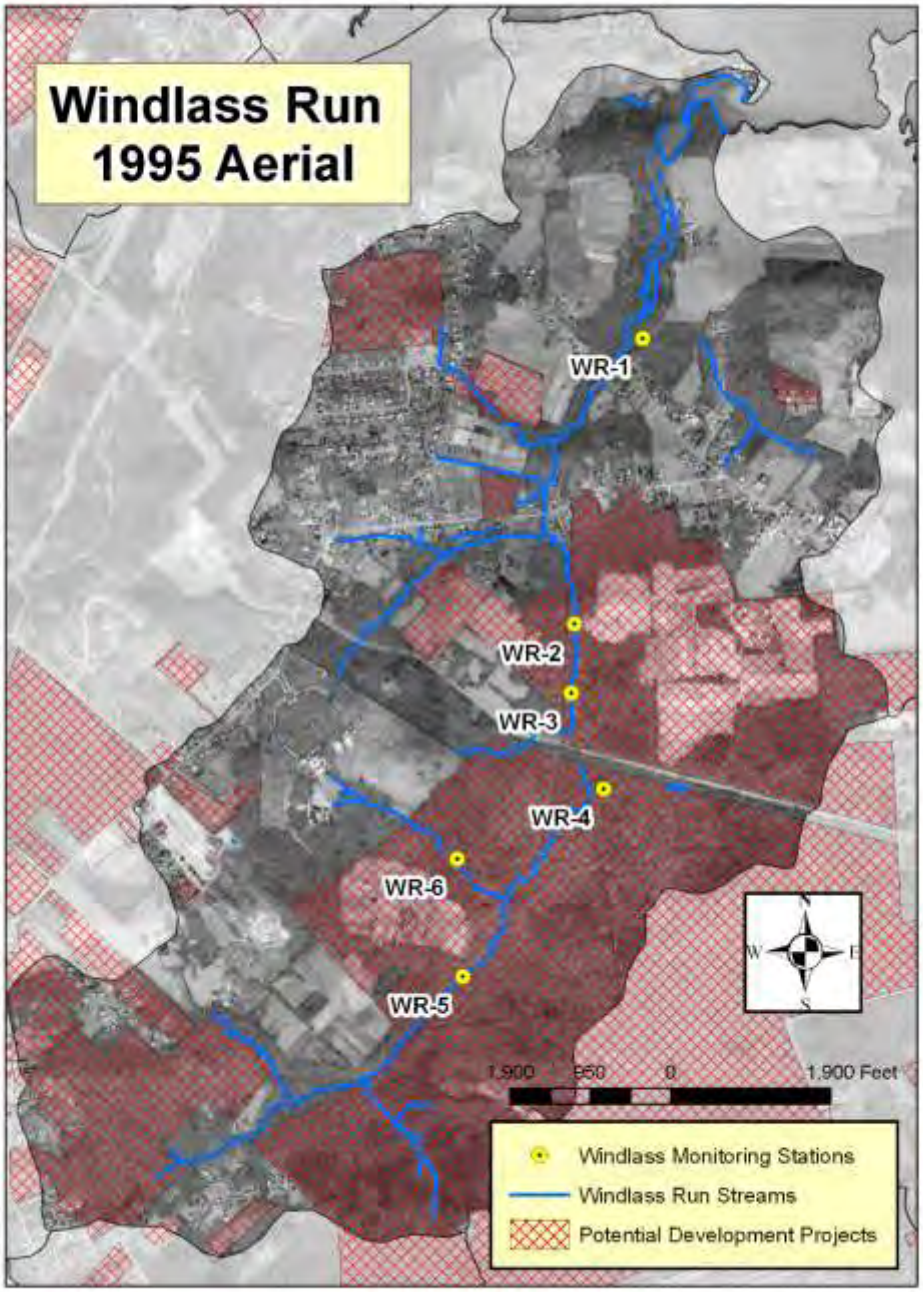


Figure 9-13: Orthophotograph of Windlass Run watershed, 1995, with potential for development highlighted in red cross-hatching.

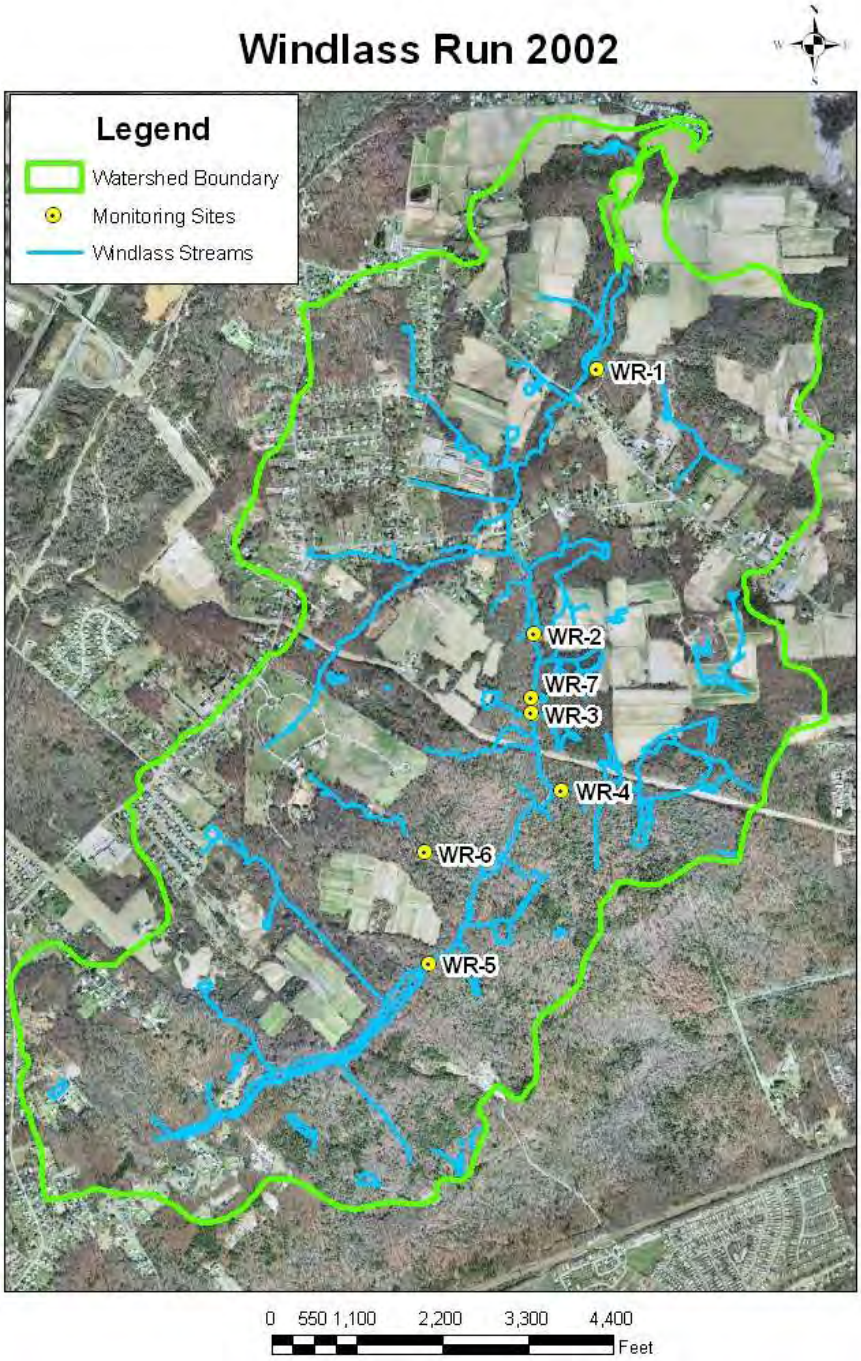


Figure 9-14: Windlass Run watershed orthophotograph, 2002.

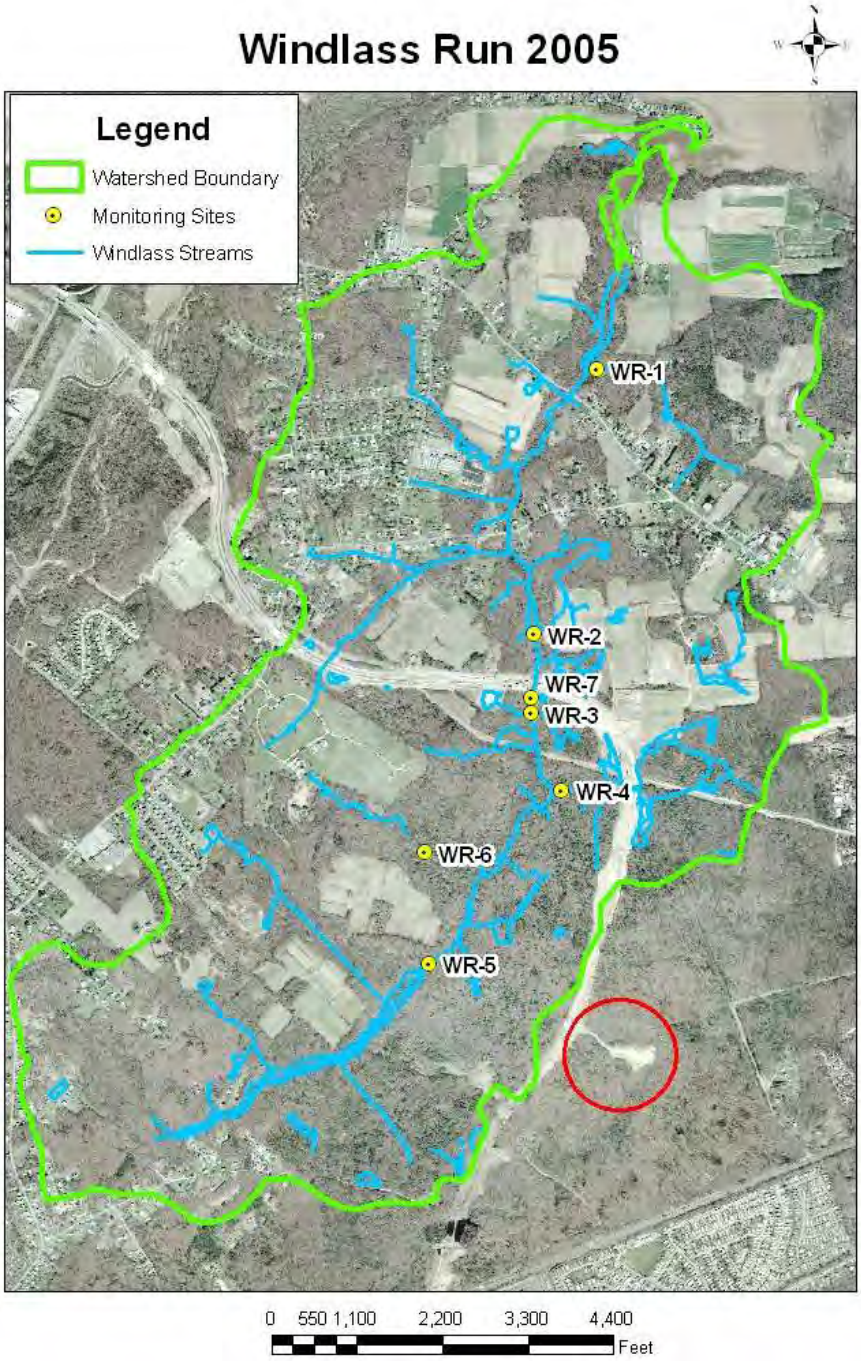


Figure 9-15: Windlass Run orthophotograph, 2005. New development/grading is circled in red.

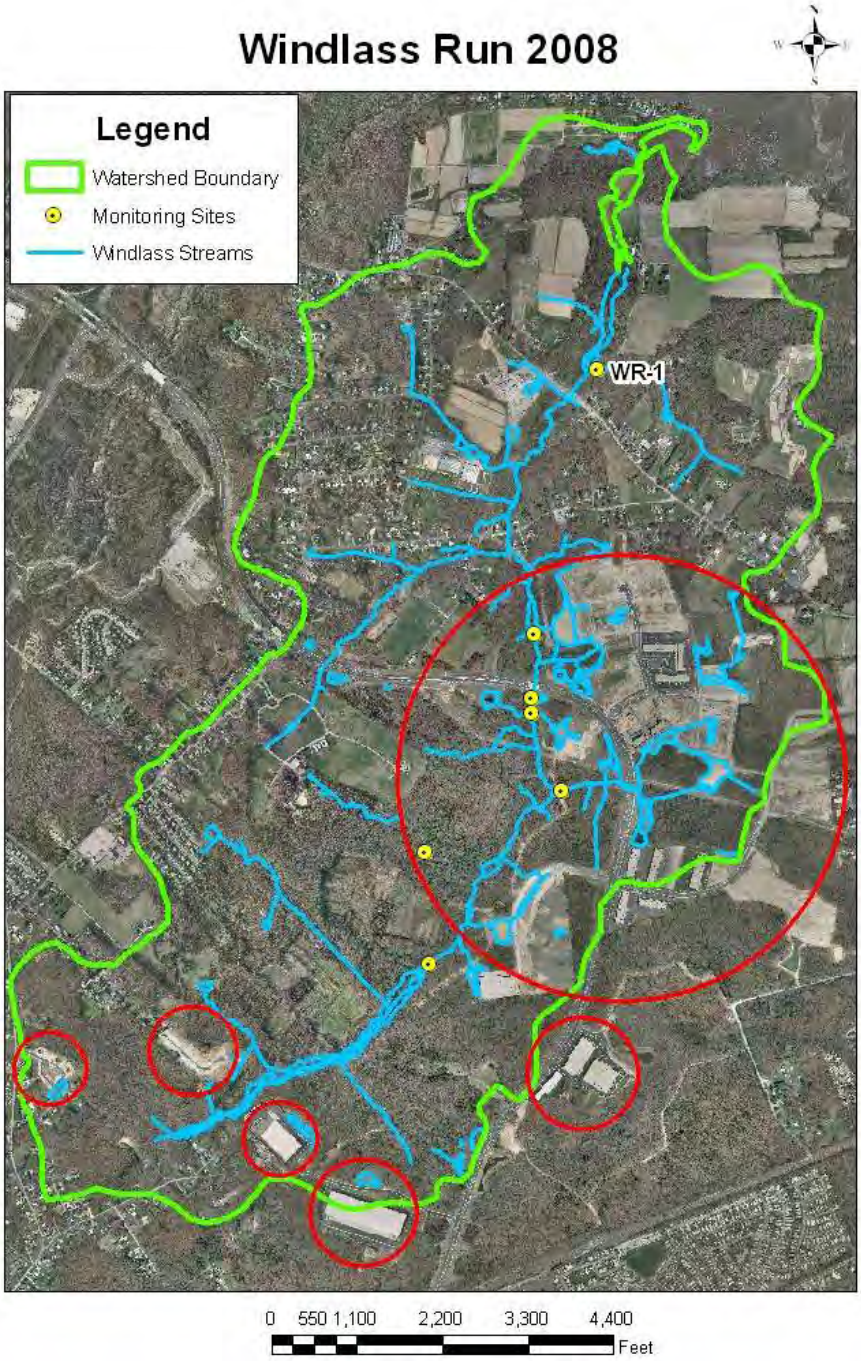


Figure 9-16: Windlass Run orthophotograph, 2008. New development/grading is circled in red.

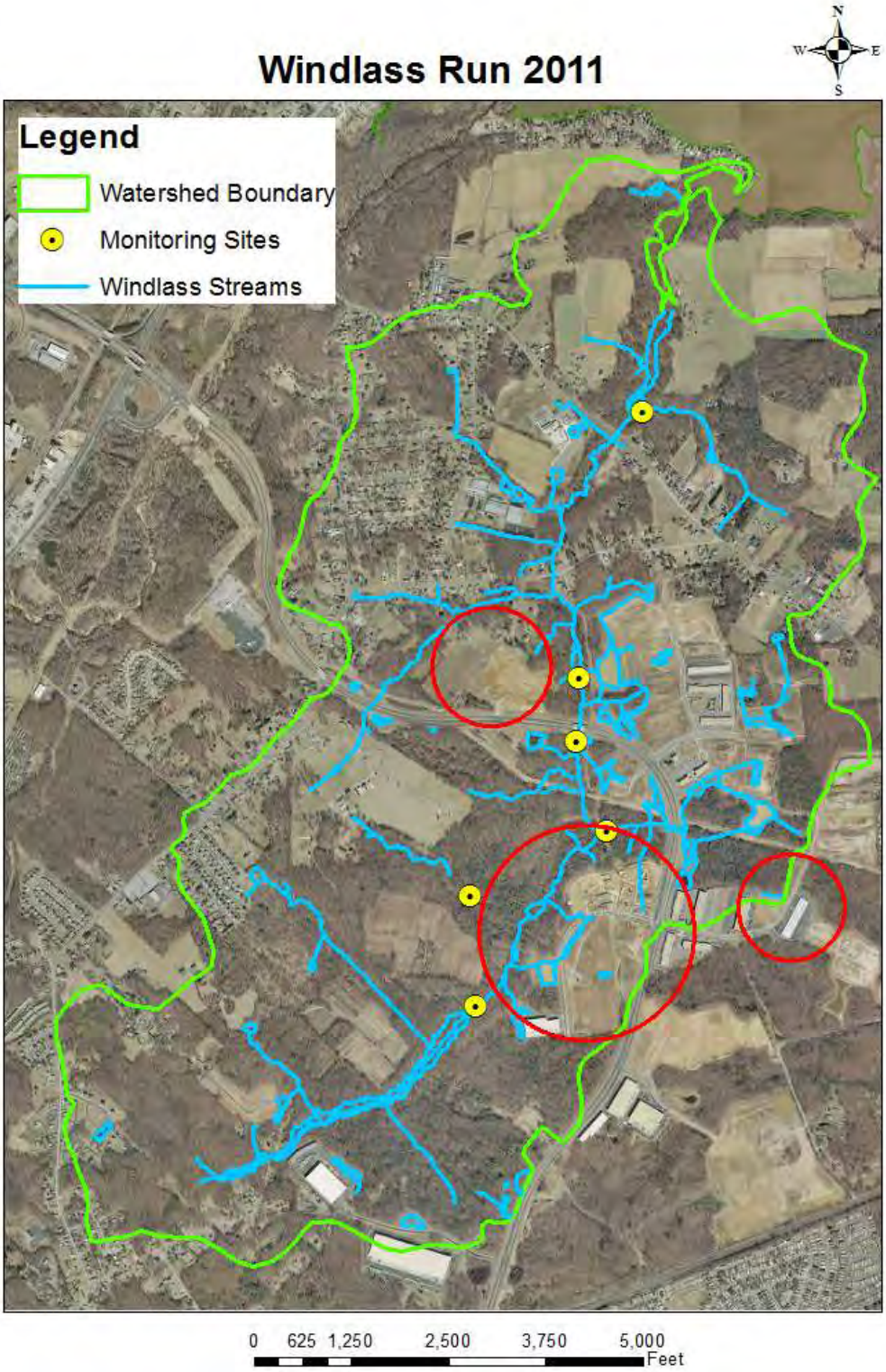


Figure 9-17: Windlass Run orthophotograph, 2011. New development/grading is circled in red.

Figure 9-18: Windlass Run orthophotograph, 2014. New development/grading in red

9.3.2 Windlass Run Monitoring Results

The Windlass Run stream channels are beginning to show changes which may be related to development. The Significant increases in impervious cover occurred between 2008 and 2014 at WR-2, WR-3, and WR-4. WR-2 saw the most movement of all the cross sections (Table 9-13). This is the most downstream cross section on Windlass Run. The SWM pond water is pumped into a forested buffer where the water runs downhill then flows into the stream. The flow has created a channel which then enters upstream of WR-2. The draining of a SWM pond and the increase in impervious cover in the vicinity may account for the loss of over 6 cubic feet of sediment. WR-6 is located on a tributary to Windlass Run. Its forest buffer has been cleared away for future development and impervious cover has increased. The loss of buffer may have caused the tributary to make a 90 degree turn whereas the channel is now running parallel to the cross section. Once the development of the area around WR-6 has been completed, new monuments will be installed. If the changes are short-term, natural responses to precipitation continued monitoring will show a return toward stability at the affected stations. If the streams in Windlass Run are adjusting to a new hydrologic regime caused by increased impervious cover, the geomorphic measurements will show increased instability. Continued monitoring is warranted to verify that these changes are being caused by development

Table 9-13: Windlass Run Cross Sections - Annualized Cut and Fill Amounts

WR 1:Change (cu ft)	Period:2014-2015	WR 2:Change (cu ft)	Period:2014 -2015	WR 3:Change (cu ft)	Period:2014 -2015
Total Cut	-6.0	Total Cut	-6.6	Total Cut	-3.8
Total Fill	0.0	Total Fill	3.1	Total Fill	1.0
Total Change	-6.0	Total Change	-3.6	Total Change	-2.8
Net Change	6.0	Net Change	9.7	Net Change	4.9
WR 4:Change (cu ft)	**Period:2014-2015**	**WR 5:Change (cu ft)**	**Period:2014 -2015**	**WR 6 * :Change (cu ft)**	**Period:2014 -2015**
Total Cut	-0.6	Total Cut	-0.6	Total Cut	0.0
Total Fill	2.4	Total Fill	2.2	Total Fill	3.6
Total Change	1.8	Total Change	1.6	Total Change	1.0
Net Change	2.9	Net Change	2.8	Net Change	4.6
WR 7:Change (cu ft)	**Period:2014-2015**				
Total Cut	-0.1				
Total Fill	2.5				
Total Change	2.4				
Net Change	2.7				

*WR-6 right bank pin is now located in the stream channel

9.3.2.1 Biological Monitoring

Benthic macroinvertebrates are being used as indicator organisms to monitor the effects of disturbance in the Windlass Run watershed. The condition of the benthic macroinvertebrate

community before and after development will help determine the effectiveness of the new stormwater regulations at maintaining the suitability of Windlass Run for aquatic life.

Benthic macroinvertebrate sampling was conducted as per MBSS protocols. Benthic macroinvertebrates were sampled annually, during the spring index period (March 1st - April 30th), at WR-1, WR-2, WR-3, WR-4, and WR-5. WR-1 was not sampled in 2004 and 2006 because a beaver dam downstream of the station, on the Windlass Run mainstem, was causing backwater effects within the station reach. Data for WR-1 from 2005 are missing because the sorted sample had dried before it could be identified. A Benthic Index of Biotic Integrity (BIBI) was calculated using metrics developed by MBSS for Coastal Plain streams (Figure 9-19). The BIBI scoring criteria are: 1.00-1.99 (Very Poor), 2.00-2.99 (Poor), 3.00-3.99 (Fair), and 4.00-5.00 (Good). Physical habitat assessments performed during benthic sampling were converted to a physical habitat index (PHI) developed by MBSS (Figure 9-20). The PHI scoring criteria are: 81-100 (minimally degraded), 66-80 (partially degraded), 51-65 (degraded), and 50 or less (severely degraded).

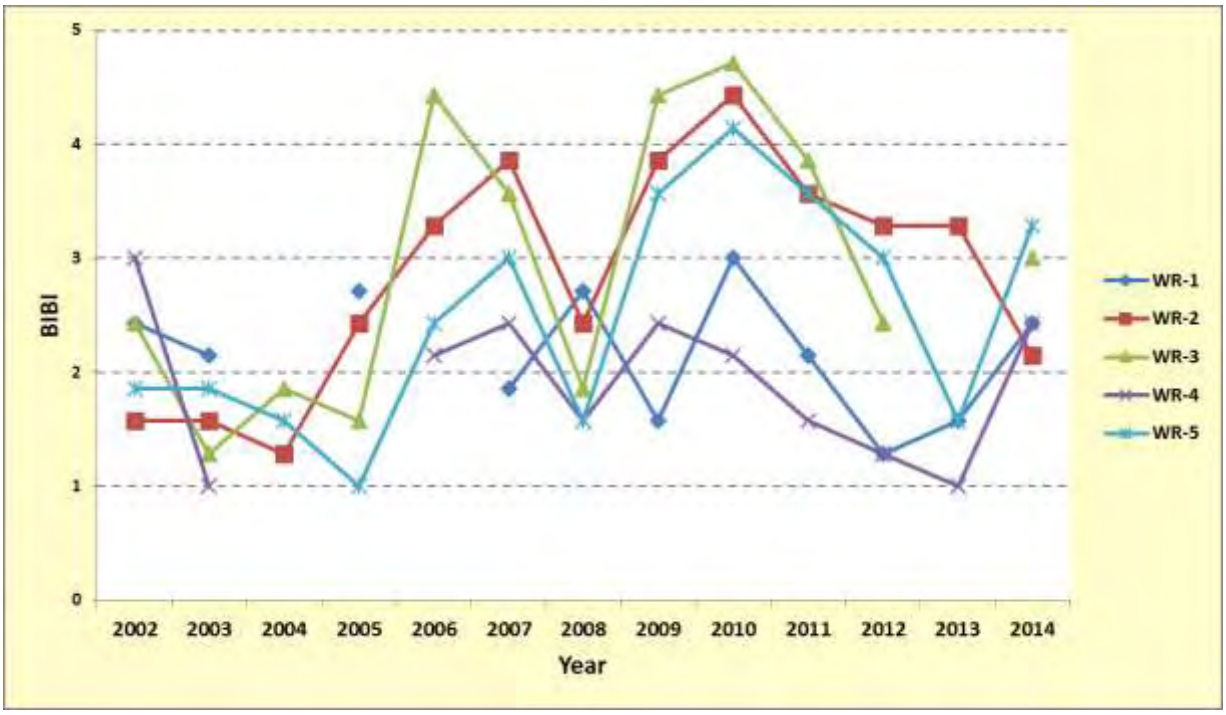


Figure 9-19: Windlass Run BIBI Scores

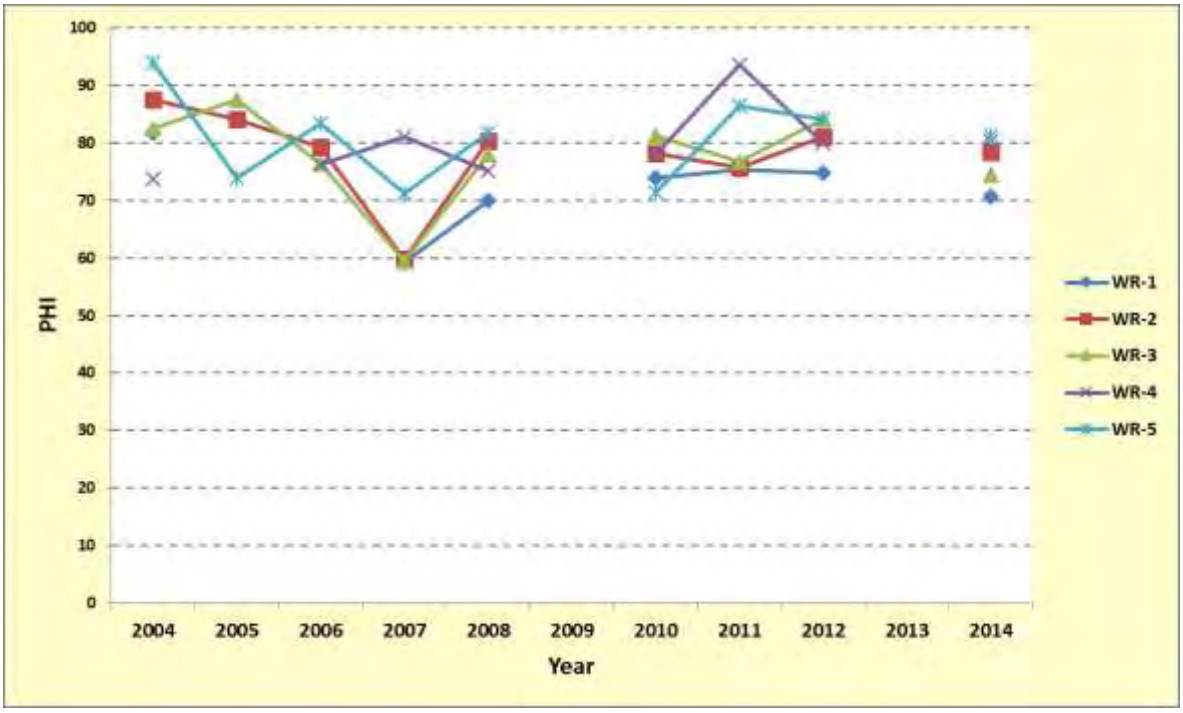


Figure 9-20: Windlass Run PHI Scores from 2004-2014

BIBI values continue to fluctuate between years. The BIBI score for WR-1, WR-3, WR-4, and WR-5 rebounded from the previous year, except for WR-2 which slightly decreased. WR-2 is the most downstream station, and it is likely that its benthic community condition reflects the effects of storm flows exacerbated by increased impervious surface. Table 9- 14 displays the 2014 BIBI scores compared to the previous year's BIBI score.

Table 9-14: Windlass Run BIBI Scores from 2013 and 2014

Station	Year	BIBI
WR-1	2013	1.57
	2014	2.43
WR-2	2013	3.29
	2014	2.14
WR-3	2013	*
	2014	3.00
WR-4	2013	1.00
	2014	2.43
WR-5	2013	1.57
	2014	3.29

* WR-03 was not sampled in 2013 due to staff constraints

No dramatic changes occurred at any of the monitoring stations immediately after development began, most likely due to stormwater regulations and maintenance of wide stream buffers.

9.4 Countywide Monitoring

9.4.1 Chemical Monitoring Program

In order to determine the condition of Baltimore County waters a trend chemical monitoring program has been implemented. The trend chemical monitoring program is intended to provide information on ambient chemical conditions and, over time, to assess trends in both chemical concentrations and chemical loads. The information will be used to better target restoration activities, to provide data for the calibration of pollutant load models, and to provide local data to assess the results of the Chesapeake Bay Program modeling efforts and TMDL modeling. The data will be used to assess water quality improvements that are the result of restoration efforts. It will also be used to determine progress in meeting the pollutant load reductions required by the Chesapeake Bay restoration efforts and as determined by the development of local watershed Total Maximum Daily Loads (TMDLs). These programs will partially fulfill the restoration effectiveness monitoring required under NPDES Permit section F.1 and H above.

9.4.1.1 Trend Monitoring

The Trend Monitoring Program was initiated in January 2011. Forty-one sites were selected throughout Baltimore County (Figure 9-21). Sites were primarily chosen where there are USGS gaged stations, which provides a good record of discharge at 15 minute intervals with the data QA/QC'd by experts. In watersheds where there was a lack of gages stations, sites were still selected but are measured manually for discharge. All sites are visited once a month approximately on the same day, regardless of weather. This will give us a better picture of the stream health and increase the number of samples per site to 12 per year. This sampling design will permit calculations of pollutant loads from each site. The standard set of monitored pollutants includes (TSS, TS, TKN, Nitrate/Nitrite, Total Phosphorus, Ortho-phosphorus, Cadmium, Copper, Lead, Zinc, BOD, COD, Chlorides, Sodium, Hardness, Magnesium and Calcium) as well as temperature and pH determined in *situ*. For 2014, most sites were sampled twelve times, once per month. A new site on Long Quarter Branch, named LR41, was added near the end of 2013 and its results have been added to Table 9-15.

9.4.1.2 Pollutant Load Calculations

Pollutant loads were calculated for each site (Table 9-15). Data from the USGS gages were recorded at 5 or 15 minute intervals. If a site was not gaged a correlation was run with gaged sites within the county, and using the gage with the highest correlation coefficient, a discharge record was created. The regression equations determined from the trend samples, relating pollutant concentration to discharge, were used to determine the pollutant concentration for each interval. All below detection limit chemical data were removed before analysis. From this data the load was calculated for each 15-minute interval using the following formula:

$P_L = (P_C*.000008345)*(CFS*448.8*I)$, where

P_L = Pollutant Load,
P_C = Pollutant Concentration,
.000008345 = Conversion factor to convert mg/L to pounds per gallon,
CFS = Cubic feet per second,
448.8 = Conversion factor to convert cubic feet per second to gallons per minute
I = number of minutes in the interval (5 or 15).

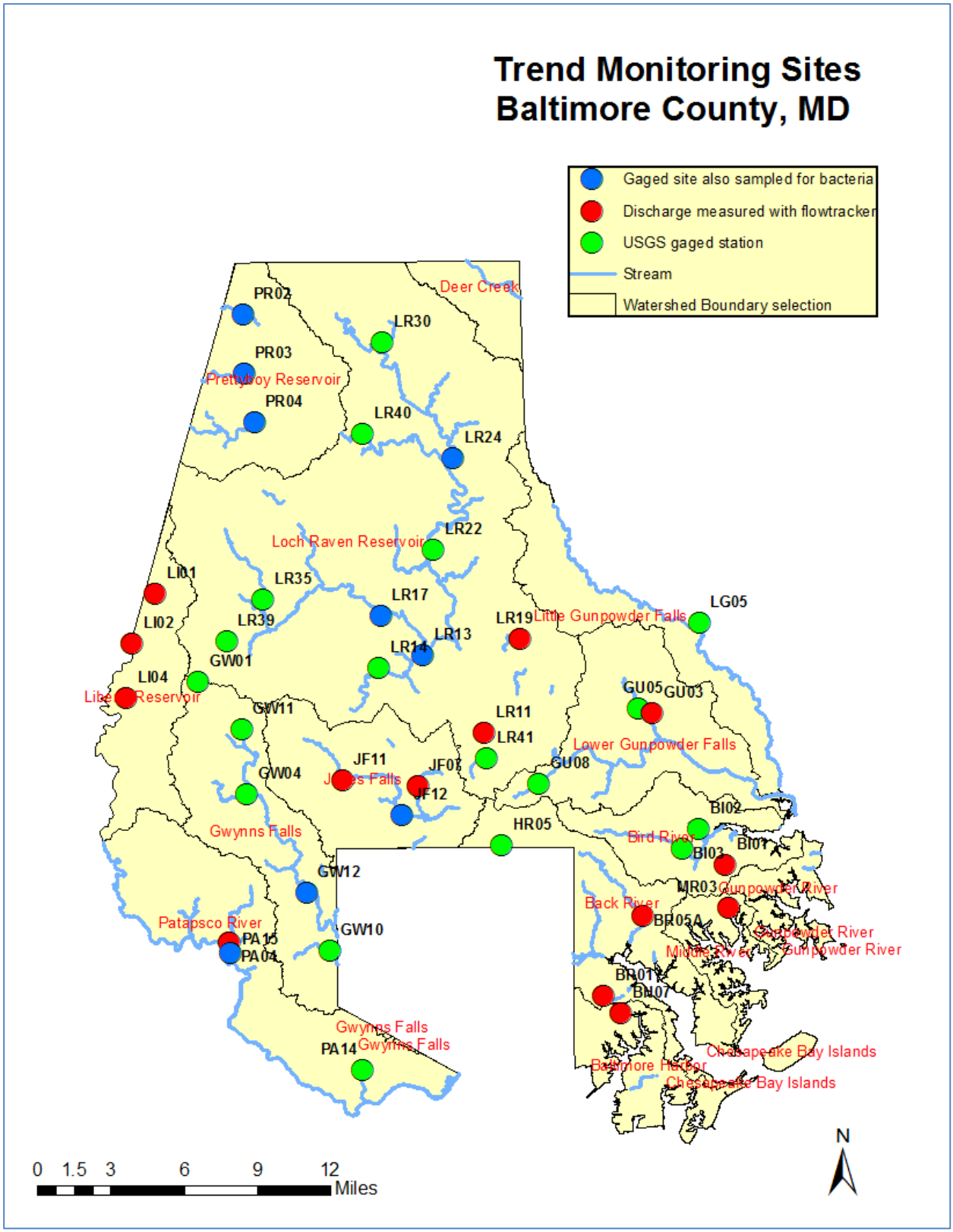


Figure 9-21: Trend Monitoring Sites

Table 9-15: Pollutant Load Analysis (lbs) 2014						
Site	Total Suspended Solids	Nitrate/ Nitrite	Total Nitrogen	Total Phosphorus	Chloride	Sodium
Prettyboy Reservoir						
PR02	2,225,326.7	260,377.1	177,359.8	7,964.4	1,782,232.3	831,843.6
PR03	463,042.5	77,781.0	98,865.7	3,362.2	509,827.5	267,971.1
PR04	840,956.8	201,165.7	120,189.4	4,038.1	1,752,645.7	818,402.1
Loch Raven Reservoir						
LR11	12,264.2	8,677.7	9,452.9	611.5	361,904.6	115,429.8
LR13	1,295,215.9	168,521.0	164,812.1	14,670.2	9,070,525.7	4,192,300.3
LR14	7,283.5	5,930.8	6,389.8	219.5	131,380.4	46,028.2
LR17	2,820,763.0	553,222.7	373,655.0	23,917.4	5,545,794.4	2,485,841.6
LR19	10,376.0	13,420.1	12,169.9	485.7	261,145.9	110,666.0
LR22	10,376.0	13,420.1	12,169.9	485.7	261,145.9	110,666.0
LR24	4,540,869.0	632,306.4	379,641.7	15,995.6	6,803,162.9	2,880,184.7
LR30	82,062.8	107,199.4	88,078.1	1,693.9	1,579,624.4	681,703.4
LR35	724,619.0	141,215.6	114,364.6	29,490.9	1,212,563.4	646,984.1
LR39	175,152.8	7,809.7	10,358.1	2,258.0	87,373.5	38,437.5
LR40	785,650.2	534,727.8	373,997.7	10,429.9	12,868,810.7	2,950,466.2
LR41	40,378.8	10,985.5	17,742.4	1,007.9	917,561.1	925,587.2
Liberty Reservoir						
LI01	51,815.3	30,173.5	27,719.5	894.9	227,402.9	70,740.5
LI02	46,761.3	15,237.7	18,445.1	1,038.2	453,451.2	145,053.9
LI04	36,572.7	10,621.1	19,116.8	2,464.9	377,061.1	104,586.1
Little Gunpowder						
LG05	761,478.1	355,792.4	248,275.7	13,195.6	3,143,993.3	1,428,353.2
Lower Gunpowder						
GU03	62,044.0	27,345.5	24,006.7	2,235.1	236,153.2	92,356.0
GU05	532,074.3	100,418.8	72,175.2	18,737.6	957,466.1	336,517.6
GU08	61,214.4	8,193.5	10,776.1	470.3	845,614.4	738,470.8
Gwynns Falls						
GW01	10,192.1	1,127.5	2,284.9	98.9	226,173.4	186,887.1
GW04	28,159.8	8,784.3	11,038.2	521.4	803,115.6	414,706.0
GW10	17,548.2	18,902.5	47,528.6	4,176.7	3,436,310.5	1,288,643.8
GW11	997,419.8	18,331.7	27,589.2	2,421.4	989,437.5	428,275.8
GW12	5,335,815.5	113,328.8	122,299.9	6,820.0	8,955,272.8	3,920,700.5
Jones Falls						
JF07	27,013.3	14,188.2	14,314.1	628.1	998,321.8	439,200.9
JF11	62,580.3	44,326.7	43,793.8	1,821.8	1,156,355.8	449,103.7
JF12	2,093,340.6	161,693.0	20,026.3	25,748.2	7,294,354.4	4,346,366.6
Bird River						
BI01	31,155.7	937.4	2,561.7	367.7	115,365.4	55,666.8
BI02	140,479.6	7,429.9	12,730.2	2,621.7	772,984.3	460,302.6
BI03	826,636.8	18,262.5	35,588.5	9,192.5	4,103,963.7	1,697,352.4

Back River						
BR01	37,923.7	3,144.7	2,609.3	517.7	169,666.5	80,667.5
BR05A	541,878.8	20,248.8	20,015.1	1,446.2	4,211,755.9	1,650,528.0
HR05	135,480.0	10,271.5	12,987.3	590.7	601,670.4	590,907.0
Middle River						
MR03	10,140.4	903.9	1,641.5	109.4	216,211.0	108,112.7
Patapsco River						
PA04	25,587.0	10,501.6	13,399.2	766.1	729,686.4	316,797.0
PA14	228,493.8	9,734.1	20,963.2	1,889.5	582,026.8	353,820.3
PA15	9,024,934.3	1,264,457.9	1,073,686.6	80,806.3	22,896,545.7	12,367,421.7
Baltimore Harbor						
BH07	4,492.9	739.2	1,254.6	144.8	86,548.1	33,653.6

Site PA-15 located on the mainstem of the Patapsco River is the highest across all parameters, which also has the greatest drainage area. Figure 9-22 and 9-23 are maps that show the total nitrogen and total phosphorus mean concentrations. As can be seen from Figure 9-22, the highest concentrations of total nitrogen are found outside the URDL. In the rural areas these increased total nitrogen concentrations may be the result of agricultural activities, septic system inputs, or a combination of both. In the urban areas the high concentrations are most likely from fertilizer, pet waste and point sources entering the streams through outfalls. The majority of Total Phosphorus is delivered during storm events, associated with sediment. The very high at the sites outside the URDL may be associated with farming and land use change from forest to residential; the predominant land use is cropland, forest and low density residential.

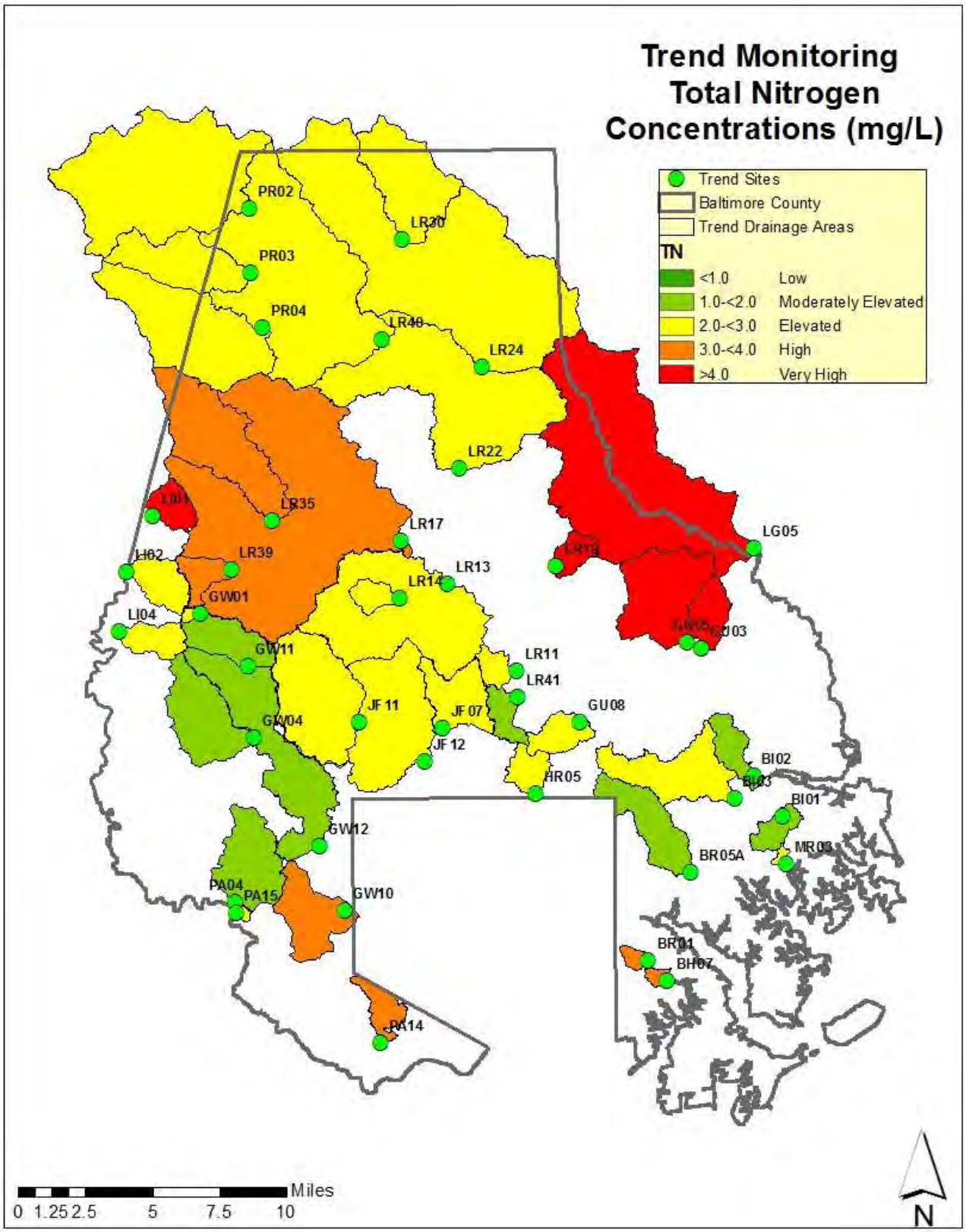


Figure 9-22: Trend Total Nitrogen Mean Concentrations for Monitoring Year 2014.

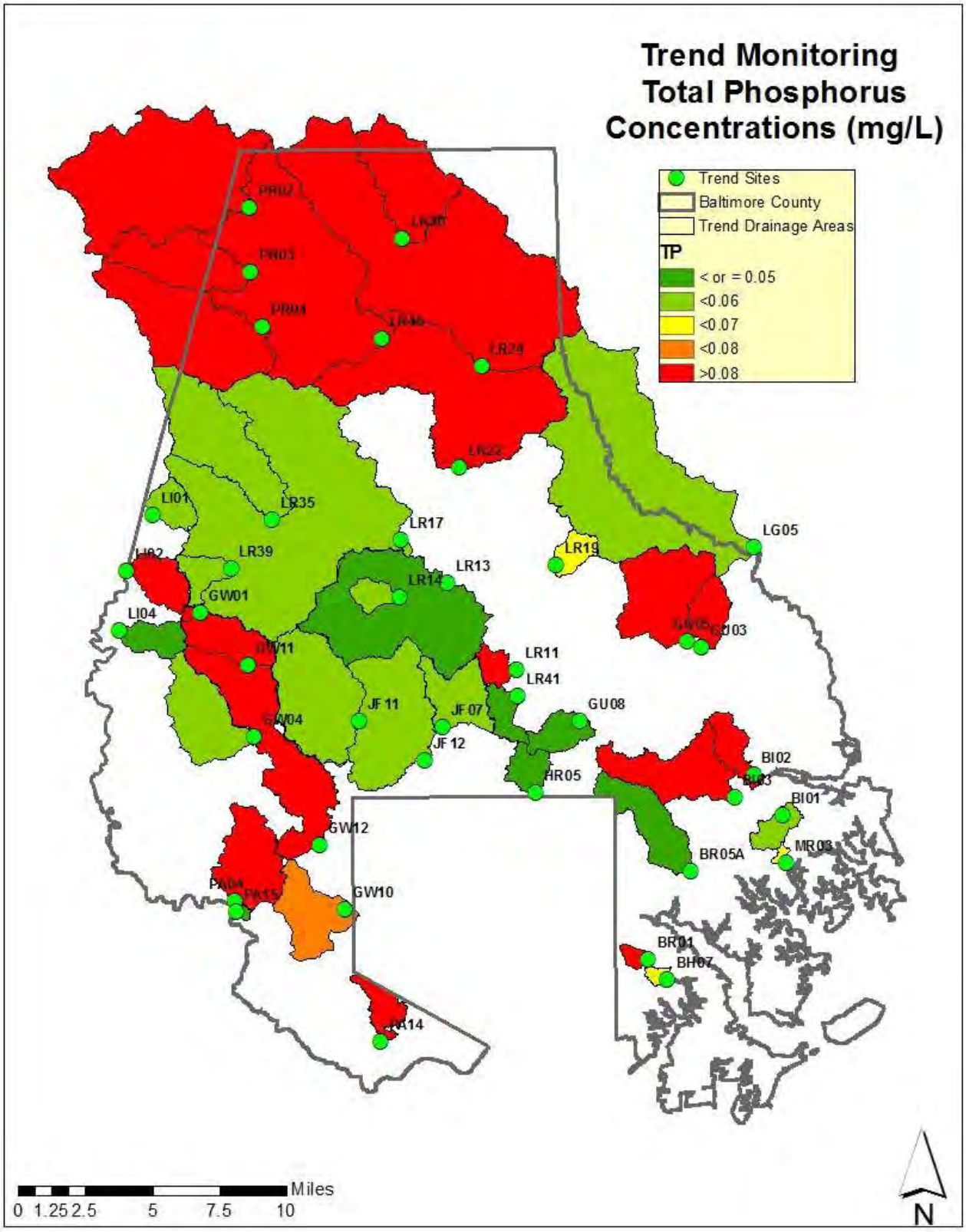


Figure 9-23: Trend Total Phosphorus Mean Concentrations for Monitoring Year 2014.

9.4.2 Bacteria TMDL Monitoring

Baltimore County EPS has coordinated with Baltimore City Surface Water Management Division, and Carroll County Department of Land Use, Planning, and Development to monitor trend over time levels of bacteria at 32 monitoring locations within 1 subwatershed and 6 major watersheds. This program was developed in response to the development of bacteria TMDLs in Herring Run, Gwynns Falls, Loch Raven, Prettyboy, Jones Falls, Liberty Reservoir, and Patapsco. Bacteria monitoring began in June 2010, with 20 sites in Baltimore County, and 7 sites in Baltimore City and 5 sites in Carroll County. Figure 9-24 shows the locations of the sites. These are the sites used by Maryland Department of the Environment in developing the bacteria TMDL.

In 2014 Baltimore County developed TMDL Implementation Plans for the 7 bacteria impairments in Baltimore County waters along with 15 additional TMDL Implementation Plans for other water quality impairments. These plans are being submitted along with the annual report. Future bacteria monitoring, to commence in 2015, is detailed in the bacteria TMDL Implementation Plans. The Bacteria Trend monitoring, as detailed in this report, will be expanded to add additional monitoring locations where streams cross the city/county line and for subwatersheds included in the bacteria TMDL for which there were no corresponding monitoring stations (Redhouse Run). Two additional bacteria monitoring programs will be initiated; the Bacteria Subwatershed Prioritization Program and the Reach Source Tracking Program. These programs are designed to narrow the focus to the subwatersheds exhibiting bacteria contamination and locating the bacteria sources, respectively. Next year's report will include the calendar year 2015 Bacteria Trend Monitoring Program results. The results from the two new bacteria monitoring programs will not be included until the 2016 annual report, as the monitoring results are reported on a calendar year basis. From this point forward the results will be reported on a watershed basis.

In 2015, eight new trend sites were added to more directly assess how the portions of impacted watersheds in Baltimore County contributed to the total bacterial load observed at the bottom of the watershed located in Baltimore City. Two trend sites were added to the Gwynns Falls watershed, two to the Jones Falls, and four to the Herring Run portion of the Back River watershed. Table 9-16 lists the locations and descriptions of the new trend sites added in 2015.

Table 9-16 New Bacteria Trend Sites added in 2015

Station Code	Subwatershed	Monitoring Type	Latitude	Longitude
DR-B-10	Dead Run	New Trend	39.304	-76.712
GF-B-8	Gwynns Falls – mainstem	New Trend	39.322	-76.712
JF-B-12	Western Run – East Branch	New Trend	39.373	-76.668
JF-B-13	Western Run – West Branch	New Trend	39.372	-76.708
HR-B-12	East Branch – Herring Run	New Trend	39.369	-76.574
HR-B-13	West Branch – Herring Run	New Trend	39.371	-76.583
HR-B-14	Unnamed Trib to Redhouse Run	New Trend	39.316	-76.518
HR-B-15	Redhouse Run	New Trend	39.317	-76.518

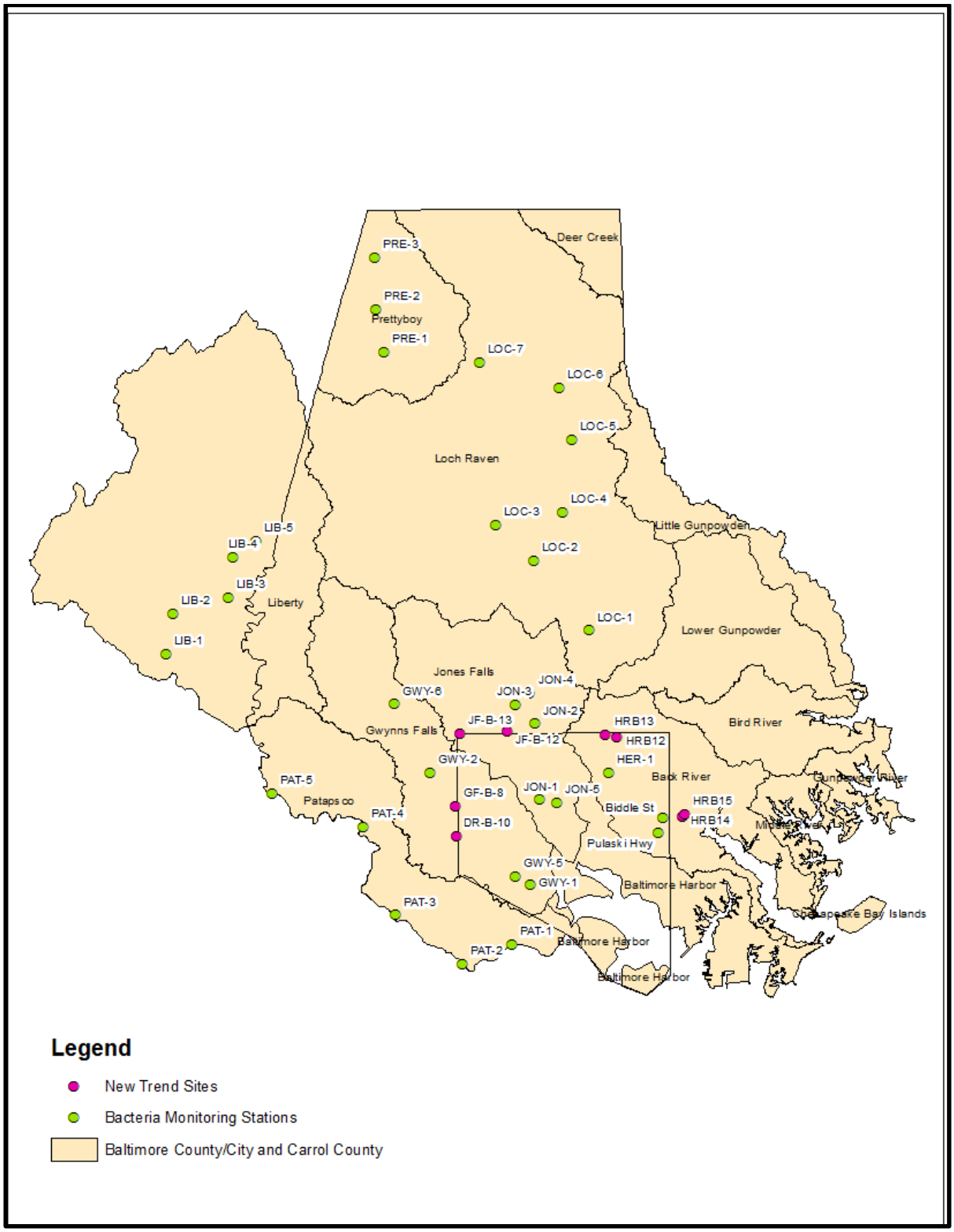


Figure 9-24: Map of Bacteria TMDL Monitoring Stations

9.4.2.1 Monitoring Protocol

Samples are collected on the first Thursday of every month, regardless of weather conditions. Using sterile sample containers containing sodium thiosulfate, 100mL of water is collected and is kept in a cooler with ice until analyzed.

The samples are analyzed for E. coli using IDEXX procedures and equipment including Colilert-18 and Quanti-Tray/2000, and are read after 18-22 hours of incubation. Results are given in Most Probable Number (MPN), which is an estimate based on the number of organisms present per sample.

Dilutions are done on samples that are taken during or after heavy rains, or at sites with chronically high levels of bacteria, so that the sample reading is within the limit of detection for the analysis (between 1 MPN and 2419.6 MPN).

9.4.2.2 Results

Prettyboy Reservoir

Table 9-17 shows the latitude/longitude locations of the current bacteria monitoring stations within the Prettyboy Reservoir watershed. The monitoring locations are on major tributaries to the Prettyboy Reservoir, with the majority of the drainage area in Carroll County.

Table 9-17 Baltimore County Bacteria Monitoring Station Locations

MDE Station Code	County Code	Watershed	Latitude	Longitude
PRE-1	GOB0042	Georges Run	39.626	-76.773
PRE-2	GRG0013	Grave Run	39.655	-76.779
PRE-3	GUN0476	Gunpowder Falls	39.689	-76.781

Table 9-18 presents the number of samples and the geometric mean for high (wet) flow and low (dry) flow by year. It also presents the geometric mean of all samples by year regardless of condition. The table is stratified by annual data (includes all data collected for the year) and seasonal data (includes only those samples collected between May 1st and September 30th each year. Geometric means that meet the water quality standard (126 MPN) are highlighted in green. These data are displayed graphically in Figures 9-25 through 9-27.

Table 9-18 Prettyboy Reservoir Watershed *E. coli* Results on an Annual and Seasonal Basis

Annual (MPN/100 ml)											
Site	Flow Type	2010		2011		2012		2013		2014	
		N	MPN	N	MPN	N	MPN	N	MPN	N	MPN
PRE-1	High	2	446	4	585	3	222	1	1300	4	1087
	Low	5	555	8	98	9	225	9	45	8	170
	All	7	521	12	178	12	225	10	63	12	329
PRE-2	High	2	595	4	165	3	165	2	105	4	750
	Low	5	229	8	80	9	80	9	33	8	73
	All	7	301	12	131	12	96	11	41	12	168
PRE-3	High	2	393	4	813	3	1434	3	104	4	831
	Low	5	359	8	136	9	135	9	67	8	213
	All	7	368	12	247	12	244	12	74	12	346

Seasonal (May 1st to September 30th) (MPN/100 ml)						
Site	Flow	2010	2011	2012	2013	2014

	Type	N	MPN	N	MPN	N	MPN	N	MPN	N	MPN
PRE-1	High	0		2	968	1	121	1	1300	2	1293
	Low	4	707	3	254	4	546	4	127	3	294
	All	4	707	5	431	5	350	5	203	5	531
PRE-2	High	0		2	743	1	59	1	186	2	1151
	Low	4	372	3	163	4	198	4	44	3	140
	All	4	372	5	299	5	155	5	59	5	326
PRE-3	High	0		2	778	1	2420	1	326	2	2420
	Low	4	415	3	615	4	176	4	74	3	335
	All	4	415	5	676	5	298	5	99	5	740

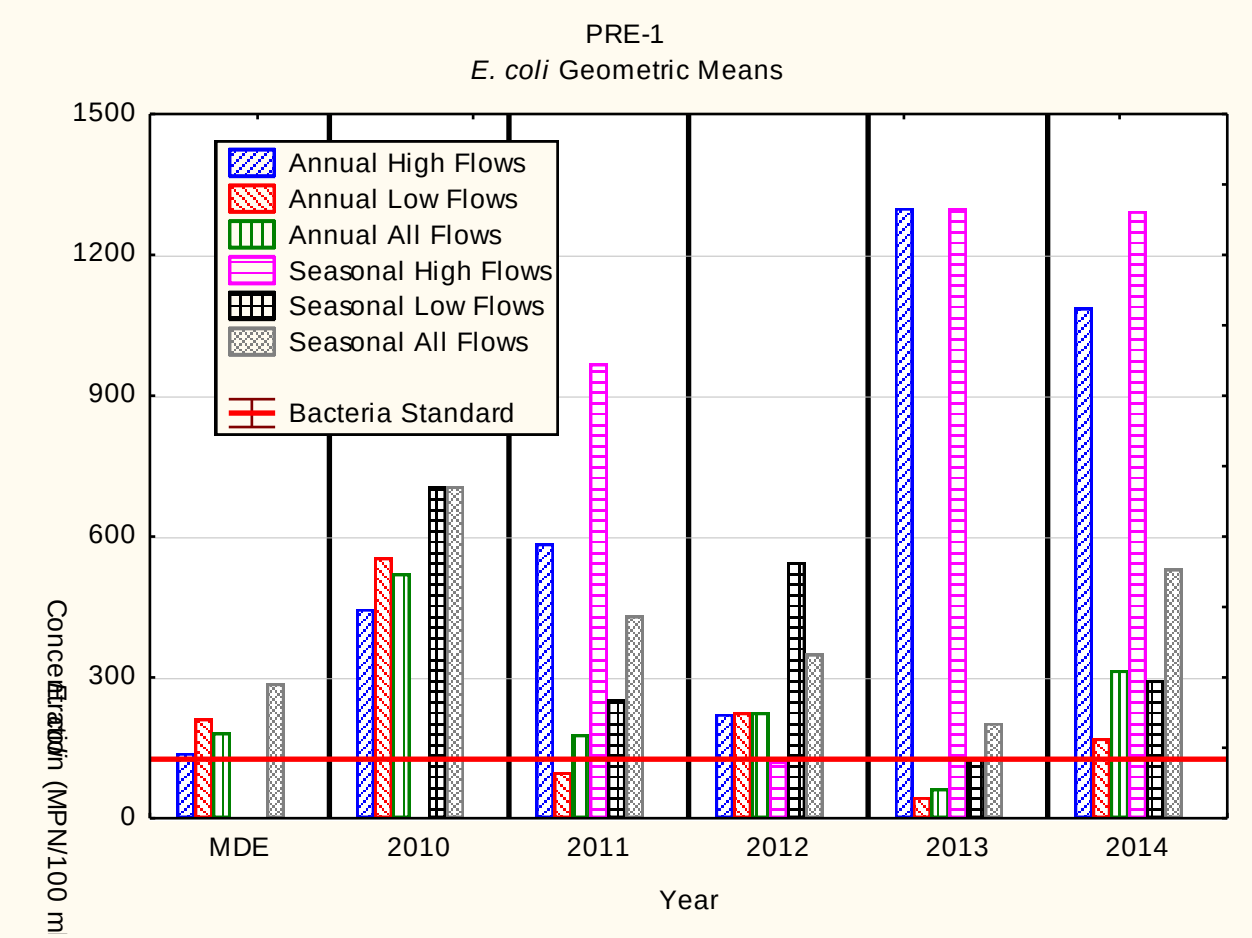


Figure 9-25: *E. coli* Geometric Mean Concentrations at Site PRE-1 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

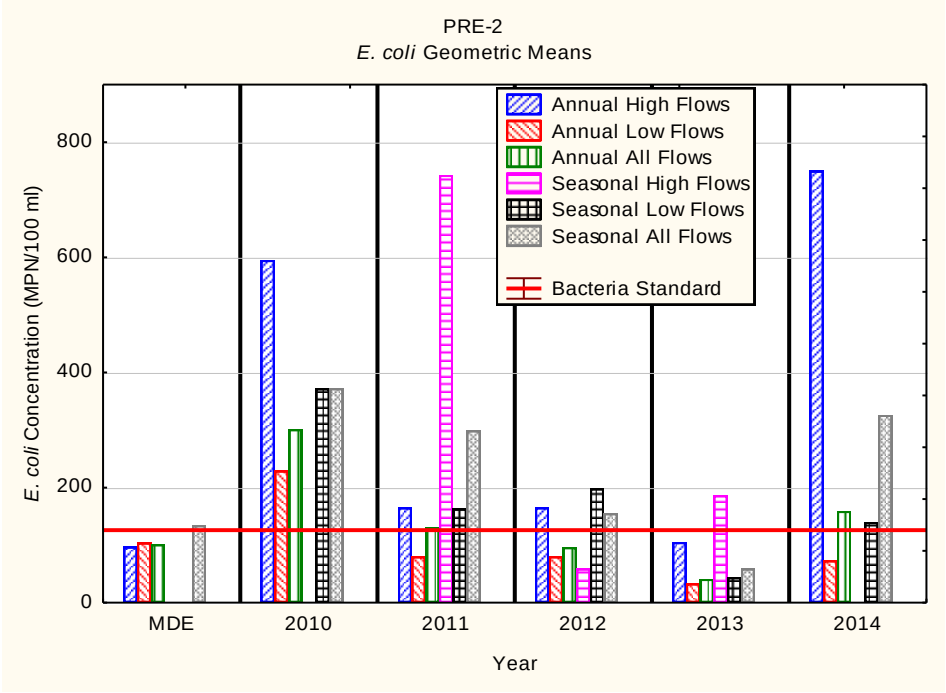


Figure 9-26: *E. coli* Geometric Mean Concentrations at Site PRE-2 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

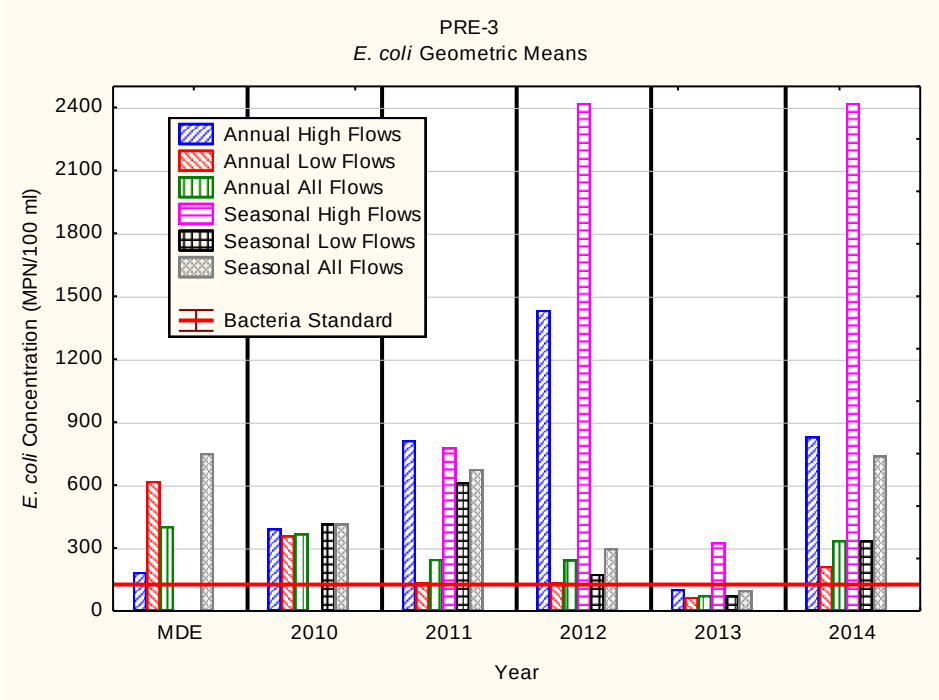


Figure 9-27: *E. coli* Geometric Mean Concentrations at Site PRE-3 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

In addition to analyzing the data for the geometric means, the data were analyzed based on the single sample exceedance for seasonal data (May 1st to September 30th). Single sample exceedance standards are based on frequency of full body contact, ranging from infrequent (576 MPN) to frequent (235). The objective in the control of bacteria is to not only meet the

geometric mean water quality standards, but to also meet the single sample water quality standards. This is particularly important for the low flow (dry weather) component of the flow regime, as this is when human recreational use of water is most likely to occur. Table 9-19 presents the results of the analysis by station, by year and by flow regime.

Table 9-19: Frequency of Exceedance of Single Sample Water Quality Standards

Site	Year	N		Percent Single Sample Exceedance (MPN)							
		Flow Type		576		410		298		235	
		High	Low	High	Low	High	Low	High	Low	High	Low
PRE-1	2010	0	4		75%		75%		75%		75%
	2011	2	3	50%	0%	50%	0%	100%	33.3%	100%	66.7%
	2012	1	4	0%	80%	0%	80%	0%	100%	0%	100%
	2013	1	4	100%	0%	100%	25%	100%	25%	100%	25%
	2014	2	3	100%	33%	100%	33%	100%	66.7%	100%	66.7%
PRE-2	2010	0	4		25%		50%		50%		50%
	2011	2	3	50%	0%	50%	0%	50%	0%	50%	0%
	2012	1	4	0%	0%	0%	25%	0%	25%	0%	25%
	2013	1	4	0%	0%	0%	0%	0%	0%	0%	0%
	2014	2	3	50%	0%	100%	0%	100%	0%	100%	0%
PRE-3	2010	0	4		50%		50%		50%		50%
	2011	2	3	50%	33%	50%	33%	50%	67%	50%	100%
	2012	1	4	100%	0%	100%	0%	100%	0%	100%	0%
	2013	1	4	0%	0%	0%	0%	100%	0%	100%	0%
	2014	2	3	100%	0%	100%	33%	100%	67%	100%	67%

The frequency of exceedance data shows improvement for all three monitoring sites with a general downward trend in the frequency of exceedance of the various single sample bacteria standards. The data from 2014, however, seem to reverse the trend from 2013, with higher rates of exceedance than the previous years.

PRE-1 (GOB0042): This site is located on Georges Run close to where it discharges into the reservoir. It receives drainage from both Carroll County and Baltimore County, with the majority of the drainage in Carroll County. The data indicate variability over the five years of monitoring on an annual and seasonal basis; the geometric mean for low flow and all samples combined was below water quality standard of 126 MPN/100 ml for *E. coli* in 2013. The Maryland Department of the Environment (MDE) data for this site indicated a geometric mean of 287 MPN/100ml for dry weather seasonal samples based on monitoring conducted between 2003-2004. A weighted mean for dry weather seasonal sampling for the five years of monitoring conducted by Baltimore County resulted in a value of 315 MPN/100ml. This would indicate the conditions are degrading at this station based on the difference between the two monitoring periods. The TMDL requires a 59.0% reduction of bacteria at this site.

PRE-2 (GRG0013): This monitoring site is located on Grave Run in Baltimore County, but with the majority of drainage area in Carroll County. The Baltimore County monitoring indicated that this site has displayed continuing improvement for both low flow and high flow on an annual and a seasonal basis. It met water quality standards for all flow conditions on an annual basis, and on for low flow on a seasonal basis. The MDE data for this site indicated a seasonal dry weather geometric mean of 134 MPN/100ml for this site. The previous five years of Baltimore County data resulted in a geometric mean of 153 MPN/100 ml for the dry weather

seasonal data. Including the latest dry weather seasonal data from 2014, this number drops to 149 MPN/100ml. This would indicate that there has been no change or slight improvement at this site. The TMDL indicated a reduction of 9.5% reduction necessary for meeting bacteria water quality standards in the drainage area to this site.

PRE-3 (GUN0476): This site is located on the mainstem of Gunpowder Falls above the Prettyboy Reservoir. The Baltimore County monitoring data indicates variability in the geometric mean *E.coli* concentrations from year to year for both low flow and high flow conditions, but the data indicated a generally improving trend. The MDE data indicated a seasonal dry weather concentration of 751 MPN/100ml for this site, while the Baltimore County data indicate a concentration of 240 MPN/100ml, indicating improvement at this site. The TMDL indicated 85.3% reduction necessary for meeting bacteria water quality standards at this site.

Loch Raven Reservoir

Table 9-20 shows the latitude/longitude locations of the current bacteria monitoring stations within the Jones Falls watershed. There are seven bacteria trend monitoring sites in the Loch Raven Reservoir watershed.

Table 9-20: Baltimore County Bacteria Monitoring Station Locations

MDE Station Code	County Code	Watershed/ Subshed	Latitude	Longitude	Location
SBH0002	LOC-1	Spring Branch	39.440	-76.597	County
BEV0005	LOC-2	Beaverdam Run	39.487	-76.645	County
WGP0050	LOC-3	Western Run	39.511	-76.677	County
GUN0233	LOC-4	Gunpowder Falls	39.519	-76.620	County
GUN0284	LOC-5	Gunpowder Falls	39.568	-76.611	County
LIT0002	LOC-6	Little Falls	39.602	-76.622	County
GUN0387	LOC-7	Gunpowder Falls	39.619	-76.690	County

Table 9-21 presents the number of samples and the geometric mean for high (wet) flow and low (dry) flow by year. It also presents the geometric mean of all samples by year regardless of condition. The table is stratified by annual data (includes all data collected for the year) and seasonal data (includes only those samples collected between May 1st and September 30th each year. Geometric means that met the water quality standard (126 MPN) are highlighted in green. These data are displayed graphically in Figures 9-28 through 9-34.

Table 9-21: Loch Raven Reservoir Watershed *E. coli* Results on an Annual and Seasonal Basis

Annual (MPN/100 ml)											
Site	Flow Type	2010		2011		2012		2013		2014	
		N	MPN	N	MPN	N	MPN	N	MPN	N	MPN
LOC-1	High	2	1540	4	825	4	364	3	1340	4	1273
	Low	5	481	9	89	8	123	9	117	8	547
	All	7	670	13	177	12	177	12	216	12	725
LOC-2	High	2	1365	4	1064	4	345	3	524	4	634
	Low	5	568	8	143	8	104	9	79	8	70
	All	7	729	12	279	12	156	12	127	12	146
LOC-3	High	2	735	4	576	4	861	3	190	4	1238

	Low	5	836	8	118	8	137	9	62	8	129
	All	7	806	12	200	12	253	12	83	12	275
LOC-4	High	2	572	4	477	3	498	3	161	4	888
	Low	5	257	8	77	9	138	9	42	8	75
	All	7	323	12	142	12	190	12	59	12	170
LOC-5	High	2	282	4	192	3	230	3	78	4	316
	Low	5	287	8	65	9	54	9	54	8	55
	All	7	286	12	94	12	77	12	59	12	98
LOC-6	High	0		2	217	3	336	3	87	4	846
	Low	1	70	6	172	9	144	9	52	8	61
	All	1	70	8	182	12	178	12	59	12	146
LOC-6a	High	2	51	2	28	0		0			
	Low	4	58	2	8	0		0			
	All	6	56	4	15	0		0			
LOC-7	High	2	13	4	14	3	16	3	11	4	18
	Low	5	10	8	5	9	6	9	8	8	3
	All	7	11	12	7	12	8	12	8	12	5

Seasonal (May 1st to September 30th) (MPN/100 ml)											
Site	**Flow Type**	**2010**		**2011**		**2012**		**2013**		**2014**	
		N	**MPN**	**N**	**MPN**	**N**	**MPN**	**N**	**MPN**	**N**	**MPN**
LOC-1	High	0		2	812	2	567	1	2420	2	1773
	Low	4	669	3	524	3	378	4	270	3	1043
	All	4	669	5	624	5	444	5	418	5	1290
LOC-2	High	0		2	1405	2	613	1	1046	2	1202
	Low	4	758	3	700	3	370	4	142	3	334
	All	4	758	5	925	5	453	5	212	5	558
LOC-3	High	0		2	968	2	1448	1	313	2	1493
	Low	4	1132	3	387	3	411	4	112	3	258
	All	4	1132	5	558	5	680	5	138	5	521
LOC-4	High	0		2	727	1	691	1	387	2	863
	Low	4	244	3	170	4	240	4	55	3	134
	All	4	244	5	304	5	296	5	81	5	282
LOC-5	High	0		2	178	1	219	1	260	2	469
	Low	4	301	3	149	4	112	4	53	3	121
	All	4	301	5	160	5	128	5	73	5	208
LOC-6	High	0		1	579	1	260	1	328	2	1850
	Low	1	70	3	661	4	263	4	78	3	85
	All	1	70	4	640	5	263	5	104	5	291
LOC-6a	High	0		0		0		0		0	
	Low	3	57	0		0		0		0	
	All	3	57								
LOC-7	High	0		2	14	1	17	1	16	2	25
	Low	4	7	3	7	4	9	4	7	3	2
	All	4	7	5	9	5	10	5	8	5	5

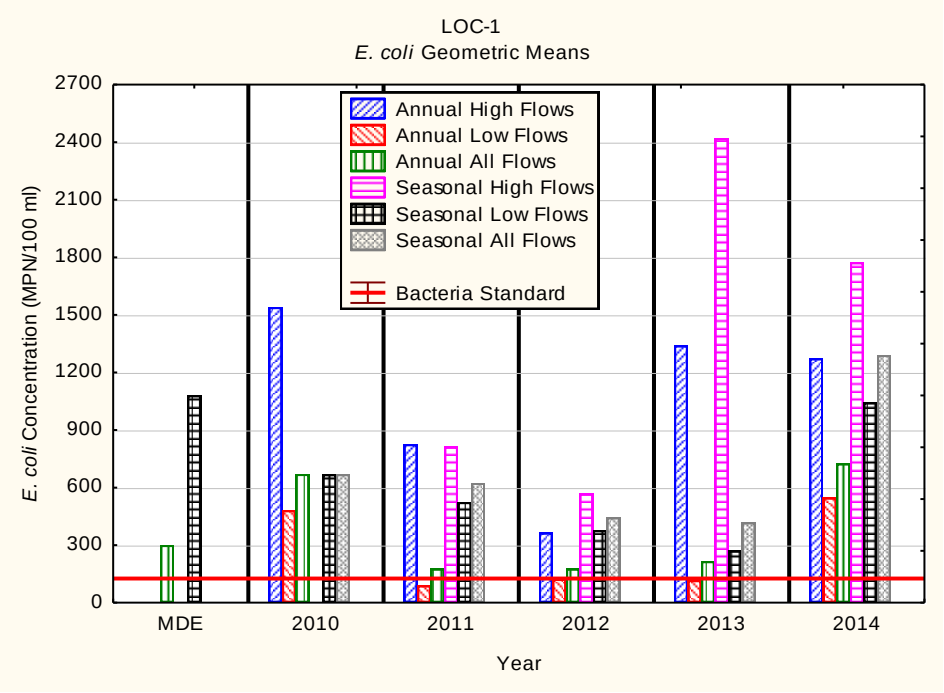


Figure 9-28: *E. coli* Geometric Mean Concentrations at Site LOC-1 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

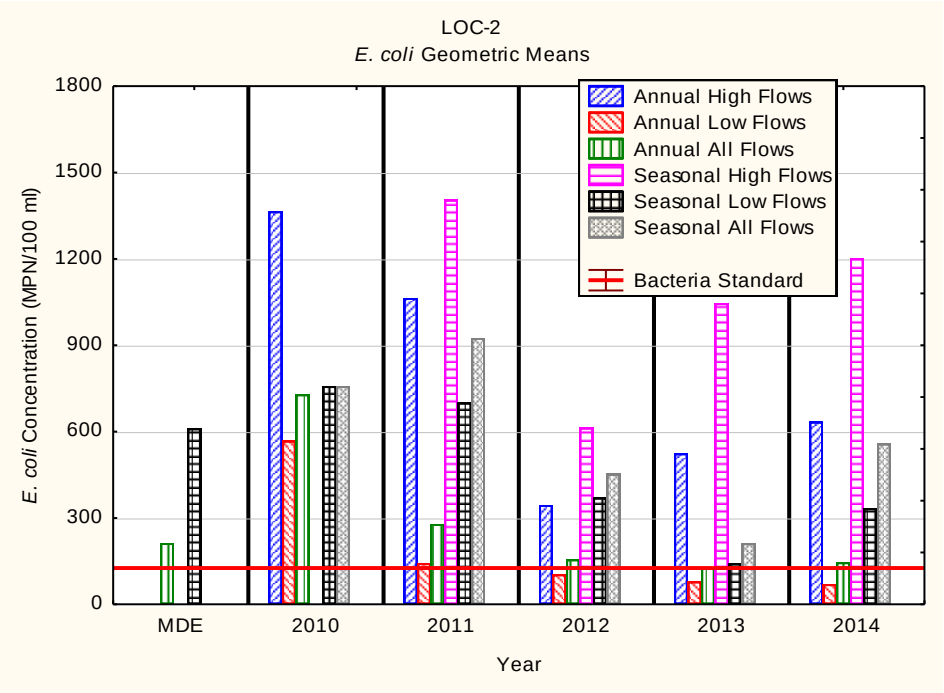


Figure 9-29: *E. coli* Geometric Mean Concentrations at Site LOC-2 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

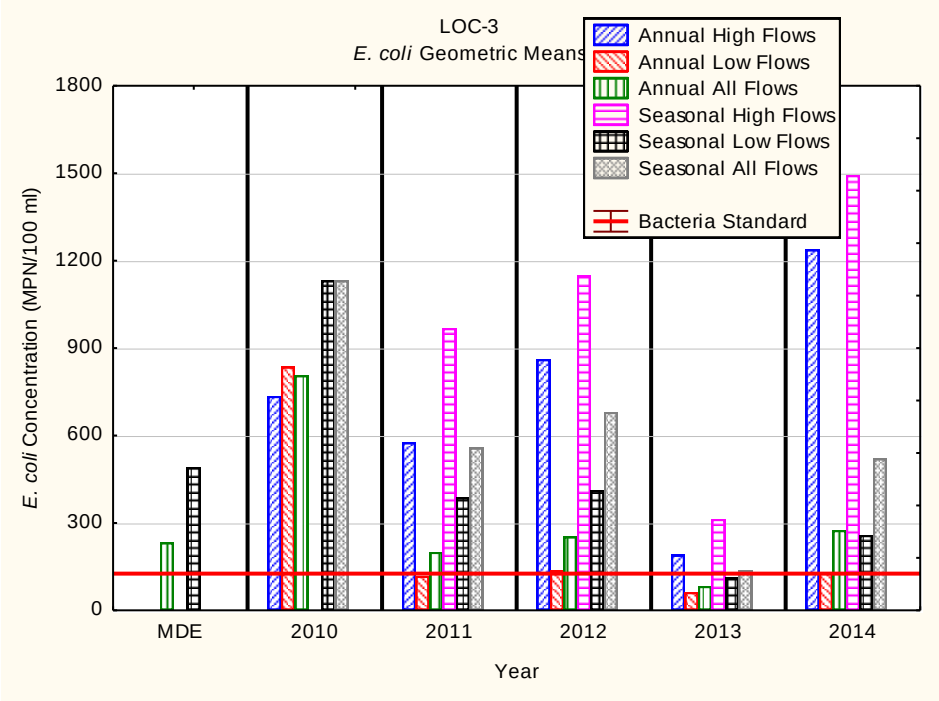


Figure 9-30: *E. coli* Geometric Mean Concentrations at Site LOC-3 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

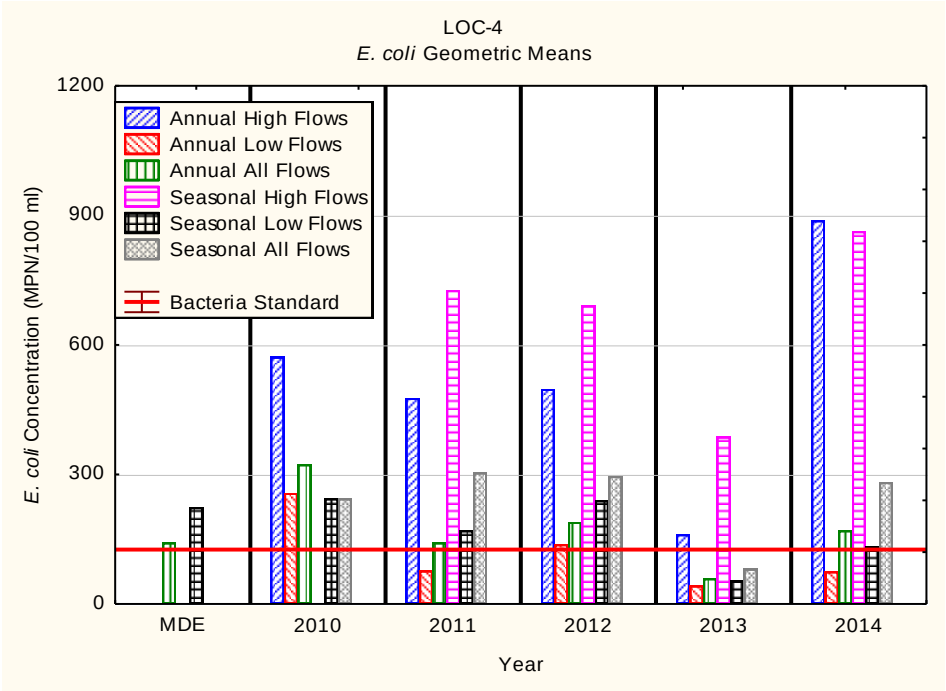


Figure 9-31: *E. coli* Geometric Mean Concentrations at Site LOC-4 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

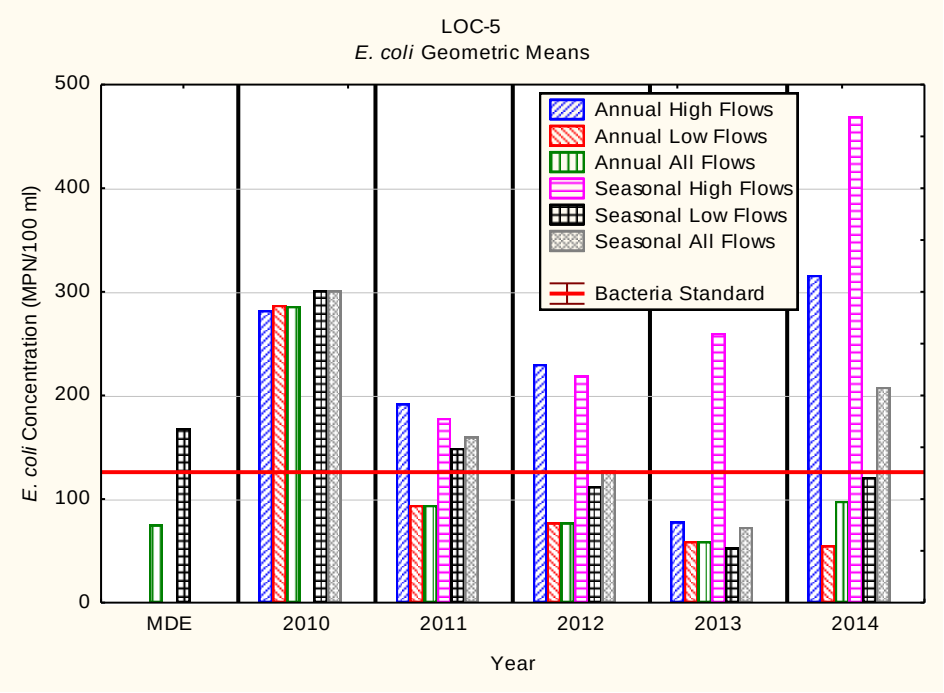


Figure 9-32: *E. coli* Geometric Mean Concentrations at Site LOC-5 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

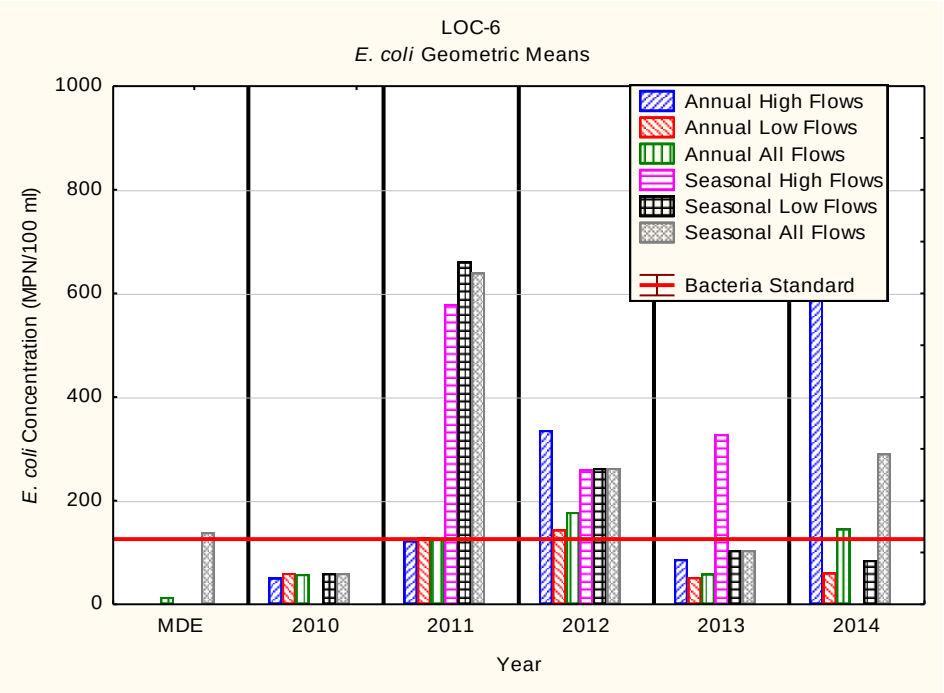


Figure 9-33: *E. coli* Geometric Mean Concentrations at Site LOC-6 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

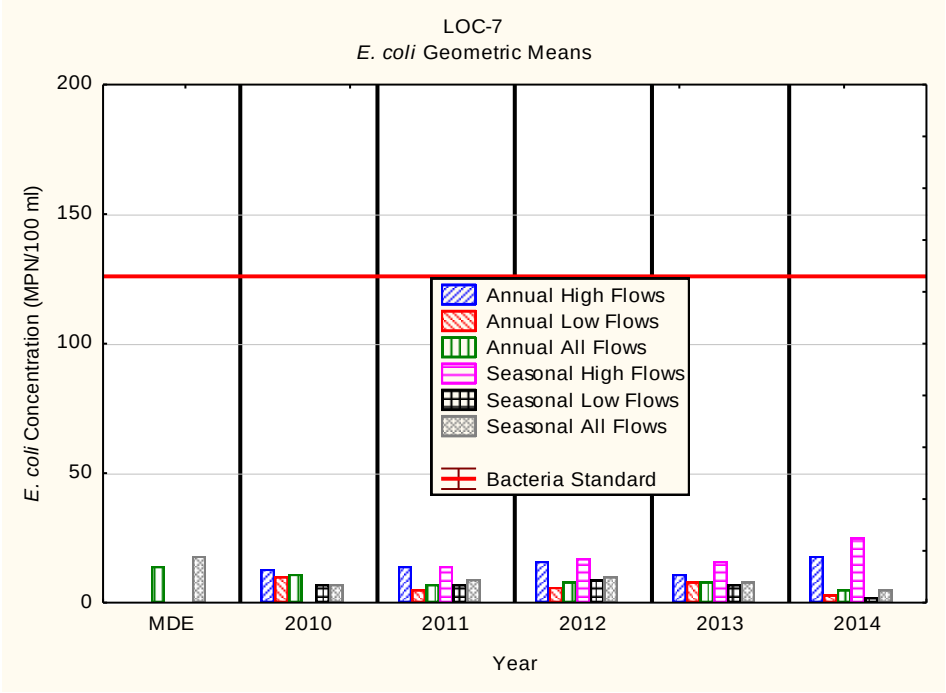


Figure 9-34: *E. coli* Geometric Mean Concentrations at Site LOC-7 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

In addition to analyzing the data for the geometric means, the data were analyzed based on the single sample exceedance for seasonal data (May 1st to September 30th). Single sample exceedance standards are based on frequency of full body contact, ranging from infrequent (576 MPN) to frequent (235). The objective in the control of bacteria is to not only meet the geometric mean water quality standards, but to also meet the single sample water quality standards. This is particularly important for the low flow (dry weather) component of the flow regime, as this is when human recreational use of water is most likely to occur. Table 9-22 presents the results of the analysis by station, by year and by flow regime. The zero percent exceedances are highlighted in green.

Table 9-22: Frequency of Exceedance of Single Sample Water Quality Standards

Site	Year	N		Percent Single Sample Exceedance (MPN)							
		Flow Type		576		410		298		235	
		High	Low	High	Low	High	Low	High	Low	High	Low
LOC-1	2010	0	4		75%		75%		100%		100%
	2011	2	3	50%	33%	50%	67%	50%	100%	100%	100%
	2012	2	3	50%	33%	50%	67%	100%	67%	100%	67%
	2013	1	4	100%	25%	100%	25%	100%	25%	100%	50%
	2014	2	3	100%	67%	100%	100%	100%	100%	100%	100%
LOC-2	2010	0	4		50%		75%		75%		100%
	2011	2	3	100%	33%	100%	67%	100%	100%	100%	100%
	2012	2	3	100%	33%	100%	33%	100%	67%	100%	67%
	2013	1	4	100%	0%	100%	0%	100%	0%	100%	25%
	2014	2	3	100%	33%	100%	33%	100%	33%	100%	67%
LOC-3	2010	0	4		100%		100%		100%		100%

	2011	2	3	50%	0%	50%	33%	100%	67%	100%	100%
	2012	1	4	100%	25%	100%	75%	100%	75%	100%	100%
	2013	1	4	0%	0%	0%	0%	100%	25%	100%	50%
	2014	2	3	100%	0%	100%	33%	100%	67%	100%	67%
LOC-4	2010	0	4		0%		25%		50%		50%
	2011	2	3	50%	0%	50%	0%	50%	0%	50%	25%
	2012	1	4	100%	0%	100%	0%	100%	0%	100%	50%
	2013	1	4	0%	0%	0%	0%	100%	0%	100%	0%
	2014	2	3	50%	0%	50%	0%	100%	0%	100%	0%
LOC-5	2010	0	4		25%		25%		25%		25%
	2011	2	3	0%	0%	0%	0%	0%	0%	50%	0%
	2012	1	4	0%	0%	0%	0%	0%	0%	0%	0%
	2013	1	4	0%	0%	0%	0%	0%	0%	100%	0%
	2014	2	3	50%	0%	50%	0%	50%	0%	50%	0%
LOC-6	2010	0	1		0%		0%		0%		0%
	2011	1	3	100%	33%	100%	67%	100%	67%	100%	100%
	2012	1	4	0%	0%	0%	0%	0%	25%	100%	75%
	2013	1	4	0%	0%	0%	0%	100%	0%	100%	0%
	2014	2	3	100%	0%	100%	0%	100%	0%	100%	33%
LOC-6A	2010	0	3		0%		0%		0%		0%
	2011	0	1		0%		0%		0%		0%
	2012	0	0								
	2013	0	0								
	2014	0	0								
LOC-7	2010	0	4		0%		0%		0%		0%
	2011	2	3	0%	0%	0%	0%	0%	0%	0%	0%
	2012	1	4	0%	0%	0%	0%	0%	0%	0%	0%
	2013	1	4	0%	0%	0%	0%	0%	0%	0%	0%
	2014	2	3	0%	0%	0%	0%	0%	0%	0%	0%

The frequency of exceedance data for low flow conditions generally shows improvement at all monitoring sites over the first four years of monitoring, but some sites experienced regression in 2014. Four (LOC-4, LOC-5, LOC-6, and LOC-7) were found to not exceed any of the low flow single sample standards during 2014, but LOC-4, LOC-5, and LOC-6 had at least one exceedance during high flow regimes. One seasonal high flow water quality exceedance occurred during a severe storm which hit Maryland between April 30th and May 1st and caused severe flooding throughout the area. LOC-1, while still exceeding the single sample standards at all levels, has shown improvement over time. LOC-2 and LOC-3 are meeting the highest single sample standards; they still have not achieved the lower level single standards, but have shown improvement. The high flow data are somewhat more variable, showing improvement in some years at some of the sites, but with reversals at other sites. LOC-7 is only station to meet all of the single sample water quality standards regardless of flow.

Based on the both the geometric mean data and the exceedance frequency data, stations LOC-1, LOC-2, and LOC-3, require additional bacteria reductions for both low flow and high flow conditions. LOC-4, LOC-5, and LOC-6 require reductions for high flow conditions. LOC-7 appears to have met all bacteria water quality standards with no additional bacteria reductions required.

LOC-1 (SBH0002): This site is the located in Baltimore County in the Spring Branch subwatershed. This subwatershed drainage area is entirely within Baltimore County and represents an urban drainage area. While the data indicate an improving trend over the four years of monitoring on an annual and seasonal basis for low flows, the data for high flows is more variable. The geometric means for the annual low flow met bacteria water quality standards for the last three years, but the seasonal low flow geometric means, while improving, are still above the standards. The geometric means for all high flows were above the standards. The Maryland Department of the Environment (MDE) data for this site indicted a geometric mean of 1,080 MPN/100ml for dry weather seasonal samples based on monitoring conducted in 2003 and 2004. A weighted geometric mean for dry weather seasonal sampling over four years of monitoring conducted by Baltimore County resulted in a value of 433 MPN/100ml. When the latest data from 2014 is included in the geometric mean, the mean jumps to 505 MPN/100ml. This would indicate the conditions are generally improving at this station based on the difference between the two monitoring periods. The TMDL requires an 89.8% reduction of bacteria at this site to meet bacteria water quality standards.

LOC-2 (BEV0005): This monitoring site is located on Beaverdam Run at the USGS gage where York Road crosses the stream. The entire drainage area is in Baltimore County. The Baltimore County monitoring indicated that this site has displayed continuing improvement for both low flows on both an annual and a seasonal basis, with the annual low flow meeting bacteria water quality standards for the last three years. None of the high flow geometric means met standards and while generally decreasing over time, 2013 samples results indicated an increase relative to the prior year. The MDE data for this site indicated a seasonal dry weather geometric mean of 611 MPN/100ml for this site. The five years of Baltimore County data resulted in a geometric mean of 384 MPN/100 ml for the dry weather seasonal data. This would indicate that there has been improvement at this site. The TMDL indicated a bacteria reduction of 80.2% is necessary for meeting bacteria water quality standards in the drainage area to this site.

LOC-3 (WPG0050): This site is located on Western Run subwatershed in Baltimore County at the USGS gage on the stream. The majority of the drainage area is in Baltimore County, with a small portion (~580 acres) from the town of Hampstead in Carroll County. This subwatershed is predominantly agricultural. The Baltimore County monitoring data indicates that the bacteria concentrations are improving, particularly for low flow conditions. Based on the annual data, bacteria water quality standards were met for low flow conditions for two of the last three years and seasonal low flow geometric means met the water quality standards in 2013. The high flow data showed a decreasing trend for the annual data, but was more variable to the seasonal data. None of the high flow geometric means met the water quality standards. The MDE data indicated a seasonal dry weather concentration of 491 MPN/100ml for this site, while the Baltimore County data, geometric mean for four years indicate a concentration of 374 MPN/100ml indicating slight improvement. This trend of improvement continues when the 2014 seasonal data is included, which drops the geometric mean to 350 MPN/100ml. The TMDL indicated 73.9% reduction necessary for meeting bacteria water quality standards at this site.

LOC-4 (GUN0233): This site is located in Baltimore County on mainstem of Gunpowder Falls at the Glencoe USGS gage site. The majority of the drainage is in Baltimore County, with some headwater drainage area is in York County, Pennsylvania (~2,700 acres) and a small amount of drainage from Harford County (~818 acres). The site also receives discharge from the upstream

Prettyboy dam. The Baltimore County monitoring data indicates variable, but improving trends for low flow on both an annual basis and a seasonal basis. Low flow bacteria water quality standards were met in 2013 for both the annual and seasonal data. The high flow for both the annual data and seasonal data show a decreasing trend, but do not meet the water quality standards. The MDE data indicated a seasonal dry weather concentration of 224 MPN/100ml for this site, while the Baltimore County data for the five years of monitoring resulted in a geometric mean concentration of 148 MPN/100ml; indicating improvement at this site. The TMDL indicated a 82.1% reduction in bacteria is necessary for meeting bacteria water quality standards at this site.

LOC-5 (GUN284): This site is located on the mainstem of Gunpowder Falls below the confluence with Little Falls. The majority of the drainage is in Baltimore County, with some headwater drainage area is in York County, Pennsylvania (~2,700 acres). The site also receives discharge from the upstream Prettyboy dam. The annual data indicate decreasing trends for high flow, low flows and all flows combined. The annual low flow and all samples combined have met the water quality standards for the last three years with the annual high flows meeting the standards in 2013. The seasonal low flows have met the standards for the last two years and the seasonal all samples combined met the standards in 2013. The MDE data indicated a seasonal dry weather concentration of 168 MPN/100ml at this site based on monitoring in 2003-2004, while the Baltimore County data for the five years of monitoring results in a geometric mean of 126 MPN/100 ml for the seasonal dry weather samples. This would indicate an improvement between the two monitoring periods. The TMDL indicated an 88.0% reduction in bacteria is necessary for meeting bacteria water quality standards at this site.

LOC-6/LOC-6a (LIT0002): This site is located on the mainstem of Little Falls. The majority of the drainage is in Baltimore County with some headwater drainage area is in York County, Pennsylvania (~2,700 acres). Baltimore County data for five years of monitoring resulted in a geometric mean concentration for seasonal low flow samples of 167 MPN/100ml.

LOC-7 (GUN0387): This site is located a short distance downstream from the Prettyboy Reservoir dam on the mainstem of the Gunpowder River. There are few small tributaries that enter the mainstem between the dam and the monitoring site. The major source of water in the stream is release from the Prettyboy Reservoir. This is a cold water release from depth in the reservoir, which results in the low *E. coli* concentrations found at this monitoring site. The site consistently meets the bacteria water quality standards for high flow, low flow, and all flow conditions combined.

Liberty Reservoir

Table 9-23 shows the latitude/longitude locations of the current bacteria monitoring stations within the Liberty Reservoir watershed. Figure 9-24 shows the locations of the monitoring sites for the entire trend monitoring program. The monitoring locations are on major tributaries to the Liberty Reservoir, with all of the sites located in Carroll County.

Table 9-23 Baltimore County Bacteria Monitoring Station Locations

MDE Station Code	County Code	Watershed	Latitude	Longitude
LMR0015	LIB-1	Little Morgan Run	39.425	-76.961
MOR0040	LIB-2	Morgan Run	39.452	-76.955
MDE0026	LIB-3	Middle Run	39.463	-76.908

BEA0016	LIB-4	Beaver Run	39.489	-76.904
NPA0016	LIB-5	North Branch Patapsco River	39.501	-76.883

Table 9-24 presents the number of samples and the geometric mean for high (wet) flow and low (dry) flow by year. It also presents the geometric mean of all samples by year regardless of condition. The table is stratified by annual data (includes all data collected for the year) and seasonal data (includes only those samples collected between May 1st and September 30th each year. Geometric means that met the water quality standard (126 MPN) are highlighted in green. These data are displayed graphically in Figure 9-35 through 9-39.

Table 9-24 Liberty Reservoir Watershed *E. coli* Results on an Annual and Seasonal Basis

Annual (MPN/100 ml)											
Site	Flow Type	2010		2011		2012		2013		2014	
		N	MPN	N	MPN	N	MPN	N	MPN	N	MPN
LIB-1	High	0		0		3	207	2	2192	3	442
	Low	0		0		5	98	8	40	7	39
	All	0		0		8	130	10	89	10	81
LIB-2	High	0		0		3	162	2	816	3	463
	Low	0		0		5	137	8	37	7	99
	All	0		0		8	146	10	118	10	166
LIB-3	High	0		0		3	683	2	1031	3	1372
	Low	0		0		5	464	8	169	7	325
	All	0		0		8	536	10	242	10	500
LIB-4	High	0		0		3	172	2	366	3	390
	Low	0		0		9	138	8	25	7	116
	All	0		0		8	146	10	42	10	167
LIB-5	High	0		0		2	380	2	115	3	524
	Low	0		0		6	220	9	36	7	155
	All	0		0		8	253	9	77	10	224

Seasonal (May 1st to September 30th) (MPN/100 ml)											
Site	Flow Type	2010		2011		2012		2013		2014	
		N	MPN	N	MPN	N	MPN	N	MPN	N	MPN
LIB-1	High	0		0		2	134	1	1986	1	579
	Low	0		0		3	163	4	105	3	86
	All	0		0		5	151	5	189	4	139
LIB-2	High	0		0		2	86	1	275	1	345
	Low	0		0		3	171	4	72	3	159
	All	0		0		5	130	5	94	4	193
LIB-3	High	0		0		2	495	1	1733	1	1553
	Low	0		0		3	687	4	260	3	554
	All	0		0		5	602	5	380	4	717
LIB-4	High	0		0		1	74	1	411	1	387
	Low	0		0		4	172	4	84	3	173
	All	0		0		5	145	5	115	4	211
LIB-5	High	0		0		1	156	1	770	1	613
	Low	0		0		4	357	3	216	3	381
	All	0		0		5	303	4	297	4	429

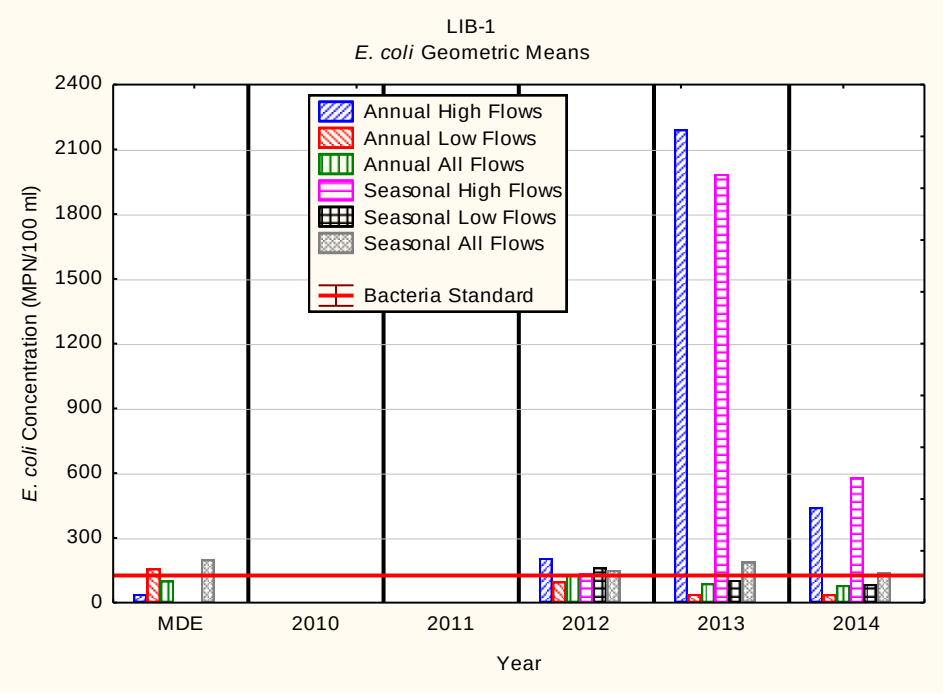


Figure 9-35: *E. coli* Geometric Mean Concentrations at Site LIB-1 for Both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison. No data for 2010 and 2011.

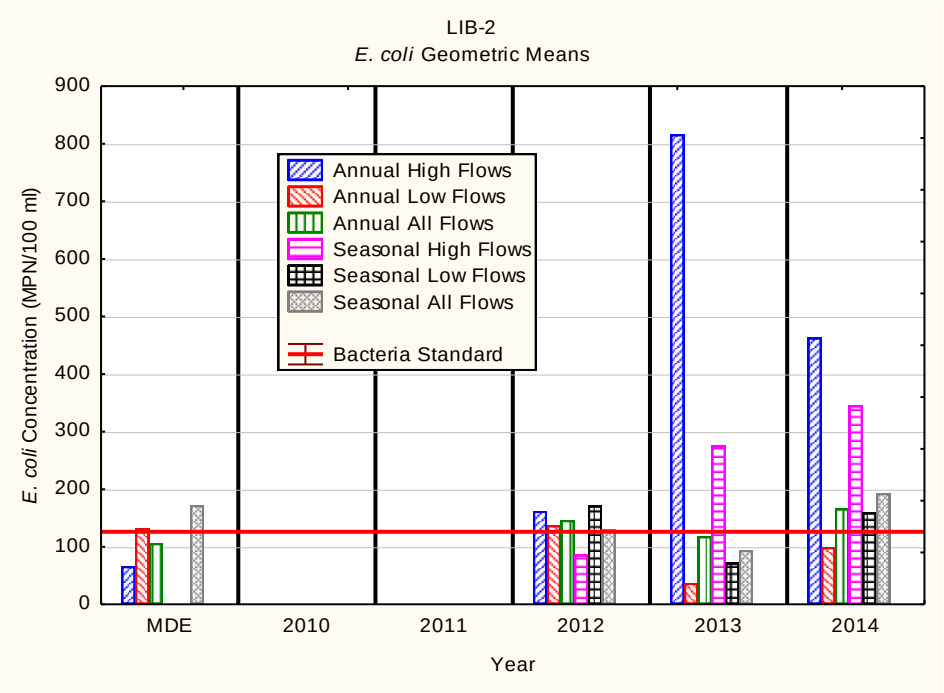


Figure 9-36: *E. coli* Geometric Mean Concentrations at Site LIB-2 for Both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison. No data for 2010 and 2011.

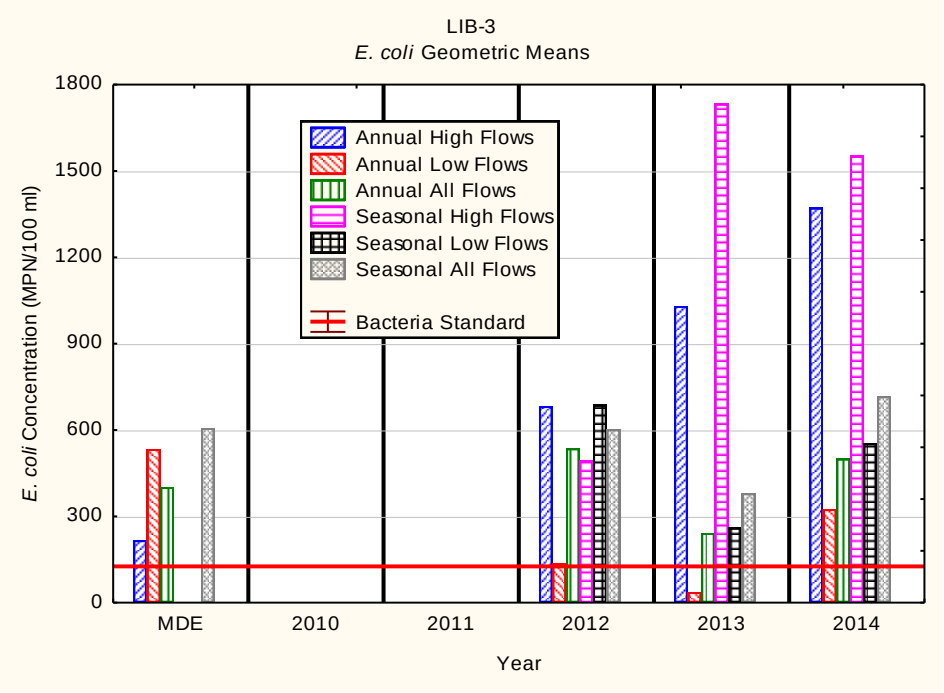


Figure 9-37: *E. coli* Geometric Mean Concentrations at Site LIB-3 for Both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison. No data for 2010 and 2011.

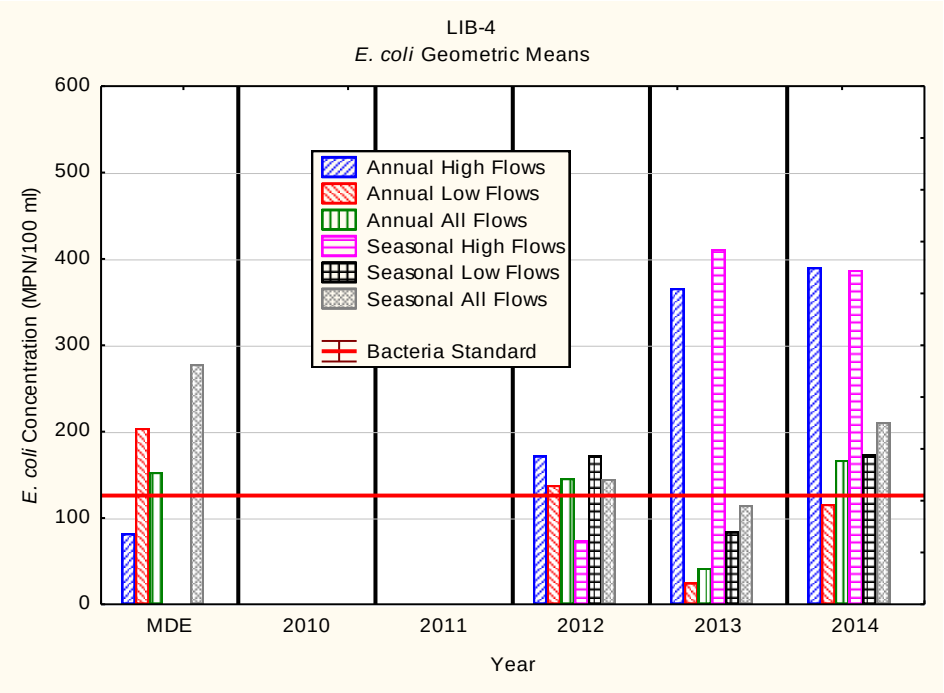


Figure 9-38: *E. coli* Geometric Mean Concentrations at Site LIB-4 for Both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison. No data for 2010 and 2011.

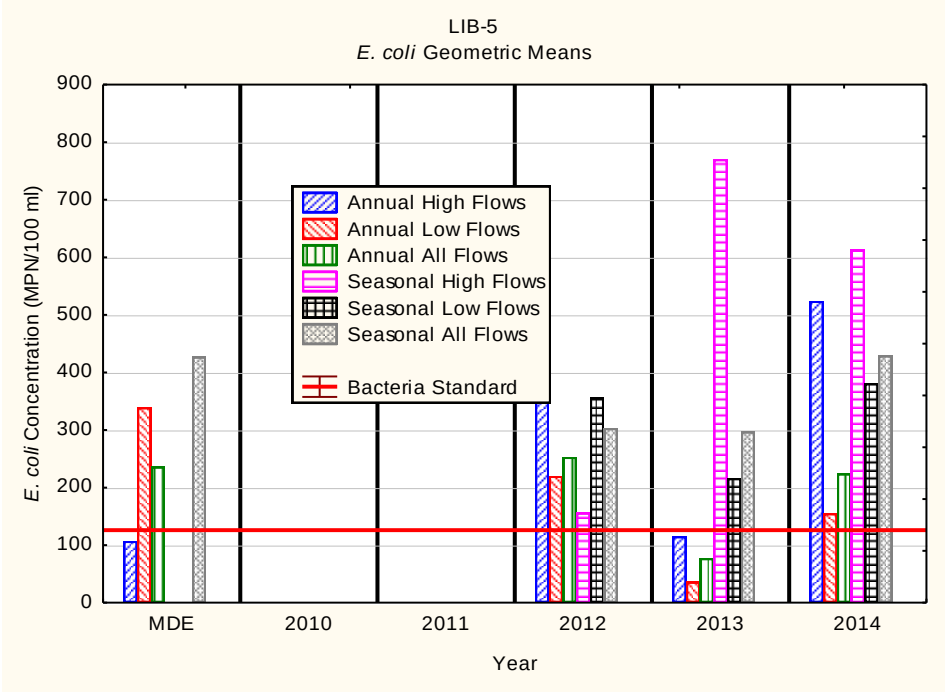


Figure 9-39: *E. coli* Geometric Mean Concentrations at Site LIB-5 for Both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison. No data for 2010 and 2011.

Given the limited amount of data collected, it is difficult to analyze the data for trends. General comments will be provided for each station.

In addition to analyzing the data for the geometric means, the data were analyzed based on the single sample exceedance for seasonal data (May 1st to September 30th). Single sample exceedance standards are based on frequency of full body contact, ranging from infrequent (576 MPN) to frequent (235). The objective in the control of bacteria is to not only meet the geometric mean water quality standards, but to also meet the single sample water quality standards. This is particularly important for the low flow (dry weather) component of the flow regime, as this is when human recreational use of water is most likely to occur. Table 9-25 presents the results of the analysis by station, by year and by flow regime. The zero percent exceedances are high-lighted in green.

Table 9-25: Frequency of Exceedance of Single Sample Water Quality Standards

Site	Year	N		Percent Single Sample Exceedance (MPN)							
		Flow Type		576		410		298		235	
		High	Low	High	Low	High	Low	High	Low	High	Low
LIB-1	2010	0	0								
	2011	0	0								
	2012	1	4	0%	0%	0%	0%	0%	0%	0%	0%
	2013	1	4	100%	0%	100%	0%	100%	0%	100%	0%
	2014	1	3	100%	0%	100%	0%	100%	0%	100%	0%
LIB-2	2010	0	0								
	2011	0	0								
	2012	2	3	0%	0%	0%	0%	0%	0%	0%	0%
	2013	1	4	0%	0%	0%	0%	0%	0%	100%	0%

	2014	1	3	0%	0%	0%	0%	100%	0%	100%	0%
LIB-3	2010	0	0								
	2011	0	0								
	2012	2	3	50%	67%	50%	100%	50%	100%	50%	100%
	2013	1	4	100%	0%	100%	0%	100%	0%	100%	0%
	2014	1	3	0%	0%	0%	0%	100%	0%	100%	33%
LIB-4	2010	0	0								
	2011	0	0								
	2012	1	4	0%	0%	0%	0%	0%	0%	0%	25%
	2013	1	4	0%	0%	100%	0%	100%	0%	100%	0%
	2014	1	3	0%	0%	0%	0%	100%	0%	100%	33%
LIB-5	2010	0	0								
	2011	0	0								
	2012	1	4	0%	0%	0%	25%	0%	100%	0%	100%
	2013	1	3	100%	33%	100%	33%	100%	33%	100%	33%
	2014	1	3	100%	0%	100%	33%	100%	67%	100%	100%

The frequency of exceedance data shows improvement for three monitoring sites (LIB-2, LIB-3, LIB-4) with a general downward trend in the frequency of exceedance of the various single sample bacteria standards. Site LIB-1 appears to be increasing in its exceedance frequencies; and LIB-5 is increasing at the higher single sample standards, but decreasing at the lower single sample standards.

LIB-1 (LMR0015): This site is located on Little Morgan Run in Carroll County. All of the drainage to the site is located in Carroll County. The data indicate the low flow geometric mean on an annual basis for 2012 and 2013 were below water quality standard of 126 MPN/100 ml and below the standard on a seasonal basis for 2013. The Maryland Department of the Environment (MDE) data for this site indicted a geometric mean of 200 MPN/100ml for dry weather seasonal samples based on monitoring conducted between 2003 and 2004. A weighted mean for dry weather seasonal sampling for the three years of monitoring conducted by Baltimore County resulted in a value of 113 MPN/100ml. This would indicate the conditions are improving at this station based on the difference between the two monitoring periods. The TMDL requires a 40.0% reduction of bacteria at this site.

LIB-2 (MOR0040): This monitoring site is located on Morgan Run in Carroll County, with the entire drainage area in Carroll County. The monitoring indicated that this site showed improvement between 2012 and 2013 for low flow concentrations, meeting the bacteria water quality standard in 2013 for low flow conditions on both an annual and seasonal basis. The MDE data for this site indicated a seasonal dry weather geometric mean of 172 MPN/100ml for this site. The previous years of Baltimore County data resulted in a geometric mean of 111 MPN/100 ml for the dry weather seasonal data. When the 2014 data is incorporated, the mean slightly increases to 118 MPN/100ml. This would indicate that there has been an improvement at this site. The TMDL indicated a reduction of 28.6% reduction necessary for meeting bacteria water quality standards in the drainage area to this site.

LIB-3 (MDE0026): This monitoring site is located on Middle Run in Carroll County, with all of the drainage area in Carroll County. The monitoring data indicate that the geometric mean *E.coli* concentrations did not meet the bacteria water quality standards for any of the flow conditions for either year of monitoring. The MDE data indicated a seasonal dry weather

concentration of 607 MPN/100ml for this site, while the Baltimore County data indicate a concentration of 437 MPN/100ml indicating improvement. The TMDL indicated 80.4% reduction necessary for meeting bacteria water quality standards at this site.

LIB-4 (BEA0016): This site is located on Beaver Run in Carroll County, with all of the drainage area in Carroll County. The monitoring data indicate that the geometric mean *E.coli* concentrations may be improving on a year over year basis, with most of the improvement in low flow conditions. The MDE data indicated a seasonal dry weather concentration of 278 MPN/100ml for this site, while the Baltimore County data indicate a concentration of 132 MPN/100ml indicating improvement. The TMDL indicated 58.3% reduction necessary for meeting bacteria water quality standards at this site.

LIB-5 (NPA0165): This site is located on the North Branch of the Patapsco River in Carroll County, with all of the drainage area in Carroll County. The monitoring data indicate that while the site is meeting bacteria water quality standards on an annual basis for both high flow and low flow conditions, it is still not meeting the standards on a seasonal basis. The MDE data indicated a seasonal dry weather concentration of 427 MPN/100ml for this site, while the Baltimore County data indicate a concentration of 298 MPN/100ml, indicating improvement. The TMDL indicated 72.1% reduction necessary for meeting bacteria water quality standards at this site.

Lower North Branch of the Patapsco River

Table 9-26 shows the latitude/longitude locations of the current bacteria monitoring stations within the Lower North Branch of the Patapsco River. All of the monitoring locations are on the mainstem of the Lower North Branch of the Patapsco River, with drainage from Baltimore, Carroll, Howard, and Anne Arundel counties, and Baltimore City.

Table 9-26 Baltimore County Bacteria Monitoring Station Locations

MDE Station Code	County Code	Watershed	Latitude	Longitude
PAT0148	PAT-1	LNB Patapsco River	39.231	-76.665
PAT0176	PAT-2	LNB Patapsco River	39.218	-76.707
PAT0222	PAT-3	LNB Patapsco River	39.251	-76.764
PAT0285	PAT-4	LNB Patapsco River	39.310	-76.792
PAT0347	PAT-5	LNB Patapsco River	39.332	-76.870

Table 9-27 presents the number of samples and the geometric mean for high (wet) flow and low (dry) flow by year. These data are presented graphically in Figures 9-40 through 9-44, which include the MDE results for comparison. It also presents the geometric mean of all samples by year regardless of condition. The table is stratified by annual data (includes all data collected for the year) and seasonal data (includes only those samples collected between May 1st and September 30th each year. Geometric means below the water quality standard (126 MPN) are highlighted in green.

Table 9-27 Lower North Branch of the Patapsco River *E. coli* Results on an Annual and Seasonal Basis

Annual Data – Geometric Mean (MPN/100 ml)											
Site	Flow Type	2010		2011		2012		2013		2014	
		N	MPN	N	MPN	N	MPN	N	MPN	N	MPN
PAT-1	High	2	2420	4	317	4	604	3	1531	3	1174
	Low	5	622	8	148	9	114	8	49	8	102

	All	7	917	12	191	11	209	11	125	11	198
PAT-2	High	2	1591	4	201	3	134	3	527	4	784
	Low	5	201	8	39	9	47	9	32	8	33
	All	7	363	12	68	11	62	12	65	12	94
PAT-3	High	2	1321	4	218	4	353	3	891	3	676
	Low	5	91	8	12	8	57	8	59	8	27
	All	7	196	12	31	12	104	11	123	11	65
PAT-4	High	2	1646	4	151	4	185	3	817	4	548
	Low	5	73	8	24	8	34	9	20	8	33
	All	7	178	12	44	12	59	12	50	12	84
PAT-5	High	2	450	4	154	4	163	3	165	4	321
	Low	5	79	8	28	8	28	9	24	7	34
	All	7	130	12	50	12	76	12	39	11	77

Seasonal Data (May 1st to September 30th) – Geometric Mean (MPN/100 ml)

Site	**Flow Type**	**2010**		**2011**		**2012**		**2013**		**2014**	
		N	**MPN**	**N**	**MPN**	**N**	**MPN**	**N**	**MPN**	**N**	**MPN**
PAT-1	High	0		2	644	3	1020	1	2420	1	921
	Low	4	443	3	992	2	130	4	163	3	141
	All	4	443	5	834	5	447	5	279	4	226
PAT-2	High	0		2	334	2	160	1	649	2	709
	Low	4	191	3	80	3	92	4	107	3	45
	All	4	191	5	142	5	115	5	153	5	135
PAT-3	High	0		2	283	2	351	1	411	1	411
	Low	4	84	3	71	3	124	4	187	3	68
	All	4	84	5	123	5	188	5	257	4	107
PAT-4	High	0		2	178	2	80	1	435	2	422
	Low	4	63	3	62	3	71	4	60	3	67
	All	4	63	5	94	5	75	5	90	5	141
PAT-5	High	0		2	111	2	115	1	248	2	322
	Low	4	78	3	83	3	139	4	64	2	109
	All	4	78	5	93	5	129	5	84	4	187

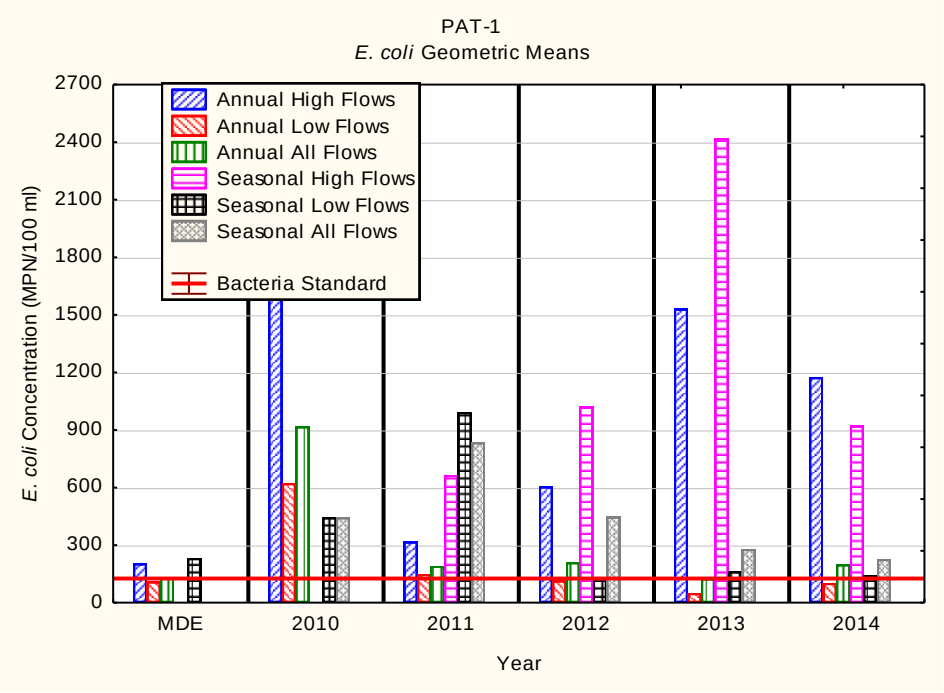


Figure 9-40: *E. coli* Geometric Mean Concentrations at Site PAT-1 for Both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

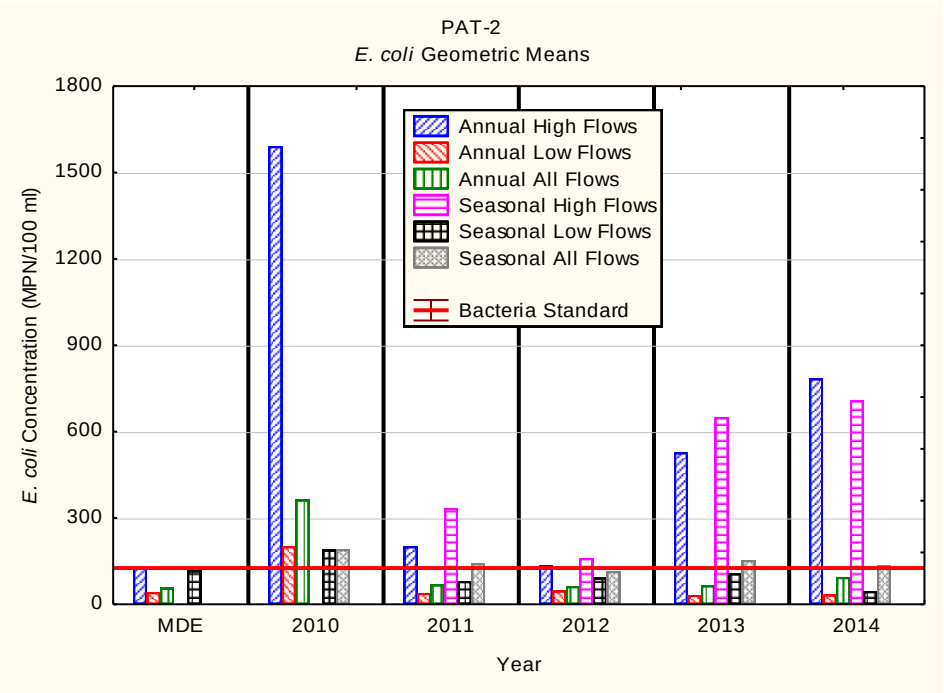


Figure 9-41: *E. coli* Geometric Mean Concentrations at Site PAT-2 for Both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

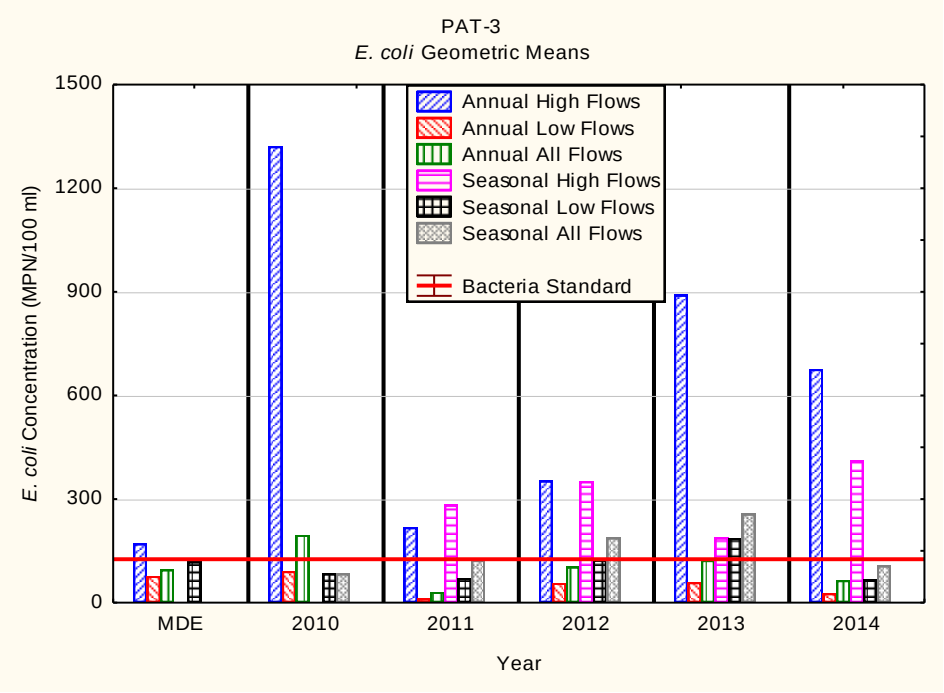


Figure 9-42: *E. coli* Geometric Mean Concentrations at Site PAT-3 for Both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

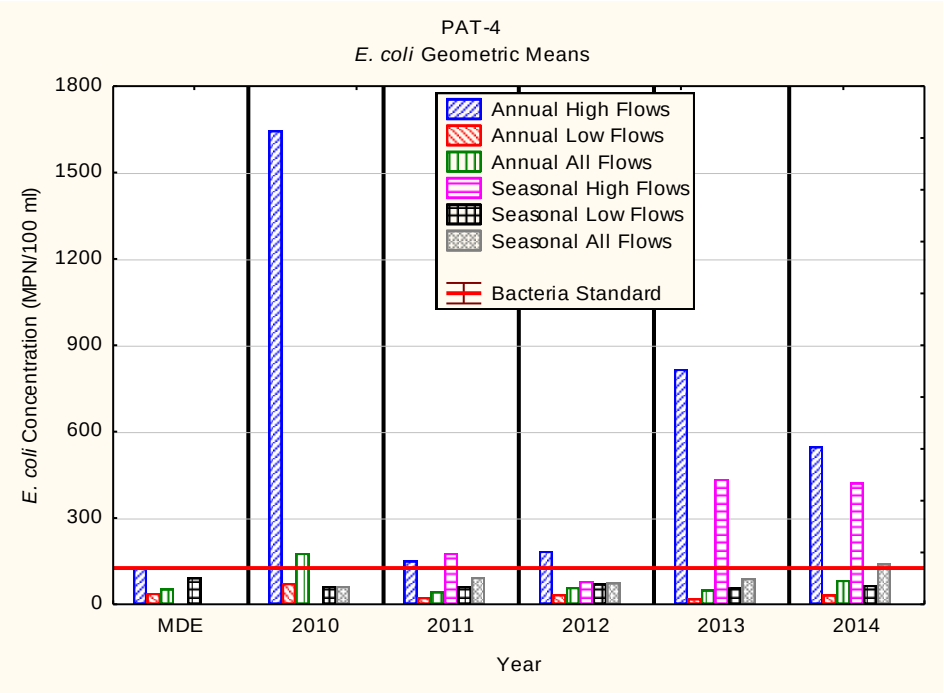


Figure 9-43: *E. coli* Geometric Mean Concentrations at Site PAT-4 for Both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

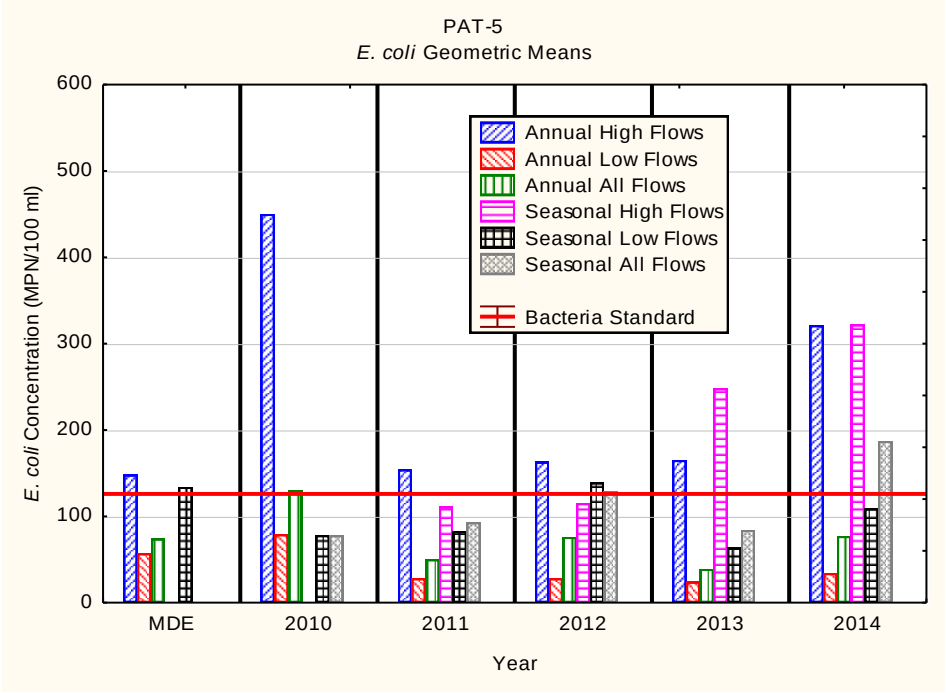


Figure 9-44: *E. coli* Geometric Mean Concentrations at Site PAT-5 for Both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

PAT-1 (PAT148): This site is the located on the mainstem of the Lower North Branch of the Patapsco River and is the lowest monitoring point on the mainstem. It receives drainage from Carroll, Baltimore, Howard, and Anne Arundel counties. The data indicate that this site is improving, with 2012 and 2013 annual low flow samples meeting the standard as well as meeting the standard when all of the samples from 2013 are considered. High flow and seasonal period samples do not yet meet the standard. In 2014, only low flow samples met the water quality standard. The Maryland Department of the Environment (MDE) data for this site indicted a geometric mean of 231 MPN/100ml for dry weather seasonal samples based on monitoring conducted between 10/2/2002 and 10/21/2003. A weighted mean for dry weather seasonal sampling for the five years of monitoring conducted by Baltimore County results in a value of 278 MPN/100ml. This would indicate worsening of conditions at this station between the two monitoring periods. The TMDL requires a 56.1% reduction of bacteria at this site.

PAT-2 (PAT0176): This monitoring site is located on the mainstem of the Lower North Branch of the Patapsco River above the confluence of the highly urbanized Herbert Run subwatershed in Baltimore County and Deep Run in Howard County. The Baltimore County monitoring indicated that this site has consistently met the water quality standard of 126 MPN/100ml for the last three years for both the annual and seasonal dry weather measurements. The MDE data for this site indicated a seasonal dry weather geometric mean of 117 MPN/100ml for this site. The five years of Baltimore County data resulted in a geometric mean of 97 MPN/100 ml for the dry weather seasonal data. This would indicate that there has been little change at this site or a slight improvement. The TMDL indicated no reductions necessary for meeting bacteria water quality standards in the drainage area to this site.

PAT-3 (PAT0222): This site is located on the mainstem of the Lower North Branch of the Patapsco River where it is crossed by Ilchester Road. The Baltimore County monitoring data

indicates that this site meets the bacteria water quality standards during dry weather flow on an annual basis for all five years of monitoring, and four of the five years for seasonal samples. The MDE data indicated a seasonal dry weather concentration of 119 MPN/100ml for this site, while the Baltimore County data indicate a concentration of 107 MPN/100ml indicating little change or a slight improvement. The TMDL indicated no reductions necessary for meeting bacteria water quality standards at this site.

PAT-4 (PAT0285): This site is located where Old Fredrick Road crosses the mainstem of the Lower North Branch of the Patapsco River. It is downstream of the confluence of a number of urbanized subwatersheds (Miller Run, Cedar Branch). The Baltimore County monitoring data indicates that this site meets the bacteria water quality standards during dry weather flow on an annual basis and a seasonal basis for all five years of monitoring. The MDE data indicated a seasonal dry weather concentration of 93 MPN/100ml for this site, while the Baltimore County data indicate a concentration of 64 MPN/100ml, indicating improvement at this site. The TMDL indicated no reductions necessary for meeting bacteria water quality standards at this site.

PAT-5 (PAT0387): This site is located where Old Court Road crosses the Patapsco River below the confluence of Falls Run and several unnamed tributaries with the Patapsco mainstem. The Baltimore County monitoring data indicates that this site meets the bacteria water quality standards during dry weather flow on an annual basis for all five years of monitoring, and three of the four years for seasonal samples. The MDE data indicated a seasonal dry weather concentration of 134 MPN/100ml for this site, while the Baltimore County data indicate a concentration of 87 MPN/100ml indicating improvement at this site. The TMDL indicated a 12.9% reduction of bacteria necessary for meeting bacteria water quality standards at this site. Based on the Baltimore County data this site may already be meeting the water quality standards. The majority of the drainage area to this site is outside of Baltimore County and lies mainly in Carroll and Howard counties.

In addition to analyzing the data for the geometric means, the data were analyzed based on the single sample exceedance for seasonal data (May 1st to September 30th). Single sample exceedance standards are based on frequency of full body contact, ranging from infrequent (576 MPN) to frequent (235). The objective in the control of bacteria is to not only meet the geometric mean water quality standards, but to also meet the single sample water quality standards. This is particularly important for the low flow (dry weather) component of the flow regime, as this is when human recreational use of water is most likely to occur. Table 9-28 presents the results of the analysis by station, by year and by flow regime. The zero percent exceedances are high-lighted in green.

Table 9-28: Frequency of Exceedance of Single Sample Water Quality Standards

Site	Year	N		Percent Single Sample Exceedance (MPN)							
		Flow Type		576		410		298		235	
		High	Low	High	Low	High	Low	High	Low	High	Low
PAT-1	2010	0	4		50%		50%		50%		75%
	2011	2	3	50%	67%	50%	67%	50%	67%	100%	67%
	2012	3	2	67%	0%	100%	0%	100%	0%	100%	0%
	2013	1	4	100%	25%	100%	25%	100%	25%	100%	50%
	2014	1	3	100%	0%	100%	0%	100%	0%	100%	33%
PAT-2	2010	0	4		0%		25%		25%		50%
	2011	2	3	0%	0%	25%	0%	25%	0%	100%	0%

	2012	2	3	0%	0%	0%	0%	0%	0%	25%	0%
	2013	1	4	100%	0%	100%	0%	100%	0%	100%	0%
	2014	2	3	50%	0%	50%	0%	100%	0%	100%	0%
PAT-3	2010	0	4		0%		0%		0%		0%
	2011	2	3	0%	0%	0%	0%	25%	0%	25%	0%
	2012	2	3	50%	0%	50%	0%	50%	0%	50%	0%
	2013	1	4	100%	25%	100%	25%	100%	25%	100%	25%
	2014	1	3	0%	0%	100%	0%	100%	0%	100%	0%
PAT-4	2010	0	4		0%		0%		0%		0%
	2011	2	3	0%	0%	0%	0%	50%	0%	50%	0%
	2012	2	3	0%	0%	0%	0%	0%	0%	0%	0%
	2013	1	4	0%	0%	100%	0%	100%	0%	100%	0%
	2014	2	3	0%	0%	50%	0%	100%	0%	100%	0%
PAT-5	2010	0	4		0%		0%		0%		0%
	2011	2	3	0%	0%	0%	0%	0%	0%	0%	0%
	2012	2	3	0%	0%	0%	0%	0%	25%	0%	25%
	2013	1	4	0%	0%	0%	0%	0%	0%	50%	0%
	2014	2	2	0%	0%	50%	0%	50%	0%	50%	0%

These data confirm that dry weather bacteria concentrations are not a concern at stations PAT-2 and PAT-4, as all dry weather samples were below all of the single sample standards. Monitoring sites PAT-3 and PAT-5 have excursions over the single sample standards and need to have potential sources identified. PAT-1 needs greater improvement and indeed has the highest bacteria reduction target at 56.1% in the TMDL. High flows are more variable in meeting the single sample standards.

Gwynns Falls

Table 9-29 shows the latitude/longitude locations of the current bacteria monitoring stations within the Gwynns Falls watershed. All of the monitoring locations are on the mainstem of the Gwynns Falls, with the upper two thirds of the watershed in Baltimore County and the lower third of the watershed in Baltimore City. Two of the monitoring sites are in the city and two are in the county.

Table 9-29: Baltimore County Bacteria Monitoring Station Locations

MDE Station Code	County Code	Watershed	Latitude	Longitude	Location
GWN0015	GWY-1	Gwynns Falls	39.271	-76.648	City
GWN0115	GWY-2	Gwynns Falls	39.346	-76.724	County
GWN0026	GWY-5	Gwynns Falls	39.277	-76.662	City
GWN0160	GWY-6	Gwynns Falls	39.392	-76.765	County

Table 9-30 presents the number of samples and the geometric mean for high (wet) flow and low (dry) flow by year. It also presents the geometric mean of all samples by year regardless of condition. The table is stratified by annual data (includes all data collected for the year) and seasonal data (includes only those samples collected between May 1st and September 30th each year. Geometric means below the water quality standard (126 MPN) are highlighted in green. These results are displayed graphically in Figures 9-45 through 9-48.

Table 9-30: Gwynns Falls *E. coli* Results on an Annual and Seasonal Basis

Annual Data (MPN/100 ml)											
Site	Flow Type	2010		2011		2012		2013		2014	
		N	MPN	N	MPN	N	MPN	N	MPN	N	MPN
GWY-1 City	High	2	1707	3	1452	3	1726	2	2420	4	1742
	Low	5	2416	8	2143	9	1554	10	542	7	925
	All	7	2187	11	1927	12	1595	12	696	11	1164
GWY-2	High	2	2420	4	732	3	567	2	212	4	1451
	Low	5	486	8	159	9	163	10	87	8	269
	All	7	769	12	265	12	222	12	101	12	471
GWY-5 City	High	2	2192	4	776	3	1083	2	1646	4	1844
	Low	5	588	8	447	9	421	10	91	7	237
	All	7	856	12	537	12	533	12	148	11	499
GWY-6	High	2	1607	4	422	3	526	3	927	4	1330
	Low	5	1046	8	127	8	169	9	72	7	119
	All	7	1183	12	190	11	231	12	137	11	285
Seasonal Data (May 1st to September 30th) (MPN/100 ml)											
Site	Flow Type	2010		2011		2012		2013		2014	
		N	MPN	N	MPN	N	MPN	N	MPN	N	MPN
GWY-1 City	High	0		2	3006	1	4352	1	2420	2	2420
	Low	4	2415	3	1124	4	2394	4	570	3	855
	All	4	2415	5	2029	5	2698	5	761	5	1296
GWY-2	High	0		2	755	1	816	1	172	2	2420
	Low	4	561	3	452	3	395	4	181	3	314
	All	4	561	5	555	4	474	5	180	5	711
GWY-5 City	High	0		2	951	1	3784	1	1120	2	2420
	Low	4	720	3	592	4	365	4	177	3	175
	All	4	720	5	716	5	404	5	256	5	501
GWY-6	High	0		2	411	1	579	1	921	2	1773
	Low	4	1480	3	198	3	267	4	96	2	298
	All	4	1480	5	265	4	324	5	151	4	727

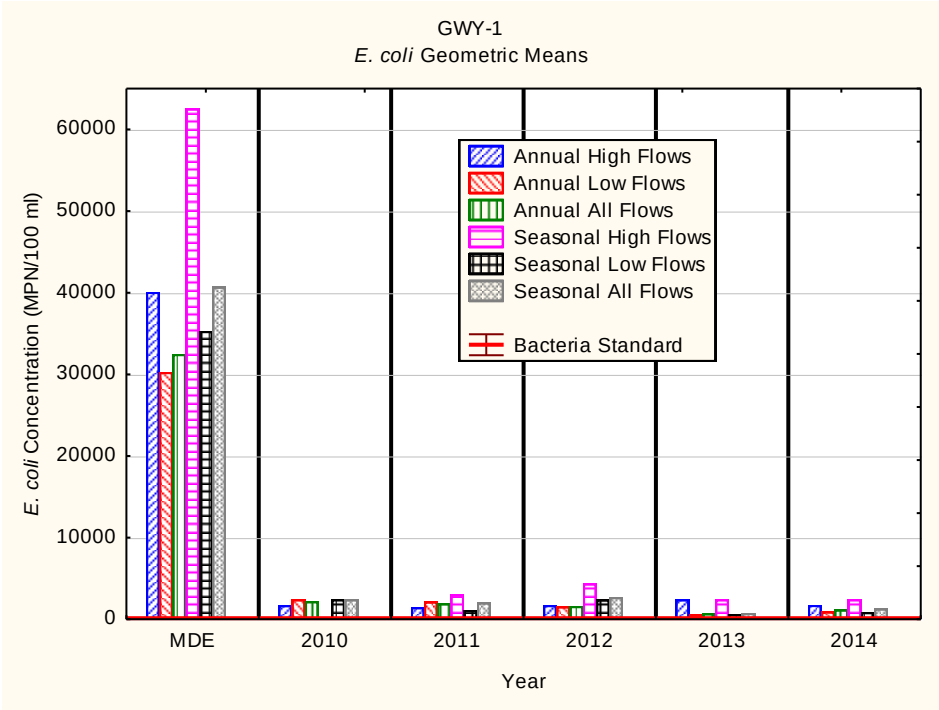


Figure 9-45: *E. coli* Geometric Mean Concentrations at Site GWY-1 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

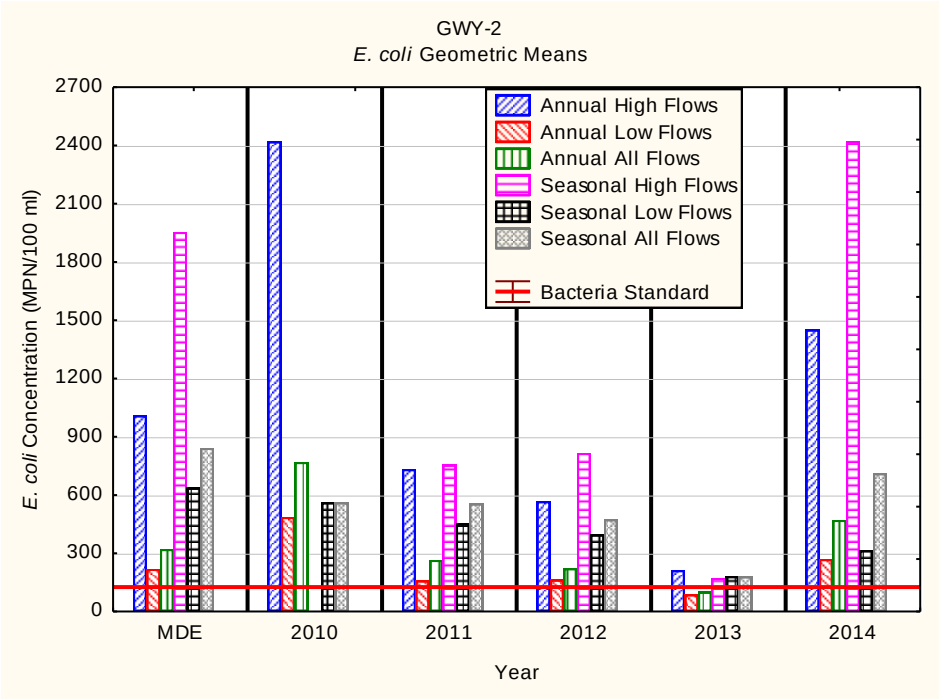


Figure 9-46: *E. coli* Geometric Mean Concentrations at Site GWY-2 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

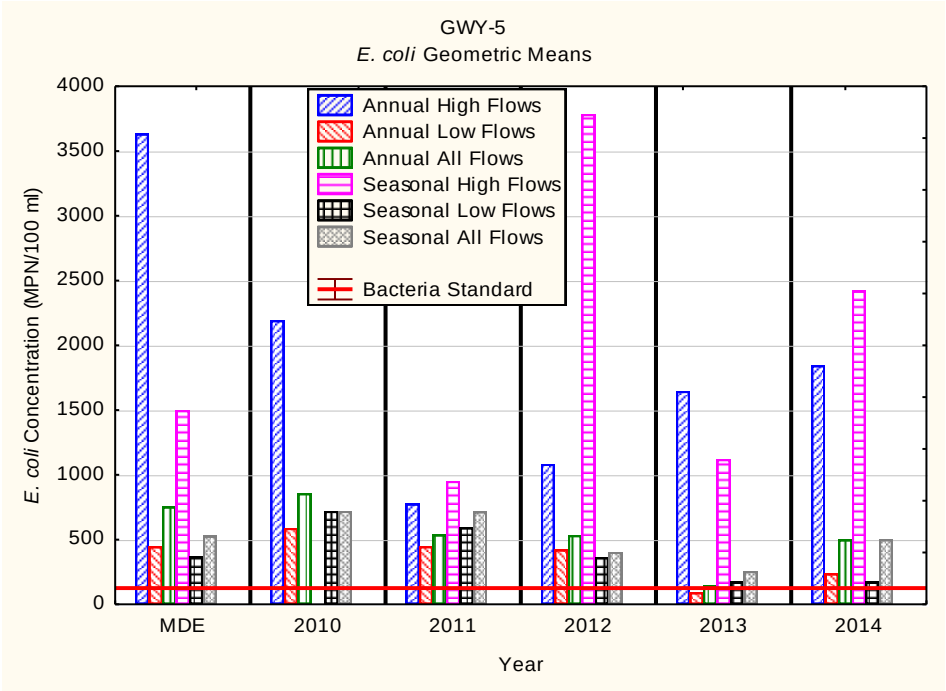


Figure 9-47: *E. coli* Geometric Mean Concentrations at Site GWY-5 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

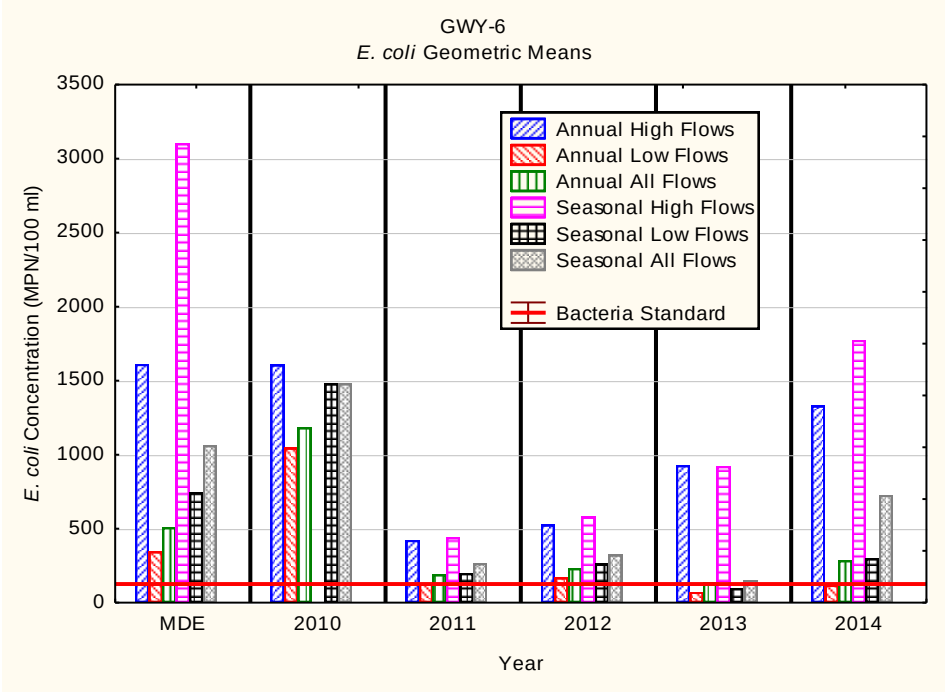


Figure 9-48: *E. coli* Geometric Mean Concentrations at Site GWY-6 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

GWY-1 (GWN0015): This site is the located in Baltimore City on the mainstem of the Gwynns Falls and is the lowest monitoring point on the mainstem. It receives drainage from both Baltimore County and Baltimore City. While the data indicate a generally improving trend over the five years of monitoring on an annual and seasonal basis, monitoring in 2014 showed an increase for both seasonal and annual geometric mean under any flow regime. The geometric mean for all conditions is still significantly higher than the water quality standard of 126 MPN/100 ml for *E. coli*. The Maryland Department of the Environment (MDE) data for this site indicted a geometric mean of 35,290 MPN/100ml for dry weather seasonal samples based on monitoring conducted between 10/2002 and 10/2003. A weighted mean for dry weather seasonal sampling for the five years of monitoring conducted by Baltimore County resulted in a value of 1,526 MPN/100ml. This would indicate the conditions are improving at this station based on the difference between the two monitoring periods. The TMDL requires a 99.98% reduction of bacteria at this site.

GWY-2 (GWN0115): This monitoring site is located on the mainstem of Gwynns Falls in Baltimore County, above the confluence of both Dead Run and Powdermill Run. The entire drainage area is in Baltimore County. The Baltimore County monitoring indicated that this site has displayed general improvement for both low flow on an annual and a seasonal basis. It met water quality standards for the annual low flow data in 2013, but exceeded those standards in 2014. The high flow data indicated more variation in the trend, due in part to only a few high flow samples being monitored. The MDE data for this site indicated a seasonal dry weather geometric mean of 373 MPN/100ml for this site. The five years of Baltimore County data resulted in a geometric mean of 349 MPN/100 ml for the dry weather seasonal data. This would indicate that there has been no change or slight improvement at this site. The TMDL indicated a reduction of 67.2% reduction necessary for meeting bacteria water quality standards in the drainage area to this site.

GWY-5 (GWN0026): This is located on the mainstem of Gwynns Falls in Baltimore City upstream of GWY-1 where the Wilkins Blvd crosses the stream. The Baltimore County monitoring data indicates that this site met the bacteria water quality standards during dry weather flow on an annual basis in 2013. The MDE data indicated a seasonal dry weather concentration of 636 MPN/100ml for this site, while the Baltimore County data indicate a concentration of 313 MPN/100ml, indicating improvement. The TMDL indicated 96.5% reduction necessary for meeting bacteria water quality standards at this site.

GWY-6 (GWN0160): This site is located in Baltimore County on the mainstem of Gwynns Falls where McDonogh Road crosses the stream. It is upstream of the confluence of Scotts Level Branch. The Baltimore County monitoring data indicates improving trends for low flow on both an annual basis and a seasonal basis. In 2013, the dry weather flows met the bacteria water quality standards for both the annual data and the seasonal data. The data for high flows is more variable. The MDE data indicated a seasonal dry weather concentration of 743 MPN/100ml for this site, while the Baltimore County data for the five years of monitoring resulted in a geometric mean concentration of 304 MPN/100ml; indicating improvement at this site. The TMDL indicated a 93.2% reduction is necessary for meeting bacteria water quality standards at this site.

In addition to analyzing the data for the geometric means, the data were analyzed based on the single sample exceedance for seasonal data (May 1st to September 30th). Single sample exceedance standards are based on frequency of full body contact, ranging from infrequent (576 MPN) to frequent (235). The objective in the control of bacteria is to not only meet the geometric mean water quality standards, but to also meet the single sample water quality standards. This is particularly important for the low flow (dry weather) component of the flow regime, as this is when human recreational use of water is most likely to occur. Table 9-31 presents the results of the analysis by station, by year and by flow regime. The zero percent exceedances are high-lighted in green.

Table 9-31: Frequency of Exceedance of Single Sample Water Quality Standards

Site	Year	N		Percent Single Sample Exceedance (MPN)							
		Flow Type		576		410		298		235	
		High	Low	High	Low	High	Low	High	Low	High	Low
GWY-1 City	2010	0	4		100%		100%		100%		100%
	2011	2	3	50%	100%	100%	100%	100%	100%	100%	100%
	2012	1	4	100%	100%	100%	100%	100%	100%	100%	100%
	2013	1	4	100%	50%	100%	75%	100%	75%	100%	75%
	2014	2	3	100%	100%	100%	100%	100%	100%	100%	100%
GWY-2	2010	0	4		50%		75%		75%		75%
	2011	2	3	100%	33%	100%	67%	100%	67%	100%	100%
	2012	1	3	100%	33%	100%	67%	100%	67%	100%	67%
	2013	1	4	0%	0%	0%	0%	0%	0%	0%	25%
	2014	2	3	100%	67%	100%	67%	100%	67%	100%	67%
GWY-5 City	2010	0	4		50%		50%		75%		75%
	2011	2	3	100%	67%	100%	67%	100%	67%	100%	100%
	2012	1	4	100%	0%	100%	0%	100%	50%	100%	50%
	2013	1	4	100%	25%	100%	25%	100%	25%	100%	25%
	2014	2	3	100%	0%	100%	0%	100%	33%	100%	33%
GWY-6	2010	0	4		100%		100%		100%		100%
	2011	2	3	0%	0%	50%	0%	100%	0%	100%	33%
	2012	1	3	100%	0%	100%	0%	100%	33%	100%	67%

	2013	1	4	100%	0%	100%	0%	100%	0%	100%	0%
	2014	2	2	100%	50%	100%	50%	100%	50%	100%	50%

The frequency of exceedance data shows improvement for station GWY-2 and GWY-6. These data indicate that dry weather bacteria concentrations may not be a concern at station GWY-6, as most dry weather samples were below all of the single sample standards. High flows are more variable in meeting the single sample standards.

Jones Falls

Table 9-32 shows the latitude/longitude locations of the current bacteria monitoring stations within the Jones Falls watershed. There are five bacteria trend monitoring sites in the Jones Falls. Two of the monitoring sites are in the city and three are in the county.

Table 9-32: Baltimore County Bacteria Monitoring Station Locations

MDE Station Code	County Code	Watershed/ Subshed	Latitude	Longitude	Location
JON0039	JON-1	Jones Falls	39.327	-76.640	City
JON0082	JON-2	Jones Falls	39.378	-76.644	County
JON0184	JON-3	Jones Falls	39.391	-76.661	County
UQQ005	JON-4	Roland Run	39.399	-76.649	County
SRU0005	JON-5	Stoney Run	39.326	-76.626	City

Table 9-33 presents the number of samples and the geometric mean for high (wet) flow and low (dry) flow by year. It also presents the geometric mean of all samples by year regardless of condition. The table is stratified by annual data (includes all data collected for the year) and seasonal data (includes only those samples collected between May 1st and September 30th each year). Geometric means below the water quality standard (126 MPN) are highlighted in green. These results are displayed graphically in Figures 9-49 through 9-53.

Table 9-33: Jones Falls *E. coli* Results on an Annual and Seasonal Basis

Annual (MPN/100 ml)											
Site	Flow Type	2010		2011		2012		2013		2014	
		N	MPN	N	MPN	N	MPN	N	MPN	N	MPN
JON-1 City	High	2	2,420	4	632	3	98	2	2,420	3	1684
	Low	5	942	8	605	8	547	8	328	8	317
	All	7	1,233	12	614	11	342	10	489	11	500
JON-2	High	2	703	4	173	3	32	2	24	4	442
	Low	5	187	8	46	9	283	10	28	7	55
	All	7	273	12	71	12	55	12	27	11	117
JON-3	High	2	1,119	4	460	3	240	2	748	4	751
	Low	5	761	8	65	9	94	10	82	8	104
	All	7	849	12	124	12	119	12	118	12	201
JON-4	High	2	1,119	4	716	3	449	2	2,420	4	688
	Low	5	696	8	111	9	64	10	60	8	186
	All	7	797	12	207	12	105	12	110	12	288
JON-5 City	High	2	2,420	4	973	3	200	2	2,420	4	1151
	Low	5	373	8	360	9	182	9	200	8	230
	All	7	636	12	502	12	186	11	315	12	394
Seasonal (May 1st to September 30th) (MPN/100 ml)											
Site	Flow Type	2010		2011		2012		2013		2014	
		N	MPN	N	MPN	N	MPN	N	MPN	N	MPN

JON-1 City	High	0		2	751	1	**	1	2,420	2	2420
	Low	4	1,210	3	538	4	824	4	283	3	706
	All	4	1,210	5	615	5	215	5	434	5	1155
JON-2	High	0		2	228	1	75	1	63	2	1087
	Low	4	147	3	186	4	35	4	17	2	113
	All	4	147	5	202	5	40	5	49	4	351
JON-3	High	0		2	551	1	387	1	770	2	1053
	Low	4	994	3	377	4	254	4	266	3	549
	All	4	994	5	439	5	277	5	329	5	712
JON-4	High	0		2	2,178	1	210	1	2,420	2	1365
	Low	4	889	3	869	4	251	4	152	3	305
	All	4	889	5	1,255	5	242	5	684	5	555
JON-5 City	High	0		2	773	1	166	1	2,420	2	1773
	Low	4	311	3	275	4	93	4	479	3	372
	All	4	311	5	416	5	105	5	662	5	695

** Data suspect, results indicated 1 MPN/100 ml

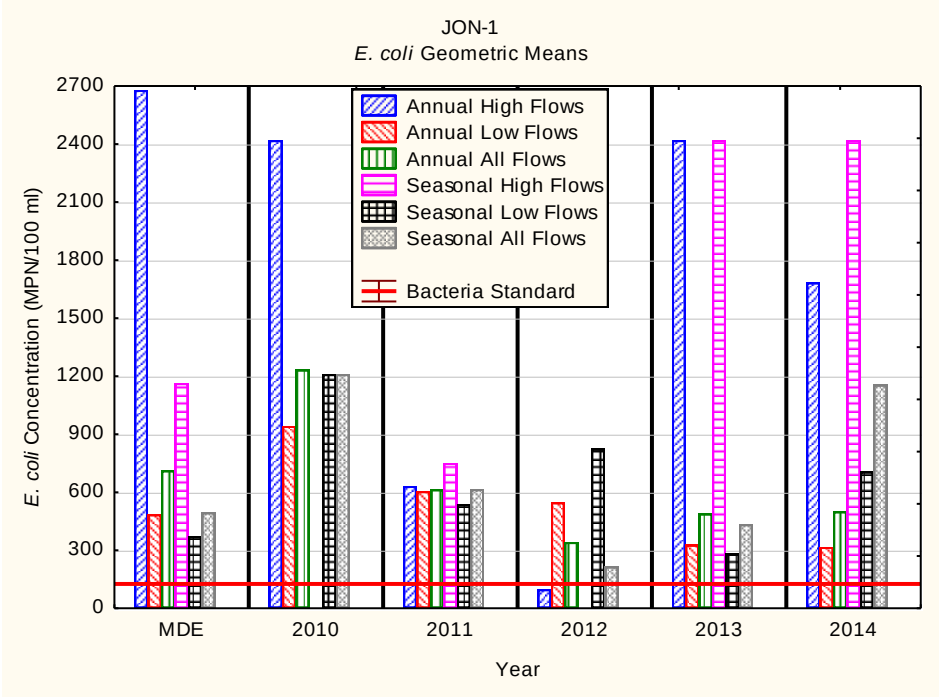


Figure 9-49: *E. coli* Geometric Mean Concentrations at Site JON-1 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

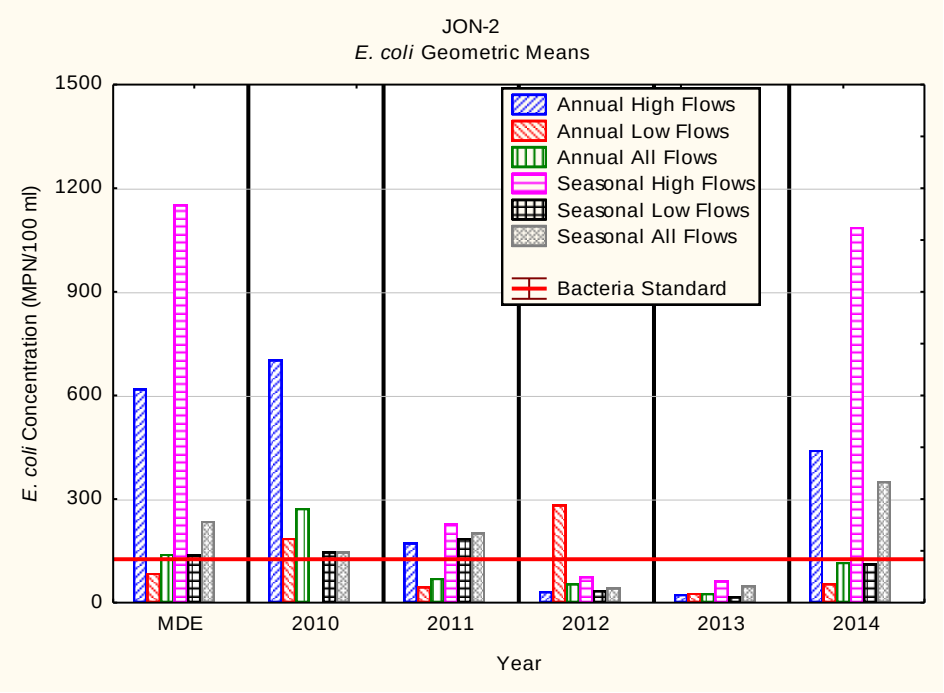


Figure 9-50: *E. coli* Geometric Mean Concentrations at Site JON-2 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

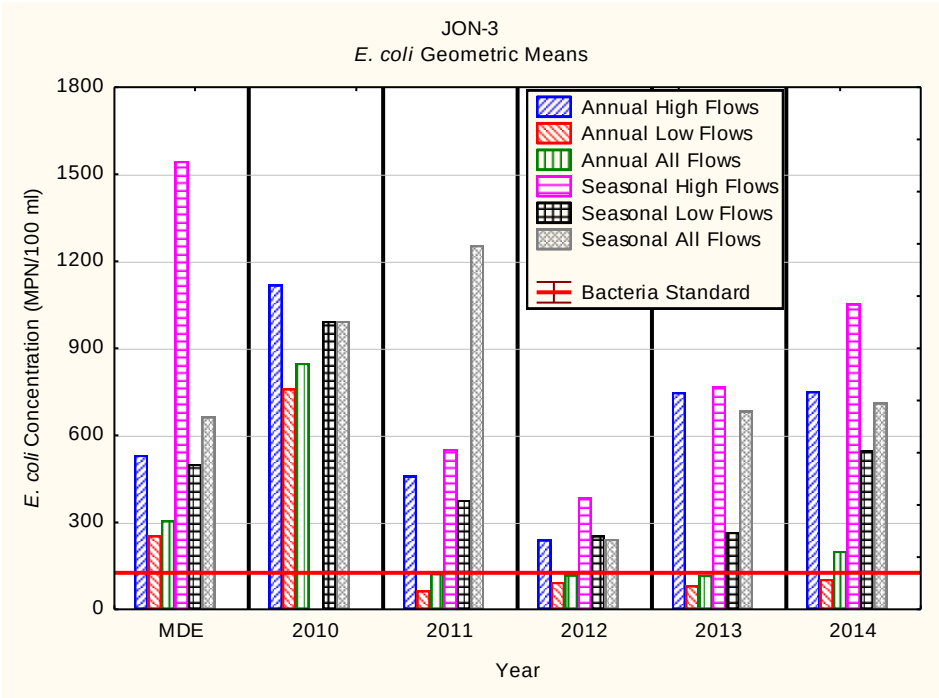


Figure 9-51: *E. coli* Geometric Mean Concentrations at Site JON-3 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

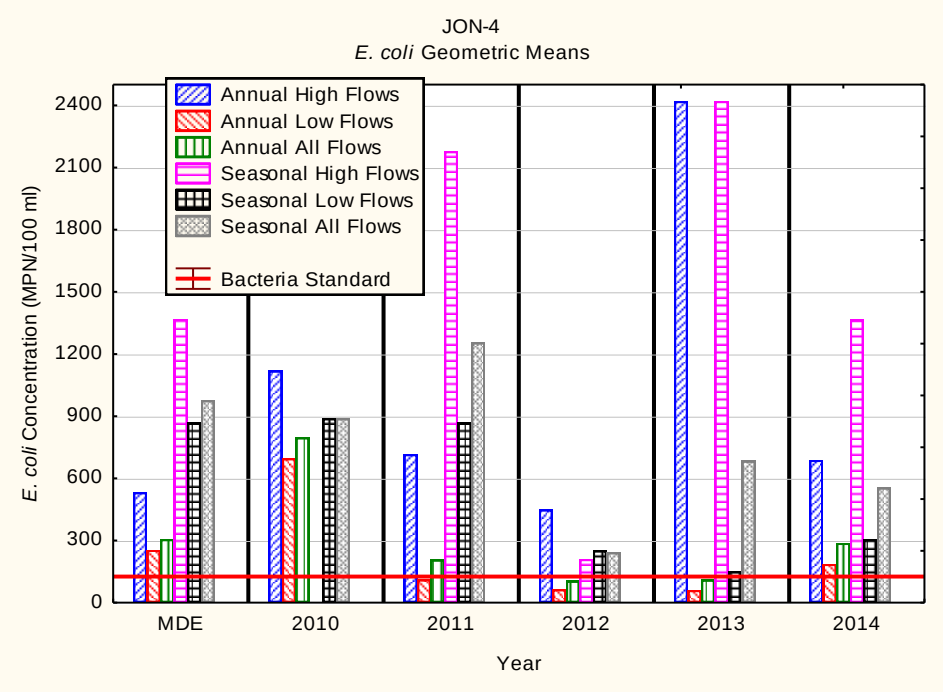


Figure 9-52: *E. coli* Geometric Mean Concentrations at Site JON-4 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

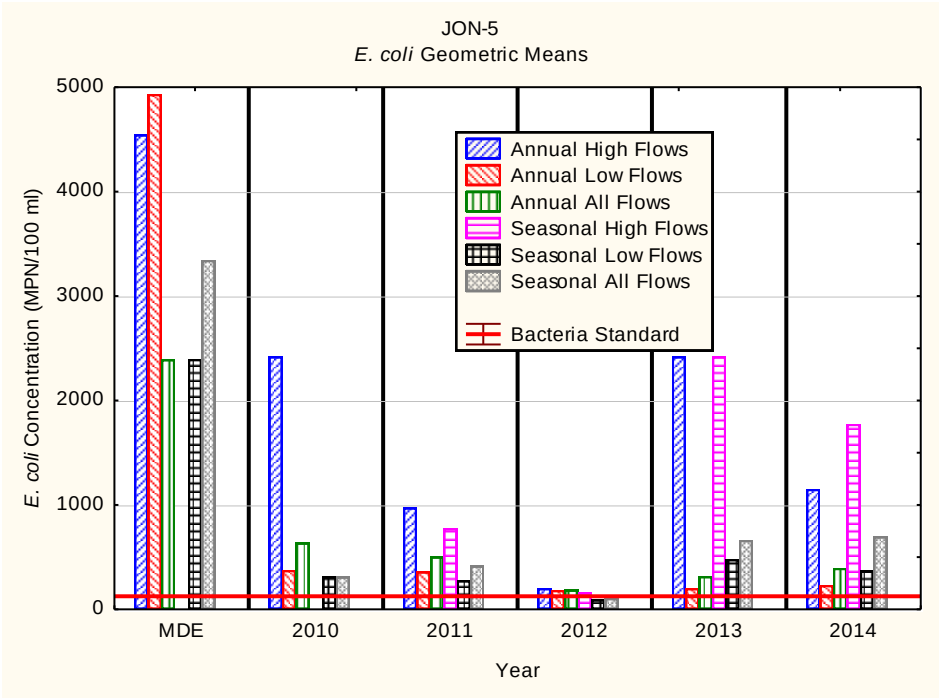


Figure 9-53: *E. coli* Geometric Mean Concentrations at Site JON-5 for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

JON-1 (JON0039): This site is the located in Baltimore City on the mainstem of the Jones Falls and is the lowest monitoring point on the mainstem. It receives drainage from both Baltimore County and Baltimore City. The monitoring site is located above the confluence with Stoney Run. While the data indicate an improving trend over the five years of monitoring on an annual

low flow conditions, the geometric mean for all conditions is still higher than the water quality standard of 126 MPN/100 ml for *E. coli*. The Maryland Department of the Environment (MDE) data for this site had a geometric mean of 372 MPN/100ml for dry weather seasonal samples based on monitoring conducted between 10/2002 and 6/2003. A weighted mean for dry weather seasonal sampling for the five years of monitoring conducted by Baltimore County resulted in a value of 642 MPN/100ml. This would indicate the conditions are worsening at this station based on the difference between the two monitoring periods. The TMDL requires a 95.3% reduction of bacteria at this site.

JON-2 (JON0082): This monitoring site is located on the mainstem of Jones Falls in Baltimore County, below the Lake Roland dam. The entire drainage area is in Baltimore County. The Baltimore County monitoring indicated that this site has displayed continuing improvement for both low flow and high flow on an annual and a seasonal basis. In 2014, the major flooding event of April 30th – May 1st may have contributed to the dramatic increase seen in the means for high flow regimes of any period and the seasonal period as a whole. Geometric mean water quality standards were met for low flow conditions and when 2014 is taken in aggregate.. The MDE data for this site indicated a seasonal dry weather geometric mean of 139 MPN/100ml for this site. The five years of Baltimore County data resulted in a geometric mean of 87 MPN/100 ml for the dry weather seasonal data. This would indicate that there has been improvement at this site. The TMDL indicated a reduction of 95.3% reduction necessary for meeting bacteria water quality standards in the drainage area to this site. Based on the Baltimore County monitoring data, this site may have had enough bacteria reduction to meet the bacteria water quality standards. Monitoring will continue at this site to confirm that bacteria water quality standards are being met.

JON-3 (JON0184): This is located on the mainstem of Jones Falls in Baltimore County upstream of Lake Roland at the Sorrento Run USGS gage. The entire drainage area is in Baltimore County. The Baltimore County monitoring data indicates that the bacteria concentrations are improving, particularly for low flow conditions. Based on the annual data, bacteria water quality standards were met only for low flow conditions for 2014 as a whole. . Previous trends in the geometric means indicating improvement during other flow regimes or time periods seem to have flattened out or increased slightly over previous years' data. . The MDE data indicated a seasonal dry weather concentration of 501 MPN/100ml for this site, while the Baltimore County data, geometric mean for five years shows a concentration of 422 MPN/100ml indicating improvement. The TMDL requires 92.4% reduction for meeting bacteria water quality standards at this site.

JON-4 (UQQ005): This site is located in Baltimore County on Roland Run upstream from Lake Roland. The entire drainage is in Baltimore County and represents an urban subwatershed. The Baltimore County monitoring data indicates improving trends for low flow on both an annual basis and a seasonal basis. The annual low flow geometric means met the bacteria water quality standards between 2011 and 2013, but exceeded the standard in 2014. However, the seasonal low flow, while improving, has yet to meet the bacteria water quality standards. The MDE data indicated a seasonal dry weather concentration of 872 MPN/100ml for this site, while the Baltimore County data for the five years of monitoring resulted in a geometric mean concentration of 378 MPN/100ml; indicating improvement at this site. The TMDL indicated a 92.1% reduction is necessary for meeting bacteria water quality standards at this site.

JON-5 (SRU0005): This site is located on Stoney Run in Baltimore City. A very small portion of the drainage area is in Baltimore County just above the city line. The data are somewhat variable on an annual basis, but a general improvement in low flow bacteria concentrations occurred the first three years of the monitoring program with an increase in 2013. In 2014, geometric means under high flow conditions decreased sharply, but all means for 2014 remained well above the water quality standard. Continued monitoring will determine if there is a consistent improvement of bacteria concentrations at this site. The MDE data indicated a seasonal dry weather concentration of 2,394 MPN/100ml at this site based on monitoring in 2002-2003, while the Baltimore County data for the five years of monitoring results in a geometric mean of 264 MPN/100 ml for the seasonal dry weather samples. This would indicate a significant improvement between the two monitoring periods. The TMDL indicated a 97.8% reduction in bacteria loads as necessary to meet bacteria water quality standards.

In addition to analyzing the data for the geometric means, the data were analyzed based on the single sample exceedance for seasonal data (May 1st to September 30th). Single sample exceedance standards are based on frequency of full body contact, ranging from infrequent (576 MPN) to frequent (235). The objective in the control of bacteria is to not only meet the geometric mean water quality standards, but to also meet the single sample water quality standards. This is particularly important for the low flow (dry weather) component of the flow regime, as this is when human recreational use of water is most likely to occur. Table 9-34 presents the results of the analysis by station, by year and by flow regime. The zero percent exceedances are highlighted in green.

Table 9-34: Frequency of Exceedance of Single Sample Water Quality Standards

Site	Year	N		Percent Single Sample Exceedance (MPN)							
		Flow Type		576		410		298		235	
		High	Low	High	Low	High	Low	High	Low	High	Low
JON-1	2010	0	4		100%		100%		100%		100%
	2011	2	3	100%	67%	100%	67%	100%	67%	100%	67%
	2012	1	4	0%	75%	0%	100%	0%	100%	0%	100%
	2013	1	4	100%	25%	100%	25%	100%	50%	100%	75%
	2014	2	3	100%	100%	100%	100%	100%	100%	100%	100%
JON-2	2010	0	4		25%		25%		25%		25%
	2011	2	3	50%	0%	50%	33%	0%	33%	0%	67%
	2012	1	4	0%	0%	0%	0%	0%	0%	0%	0%
	2013	1	4	0%	0%	0%	0%	0%	0%	0%	0%
	2014	2	2	50%	0%	100%	0%	100%	0%	100%	0%
JON-3	2010	0	4		75%		100%		100%		100%
	2011	2	3	50%	0%	50%	33%	50%	100%	100%	100%
	2012	1	4	0%	50%	0%	75%	100%	75%	100%	75%
	2013	1	4	100%	50%	100%	50%	100%	50%	100%	50%
	2014	2	3	100%	67%	100%	67%	100%	67%	100%	100%
JON-4	2010	0	4		75%		75%		75%		100%
	2011	2	3	100%	100%	100%	100%	100%	100%	100%	100%
	2012	1	4	0%	25%	0%	75%	0%	75%	0%	75%
	2013	1	4	100%	25%	100%	25%	100%	25%	100%	25%
	2014	2	3	100%	0%	100%	33%	100%	67%	100%	67%
JON-5	2010	0	4		75%		75%		75%		75%
	2011	2	3	50%	33%	50%	33%	50%	33%	100%	33%

	2012	1	4	0%	0%	0%	0%	0%	25%	0%	25%
	2013	1	4	100%	25%	100%	25%	100%	25%	100%	75%
	2014	2	3	100%	0%	100%	33%	100%	67%	100%	100%

The frequency of exceedance data shows the previous improvement for station JON-2, but with an increase in 2014. As discussed, this may be due to the severe flooding event which occurred in 2014 during the seasonal sampling period. . This site is below the Lake Roland dam and may benefit from treatment by the Lake Roland waters. The other four sites are more variable in results with no specific trends noted.

Herring Run

Table 9-35 shows the latitude/longitude locations of the current bacteria monitoring stations within Back River watershed.

Table 9-35 Baltimore County Bacteria Monitoring Station Locations

Station Code	County Code	Stream	Watershed	Latitude	Longitude	County
HER0065	HER-1	Herring Run	Back River	39 20.730	-76 34.870	Balt. City
Pulaski	Pulaski	Herring Run	Back River	39 30.512	-76 53.732	Balt. City
Biddle/62	Biddle	Moore's Run	Back River	39 30.595	-76 52.946	Balt. City

Table 9-36 presents the number of samples and the geometric mean for high (wet) flow and low (dry) flow by year. It also presents the geometric mean of all samples by year regardless of condition. The table is stratified by annual data (includes all data collected for the year) and seasonal data (includes only those samples collected between May 1st and September 30th each year. Geometric means that meet the water quality standard (126 MPN) are highlighted in green. Sampling at the Biddle Street and Pulaski Highway sites did not commence until 2011. These data are displayed graphically in Figures 9-54 through 9-56.

Table 9-36 Herring Run Annual Geometric Mean by Weather

Annul Data (number of samples and geometric mean MPN)											
Site	Flow Type	2010		2011		2012		2013		2014	
		N	MPN	N	MPN	N	MPN	N	MPN	N	MPN
HER-1	High	2	2420	4	1267	2	448	2	1253	3	2023
	Low	5	616	6	842	7	136	9	85	8	304
	All	7	910	10	991	9	177	11	139	11	510
Biddle	High			2	863	3	388	2	618	2	1591
	Low			4	667	8	196	8	103	7	251
	All			6	727	11	236	10	147	9	378
Pulaski Hwy	High			2	1218	3	763	2	1849	3	1621
	Low			4	512	8	123	4	402	8	461
	All			6	684	11	202	10	146	11	650

Seasonal Data (May 1st to September 30th)											
Site	Flow Type	2010		2011		2012		2013		2014	
		N	MPN	N	MPN	N	MPN	N	MPN	N	MPN
HER-1	High	0		2	1455	0		1	649	1	2420
	Low	4	921	3	989	4	74	3	106	3	426
	All	4	790	5	1154	4	74	4	166	4	658
Biddle	High	0		1	2420	1	167	1	158	1	2420
	Low	0		3	1383	4	356	3	192	2	461
	All	0		4	1591	5	306	4	183	3	801

Pulaski Hwy	High	0		1	2420	1	333	1	2420	1	2420
	Low	0		3	695	4	189	3	649	3	580
	All	0		4	950	5	211	4	170	4	829

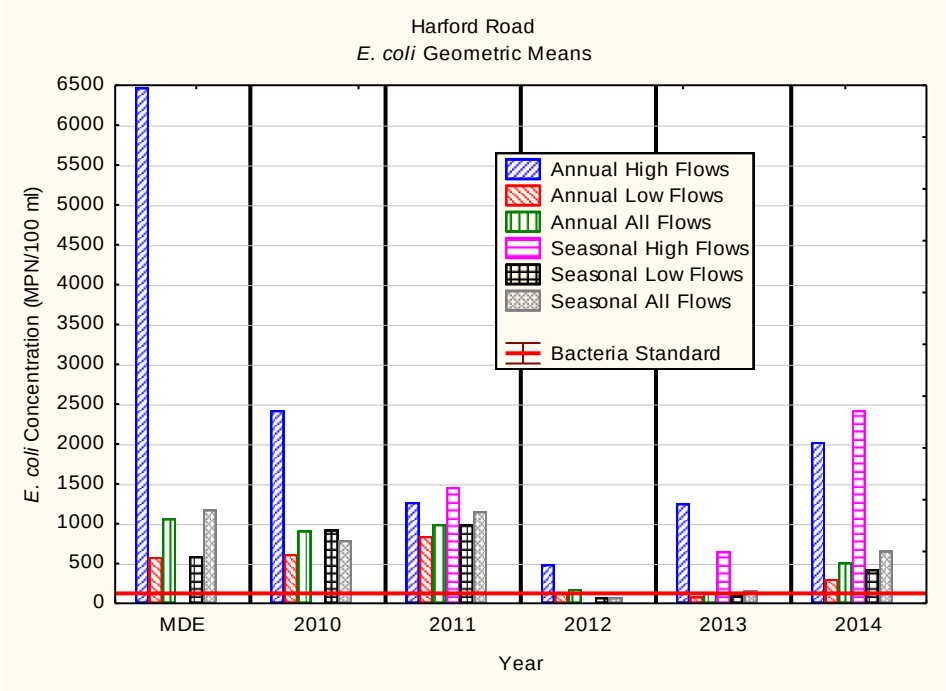


Figure 9-54: *E. coli* Geometric Mean Concentrations at the Harford Road Site (HER-1) for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison

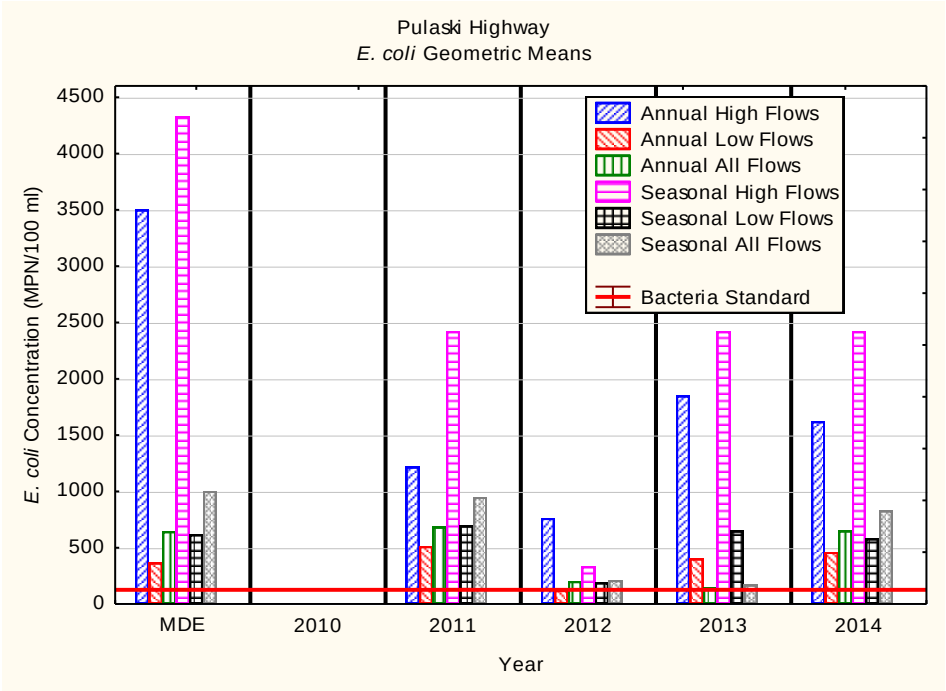


Figure 9-55: *E. coli* Geometric Mean Concentrations at the Pulaski Highway Site for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison. No Samples Collected in 2010

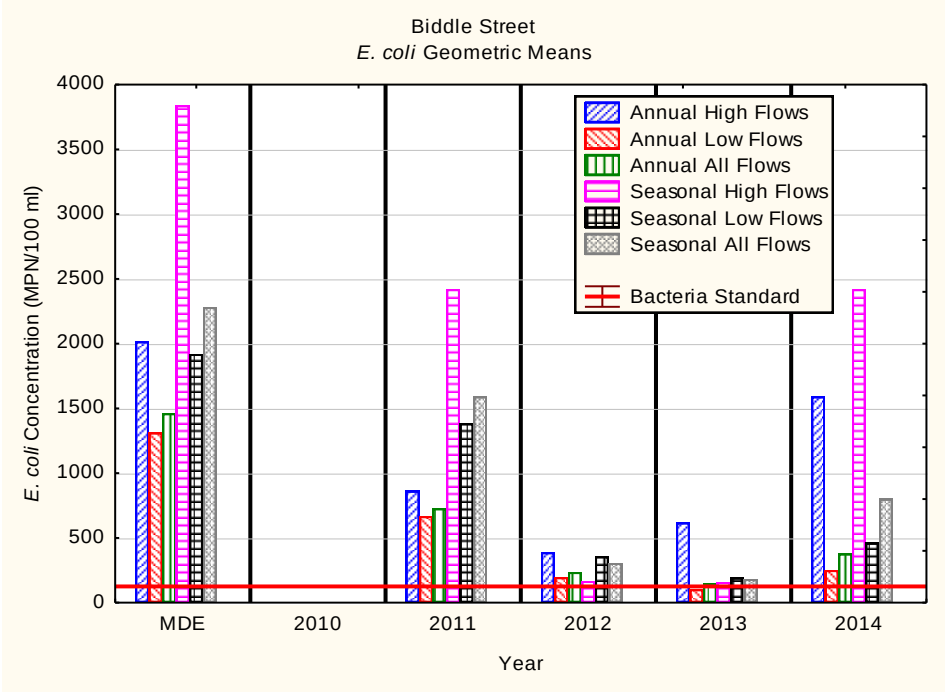


Figure 9-56: *E. coli* Geometric Mean Concentrations at the Biddle Street Site for both Annual and Seasonal Flow Periods Stratified by Flow Condition, MDE Results Added for Comparison. No Samples Collected in 2010

There appears to be an improving trend in the *E. coli* MPN concentrations, as indicated by the annual and seasonal geometric means for all samples. The bacteria water quality standard has been achieved on a sporadic basis in recent (2012, 2013) years, primarily on an annual basis, but at HER-1 on a seasonal basis as well. In 2014, the generally decreasing trend in geometric means seems to have been temporary, with none of the Herring Run sites meeting the geometric mean water quality under any condition, and most significantly increasing.

In addition to analyzing the data for the geometric means, the data were analyzed based on the single sample exceedance for seasonal data (May 1st to September 30th). Single sample exceedance standards are based on frequency of full body contact, ranging from infrequent (576 MPN) to frequent (235). The objective in the control of bacteria is to not only meet the geometric mean water quality standards, but to also meet the single sample water quality standards. This is particularly important for the low flow (dry weather) component of the flow regime, as this is when human recreational use of water is most likely to occur. Table 9-37 presents the results of the analysis by station, by year and by flow regime. The zero percent exceedances are high-lighted in green.

Table 9-37: Frequency of Exceedance of Single Sample Water Quality Standards

Site	Year	N		Percent Single Sample Exceedance (MPN)							
		Flow Type		576		410		298		235	
		High	Low	High	Low	High	Low	High	Low	High	Low
HER-1	2010	0	4		75%		75%		75%		75%
	2011	2	3	100%	67%	100%	67%	100%	100%	100%	100%
	2012	0	4		0%		0%		0%		0%
	2013	1	3	100%	0%	100%	0%	100%	0%	100%	33%
	2014	1	3	100%	33%	100%	67%	100%	67%	100%	67%
Biddle	2010	0	0								
	2011	1	3	100%	100%	100%	100%	100%	100%	100%	100%
	2012	1	4	0%	50%	0%	50%	0%	75%	75%	0%
	2013	1	3	0%	33%	0%	33%	0%	33%	0%	67%
	2014	1	2	100%	50%	100%	50%	100%	50%	100%	100%
Pulaski	2010	0	0								
	2011	1	2	100%	75%	100%	75%	100%	100%	100%	100%
	2012	1	4	0%	0%	0%	25%	0%	50%	0%	50%
	2013	1	3	0%	0%	0%	0%	0%	0%	0%	25%
	2014	1	3	100%	33%	100%	67%	100%	100%	100%	100%

These data also indicate a generally improving trend over time in the bacteria concentrations, particularly during low flow (dry weather) conditions, but 2014 represented a step back in terms of sample exceedance rates. The high flows also indicate improving trends, but given the limited number of samples, it is not possible to ascertain the accuracy of this trend.

9.4.2.3 Subwatershed Prioritization Program

In order to more effectively target Baltimore County's efforts in reducing bacterial loads, a subwatershed prioritization program was instituted beginning in May 2015. This program is intended to assess the bacterial loads associated with streams and tributaries draining to each of the watersheds impaired by fecal bacteria. If the results show that a particular stream or tributary is consistently exceeding bacterial standards, it can be considered a focus for efforts to detect and eliminate the source of the bacterial load. By systematically examining streams in the watershed and focusing detection and elimination efforts in streams with consistently high bacteria counts, Baltimore County intends to effect bacterial load reductions in the associated watersheds. Tables 9-38 to 9-43 list the subwatershed prioritization monitoring site location in latitude and longitude and the subwatershed targeted.

Table 9-38: Prettyboy Reservoir Subwatershed Prioritization Site Locations and Descriptions

Station Code	Subwatershed	Latitude	Longitude
PR-B-1	Prettyboy Branch	39.616	-76.734
PR-B-2	George's Run	39.616	-76.793
PR-B-3	Peggy's Run	39.616	-76.814
PR-B-4	Murphy Run	39.920	-76.814
PR-B-5	Compass Run	39.638	-76.781
PR-B-6	Indian Run	39.655	-76.809
PR-B-7	Poplar Run	39.662	-76.780
PR-B-8	Prettyboy Direct Drainage 1	39.676	-76.778
PR-B-9	Prettyboy Direct Drainage 2	39.681	-76.776
PR-B-10	Prettyboy Direct Drainage 3	39.658	-76.742
PR-B-11	Walker Run	39.689	-76.776
PR-B-12	Silver Run	39.691	-76.764
PR-B-13	Prettyboy Direct Drainage 4	39.682	-76.755

PR-B-14	Prettyboy Direct Drainage 5	39.675	-76.741
PR-B-15	Prettyboy Direct Drainage 6	39.663	-76.727
PR-B-16	Frog Hollow Run	39.645	-76.721

Table 9-39: Loch Raven Subwatershed Prioritization Site Locations and Descriptions

Station Code	Subwatershed	Latitude	Longitude
LR-B-1	Loch Raven Reservoir Direct Drainage 1	39.427	-76.581
LR-B-2	Hampton Branch	39.425	-76.594
LR-B-3	Long Quarter Branch	39.426	-76.596
LR-B-4	Loch Raven Reservoir Direct Drainage 2	39.461	-76.544
LR-B-5	Kelly's Branch	39.446	-76.595
LR-B-6	Merryman's Branch	39.461	-76.589
LR-B-7	Rushbrook	39.440	-76.559
LR-B-8	Lower Loch Raven	39.428	-76.545
LR-B-9	Dulaney Valley Branch	39.467	-76.545
LR-B-10	Jenkins Run	39.467	-76.558
LR-B-11	Fitzhugh Run	39.466	-76.572
LR-B-12	Goodwin Run	39.474	-76.657
LR-B-13	Upper Beaverdam Run	39.457	-76.692
LR-B-14	East Beaverdam Run	39.473	-76.640
LR-B-15	Baisman Run	39.479	-76.678
LR-B-16	Oregon Run	39.485	-76.656
LR-B-17	Slade Run	39.494	-76.778
LR-B-18	McGill Run	39.513	-76.769
LR-B-19	Piney Run	39.521	-76.767
LR-B-20	Little Piney Run	39.567	-76.735
LR-B-21	Blackrock Run	39.544	-76.733
LR-B-22	Indian Run	39.541	-76.735
LR-B-23	Quail Creek	39.515	-76.637
LR-B-24	Overshot Run	39.496	-76.569
LR-B-25	Greene Branch	39.506	-76.614
LR-B-26	Carroll Branch/My Lady's Manor Branch	39.534	-76.616
LR-B-27	Unnamed Western Run Tributary	39.514	-76.660
LR-B-28	Waterspout Run	39.492	-76.753
LR-B-29	Piney Creek	39.538	-76.648
LR-B-30	Buffalo Creek	39.556	-76.669
LR-B-31	Bush Cabin Run	39.610	-76.684
LR-B-32	Charles Run	39.576	-76.611
LR-B-33	Upper Little Falls – West Branch	39.692	-76.720
LR-B-34	Panther Branch	39.600	-76.650
LR-B-35	Mingo Branch	39.612	-76.675
LR-B-36	First Mine Branch	39.617	-76.621
LR-B-37	Second Mine Branch	39.623	-76.630
LR-B-38	Third Mine Branch	39.632	-76.640
LR-B-39	Fourth Mine Branch	39.642	-76.658
LR-B-40	Owl Branch	39.646	-76.663
LR-B-41	Upper Little Falls – East Branch	39.696	-76.710
LR-B-42	Little Falls	39.668	-76.678
LR-B-43	Beetree Run	39.672	-76.674
LR-B-44	Delaware Run/Councilman's Run	39.494	-76.777

LR-B-45	Deadman's Run	39.505	-76.743

Table 9-40: Jones Falls Subwatershed Prioritization Site Locations and Descriptions

Station Code	Subwatershed	Latitude	Longitude
JF-B-1	Towson Run	39.389	-76.641
JF-B-2	Ruxton Run	39.393	-76.642
JF-B-3	Roland Run – West Branch	39.415	-76.646
JF-B-4	Roland Run – East Branch	39.415	-76.645
JF-B-5	Deep Run – Jones Falls	39.417	-76.671
JF-B-6	Jones Falls – Unnamed Trib. 1	39.416	-76.674
JF-B-7	Dipping Pond Run	39.425	-76.689
JF-B-8	North Branch Jones Falls	39.422	-76.710
JF-B-8	Jones Falls – Headwaters	39.410	-76.719
JF-B-10	Slaughterhouse Branch	39.399	-76.668
JF-B-11	Moores Branch	39.394	-76.670
JF-B-14	Dipping Pond Run – East Branch	39.419	-76.670

Table 9-41: Gwynns Falls Subwatershed Prioritization Site Locations and Descriptions

Station Code	Subwatershed	Latitude	Longitude
GF-B-1	Gwynns Falls UN Trib 2	39.324	-76.725
GF-B-2	Gwynns Falls UN Trib 1	39.347	-76.737
GF-B-3	Gwynns Falls UN Trib 3	39.378	-76.757
GF-B-4	Gwynns Falls UN Trib 4	39.370	-76.737
GF-B-5	Gwynns Falls UN Trib 5	39.376	-76.423
GF-B-6	Gwynns Falls UN Trib 6	39.433	-76.781
RR-B-1	Red Run	39.405	-76.778
GF-B-7	Upper Gwynns Falls	39.405	-76.777
HH-B-1	Horsehead Branch	39.389	-76.780

Table 9-42: Lower North Branch Patapsco Prioritization Site Locations and Descriptions

Station Code	Subwatershed	Latitude	Longitude
PA-B-1	East Branch Herbert Run	39.235	-76.693
PA-B-2	West Branch Herbert Run	39.235	-76.692
PA-B-3	Herbert Run	39.228	-76.690
PA-B-4	Patapsco River – UN Trib. 1	39.222	-76.707
PA-B-5	Patapsco River – UN Trib. 2	39.226	-76.717
PA-B-6	Patapsco River – UN Trib. 3	39.230	-76.724
PA-B-7	Bull Branch	39.231	-76.728
PA-B-8	Patapsco River – UN Trib. 4	39.243	-76.738
PA-B-9	Patapsco River – UN Trib. 5	39.251	-76.754
PA-B-10	Thistle Branch	39.254	-76.767
PA-B-11	Patapsco River – UN Trib. 6	39.261	-76.784
PA-B-12	Cooper Branch	39.266	-76.791
PA-B-13	Miller Branch	39.294	-76.777
PA-B-14	Cedar Branch – West	39.306	-76.779
PA-B-15	Cedar Branch – East	39.301	-76.774

Table 9-43: Liberty Reservoir Prioritization Site Locations and Descriptions

Station Code	Subwatershed	Latitude	Longitude
LI-01	Aspen Run	39.562	-76.840

LI-02	Broad Run	39.543	-76.847
LI-03	Cliffs Branch – North Branch	39.524	-76.850
LI-04	Cliffs Branch – South Branch	39.511	-76.863
LI-05	Glen Falls Run	39.494	-76.868
LI-06	Keysers Run	39.467	-76.868
LI-07	Norris Run	39.462	-76.872
LI-08	Timber Run/Cooks Branch	39.478	-76.871
LI-09	Liberty Reservoir Unnamed Trib. 1	39.418	-76.866
LI-10	Chimney Branch/Locust Run	39.405	-76.861
LI-10a	Chimney Branch	39.407	-76.858
LI-10b	Locust Run	39.405	-76.861
LI-11	Liberty Reservoir – Unnamed Trib 2	39.398	-76.875
LI-12	Liberty Reservoir – Unnamed Trib 3	39.389	-76.872

9.4.3 Biological Monitoring

In addition to the biological monitoring required at Scotts Level Branch under Baltimore County's NPDES permit, the County has four additional biological monitoring programs. These programs use the biological community to assess the ecological health of the streams within the County both freshwater and tidal (Probabilistic Monitoring Program), assess the effectiveness of stream restoration projects (CIP Monitoring Program), provide data on the best streams in Baltimore County to serve as bench marks for other stream assessments (Reference Site Monitoring Program), and assess Submerged Aquatic Vegetation (Submerged Aquatic Vegetation (SAV) Monitoring Program). The first three programs use assessments based on the benthic macroinvertebrate community and, in some cases, the fish assemblage. It is widely accepted that the biological community of streams is sensitive to anthropogenic perturbations. By monitoring the biological community, the County can assess the amount of change due to anthropogenic activities and the benefit of stream restoration to stream organisms. The SAV Monitoring Program provides an assessment of the coverage of SAV and progress made in meeting the new water quality standards for water clarity and SAV coverage in Baltimore County tidal waters.

9.4.3.1 Probabilistic Monitoring

Since 2003, Baltimore County has followed Maryland Biological Stream Survey (MBSS) probabilistic monitoring methods. Probabilistic monitoring (random selection of monitoring stations) allows statistically valid conclusions to be drawn regarding stream condition. This approach provides greater resolution of County stream condition because there are more stations in County streams and the data are directly comparable to data generated by MBSS.

The County contracts a consultant to perform the probabilistic monitoring. Each year a different basin is sampled, with the Patapsco/Back River Basin (Liberty Reservoir, Patapsco River, Gwynns Falls, Jones Falls, and Back River) monitored in odd years and the Gunpowder River Basin and Deer Creek watersheds (Deer Creek, Prettyboy Reservoir, Loch Raven Reservoir, Lower Gunpowder, Little Gunpowder, and Bird River) monitored in the even years. Three watersheds are not assessed using the Biological Probabilistic Monitoring Program (Baltimore Harbor, Middle River, and Gunpowder River) due to the limited miles of free flowing streams in the watersheds.

Fifty sites are randomly selected and macroinvertebrates are sampled during the spring index period, March 1 to April 30, using the MBSS protocols. These samples are sub-sampled to 100 organisms and identified to Genus or the lowest possible taxonomic level. A Benthic Index of Biotic Integrity (BIBI) is calculated. The BIBI describes the biological condition of the streams in the County. In 2006, a subset of previously sampled random sites was selected to serve as sentinel sites. The sites were located towards the base of major subwatersheds. Eighteen sentinel sites were selected in the Patapsco/Back River basin, and 13 sentinel sites were selected in the Gunpowder/Deer Creek basin. The sentinel sites will be used to monitor biological condition over a range of watershed and stream conditions.

Baltimore County has two physiographical provinces, the Piedmont and Coastal Plain, both of which have separate BIBI metrics. These metrics according to province, what they measure and the expected response to stressors are displayed in Tables 9-44 and 9-45.

Table 9-44: BIBI Piedmont Metrics

BIBI Metric	Metric Measure	Expected Response
Number of Taxa	Species Richness	Decrease
Number of EPT	Species Richness	Decrease
Number of Ephemeroptera	Species Richness	Decrease
Percent Intolerant to Urban	Tolerance/Intolerance	Decrease
Percent Chironomidae	Taxonomic Composition	Increase
Percent Clingers	Habit	Decrease

Table 9-45: BIBI Coastal Plain Metrics

BIBI Metric	Metric Measure	Expected Response
Number of Taxa	Species Richness	Decrease
Number of EPT	Species Richness	Decrease
Number of Ephemeroptera	Species Richness	Decrease
Percent Intolerant to Urban	Tolerance/Intolerance	Decrease
Percent Ephemeroptera	Taxonomic Composition	Decrease
Number of Scrapers	Habit	Decrease
Percent Climber	Habit	Decrease

The raw BIBI scores for each site from the 2014 probabilistic monitoring are displayed in Appendix 9-1 at the end of this section. The sites are grouped by subwatershed and 12-digit watershed, along with their respective BIBI condition rating. The BIBI condition ratings are "Very Poor" (1.00 – 1.99), "Poor" (2.00 – 2.99), "Fair" (3.00 – 3.99), and "Good" (4.00 – 5.00). Table 9-46 shows the results by watershed, as the percentage of sites within each BIBI range, for the entire nine-year probabilistic data set. In 2014, 38% of sites were considered to have Good biological water quality. The highest percentage of sites were rated Good and Fair, while the rest of the sites were evenly distributed between Poor and Very Poor. Since 2003, half of sites have BIBIs of Fair (32%) or Good (21%).

Table 9-46: BIBI Score Distribution by Watershed (% by Category)

Watershed	N	1.00-1.99 Very Poor	2.00-2.99 Poor	3.00-3.99 Fair	4.00-5.00 Good
Patapsco/Back River Basin – Sampled in 2003					
Liberty Reservoir	10	10	50	30	10
Patapsco River	13	54	46	0	0
Gwynns Falls	30	43	53	3	0

Jones Falls	32	38	31	25	6
Back River	15	87	13	0	0
Total	**100**	**46**	**39**	**12**	**3**
Gunpowder River Basin/Deer Creek – Sampled in 2004					
Deer Creek	3	0	33	67	0
Prettyboy Res.	7	0	14	43	43
Loch Raven Res.	67	6	9	43	42
Lower Gunpowder	7	29	43	29	0
Little Gunpowder	6	0	0	50	50
Bird River	2	50	50	0	0
Total	**92**	**8**	**13**	**42**	**37**
Patapsco/Back River Basin – Sampled in 2005					
Liberty Reservoir	22	5	32	41	23
Patapsco River	21	29	43	24	4
Gwynns Falls	22	18	68	14	0
Jones Falls	23	17	30	48	4
Back River	12	58	42	0	0
Total	**100**	**22**	**43**	**28**	**7**
Gunpowder River Basin/Deer Creek – Sampled in 2006					
Deer Creek	13	8	8	31	53
Prettyboy Res.	17	0	30	35	35
Loch Raven Res.	44	7	16	57	20
Lower Gunpowder	17	30	35	35	0
Little Gunpowder	4	0	25	25	50
Bird River	5	80	20	0	0
Total	**100**	**13**	**21**	**42**	**24**
Patapsco/Back River Basin – Sampled in 2007					
Liberty Reservoir	20	0	0	30	70
Patapsco River	24	33	33	17	17
Gwynns Falls	26	12	54	19	15
Jones Falls	28	29	25	25	21
Back River	19	84	11	5	0
Total	**117**	**30**	**26**	**20**	**24**
Gunpowder River Basin/Deer Creek – Sampled in 2008					
Deer Creek	12	17	17	33	33
Prettyboy Res.	13	0	8	38	54
Loch Raven Res.	47	4	9	23	64
Lower Gunpowder	12	58	17	8	17
Little Gunpowder	11	0	0	64	36
Bird River	5	100	0	0	0
Total	**100**	**30**	**8**	**28**	**34**
Patapsco/Back River Basin – Sampled in 2009					
Liberty Reservoir	15	0	7	60	33
Patapsco River	23	22	30	43	4
Gwynns Falls	26	35	42	23	0
Jones Falls	20	35	50	15	0
Back River	16	69	31	0	0
Total	**100**	**32**	**34**	**28**	**6**
Gunpowder River Basin/Deer Creek – Sampled in 2010					
Deer Creek	3	0	0	100	0
Prettyboy Res.	11	0	27	64	9
Loch Raven Res.	59	7	15	68	10
Lower Gunpowder	13	8	38	54	0

Little Gunpowder	7	0	29	71	0
Bird River	7	57	43	0	0
Total	**100**	**9**	**22**	**62**	**7**
Patapsco/Back River Basin – Sampled in 2011					
Liberty Reservoir	**10**	0	10	70	20
Patapsco River	**31**	26	48	26	0
Gwynns Falls	**23**	35	30	30	4
Jones Falls	**21**	19	29	29	24
Back River	**15**	47	53	0	0
Total	**100**	**27**	**37**	**28**	**8**
Gunpowder River Basin/Deer Creek – Sampled in 2012					
Deer Creek	**4**	0	0	0	100
Prettyboy Res.	**6**	33	17	0	50
Loch Raven Res.	**58**	3	3	40	54
Lower Gunpowder	**16**	31	13	25	31
Little Gunpowder	**9**	0	11	0	89
Bird River	**7**	57	43	0	0
Total	**100**	**13**	**9**	**27**	**51**
Patapsco/Back River Basin – Sampled in 2013					
Liberty Reservoir	**7**	0	0	43	57
Patapsco River	**18**	17	22	44	17
Gwynns Falls	**10**	10	60	30	0
Jones Falls	**9**	67	0	22	11
Back River	**6**	83	17	0	0
Total	**50**	**15**	**11**	**16**	**8**
Gunpowder River Basin/Deer Creek – Sampled in 2014					
Deer Creek	**2**	0	0	50	50
Prettyboy Res.	**5**	0	0	40	60
Loch Raven Res.	**29**	4	10	38	48
Lower Gunpowder	**6**	17	50	33	0
Little Gunpowder	**4**	0	0	75	25
Bird River	**4**	100	0	0	0
Total	**50**	**6**	**6**	**19**	**19**
County Total	**1,100**	**251**	**269**	**352**	**228**

Figures 9-57 and 9-58 show the means and one standard deviation of the mean BIBI scores for each watershed between 2003 and 2014. Among Patapsco/Back River watersheds, Liberty Reservoir consistently has the highest biological integrity, while Back River has the lowest. Among Gunpowder River watersheds, the Lower Gunpowder and Bird River watersheds have the lowest biological integrity. In both the Patapsco and Gunpowder basins, the watersheds with the poorest biological condition coincide with the most populated and urbanized areas within Baltimore County.

The procedure developed by Maryland Department of the Environment and Maryland Department of Natural Resources to determine biological impairment of fresh water streams was used to determine the watershed condition for all eleven sampling years. The procedure is detailed in Part C.2.1 at the following web site:
http://www.mde.state.md.us/assets/document/2008_IR_Parts_A_thru_E(1).pdf
The method assesses watersheds at the Maryland 8-digit scale, and uses 90% confidence limits around the proportion of degraded stream miles to determine whether the proportion of degraded stream miles is significantly different from reference conditions. Watersheds are listed as "Attaining," "Impaired," or "Inconclusive." The results of the biological listing method are

presented in Table 9-47. Figure 9-59 display site and watershed condition for sites sampled in 2013 and 2014. The sites, with color-coded condition, are overlain on their respective sub-watersheds.

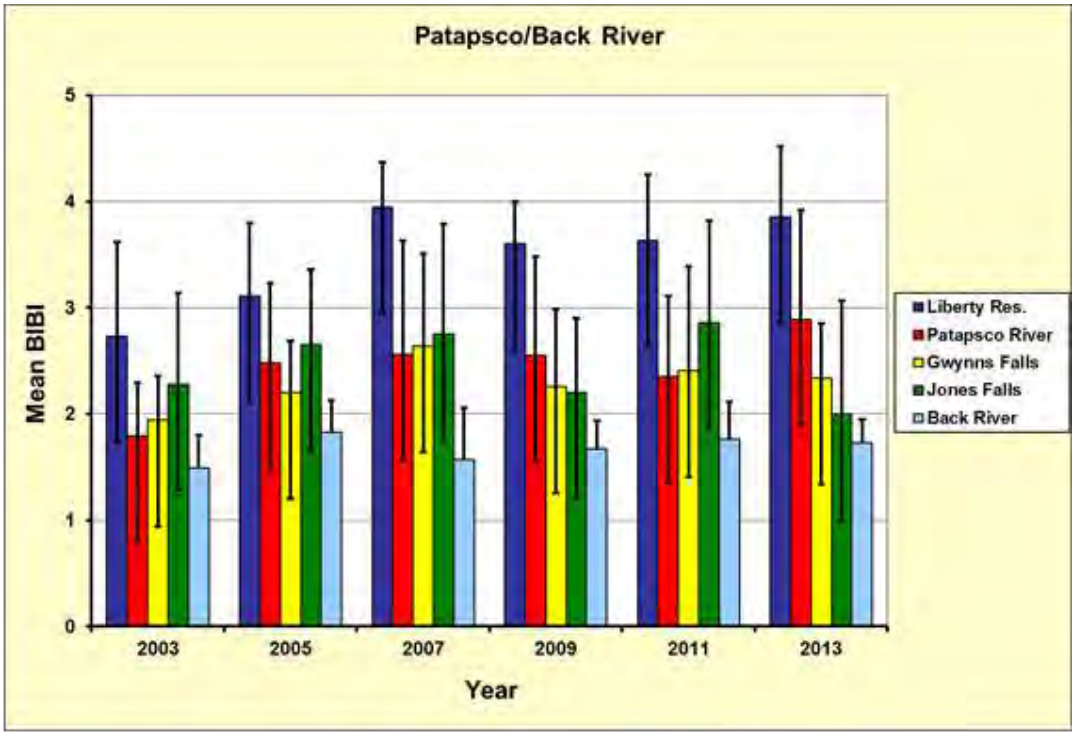


Figure 9-57: Means and one standard deviation of BIBI scores for Patapsco/Back River watersheds between 2003 and 2013.

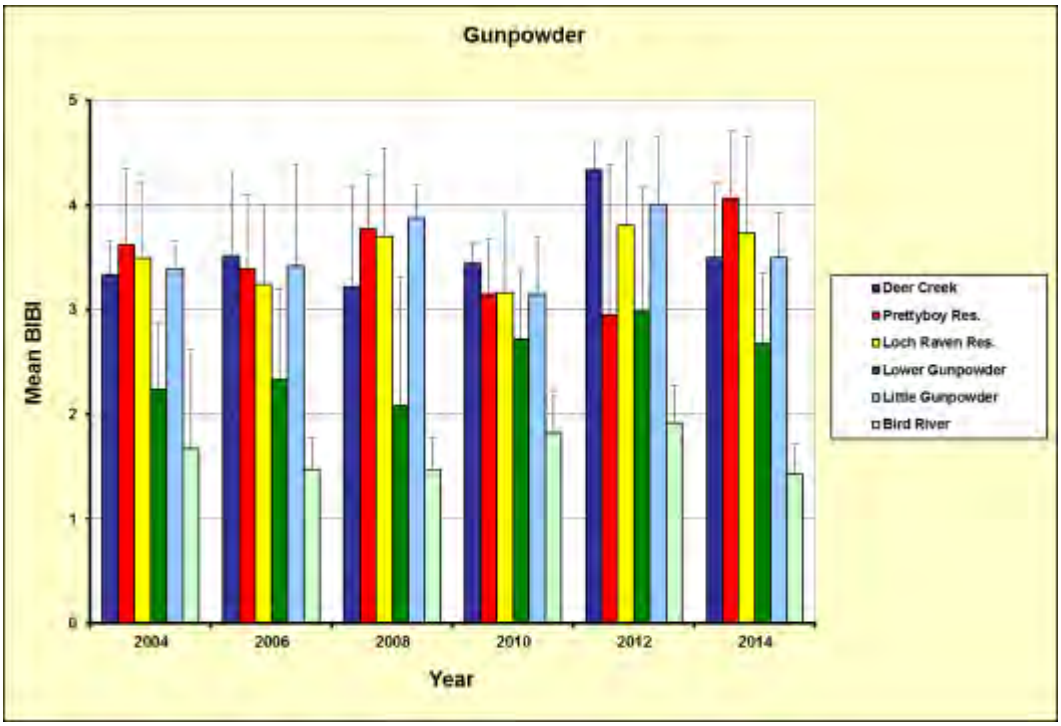


Figure 9-58: Means and one standard deviation of BIBI scores of Gunpowder Falls/Deer Creek watersheds between 2004 and 2014.

Table 9-47: Watershed Biological Condition Using Percent Stream Mile Method

Watershed	Sites Degraded	N	% Stream Miles With Possible Degradation	Category
2003 Sampling Year				
Liberty	6	10	60	Impaired
Patapsco River	13	13	100	Impaired
Gwynns Falls	29	30	97	Impaired
Jones Falls	22	32	69	Impaired
Back River	15	15	100	Impaired
2004 Sampling Year				
Deer Creek	1	3	33	Inconclusive
Prettyboy	1	7	14	Attaining
Loch Raven	10	67	15	Attaining
Lower Gunpowder	5	7	71	Impaired
Little Gunpowder	0	6	0	Attaining
Bird River	2	2	100	Impaired
2005 Sampling Year				
Liberty	8	22	36	Impaired
Patapsco River	15	21	71	Impaired
Gwynns Falls	19	22	86	Impaired
Jones Falls	11	23	48	Impaired
Back River	12	12	100	Impaired
2006 Sampling Year				
Deer Creek	2	13	15	Attaining
Prettyboy	5	17	29	Impaired
Loch Raven	10	44	23	Impaired
Lower Gunpowder	11	17	65	Impaired
Little Gunpowder	1	4	25	Inconclusive
Bird River	5	5	100	Impaired
2007 Sampling Year				
Liberty	0	20	0	Attaining
Patapsco River	16	24	67	Impaired
Gwynns Falls	17	26	65	Impaired
Jones Falls	15	28	54	Impaired
Back River	18	19	95	Impaired
2008 Sampling Year				
Deer Creek	4	12	33	Impaired
Prettyboy	1	13	8	Attaining
Loch Raven	6	47	13	Attaining
Lower Gunpowder	9	12	75	Impaired
Little Gunpowder	0	11	0	Attaining
Bird River	5	5	100	Impaired
2009 Sampling Year				
Liberty	0	15	0	Attaining
Patapsco River	9	23	39	Impaired
Gwynns Falls	18	26	69	Impaired
Jones Falls	13	20	65	Impaired
Back River	16	16	100	Impaired
2010 Sampling Year				
Deer Creek	0	3	0	Attaining
Prettyboy	3	11	27	Impaired
Loch Raven	13	59	22	Impaired
Lower Gunpowder	6	13	46	Impaired
Little Gunpowder	2	7	29	Attaining

Bird River	7	7	100	Impaired
2011 Sampling Year				
Liberty	1	10	10	Attaining
Patapsco River	23	31	74	Impaired
Gwynns Falls	15	23	65	Impaired
Jones Falls	10	21	48	Impaired
Back River	15	15	100	Impaired
2012 Sampling Year				
Deer Creek	0	4	0	Attaining
Prettyboy	3	6	50	Impaired
Loch Raven	4	58	7	Attaining
Lower Gunpowder	7	16	44	Impaired
Little Gunpowder	1	9	11	Attaining
Bird River	7	7	100	Impaired
2013 Sampling Year				
Liberty	0	7	0	Attaining
Patapsco River	7	18	39	Impaired
Gwynns Falls	7	10	70	Impaired
Jones Falls	6	9	67	Impaired
Back River	6	6	100	Impaired
2014 Sampling Year				
Deer Creek	0	2	0	Attaining
Prettyboy	0	5	0	Attaining
Loch Raven	4	29	13	Attaining
Lower Gunpowder	4	6	67	Impaired
Little Gunpowder	0	4	0	Attaining
Bird River	4	4	100	Impaired

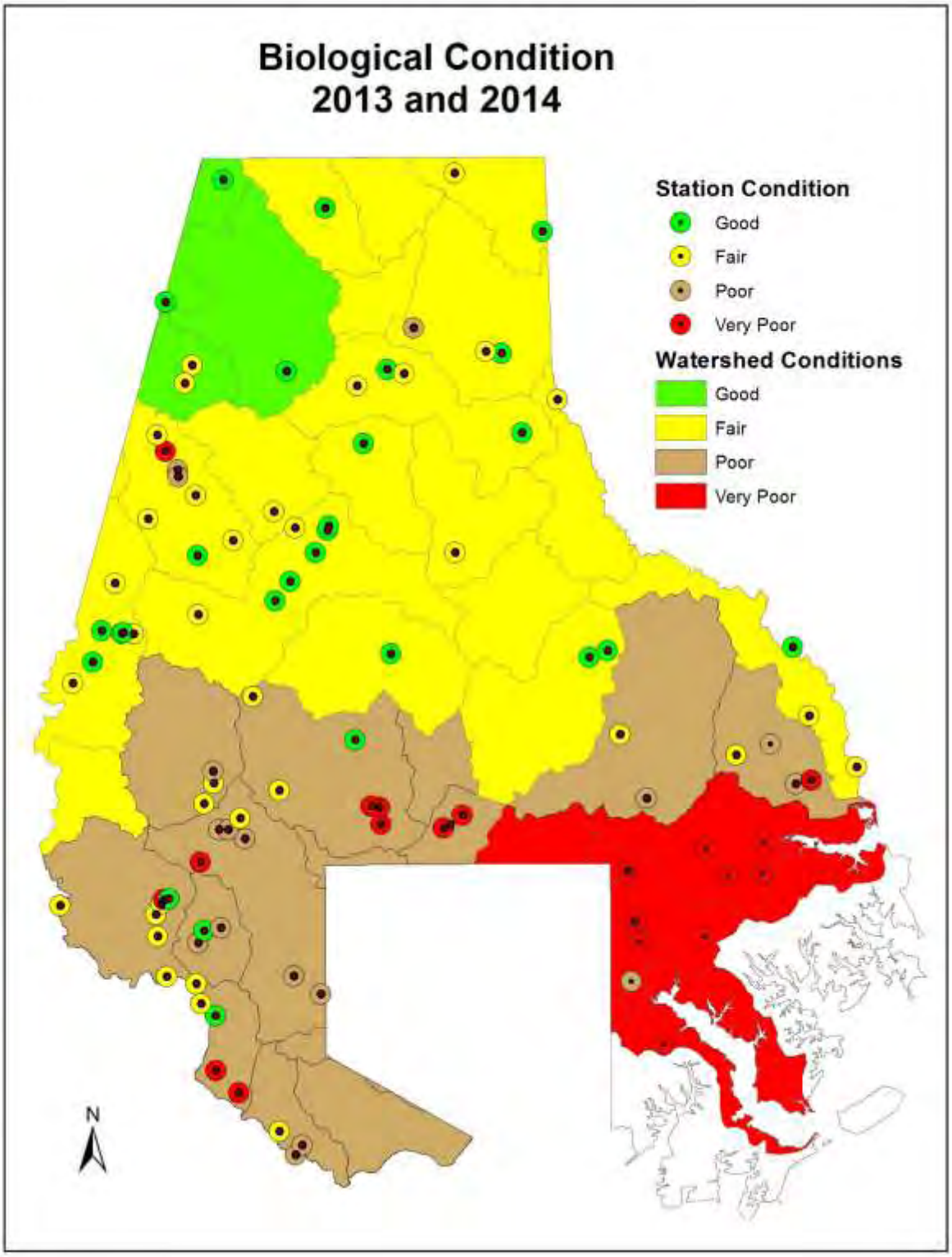


Figure 9-59: Probabilistic Biological Monitoring results for 2013 and 2014. Sample points are superimposed on named Baltimore County subwatersheds.

Based on the percent stream mile criteria, Prettyboy, Loch Raven, Deer Creek, and Little Gunpowder met biological criteria. Lower Gunpowder and Bird River were impaired. Figure 9-59 indicates sites and sub-watersheds that are close to the population centers of Baltimore County are the most impaired. Two year rolling averages were calculated using the probabilistic data for the entire period of record. This simple, smoothing technique clarifies underlying patterns in data. The results are shown in Figure 9-60. Patapsco River, Gwynns Falls, and Jones Falls averages were almost identical to the Patapsco-Back River overall averages, which showed a slight increase followed by a slight decrease. 2003 may have displayed lower results due to a 2 year drought followed by the third highest record rainfall the following year in 2004. Liberty Reservoir rolling averages were the highest in Patapsco-Back River, and Back River rolling averages were the lowest. Both were clearly separated from the other sub-watersheds. Sub-watersheds in the Gunpowder Falls showed slight changes. Little Gunpowder, Prettyboy, Loch Raven, and Deer Creek grouped together, slightly above the overall Gunpowder Falls average. For the 2012/2014 averages, Gunpowder, Little Gunpowder, Prettyboy, Loch Raven, and Lower Gunpowder increased, while Deer Creek and Bird River decreased. The Lower Gunpowder and Bird River separated from the other sub-watershed rolling averages. The Lower Gunpowder displayed significant improvement by shifting from the Poor category to the Fair category. For all watersheds, the rolling averages suggest stability in biological condition over this short period of record.

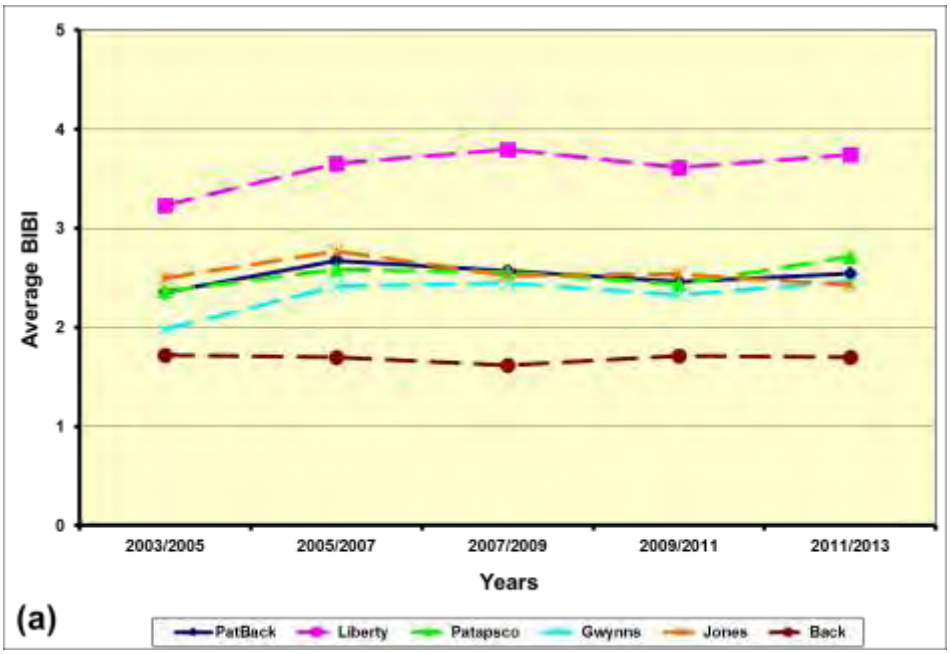


Figure 9-60a: BIBI rolling averages for Patapsco/Back River probabilistic monitoring sites between 2003 and 2013.

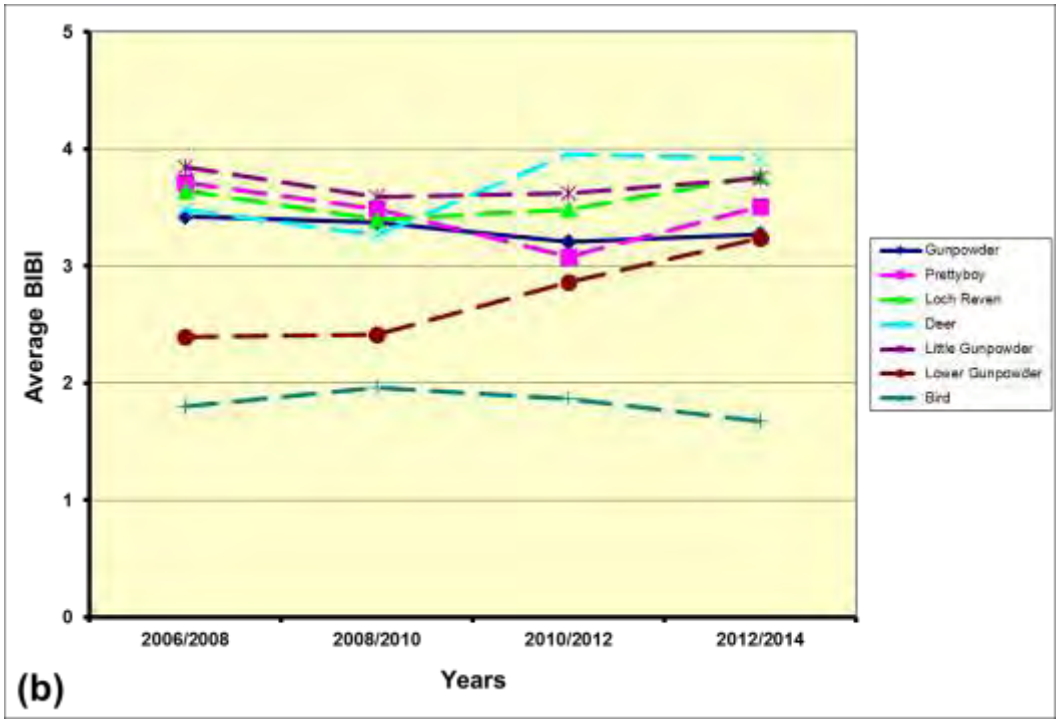


Figure 9-60b: BIBI rolling averages for Gunpowder/Deer Creek probabilistic monitoring sites between 2006 and 2014.

There are 17 sentinel sites in the Patapsco/Back River drainage and 8 sentinel sites in the Gunpowder River/Deer Creek drainage. The sentinel sites represent environmental variation over a range of watershed land use. Sentinel sites were sampled in 2003 and 2004, and 2006-2014. Figure 9-61 shows the mean BIBI scores for sentinel sites, by watershed, between 2003 and 2014. The biological condition of sentinel sites in the Patapsco/Back River drainage tended toward Poor and Very Poor ratings over the period of record. Liberty Reservoir sentinel sites were in the Fair category. The BIBI for Gunpowder River/Deer Creek sites were Fair to Good. Loch Raven BIBI varied from Poor to Fair. Lower Gunpowder BIBI varied between Very Poor and Poor.

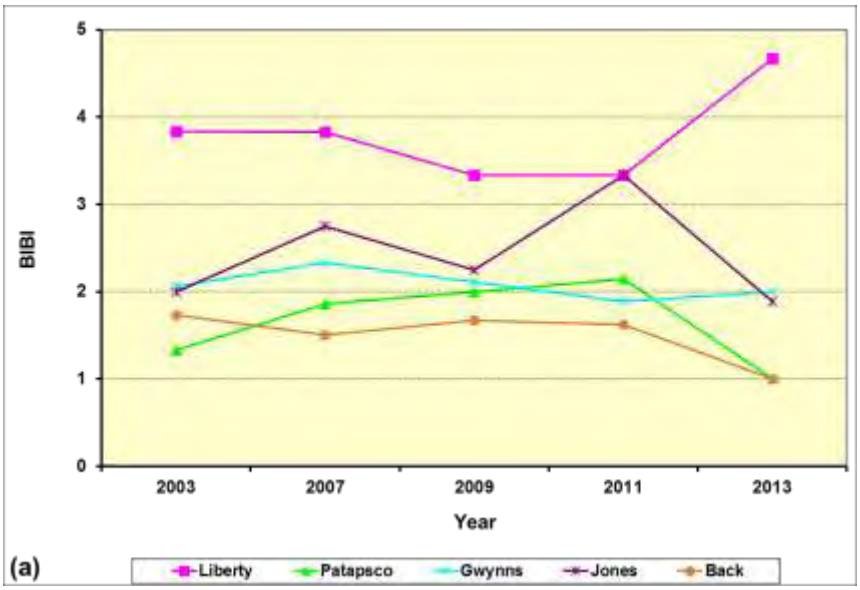


Figure 9-61a: Mean BIBI scores for Patapsco/Back River Sentinel Sites between 2003 and 2013.

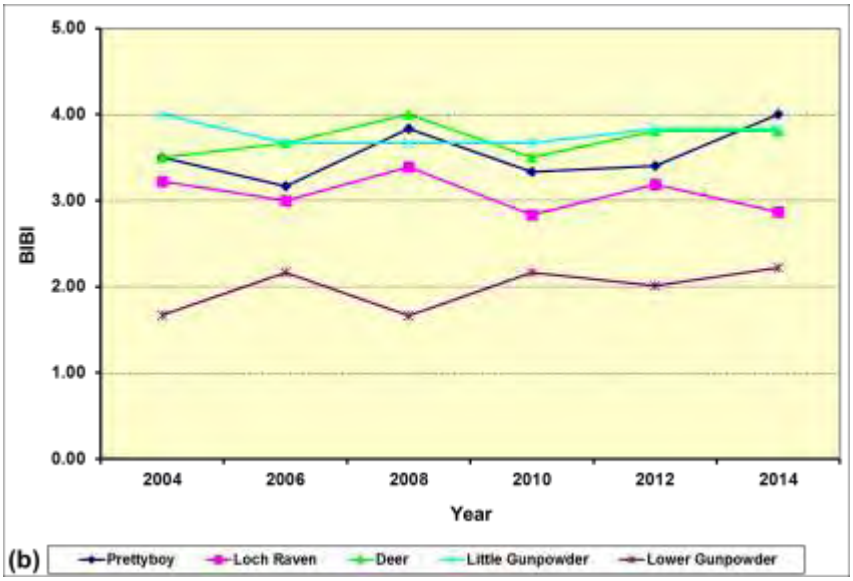


Figure 9-61b: Mean BIBI scores for Gunpowder/Deer Creek Sentinel Sites between 2004 and 2014.

9.4.3.2 Capital Improvement Projects Monitoring

Baltimore County monitors benthic macroinvertebrate and fish assemblages in conjunction with several capital improvement stream restoration projects. Stream segments are monitored pre- and post-construction to document any change in the biological community. As with the Probabilistic Monitoring Program, MBSS methods are followed, including stream physical habitat assessments. Habitat assessments are based on visual ratings of instream and riparian zone characteristics that are important to stream biological communities. A physical habitat index (PHI) is calculated based on the visual ratings. The Minebank Run, Redhouse Run, and Spring Branch projects are currently monitored under the Capital Improvement Projects Monitoring Program. The Woodvalley project was completed in 2005 and monitoring concluded in 2012. All monitoring site locations are displayed in Table 9-48.

Table 9-48: Stream Restoration Biological Monitoring Site Locations

Station	Stream and Location		
Minebank Run II Stream Restoration		**Lat**	**Long**
MNBK-1	Minebank Run upstream of Gunpowder River	-76.538880	39.421513
MNBK-2	Minebank Run upstream of USGS gage	-76.547070	39.416312
MNBK-3	Minebank Run downstream of bridge @ park	-76.550502	39.413675
MNBK-4	Minebank Run upstream of bridge @ park	-76.554317	39.411404
MNBK-5	Minebank Run behind Loch Raven High School	-76.560783	39.408448
MNBK-6	Minebank Run upstream of Cowpens Road	-76.567553	39.404432
MNBK-7	Minebank Run upstream of Glen Eagles Court	-76.574099	39.402204
MNBK-8	Minebank Run upstream of MNBK-7	-76.576146	39.402443
MNBK-9	Minebank Run downstream of Cromwell ES	-76.580078	39.401761
JB-1	Jennifer Branch upstream of Gunpowder River	-76.500100	39.420145
JB-2	Jennifer Branch near archery range	-76.501365	39.414997
Redhouse Run Stream Restoration			
RH-1	Redhouse Run upstream of Twilight Court	-76.516626	39.344482
RH-2	Redhouse Run downstream of Home Road	-76.521135	39.345776
RH-3	Redhouse Run downstream of Raspe Avenue	-76.522042	39.348331
Spring Branch Stream Restoration			
MER-1	Merryman Branch at Old Bosley and Dulaney Valley Roads	-76.589716	39.461484
SB-1	Spring Branch downstream of Pot Spring Road	-76.602684	39.439608
SB-2	Spring Branch upstream of Pot Spring Road	-76.606784	39.439811
SB-7	Spring Branch downstream of Dulaney Valley Road	-76.595263	39.439507
SB-8	Spring Branch upstream of Dulaney Valley Road	-76.597211	39.440385

Benthic, fish, and physical habitat index values are shown in Table 9-49. Refer to this table in the following discussions of each project.

Table 9-49: BIB, FIBI, and PHI values for 2014 at Capital Programs Stream Restoration Projects

Project	Station	BIBI	FIBI	PHI
Minebank Run	MNBK-1	1.00	3.00	57
	MNBK-4	2.00	1.67	64
	MNBK-7	1.33	2.67	64
	JB-1	1.00	3.00	67
	JB-2	1.33		
Redhouse Run	RH-1	1.00	2.67	48
	RH-3	1.00	1.67	44
Spring Branch	MER-1	To be sampled in 2016		
	SB-1	To be sampled in 2016		
	SB-2			
	SB-7			
	SB-8			

The Minebank Run stream restoration project has been monitored annually since April 2004, at eleven sampling stations (Figure 9-62). The stream restoration was completed in 2002 (Phase I) on the reach where MNBK-6, MNBK-7, MNBK-8, and MNBK-9 are located. The stream restoration was completed in 2005 (Phase II) where MNBK-2, MNBK-3, MNBK-4, and MNBK-5 are located. MNBK-1 restoration was completed in 2014 (Phase III). Stations JB-1, and JB-2

are controls. As of 2014, DEPS has collected ten years of post-restoration data at the Phase I stations, and two years of pre-restoration and eight years of post-restoration data at the Phase II stations. Only five of the eleven stations were sampled for macroinvertebrates. Fish were sampled at a sub-set of the stations: MNBK-1, MNBK-4, MNBK-7, and JB-1.

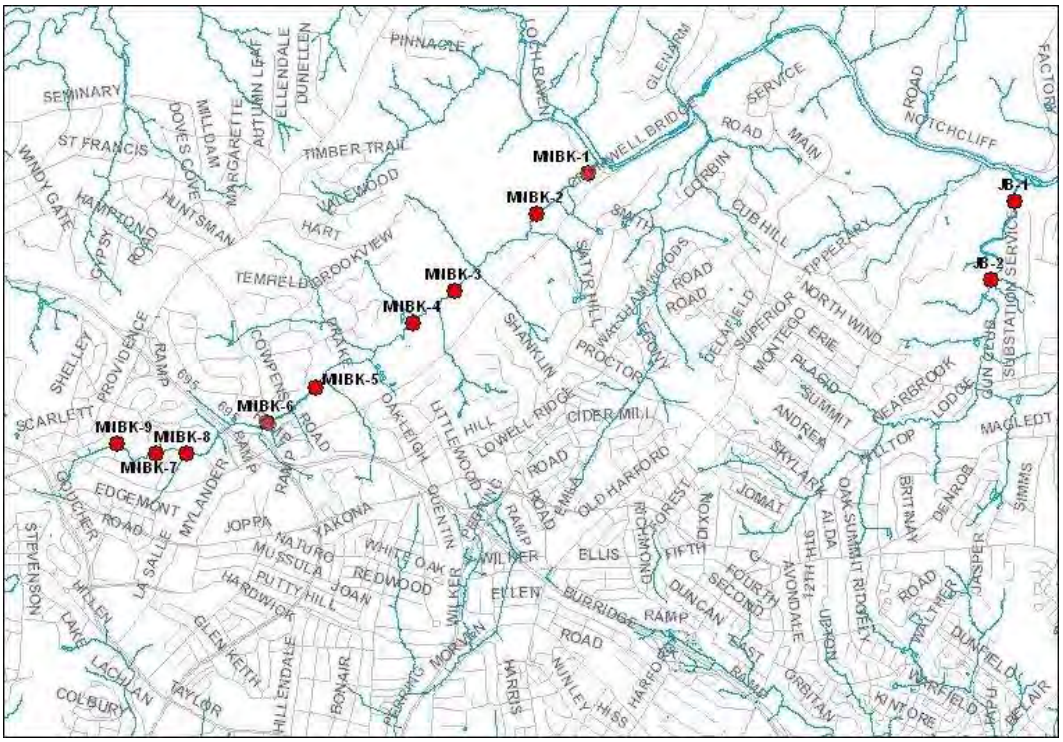


Figure 9-62: Minebank Run Biological Monitoring Stations.

BIBI scores across all treatments were Very Poor at restored stations and the two off-site, unrestored controls on Jennifer Branch. The BIBI at MNBK-1 was most likely due to the disturbance of the stream restoration construction and channel alteration. The FIBI score at MNBK-4, the restored Phase II station, was Poor. The FIBI score at MNBK-7, the restored Phase I station, was Poor. The FIBI scores at both unrestored control stations were Poor. The difference between Phase I and Phase II stations is due to surrounding land use. Phase II stations are located in Cromwell Valley Park, which provides a wide, well-vegetated riparian zone. Phase I stations are located in a heavily residential and commercial area, with steep banks lining both sides of the stream. Although the floodplain at Phase II stations is still slightly perched, it is better connected to the stream than at Phase I stations. The steep banks in Phase I stations promote funneling of storm water and thus greater stress to aquatic organisms. The restoration structures at all stations have provided stability to the Minebank Run stream channel, but the thick riparian buffer and wide riparian zone at Phase II stations promotes a more conducive environment for aquatic organisms. MNBK-1 was restored in spring of 2014. The entire left bank and portions of the right bank were armored with large boulders. Wood debris and rootwads were placed in the stream in order to provide enhanced habitat for benthos and fish. The upper reaches of Jennifer Branch, near Harford Road, were restored during fall and winter, 2012-2013. JB-1 had a BIBI score of 1.00 or very poor, and had a FIBI score of 3.33 or Fair. JB-1 will continue to be monitored to determine any ameliorating effects of the restoration on stormwater runoff.

Redhouse Run, a tributary of the Back River, was restored in early 2011. Pre-restoration monitoring of benthos and fish at three stations was completed in 2009 and 2010 (Figure 9-63). three years after restoration, Redhouse Run exhibits the biological and physical characteristics of an urbanized stream. Benthic and fish populations are depressed (all BIBI are rated Very Poor). The tropical storms of summer 2011 severely affected the biota of Redhouse Run at a time when the communities were attempting to stabilize shortly after restoration. RH-2 was dropped as a fish sampling station during 2012 because a long reach of the restoration was damaged during stormflows. The damage will not be repaired, which makes this a poor reach with which to evaluate the effects of restoration. Benthos were sampled in 2014. Both RH-1 and RH-3 exhibited Very Poor BIBI scores (1.00).

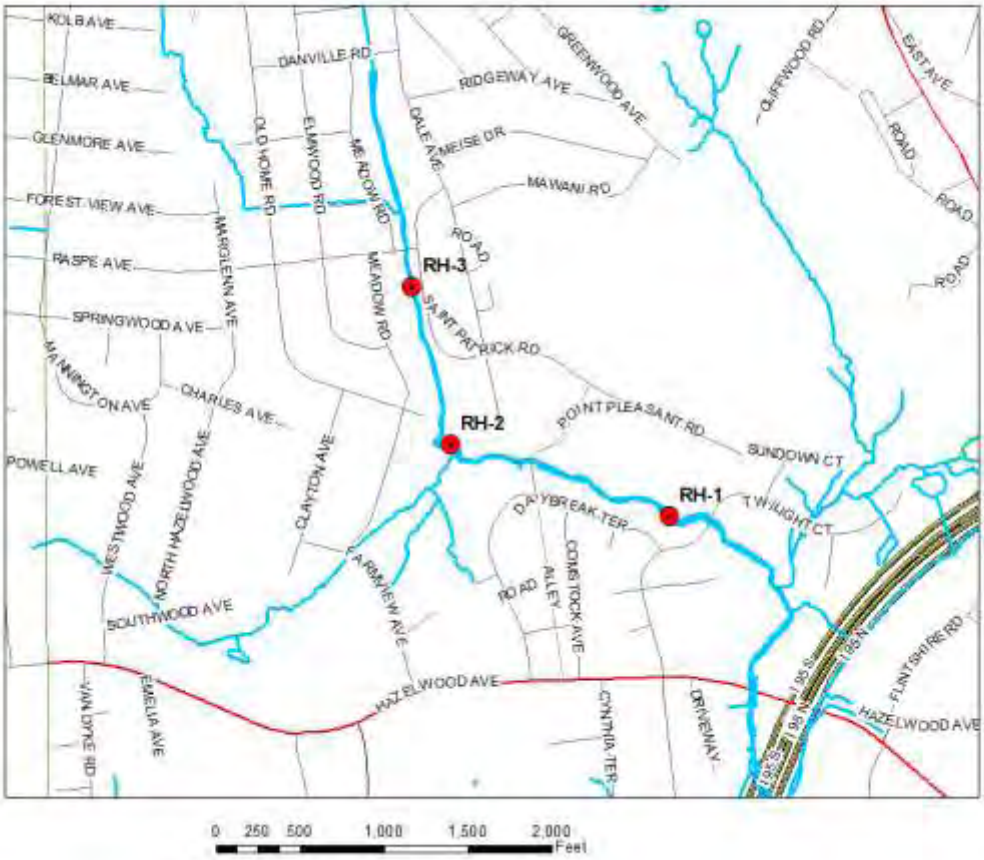


Figure 9-63: Redhouse Run Biological Monitoring Station Locations

Spring Branch, a direct tributary to Loch Raven Reservoir, was restored during the summer of 2008, between Dulaney Valley Road and Pot Spring Road. Spring Branch had previously been restored upstream of Pot Spring Road. Previous monitoring of the Pot Spring Road restoration provided the opportunity to select both a station in this reach and an off-site, unrestored control. SB-2 was selected for monitoring to evaluate the long-term effectiveness of the initial restoration and to compare its performance with that of the new restoration. MER-1, located on Merryman Branch, was used as the off-site, unrestored control. One of the monitoring stations was placed downstream of Dulaney Valley Road, outside of the restoration, to detect downstream benefits of

the restoration. In total, five stations were monitored for benthos during the Spring Index Period and three stations were monitored for fish during the Summer Index Period from 2008 (pre restoration) – 2009 through 2013 (post restoration) (Figure 9-64). Spring Branch was not sampled in 2014, but will be sampled in 2016. Those results will help to determine if the health of the biological community and the physical habitat has improved since 2013,

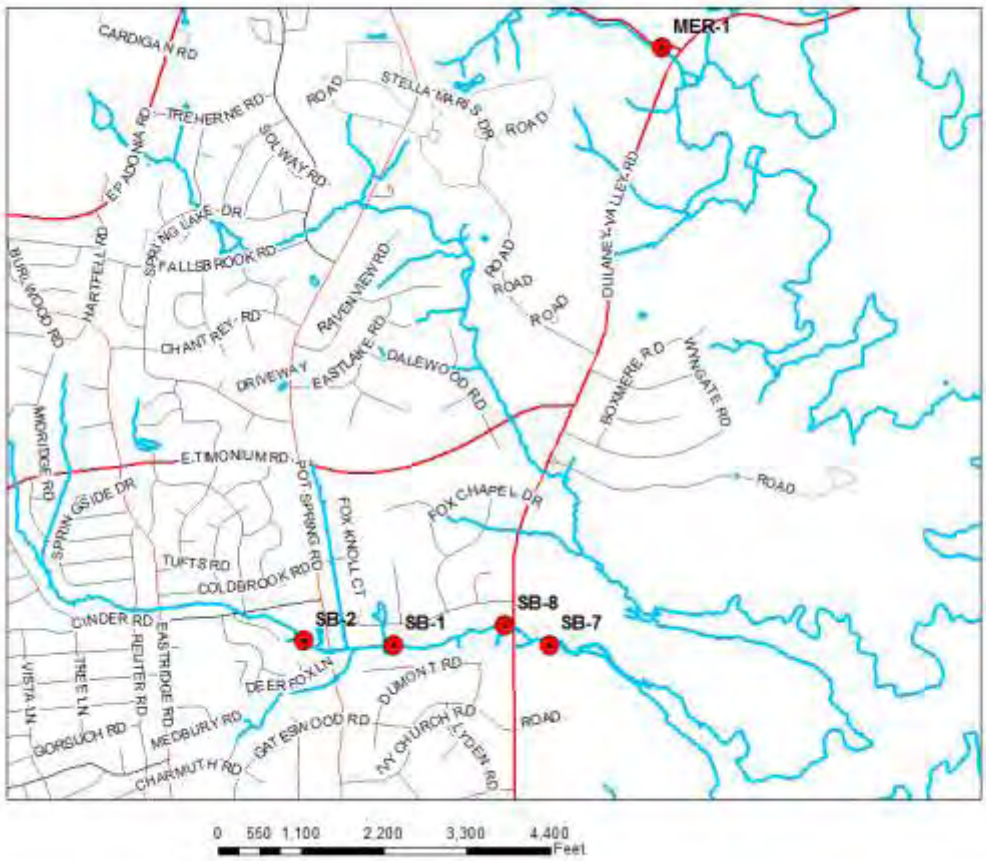


Figure 9-64: Spring Branch Biological Monitoring Station Locations

9.4.3.3 Reference Site Monitoring

Baltimore County has been monitoring eight (8) reference sites since spring of 2001. GIS was used to identify watersheds within the County that contained greater than 50% forested land use and less than 20% urban land use. An initial suite of twenty-one (21) sites was reduced to eight (8) sites for future monitoring based on land use, chemical, and stream physical habitat benchmarks. The latitude and longitude site locations, along with the stream name are displayed in Table 9-50.

Table 9-50: Reference Site Locations

Station	Stream Name and Location	Lat	Long
REF-001	Baisman Run upstream of Ivy Hill Road	-76.677939	39.480540
REF-004	Poplar Run upstream of Gunpowder Road	-76.781047	39.661848
REF-009B	Springhouse Run downstream of Gunpowder Rd	-76.771473	39.676285
REF-012	Panther Branch upstream of Gunpowder Falls	-76.642492	39.606599

REF-013	Mingo Branch upstream of Gunpowder Falls	-76.673612	39.605859
REF-015	Charles Run upstream of Gerting Road	-76.586252	39.590646
REF-017	Sunnyking Run near Sunnyking Drive	-76.824300	39.416937
REF-019	Fourth Mine Branch upstream of Stablers Church Road	-76.642243	39.655567

The eight sites are sampled annually for benthic macroinvertebrates in the spring index period using MBSS sampling protocols. The samples are sorted and identified in the laboratory to genus or the lowest practical taxonomic level, and the Maryland BIBI is calculated. Fish sampling is done only periodically to reduce stress to the naturally reproducing trout populations inhabiting these streams. All reference sites had BIBI values in the Fair to Good range in 2014 (Figure 9-65), although BIBI values have varied in relation to climactic factors over the period of record. The cycles in benthic populations are largely the result of climactic cycles (precipitation and temperature). However, the streams differed in their response to environmental conditions due to the unique characteristics of each stream (geology and land use). Extreme precipitation years were 2001-2002 (drought), 2003 (very wet), 2007 (drought), and 2009 (very wet). The expectation is that aquatic organisms will be negatively impacted most during these extremes of weather. Drought reduces habitat availability due to decreased water levels and increases water temperature. Water temperature is critical in cold-water streams, where many of the organisms are adapted for cooler temperatures. The reference streams clearly responded to the droughts of 2007. Biological condition in 2003 at all but Poplar (REF-004) and Charles (REF-015) Runs rated Fair or worse. In 2008, the condition of most streams decreased, and was largely Fair or worse. The wet year (2009) initiated a return to Good biological condition at all but Panther Branch (REF-012). Land use also influences the response of the reference streams. Baisman Run (REF-001), Panther Branch (REF-012), and Mingo Branch (REF-013) are the most urban of the reference streams. Baisman Run is located west of Hunt Valley, MD, in a suburban setting. Panther Branch originates at Interstate 83, York Road, and Monkton Road. Mingo Branch's headwaters drain Interstate 83 and Mount Carmel Road. These streams are subject to high storm flows and stormwater pollutants, which cause physical damage to stream banks and riparian zones, and degrade instream habitat. This may, in part, explain the wider annual fluctuations biological condition in these streams. Fourth Mine Branch (REF-019) is the most agricultural of the reference streams, and is subject to high sediment and nutrient loads during storms. It also had widely fluctuating annual BIBI values. Sunnyking Run (REF-017) is unique among the reference streams and most other Baltimore County streams in that it is underlain by serpentine rock. Serpentine is naturally high in metals and low in nutrients. This could make it difficult for benthic populations to recover after extreme climactic events. However, Sunnyking Run rebounded from the 2007 wet year by improving the BIBI value from Poor to Good. Stream physical habitat index (PHI) values have not varied as widely as BIBI values (Figure 9-66). Most PHI values have remained in the minimally or partially degraded categories. Differences in physical habitat appear related to the differences in stream features discussed above. Streams with more human influence have more degraded physical habitat. The reference station suite illustrates the benefits of forested land and functional stream buffers.

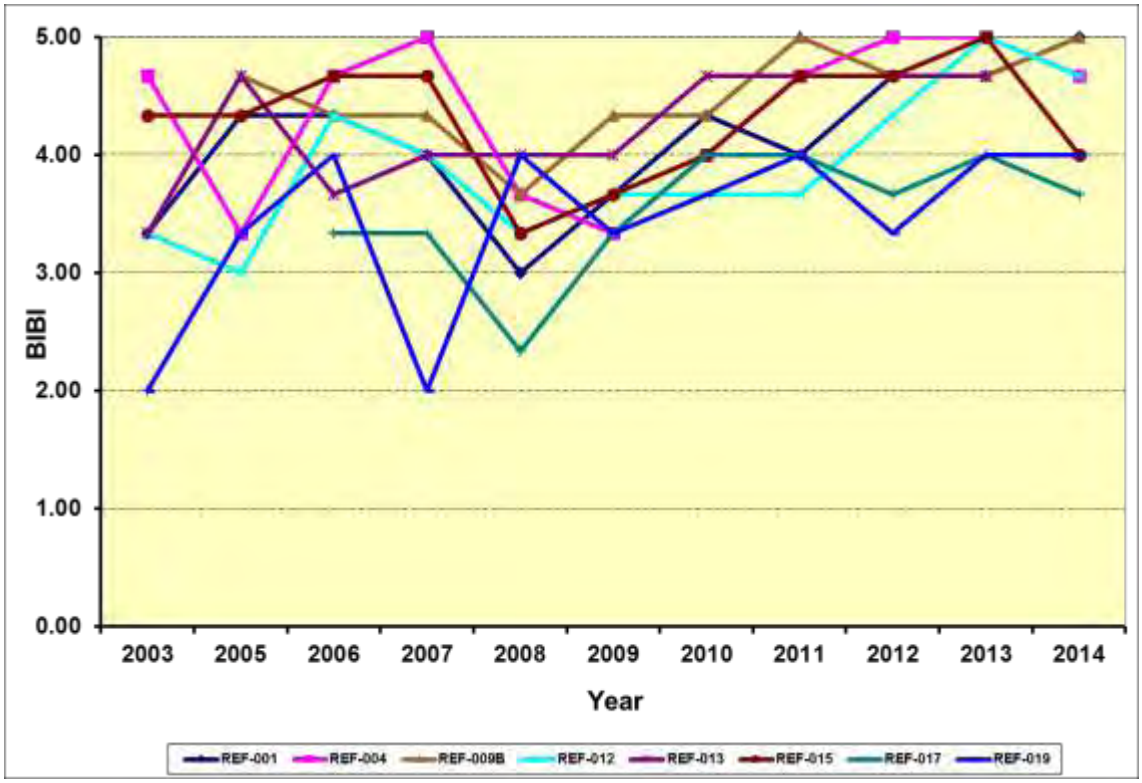


Figure 9-65: Benthic IBI values for Reference Sites, 2003-2014

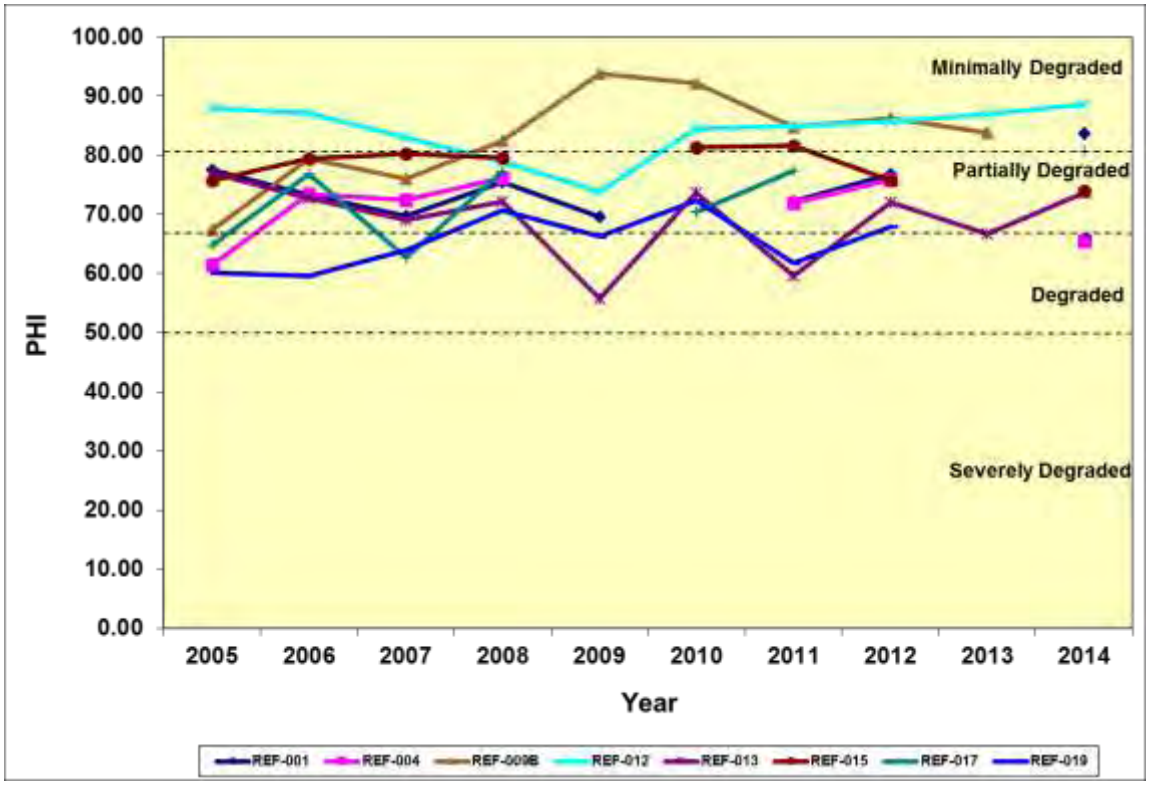


Figure 9-66: Physical Habitat Index values for Reference Sites, 2005-2014

9.4.3.4 Tidal Benthic Monitoring

In 2013, Baltimore County added Tidal Random Sampling to its County wide monitoring program. The tidal sampling occurs biennially, in the same year as the stream sites within the Patapsco/Back River and Gunpowder River Basins. The 25 tidal benthic samples were sampled from July 15 to September 30, 2014 and followed the methods established by the Maryland Department of Natural Resources (DNR) for its Chesapeake Bay Long-Term Monitoring and Assessment Program. The four tidal subestuary systems sampled in the Gunpowder River Basin for 2014, were Bird River, Gunpowder River, Middle River, and Browns Cove. All samples were taken from unvegetated soft substrates (sand or mud) using a Young Grab with a sampling area of 0.044 m^2 to a depth of 10 cm.

Along with the macroinvertebrate data, the bottom water quality and sediment characteristics were sampled. Baltimore County required the consultant to calculate the percent silt/clay, percent total organic carbon (TOC), and percent nitrogen in conjunction with the 25 tidal benthic samples. All the specimens were identified to the lowest practical taxonomic category as required by the MD DNR Long Term Benthic Program.

The Chesapeake Bay Benthic Index of Biological Integrity (BIBI) is calculated by scoring each of several attributes of benthic community structure and function (abundance, biomass, Shannon diversity, etc.) and then the scores are averaged across attributes to form the index (Table 9-51). Samples with index values of 3.0 or more are considered to have good benthic condition, indicative of good habitat quality. The BIBI was designed to account for varying salinities and substrates which effect benthic community structure. There are five salinity classes, however only three are applicable for Baltimore County tidal waters, which are the Tidal Freshwater (0-0.5 ppt), Oligohaline (≥0.5-5.0 ppt), and Low Mesohaline (≥ 5.0–12.0 ppt) ranges.

Table 9-51: Metrics used for Tidal IBI Calculations

Metrics Used in BIBI Calculations	Tidal Freshwater	Oligohaline	Low Mesohaline
Percent abundance of deep-deposit feeders	X		
Tolerance Score	X	X	
Percent Abundance of Pollution-Sensitve Taxa		X	
Percent Abundance of Carnivores & Omnivores		X	
Tanydodini to Chironomidae per abundance ratio		X	
Total Species Biomass			X
Shannon-Weiner Diversity Index			X
Percent biomass of tollution-sensitive taxa			X
Total Specied Abundance	X	X	X
Percent Abundance of Pollution Indicative Taxa	X	X	X
Total Metrics in Score	4	6	5

The results from the 2013 and 2014 tidal benthic samples can be seen in Tables 9-52 and 9-53. In 2013 44% of the samples met the restoration goal with a BIBI score above a 3.0, however 56% of the samples were below a 2.1 BIBI score indicating a degraded condition. In 2014 60% of the samples met the restoration goal, with 32% of the samples in a degraded condition. All of the sites sampled had at least one sample that met the restoration goal of 3.0 except for Shallow Creek (Figure 9-67). Overall, the average BIBI scores for 2013 fell below the impairment threshold of 3.0 (Figure 9-68), however in 2014 both Browns Cove and Middle River had average scores that met the restoration goal of 3.0 BIBI scores (Figure 9-69).

Table 9-52: 2013 Tidal BIBI Results

Station	Salinity (ppt)	% siltclay	% TOC	% N	Salinity Class	Substrate Class	Tidal BIBI Score	Condition
OR-14-01	7.63	93.99	3.16	0.35	LM	Mud	1.00	Severely Degraded
OR-14-02	7.87	95.85	3.87	0.40	LM	Mud	1.00	Severely Degraded
OR-14-03	6.43	93.04	1.60	0.21	LM	Mud	3.80	Meets Restoration Goal
BC-14-01	6.02	76.44	3.80	0.37	LM	Mud	2.60	Degraded
BC-14-02	6.00	2.11	0.19	0.02	LM	Sand	3.40	Meets Restoration Goal
BC-14-03	6.00	72.97	3.71	0.53	LM	Mud	1.80	Severely Degraded
BC-14-04	5.69	69.33	4.85	0.36	LM	Mud	1.00	Severely Degraded
BR-14-01	2.63	85.21	3.00	0.32	OH	Mud	2.66	Degraded
BR-14-02	2.55	31.79	0.76	0.11	OH	Sand	2.66	Degraded
BR-14-03	2.59	50.21	1.63	0.16	OH	Mud	2.33	Degraded
BR-14-04	2.46	60.40	2.09	0.22	OH	Mud	2.00	Severely Degraded
BR-14-05	2.28	78.23	2.24	0.28	OH	Mud	2.66	Degraded
BR-14-06	3.03	85.18	2.88	0.29	OH	Mud	3.33	Meets Restoration Goal
BR-14-07	2.54	89.80	3.40	0.38	OH	Mud	2.33	Degraded
BR-14-08	2.86	88.95	2.69	0.32	OH	Mud	3.33	Meets Restoration Goal
BR-14-09	2.86	88.29	3.52	0.37	OH	Mud	3.33	Meets Restoration Goal
BR-14-10	2.88	96.28	2.73	0.36	OH	Mud	3.66	Meets Restoration Goal
BR-14-11	1.99	95.50	3.67	0.42	OH	Mud	3.66	Meets Restoration Goal
BR-14-12	1.11	97.79	4.33	0.46	OH	Mud	3.00	Meets Restoration Goal
BR-14-13	0.54	84.34	5.05	0.52	OH	Mud	3.33	Meets Restoration Goal
BR-14-14	0.43	87.33	4.48	0.40	TF	Mud	3.50	Meets Restoration Goal
BR-14-15	0.40	92.12	5.43	0.55	TF	Mud	3.00	Meets Restoration Goal
BR-14-16	0.37	87.04	5.11	0.41	TF	Mud	2.50	Degraded
SC-14-01	4.39	18.03	0.51	0.05	OH	Mud	2.33	Degraded
SC-14-02	4.27	93.92	1.51	0.21	OH	Mud	2.60	Degraded

Table 9-53: 2014 Tidal BIBI Results

Station	Salinity (ppt)	% siltclay	% TOC	% N	Salinity Class	Substrate Class	Tidal BIBI Score	Condition
BC-14-02	3.50	71.08	2.13	0.25	OH	MUD	3.67	Meets Restoration Goal
BC-14-03	3.42	52.48	2.02	0.22	OH	MUD	3.67	Meets Restoration Goal
BR-14-01	0.18	43.59	3.39	0.35	TF	MUD	3.00	Meets Restoration Goal
BR-14-02	0.16	88.21	3.85	0.38	TF	MUD	2.00	Severely Degraded
BR-14-03	0.12	91.62	4.53	0.39	TF	MUD	3.50	Meets Restoration Goal
BR-14-04	0.11	93.15	4.44	0.43	TF	MUD	2.00	Severely Degraded
BR-14-05	0.13	35.18	2.35	0.35	TF	SAND	2.50	Degraded
GR-14-01	3.11	71.80	2.58	0.33	OH	MUD	3.00	Meets Restoration Goal
GR-14-02	2.44	87.04	3.03	0.36	OH	MUD	2.00	Severely degraded
GR-14-03	2.68	89.98	5.28	0.52	OH	MUD	3.00	Meets Restoration Goal
GR-14-04	1.63	85.32	4.80	0.46	OH	MUD	2.33	Degraded
GR-14-05	1.89	81.67	5.35	0.48	OH	MUD	3.67	Meets Restoration Goal
GR-14-06	1.90	82.87	4.35	0.41	OH	MUD	3.00	Meets Restoration Goal
GR-14-07	3.53	93.13	5.37	0.52	OH	MUD	2.67	Marginal
MR-14-01	3.03	81.06	5.01	0.42	OH	MUD	3.00	Meets Restoration Goal
MR-14-02	2.62	41.67	3.35	0.34	OH	MUD	3.67	Meets Restoration Goal
MR-14-03	2.32	35.92	2.04	0.24	OH	SAND	4.00	Meets Restoration Goal
MR-14-04	2.16	91.19	2.58	0.40	OH	MUD	4.00	Meets Restoration Goal
MR-14-05	2.09	86.56	2.35	0.28	OH	MUD	3.67	Meets Restoration Goal
MR-14-06	1.88	88.87	3.30	0.32	OH	MUD	2.67	Marginal
MR-14-07	1.93	54.57	3.67	0.38	OH	MUD	3.00	Meets Restoration Goal
MR-14-08	1.83	19.20	1.81	0.21	OH	SAND	2.33	Degraded
MR-14-09	2.34	93.19	5.18	0.46	OH	MUD	3.50	Meets Restoration Goal
MR-14-10	1.56	26.55	1.83	0.16	OH	SAND	2.00	Severely Degraded
MR-14-11	1.61	76.58	1.83	0.24	OH	MUD	2.20	Degraded

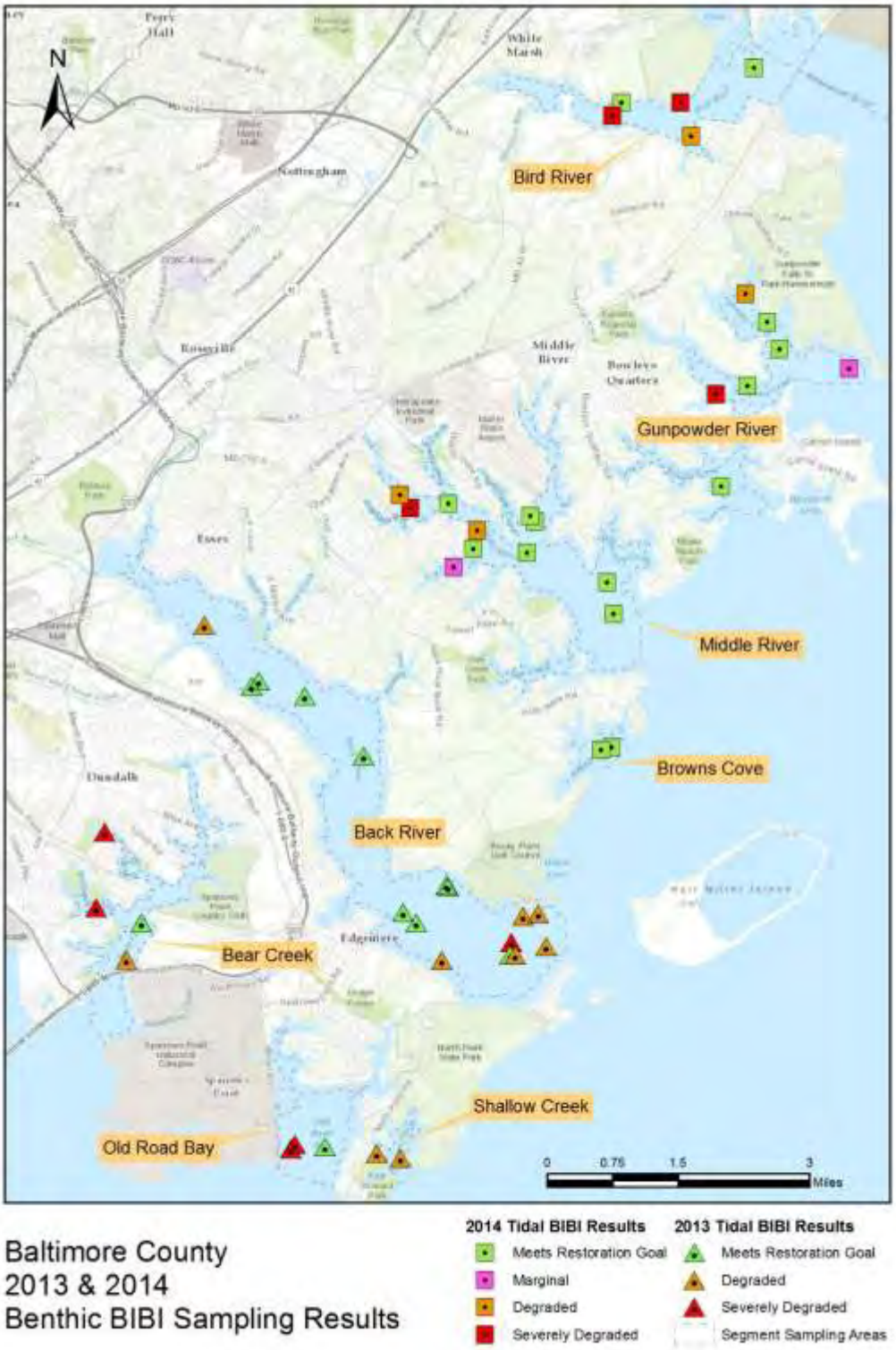


Figure 9-67: Map of 2013 and 2014 tidal benthic sample results.

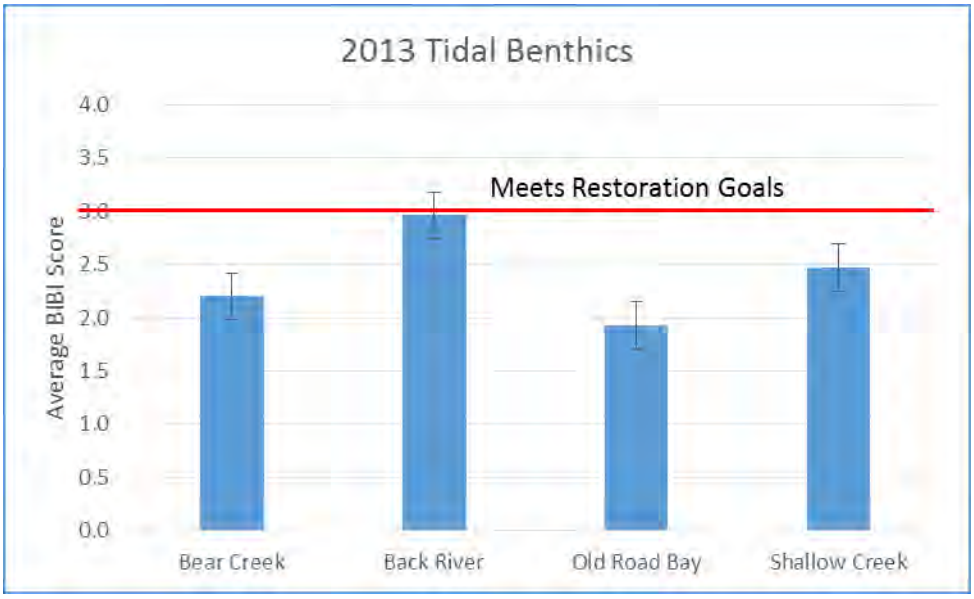


Figure 9-68: 2013 Average Tidal BIBI Scores for Each Tidal System

Figure 9-69: 2014 Average Tidal BIBI Scores for Each Tidal System

9.4.4 Submerged Aquatic Vegetation Monitoring Program

Baltimore County has conducted Submerged Aquatic Vegetation monitoring since 1989 on certain waterways. With the advent of water quality standards for submerged aquatic vegetation, reporting on the monitoring results commenced in the 2006 NPDES Annual Report. The standards are based on water quality segments that are derived from the Chesapeake Bay Program model. There are a total of seven segments in Baltimore County tidal waters. Three of the segments (MIDOH, GUNOH1, and BACOH) are entirely within Baltimore County tidal waters. Four other segments have tidal waters that extend to other jurisdictions. Two of these segments (CB2OH and CB3MH) are Chesapeake Bay mainstem segments and extend to the eastern shore of Maryland. The Chesapeake Bay Program draft document *Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll a for the Chesapeake Bay*

and Its Tidal Tributaries 2006 Addendum provides guidance on assessing the attainment of the SAV acreage criteria. The document states "the shallow-water bay grass designated use is considered in attainment if there are sufficient acres of SAV observed within the segment or there are enough acres of shallow-water habitat meeting the applicable water clarity criteria to support restoration of the desired acres of SAV for that segment." The recommended procedure is to use the single best year SAV acreage based on the most recent three-year period of available data. The criteria may also be met by attaining water clarity acres for the most recent three-year period of available data. The water clarity depth varies by tidal segment (see Table 9-54). Water clarity data is currently not collected in Baltimore County, so only the SAV acreage will be used.

The 2009 Triennial Review of Water Quality Standards proposed several changes that affect the SAV criteria. First, the tidal segment BACOH, which covers tidal Back River, has had a change in the target SAV acreage goal from 0 to 340 acres. Secondly, credit for meeting water clarity standards in areas with no SAV have changed from an acre by acre basis to 2.5 acres per acre basis. In other words, using Back River as an example, if no SAV were present in Back River, water clarity standards would have to be met for 850 acres (340 acres SAV goal X 2.5). Baltimore County monitors SAV distributions in the spring and summer of each year in accordance with the US Fish and Wildlife methodologies. There are currently 29 waterways in the County that are monitored. In order to assess the total acres of yearly coverage for the creeks surveyed, the data for the spring and summer were analyzed for overlap in SAV distribution between the two seasons. The total SAV coverage for each year is calculated by the following formula:

$$\text{Total SAV}_{acres} = (\text{Spring SAV}_{acres} - \text{Overlap}_{acres}) + (\text{Summer}_{acres}\ \text{SAV} - \text{Overlap}_{acres}) + \text{Overlap}_{acres}$$

To estimate the progress in meeting the SAV goal for each tidal segment the Total SAV_{acres} are divided by the SAV goal for that segment. Only two of the seven segments are totally within Baltimore County jurisdiction and therefore can be assessed for SAV criteria attainment. However, these two segments are not entirely surveyed for SAV coverage and so, like the other five segments this analysis will only provide a conservative estimate of SAV criteria attainment. Table 9-54 presents the SAV water quality standard for each segment and the results of the last three years of SAV monitoring. The yellow highlighted water quality segments lie entirely within Baltimore County. The green highlighted cells are the highest percent attainment for each water quality segment based on the last three years of data.

Table 9-54: SAV Standards and Baltimore County SAV Monitoring Results (2011-2013)

Water Quality Segment	SAV Goal (Acres)	Water Clarity Depth (m)	2012		2013		2014	
			Acres	% of Goal	Acres	% of Goal	Acres	% of Goal
MIDOH	**879**	**2.0**	**378.2**	43.0	**435.8**	49.6	**645.1**	73.3
GUNOH1	**1,860**	**0.5**	**	**	**	**	**	**
GUNOH2	**572**	**2.0**	**262**	45.8	**204.5**	37.8	**422.5**	73.9
BACOH	**340**	**0.5**	**2.7**	0.8	**0.0**	0.0	**3.2**	0.9
PATMH	**389**	**1.0**	**13.4**	3.4	**3.4**	0.9	**32.0**	8.2
CB2OH	**705**	**0.5**	**178.2**	25.3	**138.0**	19.6	**138.9**	19.7
CB3MH	**1,370**	**0.5**	**90.5**	6.6	**76.0**	5.5	**122.6**	8.9
Total SAV Acres	**6,115**		**925.0**		**857.7**		**1364.3**	

**** No monitoring conducted by Baltimore County in this segment.**

Overall the 2014 SAV monitoring year shows a modest increase in SAV coverage from the declining coverage trend displayed in 2010. The Middle River segment (MIDOH) continues to have one of the highest amount of SAV coverage, and shows a continued increase in the acres of coverage; from 378.2 acres in 2012 to 645.1 acres in 2014. Overall, all segments showed a increase in SAV coverage with the exception of CB2OH. All of the segments had the highest three year coverage recorded in 2014, except for CB2OH.

Since not all of the county tidal waters are monitored through this program, the numbers represent a conservative estimate of progress in meeting the SAV goals. The Gunpowder segment (GUNOH1) is not monitored by Baltimore County.

Figure 9-70 displays the trends in SAV coverage over 25 years of monitoring. The figure displays the percent of the area survey that was covered by SAV. As can be seen from the figure there is a generally increasing trend in the percent of the area surveyed that is covered by SAV from a low in 1989 of 0.37% to a high of 37.0% in 2009. The 2010 SAV coverage was reduced to 35.2% and further reduced in 2011 to 30.4%, in 2012 to 24.5% and in 2013 to 11.2%. However, 2014 has shown an increase in coverage with 23%. While there is a certain degree of variability, possibly related to climatic events (record wet year in 2003 with reduced % coverage) the overall trend is improved coverage.

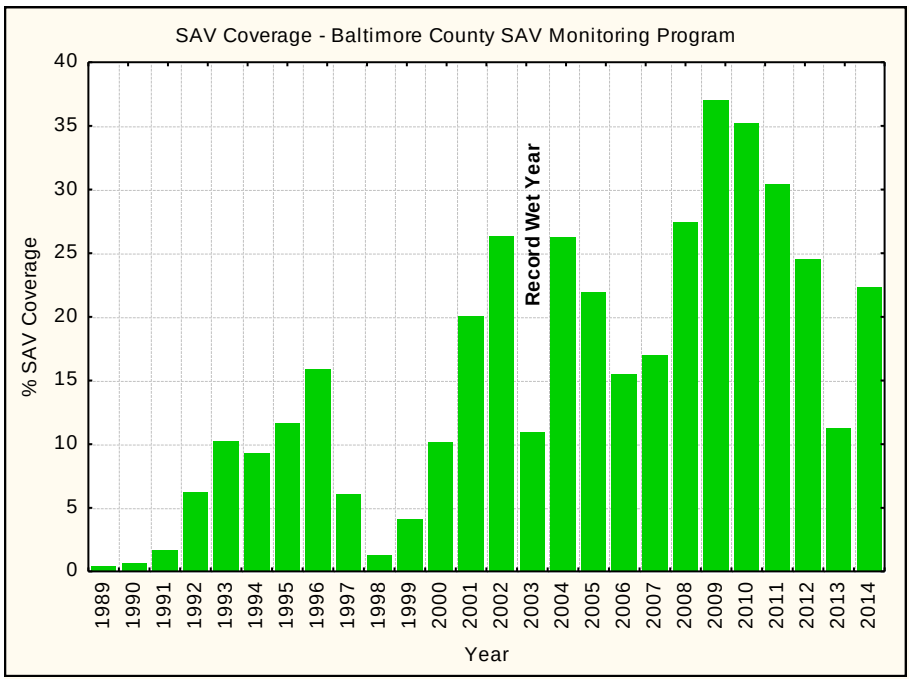


Figure 9-70: Baltimore County SAV Monitoring Program – Trends in % Coverage

Appendix 9-1: Results of 2014 Probabilistic Monitoring

StationID	Subwatershed	DNR 12digit Subsheds	Benthic Index of Biotic Integrity Score	Rating	Y	X
Prettyboy Reservoir						
0214001	Walker Run		5.00	Good	39.710347	-76.774884
0214002	Georges Run		3.33	Fair	39.6189	-76.794933
0214003	UNT Peggy's Run		3.67	Fair	39.609892	-76.799503
0214004	UNT Prettyboy Branch		4.33	Good	39.615601	-76.734757
0214005	Grave Run		4.00	Good	39.650112	-76.811857
Loch Raven Reservoir						
0314001	Piney Run		3.00	Fair	39.554473	-76.792789
0314002	UNT Gunpowder Falls		4.67	Good	39.616407	-76.670298
0314003	UNT Dulaney Branch		4.67	Good	39.473753	-76.542233
0314004	Slade Run		3.67	Fair	39.495798	-76.791593
0314006	Piney Run		2.00	Poor	39.56719	-76.804429
0314007	Western Run		4.00	Good	39.526129	-76.716482
0314008	Beaverdam Run		4.67	Good	39.476079	-76.668906
0314009	UNT Western Run		4.67	Good	39.53718	-76.708679
0314010	Piney Run		1.67	Very Poor	39.576388	-76.812122
0314011	Bush Cabin Run		3.67	Fair	39.608426	-76.68975
0314012	Gunpowder Falls		3.33	Fair	39.614327	-76.659856
0314013	Indian Run		3.00	Fair	39.546542	-76.743163
0314014	Little Falls		2.33	Poor	39.636784	-76.65342
0314015	McGill Run		3.33	Fair	39.543083	-76.823101
0314016	Piney Run		3.33	Fair	39.532142	-76.769323
0314017	UNT Charles Run		4.67	Good	39.584842	-76.584473
0314018	UNT McGill Run		4.33	Good	39.524722	-76.791803
0314019	Blackrock Run		3.33	Fair	39.538478	-76.729401
0314020	UNT Piney Creek		4.00	Good	39.579832	-76.685773
0314021	UNT Western Run		4.33	Good	39.539302	-76.708054
0314022	UNT Western Run		5.00	Good	39.51203	-76.732858
0314023	Deadman Run		4.33	Good	39.502303	-76.742488
0314024	Gunpowder Falls		3.67	Fair	39.52588	-76.627646
0314025	UNT Dulaney Branch		5.00	Good	39.477212	-76.530828
0314026	UNT First Mine Branch		5.00	Good	39.624119	-76.597216
0314027	UNT Little Falls		4.00	Good	39.696191	-76.709923
0314028	First Mine Branch		3.00	Fair	39.625316	-76.6072
0314029	Piney Run		3.00	Fair	39.58426	-76.817246
0314044	Little Piney Run		2.67	Poor	39.563697	-76.803842
Little Gunpowder Falls						
0914001	UNT Little Gunpowder Falls		3.00	Fair	39.444442	-76.402317
0914002	Little Gunpowder Falls		3.67	Fair	39.418989	-76.372484
0914003	Little Gunpowder Falls		4.00	Good	39.478274	-76.412467
0914004	Little Gunpowder Falls		3.33	Fair	39.601333	-76.561661
Lower Gunpowder						
1014001	UNT Cowen Run		3.67	Fair	39.435881	-76.522803
1014002	Jennifer Branch		2.33	Poor	39.404108	-76.506159

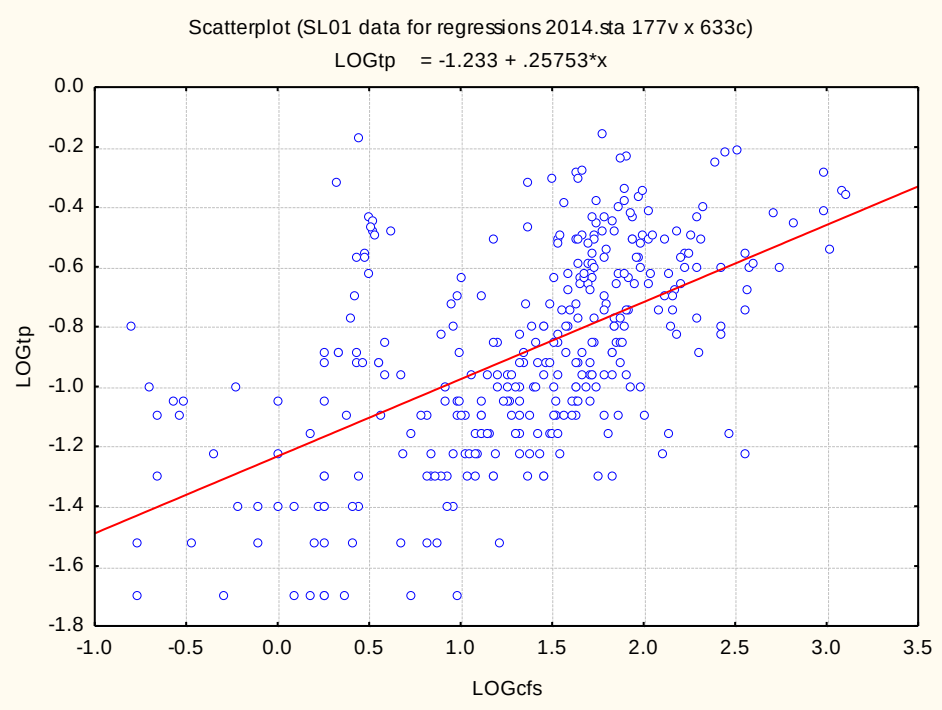
StationID	Subwatershed	DNR 12digit Subsheds	Benthic Index of Biotic Integrity Score	Rating	Y	X
1014003	UNT Gunpowder Falls		3.00	Fair	39.425265	-76.448922
1014005	UNT Gunpowder Falls		2.67	Poor	39.410937	-76.411004
1014006	UNT Gunpowder Falls		1.67	Very Poor	39.412577	-76.40096
1014004	UNT Gunpowder		2.71	Poor	39.430649	-76.427048
Deer Creek						
0414001	UNT Little Deer Creek		3.00	Fair	39.713323	-76.627023
0414002	UNT Deer Creek		4.00	Good	39.684091	-76.571002
Bird River						
1114001	White Marsh Run		1.57	Very Poor	39.379124	-76.468451
1114002	White Marsh Run		1.57	Very Poor	39.366683	-76.432452
1114003	UNT White Marsh Run		1.00	Very Poor	39.36517	-76.454354
1114004	Honeygo Run		1.57	Very Poor	39.382083	-76.431287

Appendix 9-2: Trend Monitoring Sites by Watershed

Site ID	Subwatershed	Site ID	Subwatershed
Liberty Reservoir – 3 Sites			
LI-01	Cliffs Branch	LI-04	Norris Run
LI-02	Glen Falls Run		
Patapsco River – 5 Sites			
PA-04	Ben's Run	PA-15	Patapsco River Direct Drainage
PA-14	Herbert Run- East Branch		
Gwynns Falls – 5 Sites			
GW-01	Gwynns Falls – Glyndon	GW-11	USGS gage at Gwynnbrook Road
GW-04	Red Run	GW-12	Gwynns Falls Direct Drainage
GW-10	Dead Run – Mainstem		
Jones Falls – 3 Sites			
JF-07	Roland Run	JF-12	Lake Roland Reservoir
JF-11	Jones Falls		
Back River – 3 Sites			
HR-05	Herring Run	BR-05A	Stemmers Run
BR-01	Bread and Cheese Creek		
Middle River – 1 Site			
MR-03	Frog Mortar Creek		
Prettyboy Reservoir – 3 Sites			
PR02	Gunpowder Falls above Prettyboy	PR04	George's Run
PR03	Grave Run		
Loch Raven Reservoir – 13 Sites			
LR-11	Spring Branch	LR-24	Little Falls
LR-13	Beaver Dam Run – York Road	LR-27	Third Mine Branch
LR-14	Baisman Run	LR-30	Beetree Run
LR-17	Western Run	LR-35	Piney Run
LR-19	Overshot Run	LR-39	Slade Run
LR-22	Gunpowder Falls - Glencoe	LR-40	Gunpowder Falls
LR-23	Charles Run		
Lower Gunpowder Falls – 3 Sites			
GU-03	Haystack Branch	GU-08	Minebank Run
GU-05	Long Green Creek – Hartley Mill		
Little Gunpowder Falls – 1 Site			
LG-05	Little Gunpowder Falls		
Bird River – 3 Sites			
BI-01	Windlass Run	BI-03	Whitemarsh Run - Headwaters
BI-02	Honeygo Run		

Baltimore Harbor – 1 Site			
BH-07	Bear Creek		

Appendix 9-3: Example Regression Analysis Graph



SL-01 Total Phosphorus Data and Regressions for 2005-2014.

10.0 Permit Requirements

E. Total Maximum Daily Loads

Section 402(p)(3)(B)(iii) of the Clean Water Act (CWA) states that municipal storm sewer permits must require stormwater controls to reduce the discharge of pollutants to the MEP. By regulation at 40 CFR §122.44, EPA further requires that BMPs and programs implemented pursuant to this permit must be consistent with applicable waste load allocations (WLAs) developed under EPA approved TMDLs (see list of impaired waters attached and incorporated as Attachment B). The goals of Maryland's NPDES municipal stormwater permit program are to control stormwater pollutant discharges by implementing the BMPs and programs required by this permit, show progress toward meeting WLAs, and contribute to the attainment of water quality standards according to the CWA

In pursuit of these goals, Baltimore County shall annually provide watershed assessments, restoration plans, opportunities for public participation, and TMDL compliance status. A systematic assessment shall be conducted and a detailed restoration plan developed for all watersheds within Baltimore County. As required below, watershed assessments and restoration plans shall include a thorough water quality analysis, identification of water quality improvement opportunities, and a schedule for BMP and programmatic implementation to meet stormwater WLAs included in EPA approved TMDLs.

1. Watershed Assessments

   a. By the end of the permit term, Baltimore County shall complete detailed watershed assessments for the entire County. Watershed assessments conducted during previous permit cycles may be used to comply with this requirement, provided the assessments include all the items listed in Part III.E.1.b. below. Assessments shall be performed at an appropriate watershed scale (e.g., Maryland's hierarchical eight or twelve-digit sub-basins) and be based on MDEs TMDL analysis or an equivalent and comparable County water quality analysis;

   b. Watershed assessments by the County shall:

      i. Determine current water quality conditions;

      ii. Include the results of a visual watershed inspection;

      iii. Identify and rank water quality problems;

      iv. Prioritize all structural and nonstructural water quality improvement projects; and

      v. Specify pollutant load reduction benchmarks and deadlines that demonstrate progress toward meeting all applicable stormwater WLAs.

2. Restoration Plans

a. Within one year of permit issuance, Baltimore County shall submit an impervious surface assessment consistent with the methods described the MDE document "Accounting for Stormwater Wasteload Allocations and Impervious Area Treated, Guidance for National Pollutant Discharge Elimination System Stormwater Permits (MDE 2011 or subsequent versions). Upon approval by MDE, this impervious surface area assessment shall serve as the baseline for the restoration efforts required in this permit.

b. By the end of the permit term, Baltimore County shall commence and complete the implementation of restoration efforts for twenty percent of the County's impervious surface area consistent with the methodology described in the MDE document cited in paragraph a. that is not already restored to the MEP;

c. Within one year of permit issuance, Baltimore County shall submit to MDE a restoration plan for each stormwater WLA approved by EPA prior to the effective date of the permit. The County shall submit restoration plans for subsequent TMDL WLAs within one year of EPA approval. Upon approval by MDE, these restoration plans will be enforceable under this permit. As part of the restoration plans, Baltimore County shall:

i. Include a detailed schedule for implementing all stormwater structural and nonstructural water quality improvement projects, enhanced stormwater management programs, and alternative stormwater control initiatives necessary for meeting applicable stormwater WLAs;

ii. Provide detailed cost estimates for individual projects, programs, controls, and plan implementation;

iii. Evaluate and track implementation of watershed restoration plans through monitoring or modeling to document progress toward meeting established benchmarks, deadlines, and stormwater WLAs; and

iv. Develop an ongoing, iterative process that continuously implements structural and nonstructural restoration projects, stormwater program enhancements, and alternative BMPs where EPA approved TMDL WLAs are not being met according to the benchmarks and deadlines established as part of the County's watershed assessments.

3. Public Participation

Baltimore County shall provide continual outreach to the public regarding the development of its watershed assessments and restoration plans. Additionally, the County shall allow for public participation in the TMDL process, solicit input, and incorporate any relevant ideas and program

improvements that can aid in achieving TMDLs and water quality standards. Baltimore County shall provide:

a. Notice in a local newspaper and the County's web site outlining how the public may obtain information on the development of the watershed assessments and watershed restoration plans and opportunities for comment;

b. Procedures for providing watershed assessments and watershed restoration plans to interested parties upon request;

c. A minimum 30 day comment period before finalizing watershed assessments and watershed restoration plans; and

d. A summary in each annual report of how the County addressed or will address any material comment received from the public.

4. TMDL Compliance

Baltimore County shall evaluate and document progress toward meeting all applicable WLAs included in EPA approved TMDLs. An annual TMDL assessment report with tables shall be submitted to MDE. This assessment shall include complete descriptions of the analytical methodology used to evaluate the effectiveness of the County's stormwater restoration plans and how these plans are working to achieve compliance with EPA approved TMDLs. Baltimore County shall provide:

a. Estimated net change in pollutant load reductions from all completed structural and nonstructural water quality improvement projects, enhanced stormwater management programs, and alternative stormwater control initiatives;

b. A comparison of the net change in pollutant load reductions detailed above with the established benchmarks, deadlines, and applicable stormwater WLAs;

c. Itemized costs for completed projects, programs, and initiatives to meet established pollutant reduction benchmarks and deadlines;

d. Cost estimates for completing all project, programs, and alternatives necessary for meeting applicable WLAs; and

e. A description of a plan for implementing additional watershed restoration actions that can be enforced when benchmarks, deadlines, and applicable stormwater WLAs are not being met or when projected funding is inadequate.

10.1 Introduction

This section covers watershed management planning activities and status of TMDL development (10.2), pollution load reduction calculations (10.3), restoration progress (10.4), and progress in meeting the impervious cover restoration targets (10.5) and TMDL reduction allocations (10.6). Section 10.2 discusses the development of Small Watershed Action Plans, the status of TMDL development and the development of TMDL Implementation Plans. These plans meet the

requirements for development of watershed assessment and restoration plans. The plans are intended to provide the road map for meeting TMDL reduction requirements, protecting our Tier II waters, and meeting locally developed water quality goals.

Section 10.3 clearly lays out the process used in determining the pollutant load reduction attributable to the various types of restoration conducted to meet water quality objectives. The information for the calculations is derived from the latest Chesapeake Bay Program spreadsheet on BMP efficiencies, CBP expert panel reports on various BMP practices (as they are available), and the draft document entitled *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* (MDE August, 2014).

Section 10.4 details the restoration progress made to date due to capital program restoration projects, community reforestation program efforts, and restoration efforts by the various local watershed associations. The information is presented by program and by watershed.

Section 10.5 details progress made in meeting the impervious cover treatment acres required as a tracking mechanism in the stormwater permit. An impervious cover analysis has been conducted to determine the amount of impervious cover in 2002 (the base year) in Baltimore County. The current target is 20% of the impervious cover in Baltimore County. With the issuance of the next NPDES – MS4 permit the impervious cover target is anticipated to increase to 40%. Section 10.6 details progress made in meeting the local TMDL reduction allocations and the Chesapeake Bay TMDL for the reduction of nutrients and sediment.

10.2 Status of Watershed Management Plans

10.2.1 Water Quality Management Plans

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

10.2.2 Small Watershed Action Plans (SWAPs)

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

Stakeholders are invited to participate in the development of each SWAP. A series of two to three public stakeholder meetings are held over the course of the development of each SWAP.

The first introduces the stakeholders to the process and solicits their input on the characterization of the planning area and goals. The second meeting presents the final characterization document and solicits input on preferred restoration options. The third meeting presents the SWAP, which includes not only County actions and projects, but also citizen based and business based restoration activities and options. For some SWAPs the agendas of the second and third meetings are combined into one meeting. The SWAP steering committee includes local stakeholders as representatives from the watersheds being studied. Planning areas were selected on similarity of impacts within each area, allowing focus on specific issues related to the stakeholders that live and work within each planning area. Twenty-three planning areas have been delineated. Since the reissuing of the MS4 permit, newly completed SWAPs have and will continue to be posted for a 30-day comment period prior to finalization.

When the SWAPs have been completed the Steering Committee becomes the Implementation Committee, which will meet twice each year to determine progress being made, barriers to making progress, and the need for any revisions.

Since the last NPDES Annual Report the following SWAPs have been completed:

- Loch Raven North SWAP (Area X) – May 2015
- Liberty Reservoir SWAP (Area S) – May 2015

Previously completed SWAPs include:

- Prettyboy WRAS (Area T) – January 2008
- Spring Branch SWAP – March 2008 (will be included in the larger Area O SWAP)
- Lower Jones Falls SWAP (Area H) – October 2008
- Upper Back River SWAP (Area L) – November 2008
- Tidal Back River SWAP (Area E)– February 2010
- Upper Gwynns Falls SWAP (Area V) – May 2011
- Beaver Dam Run, Baisman Run, and Oregon Branch SWAP (Area I) – November 2011
- Middle River and Tidal Gunpowder SWAP (Area F) – February 2012
- Lower Patapsco SWAP (Area A) – May 2012
- Northeastern Jones Falls SWAP (Area M) – December 2012
- Bear Creek/Old Road Bay SWAP (Area D) – December 2012
- Middle Gwynns Falls SWAP (Area C) – September 2013
- Loch Raven East SWAP (Area R)– February 2014
- Bird River SWAP (Area K)– April 2014

An additional six SWAPs are currently under development with an expected completion date within the next year, except Area O which is being done in-house, and on an independent time schedule:

- Southeastern Loch Raven Reservoir SWAP (Area O)
- Urban Lower Gunpowder SWAP (Area N)
- Rural Jones Falls SWAP (Area G)
- Rural Patapsco SWAP (Area B)
- Little Gunpowder Falls SWAP (Area P)
- Loch Raven West SWAP (Area W)

All study areas that have yet to receive a SWAP have either had their studies initiated already or are scheduled to be underway by 2017. Moreover, all SWAPs will be completed by the end of the term of the permit, as required. Figure 10-1 shows the planning areas and schedule, while Table 10-1 shows the status, schedule, and the acres for each planning area. The completed SWAPs are posted on the County web site:
http://www.baltimorecountymd.gov/Agencies/environment/watersheds/swap.html

Table 10-1: SWAP Schedule

Watershed	SWAP Area	Acres	Completed By:	Anticipated Completion
Patapsco	A	17,569	Consultant	Complete
Patapsco	B	15,761	Consultant	Underway – 2016
Gwynns Falls	C	14,884	Consultant	Complete
Balt Harbor	D	11,484	Consultant	Complete
Back River	E	7,858	Consultant	Complete
Gunpowder/Middle R.	F	6,520	Consultant	Complete
Jones Falls	G	13,187	Consultant	Underway – 2015
Jones Falls	H	5,777	EPS/Consultant	Complete
Loch Raven	I	8,350	Consultant	Complete
Bird River	K	22,528	Consultant	Complete
Back River	L	15,385	EPS	Complete
Jones Falls	M	6,957	EPS	Complete
Lower Gunpowder	N	10,553	Consultant	Underway – 2015
Loch Raven	O	17,523	EPS	Underway – 2016
Little Gunpowder	P	17,217	Consultant	Underway – 2016
Lower Gunpowder	Q	18,931	Consultant	2017
Loch Raven	R	11,466	Consultant	Complete
Liberty Reservoir	S	16,449	Consultant	Complete
Prettyboy Reservoir	T	24,027	EPS	Complete
Deer Creek	U	7,132	Harford County	Complete
Gwynns Falls	V	13,618	Consultant	Complete
Loch Raven	W	38,515	Consultant	Underway – 2016
Loch Raven	X	61,436	Consultant	Complete

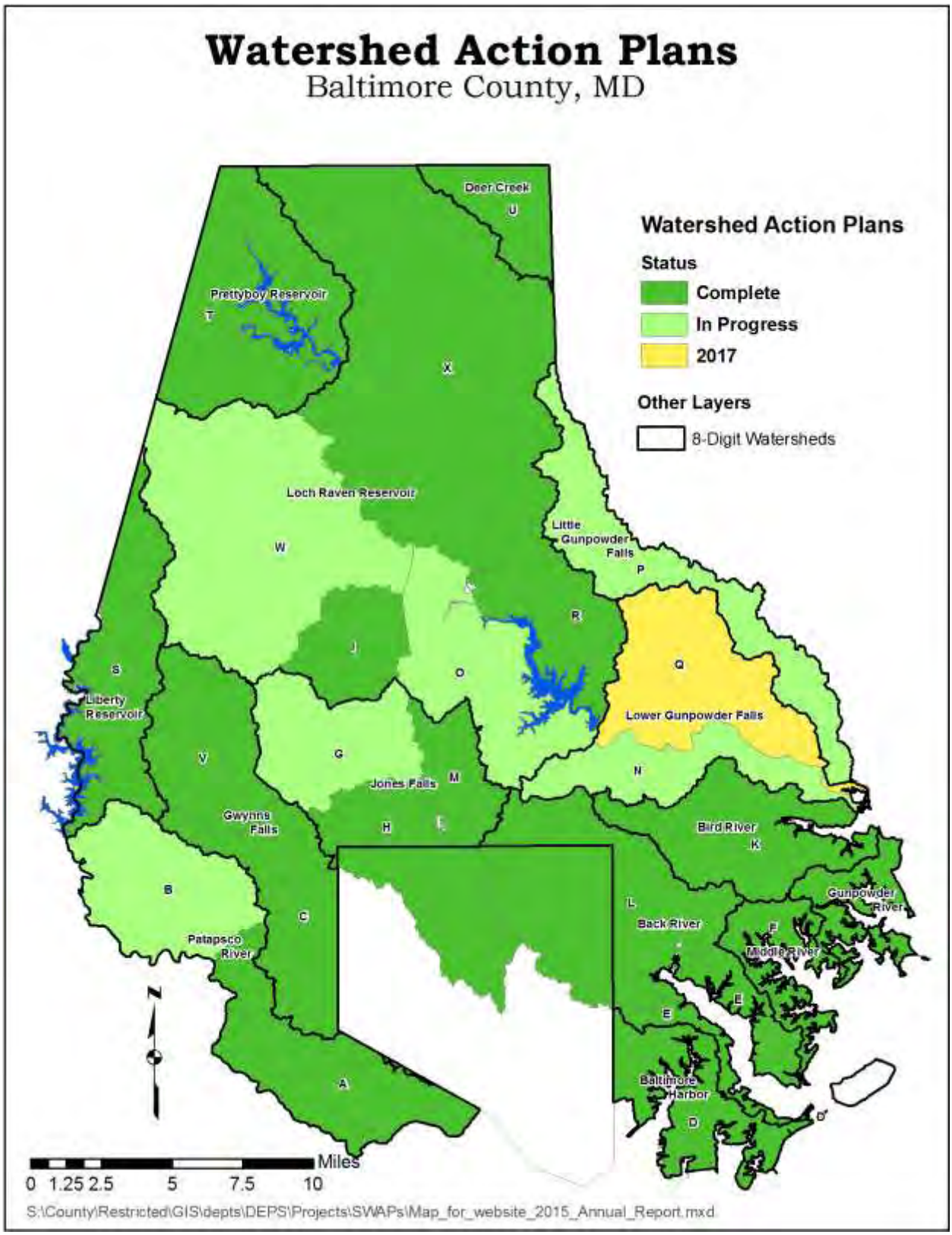


Figure 10-1: Baltimore County SWAP Status

10.2.3 Total Maximum Daily Load (TMDL) Implementation Plans

The Baltimore County NPDES – MS4 Permit was renewed December 23, 2013. A new provision of the permit was a requirement to develop a TMDL Implementation Plan for each EPA approved local TMDL within one year of permit issuance, or within one year of EPA approval for those local TMDLs that were not approved at the time of the permit renewal. Baltimore County has developed 25 local TMDL Implementation Plans. One additional plan is currently in development (Trash in Gwynns and Jones Falls), and is expected to be completed by the end of the calendar year. The completed plans include the following pollutants:

- Bacteria – 7 plans
- Sediment – 5 plans (3 stream based, 2 reservoir based)
- Phosphorus – 3 plans
- Nutrients – 2 plans
- Mercury – 3 plans
- Chlordane – 2 plans
- PCBs – 3 plans.

The County EPS developed the TMDL Implementation Plans in-house (with exception to the plans for Liberty Reservoir, which were developed in tandem with the SWAP for that area), after meeting with other Baltimore County agencies and local watershed associations for input. Prior to posting for public comment, the draft plans were distributed to Baltimore County agencies, Maryland Department of the Environment, and local watershed association to solicit comments. The comments provided were used to improve the plans prior to posting for public comment. The documents were then revised based on the comments as appropriate and a comment response document was prepared.

After final submission, MDE has provided additional feedback which will be addressed. Once the edits resulting from additional feedback have been made, the documents will be posted on the County website, along with the comment response document.

Two additional TMDLs were approved by EPA after the issuance of the Baltimore County NPDES – MS4 permit; the Liberty Reservoir Phosphorus and Sediment TMDL (approved by EPA May 4, 2014), and the Baltimore Harbor Trash TMDL (approved by EPA January 5, 2015). The Implementation Plan for the Liberty Reservoir have been completed in tandem with the SWAP for that area, and the Trash Implementation Plan is currently under development.

TMDLs are developed by the State for waters listed as impaired on the 303(d) list. The 303(d) list is updated during the course of the development of the Integrated Report. The Integrated Report is required by federal law to be submitted to EPA every two years. The Integrated Report and further information on the Report can be found on the MDE web page: http://www.mde.maryland.gov/programs/Water/TMDL/Integrated303dReports/Pages/Programs/WaterPrograms/TMDL/Maryland%20303%20dlist/index.aspx . The most recent Integrated Report was developed in 2014; it was approved by EPA – Region 3 on October, 16, 2015 (see-http://www.mde.maryland.gov/programs/Water/TMDL/Integrated303dReports/Pages/2014IR.aspx). Table 10-2 presents the status of TMDL development for watersheds within Baltimore County and impairment status as reported in the 2014 Integrated Report. Those waters listed as impaired will have a TMDL developed in future years. For review of the TDMLs, see MDE webpage:
http://www.mde.maryland.gov/programs/Water/TMDL/CurrentStatus/Pages/Programs/WaterPro

grams/TMDL/Sumittals/index.aspx The TMDLs and the Water Quality Assessments (WQAs) are listed by watershed with links to the TMDL or WQA document and supporting information. Water Quality Assessments are performed when there is limited data for the impairing substance. It is often found that the substance is not causing an impairment in the water body, so the impairment listing will be removed in the next Integrated Report. A number of assessment methodologies have been developed for determining impairments (see - http://www.mde.state.md.us/programs/Water/TMDL/Integrated303dReports/Pages/Programs/WaterPrograms/TMDL/maryland%20303%20dlist/ir_listing_methodologies.aspx). For aquatic biological community impairments, the impairment listing is removed once the cause of the impairment is determined and the waterbodies are listed for the impairing substances. For streams the assessment methodology *Maryland Biological Stressor Identification Process (http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Documents/www.mde.state.md.us/assets/document/BSID_Methodology_Final.pdf).*

The impairment listings can be based on water body type, typically they are listed based on streams, impoundments (reservoirs) or tidal water receiving waters.

Table 10-2: TMDL, WQA, and Impairment Listing Status by Watershed and Tidal Segment

Watershed	Nutrients	Sediment	Bacteria	Toxics Organics	Toxics Metals	Other
Deer Creek	Not Impaired	Not Impaired	Not Impaired	Not Impaired	Not Impaired	Not Impaired
Prettyboy Reservoir Streams	Not Impaired	Not Impaired	TMDL - 2009	Not Impaired	WQA - 2003	Not Impaired
Prettyboy Reservoir Impoundment	Phosphorus TMDL – 2008	Not Impaired	Not Impaired	Impaired – PCBs -	TMDL - Hg in fish tissue – 2006 WQA – Zn, Ni, Pb, Cu, Cr, Cd, AS - 2006	Not Impaired
Loch Raven Reservoir Streams	Not Impaired	Not Impaired	TMDL - 2009	Not Impaired	WQA- 2003	Biological Community Impaired – Sulfates, Chlorides, Temperature (water)
Loch Raven Reservoir Impoundment	Phosphorus TMDL – 2008	TMDL – 2008	Not Impaired	Impaired – PCBs	TMDL - Hg in fish tissue – 2006 WQA – Ni, Pb, Cu, Cr, Cd, As - 2004	Not Impaired
Lower Gunpowder	Impaired - Phosphorus	Impaired	Not Impaired	Not Impaired	WQA – As, Hg, Zn, Ni, Pb, Cr, Cd - 2004	Impaired – Sulfates, Chlorides, Stream Alteration
Little Gunpowder	WQA - 2009	Not Impaired	Not Impaired	Not Impaired	WQA – Hg – 2004 WQA – Zn, Ni, Pb, Cu, Cr, Cd, As - 2004	Impaired – Temperature (water)
Bird River	WQA - 2005	Not Impaired	Not Impaired	Not Impaired	Not Impaired	Impaired – Cause unknown Biological Community – Insufficient Data
Gunpowder River	Not Impaired	Not Impaired	Not Impaired	Not Impaired	Not Impaired	Not Impaired

Watershed	Nutrients	Sediment	Bacteria	Toxics Organics	Toxics Metals	Other
Middle River	Not Impaired	Not Impaired	Not Impaired	Not Impaired	WQA – Pb, Cd - 2003	Not Impaired
Liberty Reservoir - Streams	Not Impaired	Not Impaired	TMDL - 2009	Not Impaired	Not Impaired	Impaired – Chlorides, Temperature (water)
Liberty Reservoir - Impoundment	Phosphorus – TMDL – 2014	Sediment – TMDL – 2014	Not Impaired	Not Impaired	WQA - Hg - Pending WQA – Cr, Pb – 2003	Not Impaired
Lower North Branch Patapsco River	WQA - 2009	TMDL - 2011	TMDL - 2009	Not Impaired	WQA – As, Zn, Pb, Hg, Cu, Cr, Cd - 2006	Impaired – Sulfates, Chlorides, Stream Alteration
Gwynns Falls	WQA - 2010	TMDL - 2010	TMDL - 2008	Not Impaired	Not Impaired	Impaired – Chlorides, Temperature (water), Stream Alteration
Jones Falls	WQA – 2010	TMDL - 2011	TMDL – 2008	Lake Roland – PCBs- TMDL - 2014 Chlordane – TMDL - 2001 (Delisted: 2012)	WQA – Zn, Pb, Cu - 2004	Impaired – Sulfates, Chlorides, Stream Alteration, Temperature (water)
Back River	TMDL - 2005	Impaired	TMDL – Herring Run only - 2008	See tidal segments below	Not Impaired	Impaired – Sulfates, Chlorides, Stream Alteration
Baltimore Harbor	TMDL - 2007	Impaired	Not Impaired	See tidal segments below	Not Impaired	Biological Community Impaired – Chlorides, Sulfates
GUNOH	TMDL - 2010	TMDL - 2010	Not Impaired	Impaired	Impaired -Hg in fish tissue	Not Impaired
MIDOH	TMDL - 2010	TMDL - 2010	Not Impaired	Impaired	Impaired -Hg in fish tissue; WQA – Pb, Cd - 2004	Biological Community – Insufficient Data
CB2OH	TMDL - 2010	TMDL - 2010	Not Impaired	Not Impaired	Not Impaired	Not Impaired
BACOH	TMDL – 2005, 2010	TMDL - 2010	Not Impaired	PCBs – TMDL - 2012 Chlordane – TMDL - 1999	Impaired – Hg in fish tissue WQA – Zn 2006	Biological Community – Insufficient Data
CB3MH	TMDL - 2010	TMDL - 2010	Not Impaired	Not Impaired	Not Impaired	Impaired -Biological Community
PATMH	TMDL – 2005, 2010	TMDL - 2010	Not Impaired	PCBs – TMDL -2012 Chlordane – TMDL - 2001	Impaired – Cr, Zn Sediments	Impaired – Trash – Middle Branch, Northwest Harbor, Biological Community (TMDL 2015)
Total TMDLs[1]	**6 (5)**	**6 (5)**	**7 (7)**	**5 (5)**	**2 (2)**	**1 (0)**
Total Impaired – Need TMDL[1]	**1 (1)**	**2 (2)**	**0 (0)**	**4 (2)**	**4 (0)**	**33 (28)**

1. Including Chesapeake Bay TMDL (Not including Chesapeake Bay TMDL/local only).

A total of 25 local TMDLs have been developed for Baltimore County waters, not counting the Chesapeake Bay TMDLs. The Chesapeake Bay can be considered as a single TMDL; although it includes nitrogen, phosphorus, and sediment pollutants for 53 Maryland tidal segments and could be considered as 159 TMDLs. There are an additional 33 impairment listings that will require TMDLs in Baltimore County in the future, and an unknown number of additional impairment listings that will be developed once the causes of the biological community impairments are determined. Each one of these current and future TMDLs will require the development of a TMDL Implementation Plan in the future. For existing TMDLs, within one-year of the permit reissuance, for future TMDLs, within one year of EPA approval of the TMDL. The Chesapeake Bay TMDL has been addressed through the development of the Baltimore County Phase II Watershed Implementation Plan (http://www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Pages/WIPPhaseIICountyDocuments.aspx). The categories of TMDLs are discussed below (all Chesapeake Bay related TMDLs are counted as a single TMDL, e.g. Back River Nutrients and Baltimore Harbor Nutrients fall under the same Bay TMDL).

Nutrient TMDLs: There are four nutrient TMDLs for Baltimore County waters. The three drinking water reservoirs (Prettyboy, Loch Raven, and Liberty) located in Baltimore County have TMDLs completed for phosphorus. Each reservoir exceeds the water quality standards for epilimnion chlorophyll *a* and hypolimnion for dissolved oxygen. The two standards are linked through algal production, which in turn is related to the amount of phosphorus delivered to the reservoir, changes in nitrogen have been found through modeling to not have an effect on the amount of algal production within the reservoirs. This follows the general ecological principle that fresh waters are phosphorus limited and not nitrogen limited in terms of production. The increase in algal biomass can cause problems in the final drinking water product. High amounts of algae can cause taste issues with the drinking water and the algal organic matter can react with the chlorination to produce trihalomethanes in the finished water (http://water.epa.gov/drink/contaminants/basicinformation/disinfectionbyproducts.cfm). When the algal biomass dies it drifts through the thermocline to the hypolimnion where bacteria break down the organic matter and in the process reduce the oxygen in the hypolimnion (for further information http://www.ourlake.org/html/dissolved_oxygen.html or http://pubs.usgs.gov/sir/2011/5090/pdf/sir2011-5090.pdf). This in turn impacts the biological community's ability to survive.

For the Chesapeake Bay TMDL both nitrogen and phosphorus lead to increased algal growth. This has the effect in tidal water of decreasing the dissolved oxygen levels when the algae die and the algal biomass also has an effect on water clarity by intercepting the sunlight and causing shading of submerged aquatic vegetation (http://www.chesapeakebay.net/issues/issue/nutrients). These algae blooms may also have health effects for both the aquatic biological communities and humans (http://www.dnr.state.md.us/bay/hab/index.html). The Bay TMDL applies to Back River and Baltimore Harbor watersheds.

Sediment TMDLs: There are six sediment TMDLs for Baltimore County waters, two are related to drinking water reservoirs, three are related to stream biological community impacts, and one final sediment TMDL is related to water clarity in the Chesapeake Bay. Sediment TMDLs come from a variety of impacts. Sediment TMDLs for reservoirs are typically based on increasing the longevity of the drinking water supply (http://www.eolss.net/Sample-Chapters/C07/E2-12-02-05.pdf), while those for streams are based on impacts on the aquatic community (http://www.csu.edu.au/__data/assets/pdf_file/0011/749936/Harrison_Evan_139.pdf). The

sediment TMDL for the Chesapeake Bay is based on water clarity standards for the support of submerged aquatic vegetation (SAV) that provides nursery habitat for a variety of fish and crabs in support of aquatic wildlife (http://chesapeake.usgs.gov/SedimentBay605.pdf or http://www.chesapeakebay.net/indicators/indicator/reducing_sediment_pollution). The Bay TMDL applies to the stream based sediment TMDLs for Jones Falls, Gwynns Falls, and Patapsco River watersheds.

Bacteria TMDLs: The seven bacteria TMDLs developed to date have all focused on bacteria impairments in streams, with no impairments indicated for the drinking water reservoirs, and none currently to tidal water segments (although this may change for Baltimore Harbor). High levels of bacteria are an indicator of potential human health impacts for people using the waters for recreational purposes. The bacteria TMDLs present some unique challenges, due mainly to the input of wildlife and the current state of knowledge on bacteria dynamics in streams and effectiveness of various treatment options. Meeting the Consent Decree to eliminate Sanitary Sewer Overflows (SSOs) is expected to provide a majority of the reduction to bacteria counts in affected areas.

Toxics-Organics: This class of pollutants includes all those with a hydrocarbon based molecular structure and includes a variety of pesticides, polychlorinated biphenyls (PCBs), and a variety of petroleum products and their derivatives. There are two in this class that currently have TMDLs, the pesticide chlordane, and PCBs; both of these have been banned for use for several decades. The listings are typically based on presence in fish tissue and therefore available for human consumption.

Toxics-Metals: To date this category has been limited to mercury (Hg) in fish tissue related to human health. The balance of the various types of metals have not been determined to be impairing biological communities to date.

Temperature: While no TMDLs have been developed, at the time of this document's writing, temperature impairments in streams have been noted in various Baltimore County waterways. The County is currently collecting data and partnering with consultants to research possible causes of high temperature within select watersheds.

Other Impairing Substances: This is a catchall category that includes trash, and ions, such as, chlorides and sulfates. The trash impairment listing for Baltimore Harbor has resulted in a TMDL that has recently completed the public comment period. The ions, chloride and sulfate have been identified as impairing the stream biological community in a number of watersheds. No TMDLs for these two pollutants have been developed as yet. An additional category of impairment has been identified as impairing the stream communities in a number of watersheds. This is stream channel alterations. Since stream alterations are not a pollutant, TMDLs will not be developed for these types of impairments.

10.3 Pollutant Load Reduction Calculations and Crediting Actions

In order to conduct consistent pollutant load and pollutant load reduction calculations, Baltimore County has opted to use the loading rates from the Chesapeake Bay Program Phase 5.3 Watershed Model, as expressed in the Maryland Assessment Scenario Tool (MAST). The loading rates are based on the land/river segment in MAST. Some 8-digit watersheds have multiple land/river segments within their boundaries. Since data is expressed on an 8-digit watershed basis, mean weighted edge-of-stream (EOS) loading rates were calculated for each of

the fourteen 8-digit watersheds that are entirely or partially within Baltimore County. Only the loading rates for urban impervious, urban pervious, and forest are given in Table 9-3.

Table 10-3: Edge-of-Stream (EOS) Pollutant Loading Rates by Watershed

Watershed	Total Nitrogen/Acre			Total Phosphorus/Acre			Total Sediment/Acre		
	Urban Imp.	Urban Per.	Forest	Urban Imp.	Urban Per.	Forest	Urban Imp.	Urba n Per.	Forest
Deer Creek	17.36	11.55	2.77	1.51	0.30	0.04	2,158.7	294.8	89.7
Prettyboy Reservoir	17.36	11.55	2.77	1.51	0.30	0.04	1,644.3	224.6	76.1
Loch Raven Reservoir	17.36	11.55	2.77	1.51	0.30	0.04	1,601.5	220.6	64.4
Lower Gunpowder Falls	17.36	11.55	2.78	1.51	0.30	0.04	1,946.9	265.9	76.6
Little Gunpowder Falls	17.36	11.55	2.77	1.51	0.30	0.04	2,128.5	260.7	99.0
Bird River	9.64	6.39	1.53	1.48	0.28	0.04	631.0	86.4	22.0
Gunpowder River	9.64	6.39	1.53	1.48	0.28	0.04	766.7	104.7	24.0
Middle River	9.64	6.39	1.53	1.48	0.28	0.04	716.2	97.8	26.4
Liberty Reservoir	17.36	11.56	2.79	1.51	0.30	0.04	1,704.8	232.8	70.9
Patapsco River	14.49	9.73	2.78	1.26	0.25	0.04	1,549.8	208.1	88.0
Gwynns Falls	17.34	11.55	2.78	1.51	0.30	0.04	2,057.0	280.4	82.2
Jones Falls	17.36	11.55	2.77	1.51	0.30	0.04	968.4	132.3	29.7
Back River	9.64	6.39	1.53	1.48	0.28	0.04	558.9	76.9	24.7
Baltimore Harbor	9.64	6.40	1.53	1.48	0.28	0.04	675.9	92.3	31.05

There are several types of restoration programs and projects completed by EPS and the local EPS funded watershed associations that result in quantifiable pollution reduction. This section details how these numbers are obtained.

10.3.1 Stream Restoration

In September of 2014 the expert panel report on defining removal rates for stream restoration projects was completed. Baltimore County will begin using the protocols outlined in this report to calculate pollutant reductions starting with the Kelly Branch stream restoration project, which is scheduled to be completed in October of 2015. All projects completed prior to Kelly Branch will use the interim rates defined in the expert panel report. These new interim rates are available for use in WIP planning by all Bay states and localities. These interim rates are shown below:

- Total Nitrogen – 0.075 pounds per linear foot of stream restoration
- Total Phosphorus – 0.068 pounds per linear foot of stream restoration
- Total Suspended Solids (coastal plain) – 15.13 pounds per linear foot of stream restoration
- Total Suspended Solids (non-coastal plain) – 44.88 pounds per linear foot of stream

10.3.2 Shoreline Enhancement

To obtain nutrient reduction numbers associated with shoreline enhancement projects, it must be determined how much sediment the project is theoretically preventing from entering a waterway. To calculate an estimate of annual erosion at a given shoreline site, the equation V=LEB is used, where ‘V’ is volume eroded, ‘L’ is length of shoreline, ‘E’ is erosion rate and ‘B’ is bank height. This equation yields a volume expressed in cubic feet per year. Cubic feet are converted to pounds using a soil bulk density of 93.6 lb/ft^3. Pounds are then converted to tons using a factor of 0.0005. Lengths of shoreline and bank heights are taken from engineering and project plans prepared by consultants for Baltimore County and erosion rates from Department of Natural Resources website, http://shorelines.dnr.state.md.us are used.

Nitrogen and Phosphorus loading rates for shorelines are taken from *Eroding Bank Nutrient Verification Study for the Lower Chesapeake Bay* (Ibison, 92). The mean total N and total P loading concentrations in the study are 0.73 lb/ton and 0.48 lb/ton respectively (p. 44).

An expert panel report on urban shoreline erosion control is currently under review by the Chesapeake Bay Program's Watershed Technical Workgroup. Once this report is finalized Baltimore County will begin using the protocols for pollution reduction crediting outlined in the report.

10.3.3 Stormwater Management Facilities and Retrofits

Drainage areas for stormwater management facilities and retrofits are delineated to determine the acreage on which to apply the pollution reduction efficiencies shown in Table 9-4. Efficiencies are applied to pollutant loads based on land use of these drainage areas. Efficiencies used are taken from the Maryland Assessment and Scenario Tool (MAST).

Table 10-4: Percent Removal Efficiency of BMPs

BMP	Pollutants		
	TN	TP	TSS
Detention Facilities	5	10	10
Extended Detention Facilities	20	20	60
Wet Ponds and Wetlands	20	45	60
Infiltration Practices	80	85	95
Filtration Practices	40	60	80
Bioretention Practices	70	75	80
ESD Practices	50	60	90

Detention Facilities = Detention Pond and Hydrodynamic Devices
Extended Detention Facilities = Dry Extended Detention Ponds
Wet Ponds and Wetlands = Wet Pond and Shallow Marsh
Infiltration Practices = Infiltration Trench and Infiltration Basins, Porous Paving, and Dry Wells
Filtration Practices = Sand filters

Section 10.6.2 describes the calculation of pollutant loads for individual watersheds. The pollutant load reductions for stormwater management facility retrofits and conversions use the loads calculated in accordance with Section 10.6.2 and the pollutant removal efficiencies based on facility type found in Table 10-4.

Need a paragraph on the new method for calculating SWM removal, if we do not get the Guidance document written. If we do get it written, then we need to remove the material from this section and simply refer to the document.

10.3.4 Tree Planting

Tree planting occurs on public and private land, in 100' stream buffers and open areas. Nutrient reductions associated with stream buffer and tidal buffer plantings are obtained using the sum of a reduction efficiency and a land use change. For stream buffers, a reduction efficiency of 25% for Nitrogen, 50% for Phosphorus and 50% for sediment is applied to the area planted using the blended loading rate for the entire watershed in which the buffer planting is done. This blended loading rate is used because this efficiency is meant to apply to areas upland of the buffer that drain to the stream where the buffer is located. Efficiencies of 19% for N, 45% for P and 60% for sediment are used for tidal buffers. The land use change is from a pervious urban nutrient load to a forested nutrient load, using loading rates from the Phase 5.3 Chesapeake Bay Program

(CBP) Model. Table 9-3 shows these loading rates. Open area plantings (non-buffer) use only the land use change to calculate load reductions. When an area planted is not known, the ratio of 100 trees = 1 acre is used for calculations as per the MDE guidance document *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* (MDE June, 2011).

10.3.5 Downspout Disconnections, Rain Barrels and Rain Gardens

Individual downspouts that are directly connected to the storm drain system, either through piping or by discharging to impervious surfaces that lead to storm drains, can be disconnected from the system. Pollutant reductions are associated with the following types of disconnections using loading rates and reduction efficiencies from the Phase 5.3 CBP Watershed Model:

- Downspout Disconnection & Rain Barrels - Rooftop area disconnected is estimated and the impervious urban pollutant-loading rate for the respective watershed (see Table 10-3) is calculated for this estimated area. A default rooftop area of 250 sq. ft. is used when actual area is not available. Pollutant reduction efficiencies are then applied to the estimated pollutant load from the rooftop. Reduction efficiencies are taken from the MDE Guidance Document (June 2011) and are shown in Table 9-5.

- Rain Gardens - Rain gardens drain specific areas of pervious and/or impervious surface. By applying the watershed specific pollutant loading rates from Table 9-3 to the drainage area of the rain garden and applying the reduction efficiencies from Table 9-5 to these loads, pollutant reduction numbers for rain gardens can be determined. Reduction efficiencies for rain gardens are taken from MAST.

Table 10-5: Percent Removal Efficiency of BMPs

BMP	Pollutants		
	TN	TP	TSS
Downspout Disconnections	50	60	90
Rain Barrels	50	60	90
Rain Gardens	70	75	80

10.4 Restoration Progress

This section presents information on the restoration progress not cover elsewhere (Section 7 street sweeping and storm drain cleaning, Section 5 Illicit Connection Program) in the report. The Department of Environmental Protection and Sustainability (EPS) through a variety of programs is responsible for the bulk of the restoration activity within the County. These activities are reported in section 10.4.1. The Baltimore County Department of Public Works (DPW restoration activities are reported in section 10.4.2. The citizen based restoration actions of the local watershed associations supported by the Baltimore County Watershed Restoration Planning and Implementation grants are summarized in Section 10.4.3. Redevelopment/revitalization projects that have resulted in water quality improvements are reported in Section 10.4.4. All actions that result in water quality improvement are summarized by watershed in Section 10.4.5.

10.4.1 EPS Restoration Programs

EPS restoration programs are administered by various sections within the department. The restoration progress is reported of the EPS programs are reported by the Section administering the program. The Watershed Restoration Section administers the Capital Restoration Program (also called the Waterway Improvement Program). Watershed Restoration is responsible for the

oversight of the design and construction of capital projects that include; stream restoration, shoreline erosion control, conversion of existing stormwater facilities for enhanced water quality treatment, and stormwater retrofits. The Forest Management and Sustainability Section is responsible for programs related to reforestation and tree canopy planting. These activities are detailed in Section 10.4.1.2. The Groundwater Management Section has responsibility for administration of the Bay Restoration Fund grants to Baltimore County that result in connections of existing on-site disposal systems (OSDS) to the sanitary sewer and upgrades of existing OSDS to denitrifying systems, both resulting in the reduction of nutrients discharged to the environment. These activities along with OSDS pump-out information are presented in Section 10.4.1.3

10.4.1.1 Watershed Restoration Section - Capital Restoration Projects

Capital Restoration Projects are reported by watershed below and include both completed projects and projects under design or construction with a table for each watershed. Each table includes columns for project name, project type, either linear feet or acres of the project depending on project type, cost for completed projects or estimated costs for projects under design or construction, year of completion (fiscal year after 2011), calculated pollutant removal for nitrogen, phosphorus, and sediment for competed projects (estimated for projects under design or construction), and the impervious surface restoration credit for each completed project (estimated for projects under design or construction).

10.4.1.1.1 Deer Creek Watershed

Due to the rural nature of this watershed, a watershed management plan is not required by previous NPDES – Municipal Stormwater Discharge Permits, but is required by the latest permit. Baltimore County participated in the Harford County sponsored Deer Creek Watershed Restoration Action Strategy development, and considers this document as meeting the requirement to assess all of the County waters by the end of the current permit. Baltimore County's portion of this watershed is approximately eleven square miles. There are no capital improvement projects existing in or currently planned for this watershed. Deer Creek is part of the Susquehanna River Basin. The predominate land use in the watershed is agriculture.

10.4.1.1.2 Prettyboy Reservoir Watershed

There have not been any capital improvement projects completed by Baltimore County EPS – Watershed Restoration Section in the Prettyboy watershed to date.

10.4.1.1.3 Loch Raven Reservoir Watershed

Capital Improvement projects completed by Baltimore County EPS in the Loch Raven watershed are shown in Table 10-6. At the end of fiscal year 2015, nine stream restoration projects had been completed resulting in the restoration of 4.5 miles of stream channel. An additional 2.4 miles of stream restoration are either in design or construction and are anticipated to be completed within the next two years. Five existing stormwater management facilities representing 69.5 acres of urban land have been converted to provide better water quality treatment, while an additional 183.5 acres of urban land have been retrofitted with new stormwater management facilities to provide water quality treatment.

Table 10-6: CPO Projects in the Loch Raven Reservoir Watershed

Capital Improvement Projects Through FY15 Loch Raven Reservoir Watershed								
Project	**Facility Type**	**DA (LF)**	**Cost**	**Date**	**Removal Rate (lb./year)**			**Imp Acres**
					TN	**TP**	**TSS**	
Completed Projects								
Spring Branch Retrofit (#2880)	NWET	49.5	276,473	97	128.4	5.9	16,640.2	7.9
Spring Branch SR	SR	(10,000)	1,868,380	97	750.0	680.0	448,800.0	100.0
Long Quarter Branch Ret (#2879)	NWET	134.0	150,000	99	198.5	20.3	26,170.4	11.1
Long Quarter Branch SR	SR	(2,300)	564,581	99	172.5	156.4	103,224.0	23.0
Dulaney Valley Branch SR	SR	(1,700)	220,000	98	127.5	115.6	76,296.0	17.0
East Beaver Dam Run I	SR	(2,000)	372,000	00	150.0	136.0	89,760.0	20.0
Goodwin Run @ Padonia	SR	(700)	491,000	02	52.5	47.6	31,416.0	7.0
Hampton Branch	SR	(2,500)	630,000	04	187.5	170.0	112,200.0	25.0
Western Run@Ashland Ch	SR	(500)	365,675	04	37.5	34.0	22,440.0	5.0
Spring Branch II SR	SR	(2,500)	1,080,495	08	187.5	170.0	112,200.0	25.0
East Beaver Dam Run II	SR	(1,600)	765,846	15	120.0	108.8	71,808	16.0
Industry Lane Pond 2 (#578)	CNV	5.5	67,217	15	15.6	2.3	1,071.27	6.05
Mays Chapel Pond 3 (#85)	CNV	18.0	39,860	15	69.4	6.4	8,560.5	8.64
Warren Manor (#115)	CNV	9.9	32,347	15	7.4	0.4	424.2	3.91
Willowbrook (#1868)	CNV	14.5	32,144	15	30.2	3.1	1,003.8	5.78
Mayfair Pond 2 (#1064)	CNV	21.6	39,478	15	30.3	1.2	1,406.6	6.29
TOTALS		**(23,800) 253.0**	**6,995,496**		**2,264.8**	**1,658.0**	**1,123,421.0**	**287.7**
Projects Under Design or Construction								
Kelly Branch @ Dulny Vly	SR	(3,500)	949,870		262.5	238.0	157,080.0	35.0
Long Quarter @ Shetland Hills	SR	(1,500)	1,058,000		112.5	102.0	67,320.0	15.0
Dulaney Valley Branch @ Windmere	SR	(7,500)	?		562.5	510.0	336,600.0	75.0
Estimated Totals		**(12,500)**	**2,007,870+**		**937.5**	**850.0**	**561,000.0**	**125.0**

Abbreviations
NWET: New Wet Pond RET: Retrofit SR: Stream Restoration

10.4.1.1.4 Lower Gunpowder Watershed

Capital Improvement projects completed by Baltimore County EPS in the Lower Gunpowder River watershed are shown below in Table 10-7. In the Lower Gunpowder Falls 6 stream restoration projects addressing 4 miles of degraded stream channel have been completed. An addition 2 projects are under design to address a further 1.23 miles of degraded stream channel. Eleven existing stormwater management facilities serving 101 urban acres have been converted to provide better water quality, with an additional four ponds currently under design that will provide better water quality for 50.7 acres or urban land within the next two years..

Table 10-7: CPO Projects in the Lower Gunpowder Falls Watershed

Capital Improvement Projects Through FY15 Lower Gunpowder River Watershed								
Project	**Facility Type**	**DA** (LF)	**Cost**	**Date**	**Removal Rate (lb./year)**			**Imp Acres**
					TN	**TP**	**TSS**	
Completed Projects								
Minebank Run I	SR	(7,000)	1,189,684	00	525.0	476.0	314,160.0	70.0
Northwind @ Simms	REP	23.8	8,000	04	na	na	na	na
Minebank Run II Minebank LRHS Trib Retro	SR	(10,000)	4,400,000	05	750.0	680.0	448,800.0	100.0
Minebank Run Trib @Waller	SR	(482)	258,958	08	36.2	32.8	21,632.2	4.8
Gunpowder Falls @ Cromwell (DPW)	SR	(1,500)	2,500,000	09	112.5	102.0	67,320.0	15.0
Jennifer Branch	SR	(6,100)	3,449,803	13	457.5	414.8	273,768.0	61.0
Lower Minebank	SR	(3,000)	1,275,100	15	225.0	204.0	134,640.0	30.0
St Isaac Jogues (#279)	CNV	11.1	72,904	15	20.9	2.5	922.5	5.41
Cedarside Farm (#393)	CNV	15.4	47,061	15	36.4	4.2	1,940.1	7.24
Doncaster Village Pond 2 (#452)	CNV	4.6	51,937	15	21.1	1.7	2,696.9	3.11
Doncaster Village Sec 6 (#453)	CNV	7.75	76,996	15	42.6	2.8	4,057.5	3.62
Erd Manor (#473)	CNV	8.6	82,463	15	34.8	2.3	3,467.5	4.29
Fullerton Farms (#517)	CNV	8.8	57,890	15	20.5	1.4	2,269.7	1.44
Glen Mill Estates Pond 2 (#525)	CNV	6.5	72,089	15	21.4	1.4	2,027.4	1.75
Robin Ridge Pond 1 (#815)	CNV	7.0	52,155	15	29.6	2.0	2,990.1	3.66
Satyr Woods (#845)	CNV	22.0	62,278	15	88.9	6.2	9,417.7	8.41
Satyr Woods South (#846)	CNV	3.2	44,580	15	13.1	1.0	1,539.7	1.24
Robin Ridge 2 (#1764)	CNV	6.2	41,590	15	26.0	1.9	3,002.0	2.58
TOTALS		**(28,082) 125.0**	**13,743,488**		**2,461.5**	**1,937.0**	**1,294,651.3**	**323.6**
Projects Under Design or Construction								
Lower Gun @ Proctor	SR	(2,000)	1,446,872		150.0	136.0	89,760.0	20.0
Lower Gun @ 7 Courts	SR	(4,500)	1,062,714		337.5	306.0	201,960.0	45.0
Glen Mill Estates Pond 1 (#524)	CNV	10.3	51,520		36.2	2.8	3,495.9	3.78
Scott's Haven (#850)	CNV	19.2	57,910		67.4	5.2	6,516.6	9.6
Minte Homes (#631)	CNV	4.5	?		15.8	1.2	1,527.3	3.57
Perry Hall Courts Section 2 (#1744)	CNV	16.7	?		58.7	4.5	5,668.1	6.82
Estimated Totals		**(6,500) 50.7**	**2,619,016+**		**665.6**	**455.7**	**308,927.9**	**88.77**

Abbreviations:
REP: Repair SR: Stream Restoration CNV: SWM Pond Conversion

10.4.1.1.5 Little Gunpowder Falls Watershed

No capital restoration projects have been completed or are planned in the Little Gunpowder Falls watershed.

10.4.1.1.6 Bird River Watershed

Capital Improvement projects completed by Baltimore County EPS in the Bird River watershed are shown below in Table 10-8. Ten completed stream restoration projects have resulted in the

restoration of 4.8 miles of degraded stream channel by the end of fiscal year 2015. An additional 3.7 miles of stream channel restoration are under design or construction. Six stormwater management facilities serving 253.7 acres of urban land have been converted to provide better water quality, while 4 stormwater retrofit projects have provided new facilities to provide water quality for a further 236 acres of urban land.

Table 10-8: Bird River Watershed – CIP Status

Capital Improvement Projects Through FY15 Bird River Watershed								
Project	**Facility Type**	**DA** (LF)	**Cost**	**Date**	**Removal Rate (lb./year)**			**Impervious Acres**
					TN	**TP**	**TSS**	
Completed Projects								
Burnam Woods (#348)	CNV	31.7	11,687	95	50.4	6.9	3,695.5	0.1
Featherhill (#493)	CNV	77.5	18,013	95	82.1	15.5	8,485.1	0.0
Lawrence Hill (#650)	CNV	52.5	102,091	96	99.8	11.1	5,636.3	2.9
S Fork WMR SR	SR	(1,900)	391,803	98	142.5	129.2	85,272.0	19.0
N Fork WMR @ Perryvale	SR	(800)	120,000	99	60.0	54.4	35,904.0	8.0
Perryvale Retrofit (#754)	CNV	42.8	120,000	99	66.2	8.4	4,433.2	0.0
S Fork @ Franklin Square (#2057)	NWET	46.0	935,416	99	95.1	16.1	8,325.1	13.9
White Marsh Mall Retrofit (#2878)	RET	129.6	435,838	99	241.4	33.3	16,605.0	18.1
White Marsh Bus. Comm.* (#4994)	RET	53.9	235,597	99	na	na	na	na
N Fork WMR @ Slvr Mdw	SR	(400)	128,945	99	30.0	27.2	17,952.0	4.0
White Marsh Run SR	SR	(4,000)	982,387	00	300.0	272.0	179,520.0	40.0
WMR @ Woodcroft	SR	(2,000)	700,000	00	150.0	136.0	89,760.0	20.0
Evergreen Pond Retrofit (#478)	CNV	22.2	40,828	02	35.9	4.7	2,518.6	0.0
N. Fork White Marsh Run	SR	(7,000)	1,239,140	04	525.0	476.0	314,160.0	70.0
East Br. Honeygo Run	SR	(4,000)	1,330,000	04	300.0	272.0	179,520.0	40.0
S Fork @ Franklin Sq SR	SR	(2,600)	600,000	04	195.0	176.8	116,688.0	26.0
S Fork WMR@ Kings Ave.	SR	(2,500)	800,000	10	187.5	170.0	112,200.0	25.0
WMR @ Orbitan	SR	(300)	175,000	10	22.5	20.4	13,464.0	3.0
Southfield Pond 2 (#978)	CNV	27.0	86,764	14	31.3	6.7	806.6	11.4
Magnolia	RET	6.5	574,845	15	30.5	3.2	1,341.8	2.2
TOTALS		**(25,500) 489.7**	**9,028,354**		**2,645.2**	**1,839.9**	**1,196,287.2**	**241.6**
Projects Under Design or Construction								
WMR @ WM Rd	SR	(10,000)	13,064,171		750.0	680.0	151,300.0	100.0
N. Fork II West Branch	SR	(8,000)	1,948,250		600.0	544.0	121,040.0	80.0
WMR @ Upton Rd	SR	(1,350)	**?**		101.3	91.8	20,425.5	13.5
Estimated Totals		**(19,350)**	**15,012,421+**		**1,451.3**	**1,315.8**	**292,765.5**	**193.5**

Abbreviations
CNV: SWM Pond Conversion
SR: Stream Restoration
NWET: New Wet Pond
RET : Retrofit
*This project is no longer there due to I-95 expansion

10.4.1.1.7 Gunpowder River Watershed

Capital Improvement projects completed by Baltimore County EPS in the Gunpowder River watershed are shown below in Table 10-9. Due to the limited amount of urban land in the Gunpowder River watershed, little restoration effort has been completed to date, that effort consisted of a single shoreline erosion control project addressing 140 feet of shoreline, a single stormwater retrofit addressing 52.9 acres of urban land and the conversion of an existing stormwater management facility serving 4.7 acres of urban land to provide better water quality treatment.

Table 10-9: Gunpowder River Watershed – CIP Status

Capital Improvement Projects Through FY15 Gunpowder River Watershed								
Project	**Facility Type**	**DA** (LF)	**Cost**	**Date**	**Removal Rate (lb./year)**			**Impervious Acres**
					TN	**TP**	**TSS**	
Completed Projects								
Carrollwood Shoreline	SE	(140)	150,000	93	20.5	13.5	56,160.0	5.6
Carrollwood Park (#1422)	RET	52.9	350,000	95	148.1	22.2	13,666.5	19.0
Carrollwood Shoreline Replacement	REP	na	207,645	13	na	na	na	na
Chase Manor Pond (#1167)	CNV	4.7	68,834	14	7.0	1.6	335.1	0.0
TOTALS		**(140) 57.6**	**776,479**		**175.6**	**37.3**	**70,161.6**	**24.6**
Projects Under Design or Construction								

Abbreviations
REP: Repair SE: Shoreline Enhancement RET: Retrofit
CNV : SWM Pond Conversion

10.4.1.1.8 Middle River Watershed

Capital Improvement projects completed by Baltimore County EPS in the Middle River watershed are shown below in Table 10-10. Five shoreline erosion control projects have been completed in Middle River addressing 0.94 miles of eroding shoreline. A single stream restoration project has restored 1,000 feet of degraded stream channel, and 4 stormwater retrofit projects have provided water quality for 343.7 acres of urban land and one conversion of an

existing stormwater facility provides better water quality treatment for an additional 15.9 acres of urban land.

Table 10-10: Middle River Watershed – CIP Status

Capital Improvement Projects Through FY15 Middle River Watershed								
Project	**Facility Type**	**DA** (ft)	**Cost**	**Date**	**Removal Rate (lb./year)**			**Imp Acres**
					TN	**TP**	**TSS**	
Completed Projects								
Dark Head Park	SE	(780)	168,000	90	426.2	280.2	1,167,600	31.2
Rocky Point Beach	SE	(1,110)	324,945	93	1,319.7	867.7	3,615,600	44.4
Pottery Farm Park	SE	(1700)	351,000	95	190.5	125.3	521,914	68.0
Hawthorne Park	SE	(350)	64,000	95	39.1	25.7	107172	14.0
Norman Creek (#4993)	STWET	25.3	131,151	95	39.6	4.6	2,531.7	2.8
Turkey Point	SE	(1,000)	127,539	97	112.7	74.1	308,880	40.0
Sue Creek (#4992)	STWET	6.4	93,274	97	12.5	1.8	1,014.3	1.5
Dark Head Park II (repair)	REP	na	15,094	99	na	na	na	na
Tall Trees	SR	(1,000)	1,100,000 combined	06	75.0	68.0	15,130.0	10.0
Tall Trees (#4254)	RET	183.1		06	329.6	46.0	25,129.7	56.7
Frog Mortar (#4208)	RET	128.9	82,000	08	160.6	22.1	12,599.8	22.8
Middleborough Rd. (#711)	CNV	15.9	65,558	14	17.7	2.8	555.8	5.99
TOTALS		**(5,940) 359.6**	**2,522,561**		**2,723.2**	**1,518.3**	**5,778,127**	**291.4**

Abbreviations:
SR: Stream Restoration
RET: Retrofit
REP: Repair
SE: Shoreline Enhancement
STWET: Stormwater Wetland
CNV : SWM Pond Conversion

10.4.1.1.9 Liberty Reservoir Watershed

No capital restoration projects have been completed or are planned in the Liberty Reservoir watershed.

10.4.1.1.10 Lower North Branch Patapsco River Watershed

Capital Improvement projects completed by Baltimore County EPS in the Lower North Branch Patpasco watershed are shown in Table 10-11. Six stream restoration projects have been completed in the Lower North Branch of the Patapsco River watershed, however, one project does not count toward meeting either pollutant load reductions or impervious surface restoration credit as it was a required environmental project included in the Baltimore County Sanitary Sewer Concent Decree. We have left it in the table for informational purposes. The remaining 5 completed stream restoration projects have restored 0.6 miles of degraded channel. An additional 4 projects will triple the miles of stream channel restored by addressing an additional 1.8 miles of channel. Two completed stormwater retrofits have addressed water quality for 24.4 acres of urban land. An additional conversion of an existing stormwater management facility is in design and when constructed will provide enhanced water quality treatment for an additional 14.0 acres of urban land.

Table 10-11: Patapsco River Watershed – CIP Status

Capital Improvement Projects Through FY15 Patapsco River Watershed								
Project	**Facility Type**	**DA** (LF)	**Cost**	**Date**	**Removal Rate (lb./year)**			**Imp Acres**
					TN	**TP**	**TSS**	
Completed Projects								
Bloomsbury (DPW) (#4256)	RET	10.3	unknown	90	27.7	1.9	2,551.6	2.0
Herbert Run@ Selma Ave.	SR	(550)	227,000	00	41.3	37.4	24,684.0	5.5
Herbert Run @ Leeds Ave	SR	(300)	78,144	03	22.5	20.4	13,464.0	3.0
2203 Sulphur Spring Rd	SR	(200)	111,000	03	15.0	13.6	8,976.0	2.0
Halethorpe Streambank	SR	(100)	61,500	03	7.5	6.8	4,488.0	1.0
Bens Run SR	SR	(2,000)	570,964	04	150.0	136.0	89,760.0	20.0
Bens Run Retrofit (#4390)	STWET	14.1		04	37.0	3.5	4,138.0	1.6
Herbert Run @ Paradise Ave. – cd	*SR*	*(1,000)*	*482,000*	*10*	*na*	*na*	*na*	*na*
TOTALS		**(4,150) 24.4**	**1,530,608**		**301.0**	**219.6**	**148,061.6**	**35.1**
Projects Under Design or Construction								
Catonsville Park Retrofit (#358)*	SR (& RET)	(2,100)	800,000		157.5	142.8	94,248.0	21.0
Crowin Property (#421)	CNV	14.0	58,874		49.2	3.8	4,751.7	6.49
Cooper Branch @ Oella	SR	(2,400)	1,250,000		180.0	163.2	107,712.0	24.0
Cedar Branch @ Inwood	SR	(3,320)	2,056,896		249.0	225.8	149,001.6	33.2
Sawmill Trib @ Patleigh	SR	(1,920)	?		144.0	130.6	86,169.6	19.2
Estimated Totals		**9,740**	**4,165,770+**		**779.7**	**666.2**	**441,882.9**	**103.89**

Abbreviations
SR: Stream Restoration STWET: Stormwater Wetland
RET: Retrofit *cd*: Consent Decree requirement D: Design C: Construction
* joint project w/DPW

10.4.1.1.11 Gwynns Falls Watershed

Capital Improvement projects completed by Baltimore County EPS in the Gwynns Falls watershed are shown in Table 10-12. By the end of FY2015, 7,758 linear feet (1.5 miles) of degraded stream channel had been restored, however, 2,500 linear feet (0.5 miles) of stream restoration were required for the sanitary sewer consent decree and therefore cannot be counted toward pollutant load reductions nor impervious surface restoration credit. Two hundred and fifty feet are also not counted toward pollutant load and impervious surface as the project listed is associated with a repair of a previous project. An additional 250 are also not counted as the project consisted of a buffer enhancement for which there is currently no crediting of pollution reduction nor impervious surface restoration. Ten existing stormwater management facilities serving 228.5 acres of urban land have been converted to facility types providing greater water quality benefits, while an additional 34.3 acres of urban land have been retrofitted with stormwater management facilities providing water quality improvement.

Table 10-12: CPO Projects in the Gwynns Falls Watershed

Capital Improvement Projects Through FY15 Gwynns Falls Watershed								
Project	**Facility Type**	**DA** (LF)	**Cost**	**Year**	**Removal Rate (lb./year)**			**Impervious Acres**
					TN	**TP**	**TSS**	
Completed Projects								
GF Trib @ Greenshire Ct	SR	(135)	17,690	99	27.0	9.2	41,850	1.4
Dead Run @ Security/McD	BE	(250)	23,690	02	na			
Rutherford Business Ctr. (#841)	CNV	52.5	134,000	03	96.7	4.1	29,355.8	22.2
Dead R@ HS Ftbridge/wall	SR	(200)	141,000	03	40.0	13.6	62,000	2.0
Woodlawn HS retrofit (#3646)	RET/BE	10.3	206,000	03	79.7	5.1	6,804.9	4.8
Dead Run@ Whitehead 1	SCR	17.0	155,000	03	13.7	2.1	2,861.2	7.7
Dead Run@ Whitehead 2	SCR	7.0			5.5	0.8	1,116.8	5.2
DR @ Woodlawn Dr (Fox)	SR	(450)	232,594	04	90.0	30.6	139,500	4.5
GF @ Chartley SR	SR	(2,000)	970,000	06	400.0	136.0	620,000	20.0
Gwynns Falls @ Gwynnbrook – cd	*SR*	*(2,500)*	*470,000*	*09*	*NA*			
Upper Gwynns Falls 5 # 27	CNV	19.6	816,366	13	115.4	9.2	15,255.4	11.66
Upper Gwynns Falls 5 #26	CNV	19.4			75.5	5.3	8,699.7	8.16
Upper Gwynns Falls 5 #47	CNV	11.1			108.0	7.3	11,756.4	6.12
Upper Gwynns Falls 5 #33	CNV	21.4			95.5	6.9	11,151.8	11.61
Upper Gwynns Falls 5 #110	CNV	85.8			241.5	14.4	22,132.8	17.96
The Woods of Winands #996	CNV	3.7	47,738	14	16.2	1.0	1,605.2	1.2
Scott's Level @ McDonogh	SR/RET	(1,973)	2,013,059	14	148.0	134.2	88,548.2	19.7
Gwynns Falls @ Gwynnbrook Repair	REP	(250)	150,000	15	*NA*			
Rider Mill Pond 1 (#2090)	CNV	5.8	69,706	15	14.7	1.5	831.0	1.7
The Mills @ Owings Mills Pond 1 (#1687)	CNV	3.8	27,854	15	8.4	0.9	405.5	2.5
The Mills @ Owings Mills Pond 2 (#1688)	CNV	5.4	43,504	15	10.2	1.0	430.3	1.5
TOTALS		**(7,758) 262.8**	**5,518,201**		**1,586.0**	**383.2**	**1,064,305.0**	**149.9**
Projects Under Design or Construction								
DR @ West View Park	SR	(4,700)	1,540,312		352.5	319.6	210,936.0	47.0
Gwynns Falls @ Chartley II	SR	(2,000)	475,000		150.0	136.0	89,760.0	20.0
Discovery Acres 2 (#451)	CNV	23.5	102,868					5.17
Scott's Level @ Upper Scott's Level Park	SR	(2,900)	2,500,000		217.5	197.2	130,152.0	29.0
Scott's Level @ Marriottsville	SR	(1,500)	357,975		112.5	102.0	67,320.0	15.0
Holsan Prop Sec 1 #270	CNV	5.9	?		20.7	1.6	2,002.5	1.92
Church La #408	CNV	7.7	?		27.0	2.1	2,613.5	2.51
Courtland Manor #157	CNV	22.8	?		80.0	6.2	7,738.6	3.99
Sunset Ridge #1112	CNV	20.5	?		72.0	5.5	6,957.9	4.62

Pikeswood Village #1277	CNV	23.5	?		82.5	6.4	7,976.1	7.05
Estimated Totals		**(11,100) 103.9**	**4,873,287+**		**612.2**	**321.0**	**224,760.6**	**136.26**

Abbreviations:
CNV: SWM Pond Conversion
SR: Stream Restoration
RET: Retrofit
SCR: StormCeptor
HAB: Habitat improvement
BE: Buffer Enhancement
cd: Consent Decree requirement
REP: Repair

10.4.1.1.12 Jones Falls Watershed

Capital Improvement projects completed by Baltimore County EPS in the Jones Falls watershed are shown in Table 10-13. In the Jones Falls Watershed 9 stream restoration projects have been completed restoring 1.9 miles of degraded stream channel. Three stormwater retrofit projects have been completed provide water quality management for 195.9 acres of urban land. An additional 7 stream restoration projects are under design or construction and will restore an additional 4.6 miles of stream channel impacted by urban land use.

Table 10-13: Jones Falls Watershed – CIP Status

Capital Improvement Projects Through FY13 Jones Falls Watershed								
Project	**Facility Type**	**DA** (LF)	**Cost**	**Date**	**Removal Rate (lb./year)**			**Imp Acres**
					TN	**TP**	**TSS**	
Completed Projects								
Lake Roland Ag BMPs	SR	(1500)	45,000	95	112.5	102.0	67,320.0	15.0
Moore's Branch @ Ltfoot	SR	(100)	25,000	96	7.5	6.8	4,488.0	1.0
Robin Hood Cr. minor outf	RET	12.5	307,359	98	27.1	2.8	2,141.4	2.6
Kenilworth Park	RET	97.5		98	284.9	42.4	35,439.0	54.0
Orchard Hills outfall #149	RET	85.9		98	206.7	22.3	17,211.4	21.7
Rol. Run - Essex farm Rd.	SR	(250)	479,488	98	18.8	17.0	11,220.0	2.5
Roland Run – Sem. Ave.	SR	(150)		98	11.3	10.2	6,732.0	1.5
Towson Run – VFW Hall	SR	(600)	349,869	00	45.0	40.8	26,928.0	6.0
Roland Run – Jeffers Rd.	SR	(1,550)	451,083	02	116.3	105.4	69,564.0	15.5
Wood Valley	SR	(2,000)	1,077,510	04	150.0	136.0	89,760.0	20.0
Roland Run-Riderwd. Hills	SR	(2,400)	1,100,000	07	180.0	163.2	107,712.0	24.0
Roland Run @ Kellogg	SR	(1,500)	823,642	12	112.5	102.0	67,320.0	15.0
TOTALS		**(10,050) 195.9**	**4,658,951**		**1,272.6**	**750.9**	**505,835.8**	**178.8**
Projects Under Design or Construction								
Rol Run @Gspring*	SR/RET	(3,500)	2,887,000		262.5	238.0	157,080.0	35.0
Towson Run @ Cloisters	SR	(3,000)	1,558,401		225.0	204.0	134,640.0	30.0
Deep Run @ Meadowood	SR	(3,000)	1,500,000		225.0	204.0	134,640.0	30.0
Moore's Branch @ Lightfoot	SR	(6,330)	2,700,000		474.8	430.4	284,090.4	63.3
Boyce Ave	SR	(1,500)	?		112.5	102.0	67,320.0	15.0
Slaughterhouse Run (Upper)	SR	(2,300)	1,000,000		172.5	156.4	103,224.0	23.0
Slaughterhouse Run (Middle)	SR	(4,700)	800,000		352.5	319.6	210,936.0	47.0
Estimated Totals		**(24,330)**	**10,445,401+**		**1,824.8**	**1,654.4**	**1,091,930.4**	**243.3**

*reduction estimates are for SR only
Abbreviations
SR: Stream Restoration
DET: Detention Pond
RET:Retrofit

10.4.1.1.13 Back River Watershed

Capital Improvement projects completed by Baltimore County EPS in the Back River watershed are shown below in Table 10-14. A significant number of restoration projects have been completed in the Back River watershed, including:

- 10 stream restoration projects restoring 2.3 miles of stream channel,
- 6 shoreline erosion control projects restoring 2.1 miles of eroded shoreline,
- 9 stormwater management projects providing water quality improvement for 694.4 acres of urban land, and
- 11 stormwater facility conversion projects providing additional water quality for 114.9 acres of urban land.

An additional 2.0 miles of stream channel restoration are currently under construction and the conversion of an additional 5 stormwater management facilities serving 56.8 acres of urban land to provide enhanced water quality are being planned.

Table 10-14: CPO Projects in the Back River Watershed

Capital Improvement Projects Through FY13 Back River Watershed								
Project	**Facility Type**	**DA** (LF)	**Cost**	**Date**	**Removal Rate (lb./year)**			**Imp Acres**
					TN	**TP**	**TSS**	
Completed Projects								
Coxs Point I	SE	(220)	45,000	91	113.5	74.6	311,200	8.8
Rocky Point Long Creek	SE	(1,370)	151,667	94	407.2	267.7	1,115,618	54.8
Coxs Point II	SE	(1,950)	295,000	95	1,388.2	912.8	3,803,352	78.0
Lynch Point Cove – SM (#1380)	RET	26.7	250,000	95	50.1	7.0	3,094.4	0.0
Rocky Point @ Ballestone	SE	(2,000)	389,480	97	290.1	190.8	794,851.0	80.0
Stemmers Run@ Dbl Rock	SR	(1,881)	362,905	97	141.1	127.9	84,419.3	18.8
Stemmers Run VFW (#2240)	SCR	15.4	121,000	98	6.1	1.3	474.3	0.0
Stemmers Run Garnet (#2241)	SCR	13.0			4.9	0.9	309.8	0.0
Stemmers Run BIO	RET	1.0			3.4	0.6	282.7	0.6
Redhouse E.S. Retrofit (#4202)	RET	56.2	136,794	98	103.8	12.9	5,585.7	6.5
Greenhill WQ Retrofit (#2112)	SCR	3.5	35,273	98	1.4	0.3	97.7	0.0
Redhouse Run Md-7 (#1933)	SCR	1.9	49,925	99	0.9	0.3	105.5	0.0
Briens Run @ Rossville Industrial Park (#820)	RET	158.8	184,210	99	252.5	39.6	19,056.6	33.1
Herring Run (Wiltondale)	SR	(1,400)	295,860	99	105.0	95.2	62,832.0	14.0
Hart Miller Island	SE	(3,000)	338,000	99	353.0	232.1	967,075.0	120.0
Herring Run (Goucher)	SR	(300)	158,538	00	22.5	20.4	13,464.0	3.0
Redhouse Run @ Overlea Trib C	SR	(2,600)	529,260	01	195.0	176.8	116,688.0	26.0
Linover Park	SR	(1,000)	206,745	02	75.0	68.0	44,880.0	10.0
Rocky Pt. Habitat Creation	HAB	(690)	519,505	02	78.0	51.3	213,670.0	27.6
BR @ Martin Blvd Interchange (#3420 & 3421)	NEXT	417.9	629,144	04	515.1	75.2	34,322.6	57.7
Linwood Avenue	SR	(500)	283,968	04	37.5	34.0	22,440.0	5.0
Glenwest	SR	(500)	203,220	04	37.5	34.0	22,440.0	5.0

Capital Improvement Projects Through FY13 Back River Watershed								
Project	**Facility Type**	**DA** (LF)	**Cost**	**Date**	**Removal Rate (lb./year)**			**Imp Acres**
					TN	**TP**	**TSS**	
Completed Projects								
Golden Tree Sec I	CNV	23.0	Dev paid	04	33.5	2.9	2,503.0	6.8
Golden Tree Sec III	CNV	15.7	Dev paid	04	22.7	1.9	1,598.6	4.1
Herring Run Bank Sta @ Weatherbee	SR	(100)	30,000	07	7.5	6.8	4,488.0	1.0
Herring Run @ Sussex Rd.	Srepair	na	96,572	07	na	na	na	
BR Trash Boom	TRA	na	80,000	10	na	na	na	
Her Run @Collinsdale-cd	*SR*	*(2,000)*	*661,395*	*10*	*na*	*na*	*na*	
Rdhse Rn@ St. Pat Rd	SR	(2,000)	943,361	11	400.0	136.0	620,000	20.0
BR Trash Boom Maintenance	TRA	na	70,000	11	na	na	na	
Essex Skypark	SE	(2,610)	1,267,588	12	596.3	392.1	1,633,647.6	104.4
BR Trash Boom Maintenance	TRA	na	70,000	12	na	na	na	
SWAP SWM Conv #1829	CNV	10.7	15,526	13	16.6	2.5	1,226.8	4.59
SWAP SWM Conv #553	CNV	8.3	27,687	13	19.9	2.5	1,166.1	4.18
SWAP SWM Conv #932	CNV	7.8	29,229	13	10.9	1.9	288.3	7.36
SWAP SWM Conv #305	CNV	6.7	23,441	13	8.5	2.8	248.1	4.86
BR Trash Boom Maintenance	TRA	na	88,100	13	na	na	na	
Urbanwood (#381)	CNV	4.19	48,701	14	8.9	0.9	417.3	1.83
Woodward Square Pond 1 (#164)	CNV	12.1	115,531	14	13.1	2.4	281.0	3.11
Woodward Square Pond 2 (#170)	CNV	7.4	69,354	14	8.7	1.5	219.2	2.32
Perring Woods Court (#181)	CNV	8.5	75,613	14	11.1	2.0	277.6	4.28
Kahler Property (#624)	CNV	10.5	19,327	15	11.1	2.6	213.1	3.55
TOTALS		**(24,121) 809.3**	**8,916,919**		**5,350.6**	**2,982.5**	**9,902,833.3**	**721.3**
Projects Under Design or Construction								
Tidal Back River Greening*	multiple		1,207,388		68.6	9.4	4,775.0	unk
HR @ Overlook	SR	(9,000)	3,500,000		675.0	612.0	403,920.0	90.0
Bread & Ch	SR	(1,523)	1,000,000		114.2	103.6	23,043.0	15.2
Goldentree Sec 2 Pond 2 (#534)	CNV	7.5	48,651		26.3	2.0	2,545.6	3.63
Goldentree Sec 1 (#532)	CNV	25.2	68,734		88.5	6.8	8,553.1	11.87
Goldeentree Sec 2 Pond 1 (#533)	CNV	3.76	44,067		13.2	1.0	1,276.2	2.34
Goldentree Sec. 3 (#535)	CNV	15.9	39,381		55.9	4.3	5,396.6	7.35
Rustic Ridge (#832)	CNV	4.43	37,748		15.6	1.2	1,503.6	1.77
Cox's Point	SE	?						
Estimated Totals		**(10,523) 56.79**	**5,945,969**		**1,057.3**	**740.3**	**451,013.1**	**132.16**

*waiting for as-builts, will require recalculating reductions
Abbreviations
CNV: SWM Pond Conversion
NWET: New Wet Pond
RET: Retrofit
SE : Shoreline Enhancement
cd-consent decree
ENH: Enhancement
SCR: StormCeptor
SR: Stream Restoration
HAB : Habitat improvement
TP: Tree Planting
TRA: Trash Removal

10.4.1.1.14 Baltimore Harbor Watershed

Capital Improvement projects completed by Baltimore County EPS in the Baltimore Harbor watershed are shown in Table 10-15. In the Baltimore Harbor watershed 12 shoreline erosion control project addressing 2.0 miles of eroded shoreline have been completed and 10 retrofit projects addressing 866.3 acres of urban land have been completed. An additional 4 shoreline control projects currently under design will address ~1.7 miles of additional eroded shoreline.

Table 10-15: CPO Projects in the Baltimore Harbor Watershed

Capital Improvement Projects Through FY13 Baltimore Harbor Watershed								
Project	**Facility Type**	**DA** (ft.)	**Cost**	**Date**	**Removal Rate (lb./year)**			**Imp Acres**
					TN	**TP**	**TSS**	
Completed Projects								
Concrete Homes	SE	(430)	65,000	90	133.4	87.7	365,452	17.2
Watersedge Park	SE	(480)	92,000	90	72.8	47.9	199,400	19.2
Merritt Point Park	SE	(1880)	175,000	90	128.5	84.5	352,000	75.2
Bear Creek I	SE	(475)	66,000	90	112.6	74.1	308,599	19.0
West Inverness	SE	(230)	19,000	90	14.1	9.3	38,800	9.2
Geise Ave. (#1365)	SCR	1.5	unk	89	0.6	0.1	61.1	0.0
Chink Creek (#4618)	RET	93.3	unk	90	186.3	28.3	15,367.9	16.7
Hughes Ave (#1965)	SCR	9.8	unk	90	3.4	0.6	255.1	0.0
Charlesmont Park	SE	(750)	47,000	93	76.9	50.5	210,600	30.0
Sandy Plains Elem.	SE	(380)	108,000	98	82.7	54.4	226,568	15.2
Tabasco Cove (#2917)	STWET	161.3	128,209	96	313.2	55.3	28,960.9	46.1
Battle Grove Park	SE	(420)	82,000	95	153.2	100.8	419,852	16.8
North Point Creek (#3575)	NEXT	83.6	117,277	98	154.2	20.2	10,688.1	10.3
Schoolhouse Cove 8 SCRs (#1934)	SCR	4.7	419,133	98	1.8	0.4	166.3	0.0
Schoolhouse Cove 8 SCRs (#1935)	SCR	7.4			2.9	0.6	270.1	0.0
Schoolhouse Cove 8 SCRs (#1936)	SCR	8.4			3.3	0.7	290.2	0.0
Schoolhouse Cove 8 SCRs (#1937)	SCR	7.5			3.0	0.7	281.1	0.0
Schoolhouse Cove 8 SCRs (#1938)	SCR	9.0			3.4	0.7	293.8	0.0
Schoolhouse Cove 8 SCRs (#1939)	SCR	10.3			4.2	1.0	419.3	0.0
Schoolhouse Cove 8 SCRs (#1940)	SCR	11.7			2.8	0.6	264.7	0.0
Schoolhouse Cove 8 SCRs (#1941)	SCR	11.9			4.18	1.2	514.0	0.0
Bear Creek II Shore	SE	(700)	138,558	99	83.2	54.7	228,010	28.0
Bear Creek II SD Retrofit (#4644)	NWET	10.1	93,026	99	20.8	3.4	1,867.5	2.3
Watersedge Park II (repair)	SE	(90)	21,062	99	na	na	na	
Lynch Cove Retrofit site-I	STWET	240.0	500,000 combined	03	366.1	77.6	43,904.3	87.3
Lynch Cove Retrofit site-II	STWET	188.9		03	197.7	45.7	27,565.4	56.07
Fleming Park	SE	(1,767)	540,303	07	25.6	16.9	70,228	70.7
Pleasure Island	SE	(3,100)	4,200,000	11	407.3	267.8	1,116,000	124.0
Schoolhouse Cove SCR & RET (#1942)	SCR/ STWET	6.9	146,000	11	2.6	0.5	217.4	0.0
TOTALS		**(10,702) 866.3**	**6,957,568**		**2,560.8**	**1,086.2**	**3,666,896.2**	**643.3**

Projects Under Design or Construction								
Stansbury Park (Rec and Parks Project)	SE	(317)	198,400		50.7	34.9	142,967	12.68
Fort Howard Park	SE	(4,000)			640.0	440.0	1,804,000	160.00
Inverness Park	SE	(2,600)			416.0	286.0	1,172,600	104.00
Watersedge Park	SE	(2,000)			320.0	220.0	902,000	80.00
Estimated Totals		**(8,917)**	**198,400+**		**1,426.7**	**980.9**	**4,021,567**	**356.68**

Abbreviations
CNV: SWM Pond Conversion
NEXT: New Extended Detention Pond
NWET: New Wet Pond
SCR: StormCeptor
SR: Stream Restoration
SE: Shoreline Enhancement
STWET: Stormwater Wetland

10.4.1.2 Forest Management and Sustainability - Reforestation and Urban Tree Planting

The Forest Management and Sustainability Section administers a number of present and past programs that provide restoration credits for meeting nutrient and sediment reductions. These include; the Community Reforestation Program (CRP) – Section 10.4.1.2.1, Cool Trees Project – Section 10.4.1.2.2, the Growing Home Campaign – Section 10.4.1.2.3, and the Big Tree Sale Program – Section 10.4.1.2.4. The Cool Trees Project and the Growing Home Campaign are no longer in existence.

10.4.1.2.1 Community Reforestation Program

The Community Reforestation Program (CRP) was established by the Department of Environmental Protection and Sustainability to provide a dedicated workforce for planting, monitoring, and maintaining forest mitigation projects. The Program is funded primarily through fees-in-lieu of mitigation for forests removed as a result of public and private land development, as required by the implementation of the County's Forest Conservation Act and Chesapeake Bay Critical Area Regulations. The plantings conducted with mitigation monies will not be given nutrient reduction credits due to the fact that these tree plantings are offsetting deforestation. The CRP is the only full-time countywide reforestation mitigation program among Maryland's counties.

The CRP includes a four-person reforestation crew that carries out year-round reforestation operations. The crew is based at a 1-acre site in eastern Baltimore County that is provided by the Department of Recreation and Parks. This home base houses a growing out nursery for 10,000 tree seedlings; equipment and machinery needed for planting, monitoring, and maintaining the reforestation projects; and office space for the reforestation team.

In the past, the CRP would occasionally undertake special grant-funded projects to improve water quality and groundwater recharge, as well as wildlife habitat. Unlike the plantings conducted with fee-in-lieu monies, grant funded projects will be given nutrient reduction credit. The most recent example is the expansion of forest buffers and the reforestation of fields on private rural properties in 2009. Recently, the county has hired contractors to supplement the County reforestation efforts. Table 10-16 shows these projects by watershed. In FY14 the CRP began planting trees to meet Watershed Implementation Plan (WIP) goals and these plantings are also eligible for nutrient reduction credits. The reforestation efforts are also part of the nutrient and sediment reduction strategy for meeting local TMDLs. These plantings are shown in Tables 10-17 and 10-18. The method for calculating pollutant reduction involves a land use conversion from urban pervious to forest. Additional reduction efficiency is applied for trees planted within a riparian buffer. These methods are described in Section 10.3.4.

Table 10-16: Baltimore County Non-Mitigation Reforestation Projects by Watershed Through FY13

Watershed	Acres Planted With Non-Mitigation Funds	N Reduction from Non-Mitigation Projects (lbs/yr)	P Reduction From Non-Mitigation Projects (lbs/yr)	Sed Reduction From Non-Mitigation Projects (lbs/yr	Impervious Acre Equivalent
Prettyboy	11.5	120.7	5.0	3,272.6	4.4
Loch Raven	28.1	279.6	10.7	7,320.1	10.7
Grand Totals	**39.6**	**400.3**	**15.7**	**10,592.7**	**15.0**

Table 10-17: Baltimore County Non-Mitigation Reforestation Projects by Watershed FY14

Watershed	Planting Type	Acres Planted	N Reduction (lbs/yr)	P Reduction (lbs/yr)	Sed Reduction (lbs/yr)	Impervious Acre Equivalent
Loch Raven	Upland	10.68	93.66	2.78	1,669.1	4.06
Middle River	Upland	12.80	62.21	3.07	913.7	4.86
Bird River	Upland	2.60	12.64	0.62	167.4	0.99
Patapsco	Buffer	0.12	1.11	0.04	46.7	0.05
Gwynns Falls	Upland	0.10	0.88	0.03	19.8	0.04
Total Upland		**26.18**	**170.49**	**6.54**	**2,816.7**	**9.99**
Total Buffer		**0.12**	**1.11**	**0.04**	**46.7**	**0.05**
Grand Totals		**26.3**	**170.5**	**6.54**	**2,816.7**	**10.04**

Table 10-18: Baltimore County Non-Mitigation Reforestation Projects by Watershed FY15

Watershed	Planting Type	Acres Planted	N Reduction (lbs/yr)	P Reduction (lbs/yr)	Sed Reduction (lbs/yr)	Impervious Acre Equivalent
Prettyboy	Upland	3.50	30.73	0.91	519.6	1.33
Loch Raven	Upland	42.16	369.74	10.96	6,588.8	16.02
	Buffer	10.68	119.14	4.03	2,511.78	4.06
Lower Gunpowder	Upland	1.70	14.93	0.44	321.8	0.65
	Buffer	1.79	20.22	0.67	816.02	0.68
Bird River	Upland	2.51	12.20	0.60	161.6	0.95
Liberty Reservoir	Buffer	0.60	6.48	0.21	200.3	0.23
Patapsco	Buffer	1.78	16.40	0.58	692.8	0.68
Gwynns Falls	Upland	1.32	11.58	0.34	261.7	0.5
Jones Falls	Upland	2.28	20.02	0.59	234.0	0.87
	Buffer	0.13	1.45	0.05	30.6	0.05
Back River	Buffer	1.24	8.12	1.98	209.1	0.47
Baltimore Harbor	Upland	1.67	8.13	0.40	102.2	0.63
	Buffer	4.70	31.41	1.88	1,034.63	1.79
Total Upland		**55.14**	**467.33**	**14.25**	**8,189.7**	**20.95**
Total Buffer		**20.92**	**203.22**	**9.41**	**4,495.2**	**7.95**
Grand Totals		**76.06**	**670.54**	**23.66**	**13,684.9**	**28.90**

Table 10-19: Baltimore County Non-Mitigation Proposed Reforestation Projects

Watershed	Planting Type	Acres	N Reduction (lbs/yr)	P Reduction (lbs/yr)	Sed Reduction (lbs/yr)	Impervious Acre Equivalent
Deer Creek	Upland	0.60	5.27	0.16	123.09	0.23
Prettyboy	Upland	8.80	77.26	2.29	1,306.45	3.34
Loch Raven	Upland	10.84	95.18	2.82	1,694.08	4.12
	Buffer	14.85	140.94	4.38	3,304.52	5.64
Lower Gunpowder	Upland	5.86	51.39	1.52	1,109.30	5.86
	Buffer	11.30	127.66	4.38	5,151.39	4.29
Bird River	Upland	2.71	13.17	0.65	174.52	1.03
Middle River	Buffer	0.77	4.93	0.29	148.22	0.29
Liberty Reservoir	Upland	10.00	87.70	2.60	1,619.40	3.80
	Buffer	2.00	21.61	0.72	667.60	0.76
Patapsco	Upland	4.25	29.54	0.89	510.55	1.62
	Buffer	0.59	5.44	0.19	229.63	0.22
Gwynns Falls	Buffer	5.79	68.86	2.46	3,659.89	2.20
Jones Falls	Upland	1.93	16.95	0.50	198.04	0.73
Back River	Upland	1.42	6.90	0.34	74.11	0.54
	Buffer	0.09	0.59	0.04	15.18	0.03
Total Upland		**46.41**	**383.36**	**11.77**	**6,809.54**	**21.27**
Total Buffer		**35.39**	**370.03**	**12.46**	**13,176.43**	**13.43**
Grand Totals		**81.80**	**753.39**	**24.23**	**19,985.97**	**34.70**

10.4.1.2.2 Energy Trees

Refer to the 2014 NPDES report for a description of the Cool Trees project. Table 10-20 below shows the watersheds and nutrient reductions that result from this project. This program was grant funded and with the end of the grant funding period is no longer in operation.

Table 10-20: Energy Trees Planting Projects by Watershed Through FY13

Watershed	Acres Planted	N Reduction (lbs/yr)	P Reduction (lbs/yr)	Sed Reduction (lbs/yr)	Impervious Acre Equivalent
Upper Western Shore					
Loch Raven	0.43	3.8	0.1	67.2	0.2
Lower Gunpowder	0.64	5.6	0.2	121.2	0.2
Bird River	0.76	3.7	0.2	48.9	0.3
Gunpowder River	0.19	0.9	0.1	15.33	0.1
Middle River	0.16	0.8	0.0	11.4	0.1
Patapsco/Back River					
Patapsco	2.21	15.4	0.5	265.5	0.8
Gwynns Falls	1.78	15.6	0.5	352.9	0.7
Jones Falls	0.19	1.7	0.0	19.5	0.1
Back River	1.28	6.2	0.3	66.8	0.5
Baltimore Harbor	1.91	9.3	0.5	116.9	0.7
Grand Totals	**9.6**	**62.9**	**2.3**	**1,085.6**	**3.6**

10.4.1.2.3 Growing Home Campaign

Refer to the 2014 NPDES report for a description of the Growing Home campaign. Table 10-21 shows Growing Home data for the Upper western Shore and Patapsco/Back Basin watersheds.

This program is no longer operated through Baltimore County, but has been supplanted by the Maryland Department of Natural Resources – Marylanders Plant Trees Program.

Table 10-21: Growing Home Trees Planted by Watershed Through FY13

Watershed	Acres Planted	N Reduction (lbs/yr)	P Reduction (lbs/yr)	Sed Reduction (lbs/yr)	Impervious Acre Equivalent
Upper Western Shore					
Deer Creek	0.65	5.7	0.2	133.3	0.2
Prettyboy Reservoir	0.52	4.6	0.1	77.2	0.2
Loch Raven	10.48	91.9	2.7	1,637.8	4.0
Lower Gunpowder	3.94	34.6	1.0	745.8	1.5
Little Gunpowder	1.79	15.7	0.5	343.2	0.7
Bird River	3.16	15.4	0.8	203.5	1.2
Gunpowder River	1.30	6.2	0.3	104.9	0.5
Middle River	2.03	9.9	0.5	144.9	0.8
Patapsco/Back River					
Liberty Reservoir	0.39	3.4	0.1	63.2	0.1
Patapsco	2.42	16.8	0.5	290.7	0.9
Gwynns Falls	2.32	20.3	0.6	460.0	0.9
Jones Falls	4.61	40.5	1.2	473.0	1.8
Back River	4.70	22.8	1.1	245.3	1.8
Baltimore Harbor	1.08	5.3	0.3	66.1	0.4
Grand Totals	**39.39**	**293.1**	**9.9**	**4,988.9**	**15.0**

10.4.1.2.4 Big Tree Sale

EPS hosted its first Big Tree Sale in 2009. In FY15, Big Tree Sales were held on October 18, 2014 and May 9, 2015. There were 780 total trees sold at the sales in FY15 to address in Baltimore County. Watershed locations for all trees sold are not available, but nutrient reductions for those with location data that are located within Baltimore County are shown in Table 10-22 for FY13 and in Table 10-23 for FY14. Table 10-24 shows the most recent data for sales in FY15. For the sake of producing conservative nutrient reduction estimates, trees are presumed planted in upland areas and not in stream buffers.

Table 10-22: Big Tree Sale #s and Associated Nutrient Reductions Through FY13

8 Digit Watershed	# Trees	N Red	P Red	Sed Red	Imp Ac Eq
Deer Creek	**18**	1.6	0.0	36.9	0.1
Prettyboy	**36**	3.2	0.1	53.4	0.1
Loch Raven	**691**	60.6	1.8	1,079.9	2.6
Lower Gun	**45**	4.0	0.1	85.2	0.2
Little Gun	**34**	3.0	0.1	65.2	0.1
Bird River	**35**	1.7	0.1	22.5	0.1
Gunpowder River	**6**	0.3	0.0	4.8	0.0
Middle River	**17**	0.8	0.0	12.1	0.1
Liberty	**17**	1.5	0.0	27.5	0.1
Patapsco	**46**	3.2	0.1	55.3	0.2
Gwynns Falls	**19**	1.7	0.0	37.7	0.1
Jones Falls	**212**	18.6	0.6	217.5	0.8
Back River	**35**	1.7	0.1	18.3	0.1
Baltimore Harbor	**107**	5.2	0.3	65.5	0.4
Totals	**1,318**	**107.0**	**3.4**	**1,781.9**	**5.0**

Table 10-23: Big Tree Sale #s FY14 by 8 Digit Watershed and Associated Nutrient Reductions

8 Digit Watershed	# Trees	N Red	P Red	Sed Red	Imp Ac Eq
Deer Creek	14	1.2	0.0	28.7	0.1
Prettyboy	0	0.0	0.0	0.0	0.0
Loch Raven	317	27.8	0.8	495.4	1.2
Lower Gun	27	2.4	0.1	51.1	0.1
Little Gun	13	1.1	0.0	24.9	0.0
Bird River	18	0.9	0.0	11.6	0.1
Gunpowder River	0	0.0	0.0	0.0	0.0
Middle River	11	0.5	0.0	7.9	0.0
Liberty	13	1.1	0.0	24.9	0.0
Patapsco	39	2.7	0.1	46.9	0.1
Gwynns Falls	23	2.0	0.1	45.6	0.1
Jones Falls	119	10.4	0.3	122.1	0.5
Back River	43	2.1	0.1	22.4	0.2
Baltimore Harbor	15	0.7	0.0	9.2	0.1
Totals	**652**	**53.1**	**1.7**	**886.8**	**2.5**

Table 10-24: Big Tree Sale #s FY15 by 8 Digit Watershed and Associated Nutrient Reductions

8 Digit Watershed	# Trees	N Red	P Red	Sed Red	Imp Ac Eq
Deer Creek	0	0.0	0.0	0.0	0.0
Prettyboy	12	1.1	0.0	17.8	0.0
Loch Raven	257	22.5	0.7	401.6	1.0
Lower Gun	52	4.6	0.1	98.4	0.2
Little Gun	43	3.8	0.1	82.4	0.2
Bird River	44	2.1	0.1	28..3	0.2
Gunpowder River	24	1.1	0.1	19.4	0.1
Middle River	15	0.7	0.0	10.7	0.1
Liberty	8	0.7	0.0	13.0	0.0
Patapsco	63	4.4	0.1	75.7	0.2
Gwynns Falls	28	2.5	0.1	55.5	0.1
Jones Falls	73	6.4	0.2	74.9	0.3
Back River	36	1.7	0.1	18.8	0.1
Baltimore Harbor	125	6.1	0.3	76.5	0.5
Totals	**780**	**57.7**	**1.9**	**973.1**	**3.0**

10.4.1.3 Groundwater Management Section - Septic System Related Programs

The OSDS Strategy for meeting the OSDS nitrogen reduction target for 2025 is presented in Table 10-25. This translates into 20 upgrades per year of existing OSDS to denitrifying systems, 14 hook-ups to the sanitary sewer system per year of existing OSDS, and 7,800 pump-outs per year.

Table 10-25: OSDS Strategy for Meeting Nitrogen Reductions Targets by 2025

Strategy	# of Systems	Nitrogen Reduction	Remaining Nitrogen Load	Remaining to Meet Target
2009 Progress from MAST			166,285	60,148
Health Projects	1,537	-24,201	142,084	35,947
Growth Area Adjustments	7,805	-33,649	108,435	2,298
De-nitrifying Systems	220	-897	107,538	1,401
Future Health Projects	200	*	*	*

OSDS Pump-outs	7,800/yr	-464	106,469	332

The installation of OSDS denitrifying systems is supported by the Bay Restoration Fund (see: http://www.mde.maryland.gov/programs/Water/BayRestorationFund/OnsiteDisposalSystems/Pages/Water/cbwrf/index.aspx for further information). Maryland Department of the Environment provides assessment of the nitrogen removal efficiencies for the various denitrifying systems available through the Maryland Verification Process. There are seven different types of systems installed in Baltimore County during the reporting period.

Only BAT systems installed to replace existing septic systems count as credit toward meeting our septic system reduction allocation for nitrogen and are reported below. Please note this process is new this reporting period but we have updated the data from FY2012-2013 and FY 2014 to reflect this change.

Table 10-26 indicates the number of systems installed by type, location, and the MDE reported pollutant removal efficiencies for FY 2012 and FY 2013, the first 2-yr milestone. Table 10-27 presents the same data for the first reporting year of the FY 2014-2015 2-year milestone along with the impervious surface equivalent. Table 10-28 presents the same data for FY 2015.

Table 10-26: FY 2012 and FY 2013 - Number of Denitrifying Systems Installed by Type and Removal Efficiency for Replacement Systems Only

System Type	Number Installed			Removal Efficiency
	CBCA	>1,000	<1,000	
Hoot	4	7	4	64%
Singular	6	4	4	55%
Biomicrobics – Microfast/Retrofast	0	0	1	57%
Adventex	1	0	0	71%
Septi-Tech	0	0	2	67%
Waterloo	0	0	1	55%
Total Installations	**11**	**11**	**12**	

Table 10-27: FY 2014 - Number of Denitrifying Systems Installed by Type and Removal Efficiency for Replacement Systems Only

System Type	Number Installed			Removal Efficiency
	CBCA	>1,000	<1,000	
Hoot	1	7	8	64%
Singular	0	1	2	55%
Adventex	0	2	0	71%
Septi-Tech	0	1	1	67%
Bionest	0	0	1	unknown
Total Installations	**1**	**11**	**12**	

Table 10-28: FY 2015 - Number of Denitrifying Systems Installed by Type and Removal Efficiency for Replacement Systems Only

System Type	Number Installed			Removal Efficiency
	CBCA	>1,000	<1,000	
Advantex AX20	0	1	0	71%
Advantex RT	1	1	0	76%
Biomicrobics – Microfast/Retrofast	1	0	0	57%
Hoot	2	1	6	64%
Septi-Tech	1	1	1	67%
Singulair	0	3	4	55%
Singulair Green	0	1	0	55%
Total Installations	**5**	**8**	**11**	

The amount of nitrogen delivered to the Chesapeake Bay from OSDS is the result of the landscape location of the system and the delivery ratio of the watershed for nitrogen. There are three landscape position factors that relate to the delivery of nitrogen from OSDS to the edge-of-stream:

- Chesapeake Bay Critical Area (CBCA) – 16.44 pounds nitrogen per OSDS
- Less than 1,000 feet from a perennial stream (<1,000) – 10.27 pounds nitrogen per OSDS
- Greater than 1,000 feet from a perennial stream (>1,000) – 6.16 pounds nitrogen per OSDS.

The numbers above are derived from Maryland Assessment Scenario Tool (MAST) by dividing the number of MAST derived septic systems into the Edge-of-Stream nitrogen load. Using this information and the geographical location of the installed denitrifying systems, the edge-of-stream (EOS) nitrogen load, the EOS nitrogen reduction and delivered load (based on the watershed specific nitrogen delivery ratio) can be calculated. The impervious acre equivalent multiplier comes from *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated: Guidance for the National Pollutant Discharge Elimination System Stormwater Permits (August 2014)*. The impervious surface equivalent credits are as follows:

- Septic Pumping – 0.03 per pumpout
- Septic Denitrification – 0.26 per installation
- Septic connection to WWTP – 0.39 per connection

The results of the calculations are presented in Table 10-29 for first 2-year milestone period and in Table 10-30 for the first year of the FY 2014-2015 septic 2-year milestone and Table 10-31 for the second year of the current 2-year milestone.

Table 10-29: OSDS Upgrades to Denitrifying Systems July 1, 2011 Through June 30, 2013 (FY12 - FY13) by Watershed for Replacement Systems Only

Watershed	OSDS Location			EOS Total Nitrogen	EOS Total Reduction	Delivery Ratio	Delivered Load Reduction	Equiv. Imperv. Acres
	CBCA	<1,000 feet	>1,000 feet					
Deer Creek	0	0	0	0.00	0.00	57.40%	0.00	0.00
Prettyboy	0	0	0	0.00	0.00	5.50%	0.00	0.00
Loch Raven	0	4	3	59.56	35.90	25.90%	9.30	1.82
Lower Gunpowder	0	5	6	88.31	54.24	88.80%	48.16	2.86
Little Gunpowder	0	2	0	20.54	12.22	70.80%	8.65	0.52
Bird River	7	0	0	115.08	71.84	87.50%	62.86	1.82
Gunpowder River	3	0	0	49.32	27.13	100.00%	27.13	0.78
Middle River	0	0	0	0.00	0.00	100.00%	0.00	0.00
Liberty	0	0	1	6.16	3.39	0.00%	0.00	0.26
Patapsco River	0	0	0	0.00	0.00	53.20%	0.00	0.00
Gwynns Falls	0	0	0	0.00	0.00	33.70%	0.00	0.00
Jones Falls	0	0	2	12.32	7.02	18.60%	1.31	0.52
Back River	1	0	0	16.44	9.04	96.20%	8.70	0.26
Baltimore Harbor	0	0	0	0.00	0.00	100.00%	0.00	0.00
Totals	**11**	**11**	**12**	**367.73**	**220.78**		**166.11**	**8.84**

Table 10-30: OSDS Upgrades to Denitrifying Systems July 1, 2013 Through June 30, 2014 (FY14) by Watershed for Replacement Systems Only

Watershed	OSDS Location			EOS Total Nitrogen	EOS Total Reduction	Delivery Ratio	Delivered Load Reduction	Equiv. Imperv. Acres
	CBCA	<1,000 feet	>1,000 feet					
Deer Creek	0	0	0	0.00	0.00	57.40%	0.00	0.00
Prettyboy	0	0	0	0.00	0.00	5.50%	0.00	0.00
Loch Raven	0	3	5	61.61	39.59	25.90%	10.26	2.08
Lower Gunpowder	0	4	1	47.24	29.93	88.80%	26.57	1.30
Little Gunpowder	0	0	1	6.16	4.13	70.80%	2.92	0.26
Bird River	0	0	1	6.16	3.94	87.50%	3.45	0.26
Gunpowder River	0	0	0	0.00	0.00	100.00%	0.00	0.00
Middle River	0	0	0	0.00	0.00	100.00%	0.00	0.00
Liberty	0	0	0	0.00	0.00	0.00%	0.00	0.00
Patapsco River	0	3	1	36.97	24.38	53.20%	12.97	1.04
Gwynns Falls	0	0	0	0.00	0.00	33.70%	0.00	0.00
Jones Falls	0	2	3	39.02	23.56	18.60%	4.38	1.30
Back River	1	0	0	16.44	10.52	96.20%	10.12	0.26
Baltimore Harbor	0	0	0	0.00	0.00	100.00%	0.00	0.00
Totals	**1**	**12**	**12**	**213.60**	**136.05**		**70.67**	**6.50**

Table 10-31: OSDS Upgrades to Denitrifying Systems July 1, 2014 Through June 30, 2015 (FY15) by Watershed for Replacement Systems Only

Watershed	OSDS Location			EOS Total Nitrogen	EOS Total Reduction	Delivery Ratio	Delivered Load Reduction	Equiv. Imperv. Acres
	CBCA	<1,000 feet	>1,000 feet					
Deer Creek	0	0	0	0.00	0.00	57.40%	0.00	0.00
Prettyboy	0	0	0	0.00	0.00	5.50%	0.00	0.00
Loch Raven	0	0	3	18.48	11.83	25.90%	3.06	0.78
Lower Gunpowder	0	4	2	53.40	31.03	88.80%	27.56	1.56
Little Gunpowder	0	1	2	22.59	14.77	70.80%	10.45	0.78
Bird River	5	0	0	82.20	53.92	87.50%	47.18	1.30
Gunpowder River	0	0	0	0.00	0.00	100.00%	0.00	0.00
Middle River	0	0	0	0.00	0.00	100.00%	0.00	0.00
Liberty	0	0	0	0.00	0.00	0.00%	0.00	0.00
Patapsco River	0	2	2	32.86	21.87	53.20%	11.64	1.04
Gwynns Falls	0	0	0	0.00	0.00	33.70%	0.00	0.00
Jones Falls	0	1	1	16.43	9.04	18.60%	1.68	0.52
Back River	0	0	1	6.16	3.94	96.20%	3.79	0.26
Baltimore Harbor	0	0	0	0.00	0.00	100.00%	0.00	0.00
Totals	**5**	**8**	**11**	**232.12**	**146.40**		**105.37**	**6.24**

The installation of thirty-four denitrifying systems during the first 2-year milestone period resulted in 166 pounds of nitrogen reduction. During the first year of the second 2-year milestone period (FY2014), an additional 25 denitrifying systems were installed for an additional 71 pounds of reduction, while 24 denitrifying systems were install in FY2015 for a further reduction of 105 pounds. The lower reduction for FY2014 and FY 2015 is the result of the distribution of the installed systems, both in relation to the tidal water and the streams, and with a greater number in watersheds that have lower delivery ratio to the Bay. The target of the 2-year milestones was 40 denitrifying systems and 163.2 pounds of nitrogen reduction (an average of 4.08 pounds nitrogen reduction per system times 40 systems). This target was met for both the first 2-year milestone period and for the current 2-year milestone period.

The OSDS pump out information for fiscal year 2014 is presented in Table 10-32 and Table 10-33 shows data for fiscal year 2015.

Table 10-32: OSDS Pump-outs July 1, 2013 Through June 30, 2014 by Watershed (FY2014)

Watershed	OSDS Location			EOS Total Nitrogen	EOS Total Reduction	Delivery Ratio	Delivered Load Reduction	Equiv. Imperv. Acres
	CB CA	<1,000 feet	>1,000 feet					
Deer Creek	0	5	17	156.07	7.80	57.4%	1.98	0.66
Prettyboy	0	5	35	266.95	13.34	5.5%	.73	1.20
Loch Raven	0	339	709	7,848.97	392.24	25.9%	101.59	31.44
Lower Gunpowder	0	158	152	2,558.98	127.93	88.8%	113.60	9.30
Little Gunpowder	0	69	148	1,620.31	81.00	70.8%	57.35	6.51
Bird River	4	11	18	289.61	14.49	87.5%	12.68	0.99
Gunpowder River	3	1	1	65.75	3.29	100%	3.29	0.15
Middle River	2	0	0	32.88	1.64	100%	1.64	0.06
Liberty	0	32	92	895.36	44.76	0.0%	0.00	3.72
Patapsco River	0	38	128	1,178.74	58.93	53.2%	31.35	4.98
Gwynns Falls	0	41	82	926.19	46.30	33.7%	15.60	3.69
Jones Falls	0	108	228	2,513.64	125.66	18.6%	23.37	10.08
Back River	0	1	2	22.59	1.13	96.2%	21.73	0.09
Baltimore Harbor	1	0	1	22.30	1.30	100%	1.30	0.06
Totals	**10**	**808**	**1,613**	**18,398.64**	**919.81**		**386.21**	**72.93**

Table 10-33: OSDS Pump-outs July 1, 2014 Through June 30, 2015 by Watershed (FY2015)

Watershed	OSDS Location			EOS Total Nitrogen	EOS Total Reduction	Delivery Ratio	Delivered Load Reduction	Equiv. Imperv. Acres
	CBCA	<1,000 feet	>1,000 feet					
Deer Creek	0	0	10	61.60	3.08	57.40%	1.77	0.30
Prettyboy	0	7	53	398.37	19.92	5.50%	1.10	1.80
Loch Raven	0	168	318	3,684.24	184.21	25.90%	47.71	14.58
Lower Gunpowder	0	36	69	794.76	39.74	88.80%	35.29	3.15
Little Gunpowder	0	17	40	420.99	21.05	70.80%	14.90	1.71
Bird River	1	1	7	69.83	3.49	87.50%	3.06	0.27
Gunpowder River	0	1	1	16.43	0.82	100%	0.82	0.06
Middle River	2	0	0	32.88	1.64	100%	1.64	0.06
Liberty	0	32	74	784.48	39.22	0.00%	0.00	3.18
Patapsco River	0	46	125	1,242.42	62.12	53.20%	33.05	5.13
Gwynns Falls	0	24	56	591.44	29.57	33.70%	9.97	2.40
Jones Falls	0	72	144	1,626.48	81.32	18.60%	15.13	6.48
Back River	0	2	3	39.02	1.95	96.20%	1.88	0.15
Baltimore Harbor	1	0	1	22.60	1.13	100%	1.13	0.06
Totals	**4**	**406**	**901**	**9,785.54**	**489.28**		**167.43**	**39.33**

The number of OSDS pump-outs still runs below the target of 7,800 systems per year (FY2014 – 2,431 and FY2015 – 1,311) and the target reduction of 464 pound of nitrogen (FY2014 – 386 pounds and FY2015 – 167 pounds). The credits for OSDS pump-outs are annual, so only the most recent year counts.

Connection to the sanitary sewer system and abandonment of OSDS systems (AKA septic hook-ups) reduce nitrogen discharges from the OSDS source sector. Year-over-year comparison of Bay Restoration Fund billing files, with quality control provided by review of plumbing permits, enables Baltimore County to track the number and location of septic hookups, and estimate the associated nitrogen load reductions.

Baltimore County learns the number of and location of septic to sewer connections through year-over-year comparison of Bay Restoration Fund (BRF) billing files. Any connections identified by BRF comparison is quality controlled through review against a separate sewer benefit assessment database from DPW Metro Finance, and by review by Groundwater Management section staff against a list of connections paid for via BRF funds and another list of connections made pursuant to extension of sewer service for sanitary health purposes. If the quality control results are favorable, we assume the change in the BRF represents a real septic to sewer connection. The connection is assigned the date of the earliest BRF file showing public sewer service instead of private septic system.

Note that the BRF billing file is not updated between May and August, to free up staff time for the annual tax bill season. Changes during those months are reflected in the BRF billing file by August. To best approximate the fiscal year, comparisons are made August to August. Note also that this mechanism for tracking septic to sewer connections began in 2014. Before then, BRF billing files were capture as-needed. We have grouped the available BRF billing file comparisons in a way that approximates fiscal years as closely as possible. Table 10-34 shows the septic to sewer connections completed for FY2012 and 2013; Table 10-35 shows connections for FY2014 and Table 10-36 shows connections for FY2015. Hook-ups of 179 septic systems resulted in a 2,427.7 pound reduction in nitrogen delivered to the Bay since October 2011.

Table 10-34: Septic to Sewer Connections completed between 10/18/2011 and 1/23/2014 (approx.FY2012 - FY2013)

Watershed	OSDS Location			EOS Total Nitrogen	Delivery Ratio	Delivered Load Reduction	Equiv. Imperv. Acres
	CBCA	<1,000 feet	>1,000 feet				
Deer Creek	0	0	0	0.00	57.40%	0.00	0.00
Prettyboy	0	0	0	0.00	5.50%	0.00	0.00
Loch Raven	0	0	1	6.16	25.90%	1.60	0.39
Lower Gunpowder	0	0	0	0.00	88.80%	0.00	0.00
Little Gunpowder	0	0	0	0.00	70.80%	0.00	0.00
Bird River	1	2	4	61.62	87.50%	53.92	2.73
Gunpowder River	0	0	0	0.00	100.00%	0.00	0.00
Middle River	3	0	0	49.32	100.00%	49.32	1.17
Liberty	0	0	0	0.00	0.00%	0.00	0.00
Patapsco River	0	3	1	36.97	53.20%	19.67	1.56
Gwynns Falls	0	1	0	10.27	33.70%	3.46	0.39
Jones Falls	0	2	0	20.54	18.60%	3.82	2.78
Back River	21	0	0	345.24	96.20%	332.12	8.19
Baltimore Harbor	0	0	0	0.00	100.00%	0.00	0.00
Totals	**25**	**8**	**6**	**530.12**		**463.90**	**17.21**

Table 10-35: Septic to Sewer Connections completed between 1/23/2014 and 8/20/2014 (approx. FY2014)

Watershed	OSDS Location			EOS Total Nitrogen	Delivery Ratio	Delivered Load Reduction	Equiv. Imperv. Acres
	CBCA	<1,000 feet	>1,000 feet				
Deer Creek	0	0	0	0.00	57.40%	0.00	0.00
Prettyboy	0	0	0	0.00	5.50%	0.00	0.00
Loch Raven	0	0	0	0.00	25.90%	0.00	0.00
Lower Gunpowder	0	0	0	0.00	88.80%	0.00	0.00
Little Gunpowder	0	0	0	0.00	70.80%	0.00	0.00
Bird River	0	0	2	12.32	87.50%	10.78	0.78
Gunpowder River	2	0	0	32.88	100.00%	32.88	0.78
Middle River	0	0	0	0.00	100.00%	0.00	0.00
Liberty	0	0	0	0.00	0.00%	0.00	0.00
Patapsco River	0	0	0	0.00	53.20%	0.00	0.00
Gwynns Falls	0	0	2	12.32	33.70%	4.15	0.78
Jones Falls	0	0	0	0.00	18.60%	0.00	0.00
Back River	1	0	0	16.44	96.20%	15.82	0.39
Baltimore Harbor	104	0	0	1,709.76	100.00%	1,709.76	40.56
Totals	**107**	**0**	**4**	**1,783.72**		**1,773.39**	**43.29**

Table 10-36: Septic to Sewer Connections completed between 8/20/2014 and 8/20/2015 (approx. FY2015)

Watershed	OSDS Location			EOS Total Nitrogen	Delivery Ratio	Delivered Load Reduction	Equiv. Imperv. Acres
	CBCA	<1,000 feet	>1,000 feet				
Deer Creek	0	0	0	0.00	57.40%	0.00	0.00
Prettyboy	0	0	0	0.00	5.50%	0.00	0.00
Loch Raven	0	1	0	10.27	25.90%	2.66	0.39
Lower Gunpowder	0	0	1	6.16	88.80%	5.47	0.39
Little Gunpowder	0	0	0	0.00	70.80%	0.00	0.00
Bird River	1	4	17	162.24	87.50%	141.96	8.58
Gunpowder River	0	0	0	0.00	100.00%	0.00	0.00
Middle River	2	0	0	32.88	100.00%	32.88	0.78
Liberty	0	0	0	0.00	0.00%	0.00	0.00
Patapsco River	0	0	1	6.16	53.20%	3.28	0.39
Gwynns Falls	0	0	2	12.32	33.70%	4.15	0.78
Jones Falls	0	0	0	0.00	18.60%	0.00	0.00
Back River	0	0	0	0.00	96.20%	0.00	0.00
Baltimore Harbor	0	0	0	0.00	100.00%	0.00	0.00
Totals	**3**	**5**	**21**	**230.03**		**190.40**	**11.31**

The target number of OSDS hook-ups to the sanitary sewer system is 14 per year. Baltimore County continues to exceed that number (FY2012-2013 – average 19.5 per year, FY2014 – 111 and FY2015 – 29). Over the four year period of the first two 2-year milestone timeframe greater than 2,400 pounds of nitrogen have been removed due to hook-ups of existing OSDS to the sanitary sewer system.

10.4.2 DPW Restoration Programs

Several programs under Baltimore County's Department of Public Works result in the pollutant reductions. These programs are listed below. For information on street sweeping, storm drain cleaning and sanitary sewer projects please see Section 7 of this report. Retrofits of the County facilities that fall under the General Industrial Stormwater Permit with the exception of the Public School and Community College sites are being coordinated by DPW (Section 10.4.2.1).

The Storm Drain Engineering Section is addressing problems related to storm drain outfalls, of which some of the corrections will result in nutrient and sediment reductions (Section 10.4.2.2). Finally, DPW is the lead in organizing the annual rain barrel sale that Baltimore County offers for citizens (Section 10.4.2.3)

10.4.2.1 County Facility Retrofits Under the General Industrial Stormwater Permit

The Department of Public Works (DPW) has assumed responsibility for ensuring that regulated general government facilities comply with the new permit requirements. Consultants were hired to conduct stormwater assessments on industrial sites, develop Stormwater Pollution Prevention Plans (SWPPPs) (see Section 7 of this report for the status of plan development), and to design restoration plans to address untreated impervious surface area. Municipal facilities were specifically exempted from the restoration requirement in the final version of the General Industrial Stormwater Permit based on the fact that the MS4 permit would have a restoration requirement. Further clarification of this requirement revealed that industrial sites impervious areas can be addressed through the general stormwater permit impervious reduction requirements. Table 10-37 shows the completed and planned projects associated with this effort. The pollutant reduction and impervious surface credits for the planned projects are based on the per acre reductions and impervious surface credits for the completed projects. The calculated per acre reductions and impervious surface credits are:

- Nitrogen – 5.1189 pounds per acre
- Phosphorus – 0.4343 pounds per acre
- TSS – 446.97 pound per acre
- Impervious Acre Credit – 0.7653 acres of impervious credit per restored acre.

When the project are constructed the actual amount of pollutant reduction and impervious surface credit will be calculated and reported.

Table 10-37: DPW Stormwater Projects Associated With the Industrial Permit

Projects Through FY15								
Project	**Facility Type**	**DA**	**Watershed**	**FY**	**Removal Rate (lb./year)**			**Imp Acres**
					TN	**TP**	**TSS**	
Completed Projects								
Longview Highway Shop (#5416)	BS	0.27	Loch Raven Reservoir	15	2.1	0.1	121.3	1.6
Essex Utility Yard (#5400)	ESD	0.91	Back River	15	4.2	0.6	239.0	0.8
Double Rock Maintenance Facility (#5412)	MB	0.28		15	2.5	0.4	166.9	0.2
Clarks Lane Highway Shop 3 (#5405)	BS	2.28	Liberty Reservoir	15	14.8	0.8	851.8	0.9
Windsor Mill Highway Shop Phase 1 (#5403)	MB	4.43	Gwynns Falls	15	19.5	1.9	2,754.1	2.4
Chesterwood Park (#5404)	SFB	1.50	Baltimore Harbor	15	6.4	0.4	189.1	1.5
Totals		**9.67**			**49.5**	**4.2**	**4,322.2**	**7.4**

Projects Through FY15								
Project	Facility Type	DA	Watershed	FY	Removal Rate (lb./year)			Imp Acres
					TN	TP	TSS	
Projects Under Design or Construction								
Middletown Rd Highway Shop Improvements (#5406)	GS	0.25	Prettyboy Reservoir		1.3	0.1	111.7	0.2
Ridge Road Highway Shop (#5401)	MB	0.46	Loch Raven Reservoir		2.4	0.2	205.6	0.4
Industry Lane Salt Dome (#5402)	MB	0.52			2.7	0.2	232.4	0.4
Public Works Training Facility (#5397)	RB	12.00			61.4	5.2	5,363.6	9.2
White Hall Highway Shop 4-3 (#5407)	BS	0.52			2.7	0.2	232.4	0.4
Special Forces (#5486)	ESD	1.60			7.7	0.7	715.2	1.2
Brady Ave Highway and Utility Yard (#5398)	BS	0.65	Patapsco River		3.3	0.3	290.5	0.5
Emala Ave Highway Shop Improvements (#5396)	SGW	2.80	Middle River		14.3	1.2	1,251.5	2.1
Essex VOM Facility (#5399)	PPAV	0.42	Back River		2.1	0.2	187.7	0.3
Perry Rd Highway Shop Improvements (#5410)	ESD	1.02			5.2	0.4	455.9	0.8
Estimated Totals		**20.24**			**103.1**	**8.7**	**9,046.5**	**15.5**

Abbreviations
BS: Bioswale MB: Micro-bioretention SGW: Submerged gravel wetland
SFB: Sheet flow to buffer ESD: Environmental Site Design RB: Rain barrel
PPAV: Porous pavement GS: Grass swale SFB: Sheet flow buffer

10.4.2.2 DPW Storm Drain System Restoration Program

In addition to projects completed for industrial permit compliance, DPW also has other restoration projects planned related to the storm drain system that will contribute to nutrient reductions. These projects are shown in Table 10-38. Insufficient information has been provided at this time to be able to assess the amount of nutrient reduction and impervious surface credit for each of the project listed in the table. As these projects move forward the information will be acquired and the reductions and credits will be calculated.

Table 10-38: DPW Planned Stormwater Restoration Projects

Project	Facility Type	DA (LF)	Watershed	Cost
Stags Head Rd (2 locations)	OUT	UNK	Loch Raven Reservoir	UNK
Freeland Rd.	STRE	UNK		UNK
Dogwood Hill Rd TMDL Drainage Retrofits	OUT	UNK		UNK
Clubhouse Rd	OUT	UNK		UNK
Valewood Rd (2 outfalls)	OUT	UNK		UNK
Beach Rd	OUT	UNK	Bird River	UNK
Chapel Rd TMDL Drainage Retrofits	OUT/STRE	UNK		UNK
Clarks Point Rd Drainage Remediation	MB	UNK	Gunpowder River	UNK

Bayside Drive SD	SCR	UNK	Patapsco River	UNK
Alabama Ave	OUT	UNK		UNK
Cherry Hill TMDL Drainage Retrofits	OUT	UNK	Gwynns Falls	UNK
North Forest Park TMDL Drainage Retrofits	OUT	UNK		UNK
Smith Ave TMDL Drainage Retrofits	OUT	UNK	Jones Falls	UNK
Millridge Rd Drainage Retrofit	OUT	UNK		UNK
Branchwood Ct	OUT	UNK		UNK
Tributary 12 to Redhouse Run	STRE	UNK	Back River	UNK
6 Yew Rd.	OUT	UNK		UNK
Madeline and Linden Aves	STRE	UNK		UNK
Weyburn Rd	STRE	UNK		UNK
Sipple Ave	UNK	UNK		UNK
Karl Ave	OUT	UNK		UNK
Todds Lane		UNK		UNK
6000 Block Radecke Ave Pavement Reduction for TMDL	IMPP	UNK		UNK
Chesapeake Ave (Millers Island) SDs (4)	UNK	UNK	Baltimore Harbor	UNK
Maple Ave	BS	UNK		UNK

Abbreviations
OUT: Outfall Stabilization MB: Micro-bioretention STRE: Stream Restoration
IMPP: Impervious Surface Removal BS: Bioswale UNK: Unknown
SCR: Stormceptor

10.4.2.3 Annual County Rain Barrel Sale

Starting in 2010, Baltimore County DPW began collaborating with EPS and offering 55 gallon rain barrels for sale at their annual compost bin sale. This paired well with the compost bins because, as the bins help to reduce material sent to county landfills, rain barrels help reduce stormwater flowing to local streams.

In the future, Baltimore County will implement an audit program to determine the rate of installation of the rain barrels and the rate at which those installed are emptied prior to storm events. This program will be designed to meet the validation requirements that are currently being prepared by Maryland. This will improve the accuracy of the pollutant reduction estimates attributed to the sale. For the purposes of this report, 100% of barrels sold are assumed to have been installed and frequently emptied, maximizing the effectiveness of storm water benefits.

Table 10-39 shows the number of barrels sold per year with a Baltimore County address. Table 10-40a shows the number of rain barrels and the amount of pollutants reduced and the impervious surface equivalents by watershed from 2011-FY13 for tracking WIP 2-year milestones. Table 10-40b displays the same information for FY2014 and Table 10-40c shows the information for FY2015. Locations are based on addresses given on the receipts from the rain barrel sales. Each rain barrel is estimated to drain 250 sq ft of rooftop for pollution reduction calculation purposes. Note that this analysis of the receipts showed lower numbers sold for each year then reported by the vendor, especially for 2010. This will need to be addressed and possibly re-analyzed in future reports. Pollutant reductions are calculated as described in section 10.3.5.

Table 10-39: Baltimore County Rain Barrel Sales by Fiscal Year

Year	# Barrels Sold to Baltimore County Addresses
FY10	469
FY11	894
FY12	620
FY13	536
FY14	505
FY15	523
Totals	**3,547**

Table 10-40a: Baltimore County Rain Barrel Total Sales Through FY13 by 8 Digit Watershed and Associated Nutrient Reductions

Watershed	# Barrels Sold	N Reduction (lbs/yr)	P Reduction (lbs/yr)	Sed Reduction (lbs/yr)	Equivalent Impervious Acres Treated
Lower Susquehanna					
Deer Creek	4	0.14	0.01	22.17	0.01
Upper Western Shore					
Loch Raven	445	15.89	1.61	1,830.02	0.89
Lower Gunpowder	339	12.11	1.23	1,694.76	0.68
Bird River	262	5.20	0.93	424.55	0.53
Little Gunpowder	64	2.29	0.23	349.80	0.13
Gunpowder	29	0.58	0.10	57.09	0.06
Middle River	71	1.43	0.26	132.42	0.14
Patapsco/Back River					
Liberty	9	0.32	0.03	39.40	0.02
Patapsco	214	6.38	0.65	851.62	0.43
Gwynns Falls	148	5.28	0.54	781.72	0.30
Jones Falls	206	7.36	0.75	512.26	0.41
Back River	573	11.42	2.04	826.64	1.16
Baltimore Harbor	131	2.60	0.46	227.35	0.26
Prettyboy	20	0.71	0.07	84.44	0.04
Totals	**2,519**	**71.70**	**8.91**	**7,834.22**	**5.06**

Table 10-40b: Baltimore County Rain Barrel Sales FY14 by 8 Digit Watershed and Associated Nutrient Reductions

Watershed	# Barrels Sold	N Reduction (lbs/yr)	P Reduction (lbs/yr)	Sed Reduction (lbs/yr)	Equivalent Impervious Acres Treated
Lower Susquehanna					
Deer Creek	0	0.0	0.0	0.0	0.00
Upper Western Shore					
Prettyboy	1	0.03	0.0	3.98	0.00
Loch Raven	66	2.36	0.24	360.73	0.13
Lower Gunpowder	79	2.82	0.29	324.88	0.16
Bird River	68	1.35	0.24	110.19	0.14
Little Gunpowder	13	0.46	0.05	56.91	0.03
Gunpowder	17	0.61	0.06	94.24	0.03
Middle River	10	0.36	0.04	49.99	0.02
Patapsco/Back River					
Liberty	1	0.04	0.00	2.49	0.00
Patapsco	49	0.97	0.17	90.12	0.10
Gwynns Falls	36	0.71	0.13	70.87	0.07
Jones Falls	30	1.07	0.11	158.46	0.06
Back River	117	2.32	0.42	167.91	0.24
Baltimore Harbor	18	0.36	0.06	31.24	0.04
Totals	**505**	**13.45**	**1.81**	**1,521.99**	**1.01**

Table 10-40c: Baltimore County Rain Barrel Sales FY15 by 8 Digit Watershed and Associated Nutrient Reductions

Watershed	# Barrels Sold	N Reduction (lbs/yr)	P Reduction (lbs/yr)	Sed Reduction (lbs/yr)	Equivalent Impervious Acres Treated
Lower Susquehanna					
Deer Creek	3	0.11	0.01	16.63	0.01
Upper Western Shore					
Prettyboy	5	0.18	0.02	21.11	0.01
Loch Raven	56	2.00	0.20	230.29	0.11
Lower Gunpowder	55	1.96	0.20	274.96	0.11
Bird River	42	0.83	0.15	68.06	0.08
Little Gunpowder	12	0.43	0.04	65.59	0.02
Gunpowder	4	0.08	0.01	7.87	0.01
Middle River	11	0.22	0.04	20.23	0.02
Patapsco/Back River					
Liberty	2	0.07	0.01	8.76	0.00
Patapsco	75	2.24	0.23	298.46	0.15
Gwynns Falls	69	2.46	0.25	364.45	0.14
Jones Falls	55	1.96	0.20	136.77	0.11
Back River	109	2.16	0.39	156.43	0.22
Baltimore Harbor	25	0.50	0.09	43.39	0.05
Totals	**523**	**15.20**	**1.83**	**1,713.00**	**1.05**

10.4.3 Local Watershed Associations Restoration Efforts

Baltimore County has several active volunteer organizations whose mission is focused on enhancement of environmental resources. In an effort to expand their ability to organize and conduct restoration activities, EPS developed a grant program entitled the *Watershed Association Restoration Planning and Implementation Grant* program. This grant program was developed to

keep permanent staff with the county's local Watershed Associations. The groups implement restoration projects and educational activities, participate in County restoration planning and support the Stream Watch program. The funds can be used by the groups to leverage additional grant funding. The grant program captures an accounting of the group's efforts and then adds these restoration activities into the County's totals for meeting nutrient reduction goals. Table 10-41 below is the nutrient reductions by group through FY13. For the purposes of tracking progress in meeting the Baltimore County Watershed Implementation Plan (WIP) 2-year milestones for addressing the reduction requirements of the Chesapeake Bay TMDL, FY14 and FY15 data are presented in Tables 10-42 and 10-43.

Table 10-41: Watershed Groups' Projects Through FY13

Watershed Group	N Reduction (lbs/yr)	P Reduction (lbs/yr)	Sed Reduction (lbs/yr)
Gunpowder Valley Conservancy (GVC)	905.1	30.8	21,814.8
Blue Water Baltimore (BWB)	403.7	17.2	9,211.1
Patapsco Heritage Greenway (PHG)	39.7	1.5	1,704.4
Prettyboy Watershed Association (PWA)	171.4	5.8	4,919.0
Back River Restoration Committee (BRRC)	25.5	2.1	368.7
Dundalk Renaissance Corporation (DRC)	16.3	0.9	332.7
TOTALS	**1,561.7**	**58.3**	**38,350.8**

Table 10-42: Watershed Groups' Projects Pollutant Reductions FY14

Watershed Group	N Reduction (lbs/yr)	P Reduction (lbs/yr)	Sed Reduction (lbs/yr)
GVC	100.2	3.6	1,845.5
BWB	13.8	0.5	191.7
PHG	3.5	0.1	60.1
PWA	34.2	1.0	576.2
BRRC	12.8	0.6	152.3
DRC	29.5	1.9	651.7
TOTALS	**194.1**	**7.6**	**3,477.5**

Table 10-43: Watershed Groups' Projects Pollutant Reductions FY15

Watershed Group	N Reduction (lbs/yr)	P Reduction (lbs/yr)	Sed Reduction (lbs/yr)
GVC	107.5	4.0	1,762.2
BWB	39.2	1.3	629.8
PHG	0.0	0.0	0.0
PWA	7.3	0.2	100.3
BRRC	0.5	0.0	13.9
DRC	0.1	0.0	12.2
TOTALS	**154.6**	**5.6**	**2,518.5**

Tables 10-44 through 10-46 show the pollutant reductions achieved by the watershed groups by watershed.

Table 10-44: Watershed Group Projects Pollutant Reductions Through FY13 by Watershed

Watershed	N Red	P Red	Sed Red	Imp Acres
Prettyboy	166.9	5.7	4,825.0	5.8
Loch Raven	648.8	21.2	11,736.6	24.2
Lower Gunpowder	227.5	7.7	9,420.5	8.7
Little Gunpowder	0.4	0.0	18.6	0.0
Bird River	0.4	0.0	9.4	1.1
Gunpowder River	42.1	2.1	711.3	3.3
Middle River	0.9	0.2	78.4	0.1
Liberty	1.1	0.0	19.4	0.1
Patapsco River	45.7	1.7	1,876.2	2.2
Gwynns Falls	93.4	3.0	3,192.0	3.7
Jones Falls	224.2	8.5	4,767.7	9.7
Back River	94.8	7.3	1,364.0	16.2
Baltimore Harbor	15.5	0.9	331.6	1.1
Totals	**1,561.7**	**58.3**	**38,350.7**	**76.2**

Table 10-45: Watershed Group Projects Pollutant Reductions FY14 by Watershed

Watershed	N Red	P Red	Sed Red	Imp Acres
Prettyboy	33.7	1.0	570.1	1.5
Loch Raven	94.2	3.0	1,617.8	3.6
Lower Gunpowder	0.8	0.0	22.1	0.0
Little Gunpowder	0.0	0.0	0.0	0.0
Bird River	0.4	0.0	5.2	0.0
Gunpowder River	7.0	0.4	131.5	0.6
Middle River	3.3	0.3	145.9	0.3
Liberty	0.0	0.0	0.0	0.0
Patapsco River	3.6	0.1	67.5	0.2
Gwynns Falls	0.1	0.0	8.1	0.0
Jones Falls	11.9	0.4	155.3	0.6
Back River	11.2	0.6	129.7	0.9
Baltimore Harbor	27.8	1.8	624.3	2.1
Totals	**194.0**	**7.6**	**3,477.5**	**9.8**

Table 10-46 Watershed Group Projects Pollutant Reductions FY15 by Watershed

Watershed	N Red	P Red	Sed Red	Imp Acres
Prettyboy	2.9	0.1	49.0	0.1
Loch Raven	94.5	2.9	1,391.4	4.0
Lower Gunpowder	2.5	0.1	80.2	0.1
Little Gunpowder	0.2	0.0	3.8	0.2
Bird River	10.8	0.6	195.1	0.9
Gunpowder River	3.9	0.2	67.3	0.3
Middle River	8.9	0.6	204.4	0.8
Liberty	0.2	0.0	3.2	0.6
Patapsco River	0.6	0.0	10.8	0.0
Gwynns Falls	12.2	0.4	278.1	0.5
Jones Falls	10.2	0.3	127.0	0.5
Back River	7.7	0.4	96.0	0.7
Baltimore Harbor	0.1	0.0	12.2	0.0
Totals	**154.7**	**5.6**	**2,518.5**	**8.7**

10.4.4 Redevelopment/Revitalization Pollutant Load Reductions

A process has been developed for tracking redevelopment/revitalization projects and the calculation of the pollutant load reductions due to these projects. Baltimore County has identified redevelopment/revitalization as one of the restoration actions to meet the Chesapeake Bay TMDL and local nutrient and sediment TMDLS. Redevelopment has also been identified as an action for meeting the 20% impervious surface treatment requirements of the NPDES – MS4 permit.

Redevelopment is defined as a pre-development site impervious cover >40% as per the stormwater management regulations. Revitalization, for purposes of calculating pollutant load reductions, is defined as pre-development impervious cover that ranges from 20% to 40%. Both redevelopment and revitalization projects are already accounted for in the Chesapeake Bay Watershed Model as urban land, and therefore included in the load reduction allocation for Baltimore County. For the identified projects, pollutant load calculations were performed to calculate the pre-development load and the post development load, using the watershed specific Edge-of-Stream loading rates and the efficiencies of the various Best Management Practices. The differential between the pre-development load and the post-development load is then calculated to determine the pollutant load reduction on a project by project basis. The pre and post impervious cover is also calculated.

The crediting of redevelopment/revitalization is based on different time scales. For the Chesapeake Bay TMDL, credits are based on any project completed after 2011. As the reduction allocations are based on the 2010 progress run of the Watershed Model. For the local TMDLs and the impervious surface treatment credits the time period is based on the re-issuance of the MS4 permit and the development of the local TMDL Implementation Plans. That time period is from the beginning of fiscal year 2014. Table 10-47 provides information from the time period of January 1, 2011 through June 30, 2013. Table 10-48 provides information from the time period of July 1, 2013 through June 30, 2015. The load reductions from both tables is used for crediting nutrient load reductions for the Chesapeake Bay TMDL, while only the information from Table 10-48 is used for crediting nutrient and sediment load reductions for the local TMDLs and impervious surface treatment credits.

Table 10-47: Pollutant Load Reduction as a Result of Redevelopment/Revitalization Projects (January 1, 2011 through June 30, 2013)

Project Name	Pre-development			Type*	Post Development Impervious	Pollutant Load Change			As-built Date	Fiscal Year	Watershed
	Site Acres	Impervious Acres	% Impervious			N	P	TSS			
Towson Manor	19.3	5.5	28.4	Rev	8.9	-43.5	-1.5	-1,323	6/20/2013	13	JF
1400 Taylor Avenue PUD	13.6	6.7	49.4	Red	11.6	13.5	3.7	831	11/10/2011	12	BR
Landsdowne Station	40.2	17.9	44.6	Red	26.6	-96.0	-9.6	-16,934	1/12/2011	11	PA
Walgreens – Rt. 40	1.7	1.5	88.6	Red	1.4	-2.0	-0.3	-440	4/11/2011	11	PA
Minis of Owings Mills	3.9	2.0	52.6	Red	3.2	-35.2	-2.5	-3,758	2/28/2011	11	GF
Hillcrest Elementary School	11.1	2.3	21.0	Rev	3.4	0.3	0.5	609	4/11/2011	11	PA
McDonalds – Dundalk	1.0	0.7	73.7	Red	0.8	-7.4	-1.0	-479	8/30/2011	12	BH
Traget – Whitemarsh	1.0	0.9	86.4	Red	0.9	-9.3	-0.9	-1,394	10/6/2011	12	BI
York Road 1209	5.7	4.7	82.3	Red	4.8	-92.0	-7.2	-9,847	10/18/2011	12	LR
Sonic - Pulaski Highway	1.1	0.7	61.9	Red	0.5	-1.9	-0.5	-203	3/23/2012	12	BR
Oella Mill Property	3.4	1.9	57.3	Red	2.2	-12.7	-1.4	-2,279	4/28/2012	12	PA
Cardiff Hall Apt.	3.6	1.5	40.5	Red	2.7	-3.9	0.6	887	5/15/2012	12	JF
YMCA – Chesapeake Ave.	1.4	0.8	57.0	Red	1.0	-5.63	-0.44	-641	5/25/2012	12	JF
Patient First – Catonsville	0.8	0.7	85.2	Red	0.5	-4.2	-0.6	-822	8/7/2012	13	PA
WAWA – 516 Main Street	2.2	0.9	39.5	Red	1.6	-29.8	-1.7	-2,146	3/7/2013	13	GF
Lord Property	0.3	0.2	75.7	Red	0.2	-0.9	-0.2	-95	10/26/2012	13	BR
Walmart Golden Ring	1.9	1.9	100	Red	1.9	-2.2	-0.5	-256	1/2/2013	13	BR
Franklin Woods	10.6	2.3	22.0	Rev	2.8	-8.7	-0.1	40	1/9/2013	13	BI
Loh Property	0.8	0.5	65.4	Red	0.5	-0.6	-0.2	-83	6/24/2013	13	BR
Hunt Valley Town Center – Main Street and Loop Road	3.1	2.8	88.7	Red	2.6	-52.0	-4.3	-5,882	1/11/2013	13	LR
NDX Archives	3.5	3.0	83.9	Red	3.0	-1.9	-0.2	-324	3/27/2013	13	GF
Royal Farms Store #181	1.4	1.4	100	Red	1.3	-10.6	-0.9	-1,278	7/24/2013	13	BI
Hereford United Methodist Church	1.8	1.2	66.9	Red	1.6	-27.5	-2.0	-2,659	9/10/2013	13	LR
Totals	**133.4**	**62.0**			**84.0**	**-434.1**	**-31.2**	**-48,480**			

- **Red = Redevelopment, Rev = Revitalization**

Table 10-48: Pollutant Load Reduction as a Result of Redevelopment/Revitalization Projects (July 1, 2013 through June 30, 2015)

Project Name	Pre-development			Type*	Post Development Impervious	Pollutant Load Change			Imp. Surface Credit	As-built Date	Fiscal Year	Watershed
	Site Acres	Impervious Acres	% Impervious			N	P	TSS				
Easter Seals	1.6	0.7	40.8	Red	0.7	-5.59	-0.44	-652	0.48	3/11/2015	15	GF
Mr. Tire	1.0	0.5	50.0	Red	0.6	-5.78	-0.59	-871	0.57	3/19/2015	15	BI
Sheppard Prat Gatehouse	0.7	0.6	82.6	Red	0.7	-4.1	-0.4	-517	0.30	4/2/2015	15	JF
McDonalds – Putty Hill	0.4	0.2	52.2	Red	0.4	-0.92	-0.12	-108	0.22	4/2/2015	15	BR
Osprey at Pikeswood Apts.	0.4	0.2	57.1	Red	0.3	-4.23	-0.36	-472	0.23	6/9/2014	14	GF
Holly Hill Nursing Facility	2.0	0.6	27.1	Rev	0.6	-1.51	-0.10	-101	0.22	6/26/2014		
Maryland Food Bank	6.6	3.7	55.4	Red	4.8	-9.76	0.01	90	1.16	12/8/2014	15	PA
Valley Center Lot 3	3.1	2.2	72.7	Red	2.2	-12.01	-1.17	-1,717	1.16	1/5/2015	15	GF
Hunt Valley Town Center – Marshalls and Pier One	2.4	2.4	100	Red	0.5	-10.92	-2.27	-3,412	1.16	Imp Surface Removal	15	LR
McDonalds – Bel Air Road	0.4	0.4	90.5	Red	0.4	-1.34	-0.24	-97	.23	3/11/2014	14	BR
Villa Julie Front Parking	15.7	7.3	46.6	Red	9.8	-112.0	-7.44	-10,592	10.67	5/22/2014	14	GF
Dulaney Valley Apts. – Ph II	7.20	2.6	36.7	Rev	4.6	-31.88	-2.05	-3,115	4.32	6/12/2015	15	LR
The Greens at Logan Field	3.07	3.02	98.4	Red	1.8	-5.95	-1.82	-886	1.57	1/20/2015	15	BH
Totals	**41.5**	**21.4**			**25.6**	**-200.0**	**-15.2**	**-21,563**	**20.72**			

A number of redevelopment/revitalization projects are currently in the project planning or construction phase. These projects and the anticipated pollutant load reductions and impervious surface credits are presented in Table 10-49. When these projects are completed and the as-builts are approved, the calculation of the pollutant load reductions and the impervious surface credits will be verified and if necessary changed to reflect the built condition.

Table 10-49: Future Pollutant Load Reduction as a Result of Redevelopment/Revitalization Projects (Currently in the Planning or Construction Phase)

Project Name	Pre-development			Type*	Post Development Impervious	Pollutant Load Change			Est. Imp. Surface Credit	Status	Watershed
	Site Acres	Impervious Acres	% Impervious			N	P	TSS			
Towson Square	4.6	3.4	74.5	Red	3.9	-11.2	-1.1	-924.9	1.89	Const.	JF
Metro Center – North	13. 8	9.4	68.3	Red	9.4	-27.3	-3.0	-5,262.5	5.30	Const.	GF
Metro Center – South	30.2	24.7	81.9	Red	23.2	-94.7	-8.5	-12,209.6	6.14	Const.	GF
Galloway Creek PUD	3.9	3.0	77.9	Red	1.0	-13.5	-5.0	-2,560.1	2.07	Plan	MR
Shelter Harbor PUD	5.5	4.5	81.8	Red	4.2	-1.7	-1.0	-588.8	0.39	Const.	BH
The Townes at North Point	16.3	12.7	77.8	Red	12.2	-36.8	-7.8	-4,643.2	7.28	Const.	BH
Totals	**121.7**	**77.8**			**84.1**	**-399.3**	**-51.4**	**-68,215.6**	**23.07**		

10.4.5 Restoration Summary

The information on the pollutant load reductions and the impervious surface credits is summarized in the section by watershed. This will provide a convenient reference for the following sections on meeting the impervious surface restoration requirements and the load reductions associated with the nutrient and sediment TMDLs.

In order to provide tracking for the current permit and the 2-year milestones, data on pollutant removal and impervious surface restoration credits are presented below in three separate tables,

Table 10-50 for progress through FY2013, Table 10-51 for projects completed in FY2014, and Table 10-52 for projects completed in FY2015. Subsequent reports will provide additional tables to summarize the pollutant load reductions and impervious surface credits for each successive fiscal year.

Table 10-50: Progress Made in Pollutant Load Reductions and Impervious Area Treated Through FY13

Deer Creek Watershed Through FY13				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
All WR Projects	0.0	0.0	0.0	0.0
Growing Home Campaign	5.7	0.2	133.3	0.2
EPS Community Reforestation Program	0.0	0.0	0.0	0.0
Energy Trees	0.0	0.0	0.0	0.0
Watershed Association Projects	0.0	0.0	0.0	0.0
EPS Big Tree Sale	1.6	0.0	36.9	0.1
BC Rain Barrel Sale	0.1	0.0	22.2	0.0
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
Restoration Progress through FY13	**7.4**	**0.2**	**192.4**	**0.3**
Prettyboy Watershed Through FY13				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
All WR Projects	0.0	0.0	0.0	0.0
Growing Home Campaign	4.6	0.1	77.2	0.2
EPS Rural Reforestation	120.7	5.0	3,272.6	4.4
Energy Trees	0.0	0.0	0.0	0.0
Watershed Association Projects	166.9	5.7	4,825.0	5.8
EPS Big Tree Sale	3.2	0.1	53.4	0.1
BC Rain Barrel Sale	0.7	0.1	84.44	0.0
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
Restoration Progress through FY13	**296.1**	**11.0**	**8,312.6**	**10.5**

Loch Raven Watershed Through FY13				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	1,665.0	1,510.0	996,336.0	222.0
Shoreline Erosion Control	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	326.9	26.2	42,810.6	19.0
Growing Home Campaign	91.9	2.7	1,637.8	4.0
EPS Rural Residential Reforestation	279.6	10.7	7320.1	10.7
Energy Trees	3.8	0.1	67.2	0.2
Watershed Association Projects	648.8	21.2	11,736.6	24.2
EPS Big Tree Sale	60.6	1.8	1,079.9	2.6
BC Rain Barrel Sale	15.9	1.6	1,830.0	0.9
Redevelopment/Revitalization	109.0	10.1	15,373.6	0.0
Restoration Progress through FY13	**3,201.5**	**1,584.4**	**1,078,191.8**	**283.6**

Lower Gunpowder Falls Through FY13				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	1,881.2	1,706.0	1,125,680.2	250.8
Shoreline Erosion Control	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
Growing Home Campaign	34.6	1.0	745.8	1.5
EPS Rural Reforestation	0.0	0.0	0.0	0.0
Energy Trees	5.6	0.2	121.2	0.2
Watershed Association Projects	227.5	7.7	9,420.5	8.7
EPS Big Tree Sale	4.0	0.1	85.2	0.2
BC Rain Barrel Sale	12.1	1.2	1,694.8	0.7
Redevelopment/Revitalization	0.0	0.0	0.0	
Restoration Progress through FY13	**2,165.0**	**1,716.2**	**1,137,747.7**	**262.1**

Restoration in the Little Gunpowder Watershed FY13				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Erosion Control	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
Growing Home Campaign	15.7	0.5	343.2	0.7
EPS Community Reforestation Program	0.0	0.0	0.0	0.0
Watershed Association Projects	0.4	0.0	18.6	0.0
EPS Big Tree Sale	0.49	0.02	5.22	0.04
BC Rain Barrel Sale	2.3	0.2	349.8	0.1
Redevelopment/Revitalization	0.0	0.0	0.0	
Restoration Progress through FY13	**18.9**	**0.7**	**716.8**	**0.8**

Bird River Through FY13				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	1,912.5	1,734.0	1,144,440.0	255.0
Shoreline Erosion Control	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	670.9	96.0	49,698.8	35.0
Growing Home Campaign	15.4	0.8	203.5	1.2
EPS Rural Reforestation	0.0	0.0	0.0	0.0
Energy Trees	3.7	0.2	48.9	0.3
Watershed Association Projects	0.4	0.0	9.4	1.1
EPS Big Tree Sale	1.7	0.1	22.5	0.1
BC Rain Barrel Sale	5.2	0.9	424.6	0.5
Redevelopment/Revitalization	26.6	1.7	2,554.0	
Restoration Progress through FY13	**2,636.4**	**1,833.7**	**1,197,401.7** **1,194,847.7**	**293.2**

Gunpowder River Through FY13				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Erosion Control	20.5	13.5	56,160.0	5.6
SWM Retrofit/Conversions	148.1	22.2	13,666.5	19.0
Growing Home Campaign	6.2	0.3	104.9	0.5
EPS Rural Reforestation	0.0	0.0	0.0	0.0
Energy Trees	0.9	0.1	15.3	0.1
Watershed Association Projects	42.1	2.1	711.3	3.3
EPS Big Tree Sale	0.3	0.0	4.8	0.0
BC Rain Barrel Sale	0.6	0.1	57.1	0.1
Redevelopment/Revitalization	0.0	0.0	0.0	
Restoration Progress through FY13	**218.7**	**38.3**	**70,719.9**	**28.6**

Middle River Through FY13				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	75.0	68.0	15,130.0	10.0
Shoreline Erosion Control	2,088.2	1,373.0	5,721,116.0	197.6
SWM Retrofit/Conversions	542.3	74.5	41,275.5	83.3
Growing Home Campaign	9.9	0.5	144.9	0.8
EPS Rural Reforestation	0.0	0.0	0.0	0.0
Energy Trees	0.8	0.0	11.4	0.1
Watershed Association Projects	0.9	0.2	78.4	0.1
EPS Big Tree Sale	0.8	0.0	12.1	0.1
BC Rain Barrel Sale	1.4	0.3	132.4	0.1
Redevelopment/Revitalization	0.0	0.0	0.0	
Restoration Progress through FY13	**2,719.3**	**1,516.5**	**5,777,900.7**	**292.1**

Liberty Reservoir Through FY13				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Erosion Control	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
Growing Home Campaign	3.4	0.1	63.2	0.1
EPS Community Reforestation Program	0.0	0.0	0.0	0.0
Energy Trees	0.0	0.0	0.0	0.0
Watershed Association Projects	1.1	0.0	19.4	0.1
EPS Big Tree Sale	1.5	0.0	27.5	0.1
BC Rain Barrel Sale	0.3	0.0	39.4	0.0
Redevelopment/Revitalization	0.0	0.0	0.0	
Restoration Progress through FY13	**6.5**	**0.1**	**149.5**	**0.3**

Lower North Branch Patapsco River Through FY13				
Program	Removal Rate (lb./year)			Equivalent Impervious Acres
	TN	TP	TSS	
Stream Restoration	236.3	214.2	141,372.0	31.5
Shoreline Erosion Control	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	64.7	5.4	6,689.6	3.6
Growing Home Campaign	16.8	0.5	290.7	0.9
EPS Rural Reforestation	0.0	0.0	0.0	0.0
Energy Trees	15.4	0.5	265.5	0.8
Watershed Association Projects	45.7	1.7	1,876.2	2.2
EPS Big Tree Sale	3.2	0.1	55.3	0.2
BC Rain Barrel Sale	6.4	0.7	851.6	0.4
Redevelopment/Revitalization	114.6	11.3	19,868.0	
Restoration Progress through FY13	**503.1**	**234.4**	**171,268.9**	**39.6**

Gwynns Falls Through FY13				
Program	Removal Rate (lb./year)			Equivalent Impervious Acres
	TN	TP	TSS	
Stream Restoration	557.0	189.4	863,350.0	27.9
Shoreline Erosion Control	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	831.5	55.2	109,134.8	89.0
Growing Home Campaign	20.3	0.6	460.0	0.9
EPS Rural Reforestation	0.0	0.0	0.0	0.0
Energy Trees	15.6	0.5	352.9	0.7
Watershed Association Projects	93.4	3.0	3,192.0	3.7
EPS Big Tree Sale	1.7	0.0	37.7	0.1
BC Rain Barrel Sale	5.3	0.5	781.7	0.3
Redevelopment/Revitalization	66.8	4.4	6228.6	
Restoration Progress through FY13	**1591.6**	**253.6**	**983,537.7**	**122.6**

Jones Falls Through FY13				
Program	Removal Rate (lb./year)			Equivalent Impervious Acres
	TN	TP	TSS	
Stream Restoration	753.9	683.4	451,044.0	100.5
Shoreline Erosion Control	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	518.7	67.5	54,791.8	78.3
Growing Home Campaign	40.5	1.2	473.0	1.8
EPS Rural Reforestation	0.0	0.0	0.0	0.0
Energy Trees	1.7	0.0	19.5	0.1
Watershed Association Projects	224.2	8.5	4,767.7	9.7
EPS Big Tree Sale	18.6	0.6	217.5	0.8
BC Rain Barrel Sale	7.4	0.8	512.3	0.4
Redevelopment/Revitalization	53.1	1.4	1,078.2	
Restoration Progress through FY13	**1618.1**	**763.4**	**512,904**	**191.6**

Back River Through FY13				
Program	Removal Rate (lb./year)			Equivalent Impervious Acres
	TN	TP	TSS	
Stream Restoration	1,021.1	699.1	991,651.3	102.8
Shoreline Management	3,394.0	2,232.3	9,300,186.0	473.6
SWM Retrofit/Conversions	1,050.3	152.6	70,360.2	120.2
Growing Home Campaign	22.8	1.1	245.3	1.8
EPS Rural Reforestation	0.0	0.0	0.0	0.0
Energy Trees	6.2	0.3	66.8	0.5
Watershed Association Projects	94.8	7.3	1,364.0	16.2
EPS Big Tree Sale	1.7	0.1	18.3	0.1
BC Rain Barrel Sale	11.4	2.0	826.6	1.2
Redevelopment/Revitalization	7.1	2.3	187.4	
Restoration Progress through FY13	**5,609.4**	**3,097.1**	**10,364,905.9**	**716.4**
Baltimore Harbor Through FY13				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	1,290.3	848.6	3,535,509.0	424.5
SWM Retrofit/Conversions	1,270.5	237.6	131,387.2	218.8
Growing Home Campaign	5.3	0.3	66.1	0.4
EPS Rural Reforestation	0.0	0.0	0.0	0.0
Energy Trees	9.3	0.5	116.9	0.7
Watershed Association Projects	15.5	0.9	331.6	1.1
EPS Big Tree Sale	5.2	0.3	65.5	0.4
BC Rain Barrel Sale	2.6	0.5	227.4	0.3
Redevelopment/Revitalization	7.4	1.0	479.0	
Restoration Progress through FY13	**2,606.1**	**1089.7**	**3,668,182.7**	**646.2**

Table 10-51: Progress Made in Pollutant Load Reductions and Impervious Area Treated – July 1, 2013 through June 30, 2014 (FY14)

Restoration In Deer Creek Watershed FY14				
Program	Removal Rate (lb./year)			Equivalent Impervious Acres
	TN	TP	TSS	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Erosion Control	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	0.0	0.0	0.0	0.0
Watershed Association Projects	0.0	0.0	0.0	0.0
EPS Big Tree Sale	1.2	0.0	28.7	0.1
BC Rain Barrel Sale	0.0	0.0	0.0	0.0
Septic Connections	0.0	0.0	0.0	0.0
Septic Denitrification Systems	0.0	0.0	0.0	0.0
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
Restoration Progress FY14	**1.2**	**0.0**	**28.7**	**0.1**

Restoration In Prettyboy Watershed FY14				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Erosion Control	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	0.0	0.0	0.0	0.0
Watershed Association Projects	33.7	1.0	570.1	1.5
EPS Big Tree Sale	0.0	0.0	0.0	0.0
BC Rain Barrel Sale	0.0	0.0	4.0	0.0
Septic Connections	0.0	0.0	0.0	0.0
Septic Denitrification Systems	0.0	0.0	0.0	0.0
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
Restoration Progress FY14	**33.7**	**1.0**	**574.1**	**1.5**

Restoration in the Loch Raven Watershed FY14				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	93.7	2.8	1,669.1	4.1
Watershed Association Projects	94.2	3.0	1,617.8	3.6
EPS Big Tree Sale	27.8	0.8	495.4	1.2
BC Rain Barrel Sale	2.4	0.2	360.7	0.1
Septic Connections	0.0	0.0	0.0	0.0
Septic Denitrification Systems	10.3	0.0	0.0	2.1
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
Restoration Progress FY14	**228.4**	**6.8**	**4,143**	**11.1**

Restoration in the Lower Gunpowder Watershed FY14				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	0.0	0.0	0.0	0.0
Watershed Association Projects	0.8	0.0	22.1	0.0
EPS Big Tree Sale	2.4	0.1	51.1	0.1
BC Rain Barrel Sale	2.8	0.3	324.9	0.2
Septic Connections	0.0	0.0	0.0	0.0
Septic Denitrification Systems	26.6	0.0	0.0	1.3
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
Restoration Progress FY14	**32.6**	**0.4**	**398.1**	**1.6**

Restoration in the Little Gunpowder Watershed FY14				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	0.0	0.0	0.0	0.0
Watershed Association Projects	0.0	0.0	0.0	0.0
EPS Big Tree Sale	1.1	0.0	24.9	0.0
BC Rain Barrel Sale	0.5	0.1	56.9	0.0
Septic Connections	0.0	0.0	0.0	0.0
Septic Denitrification Systems	2.9	0.0	0.0	0.3
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
Restoration Progress FY14	**4.5**	**0.1**	**81.8**	**0.3**

Restoration in the Bird River Watershed FY14				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	31.3	6.7	806.6	0.0
EPS Community Reforestation Program	12.6	0.6	167.4	1.0
Watershed Association Projects	0.4	0.0	5.2	0.0
EPS Big Tree Sale	0.9	0.0	11.6	0.1
BC Rain Barrel Sale	1.4	0.2	110.2	0.1
Septic Connections	10.8	0.0	0.0	0.8
Septic Denitrification Systems	3.5	0.0	0.0	0.3
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
Restoration Progress FY14	**60.9**	**7.5**	**1,101**	**2.3**

Restoration in the Gunpowder River Watershed FY14				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	7.0	1.6	335.1	0.0
EPS Community Reforestation Program	0.0	0.0	0.0	0.0
Watershed Association Projects	7.0	0.4	131.5	0.6
EPS Big Tree Sale	0.0	0.0	0.0	0.0
BC Rain Barrel Sale	0.6	0.1	94.2	0.0
Septic Connections	32.9	0.0	0.0	0.8
Septic Denitrification Systems	0.0	0.0	0.0	0.0
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
Restoration Progress FY14	**47.5**	**2.1**	**560.8**	**1.4**

All Restoration in the Middle River Watershed FY14				
Program	Removal Rate (lb./year)			Equivalent Impervious Acres
	TN	TP	TSS	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	17.7	2.8	555.8	7.5
EPS Community Reforestation Program	62.2	3.1	913.7	4.9
Watershed Association Projects	3.3	0.3	145.9	0.3
EPS Big Tree Sale	0.5	0.0	7.9	0.0
BC Rain Barrel Sale	0.4	0.0	50.0	0.0
Septic Connections	0.0	0.0	0.0	0.0
Septic Denitrification Systems	0.0	0.0	0.0	0.0
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
Restoration Progress FY14	**84.1**	**6.2**	**1,673.3**	**12.7**

All Restoration in the Liberty Reservoir Watershed FY14				
Program	Removal Rate (lb./year)			Equivalent Impervious Acres
	TN	TP	TSS	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	0.0	0.0	0.0	0.0
Watershed Association Projects	0.0	0.0	0.0	0.0
EPS Big Tree Sale	1.1	0.0	24.9	0.0
BC Rain Barrel Sale	0.0	0.0	2.5	0.0
Septic Connections	0.0	0.0	0.0	0.0
Septic Denitrification Systems	0.0	0.0	0.0	0.0
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
Restoration Progress FY14	**1.1**	**0.0**	**27.4**	**0.0**

All Restoration in the Lower North Branch Patapsco Watershed FY14				
Program	Removal Rate (lb./year)			Equivalent Impervious Acres
	TN	TP	TSS	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	1.1	0.0	46.7	0.0
Watershed Association Projects	3.6	0.1	67.5	0.2
EPS Big Tree Sale	2.7	0.1	46.9	0.1
BC Rain Barrel Sale	1.0	0.2	90.1	0.1
Septic Connections	0.0	0.0	0.0	0.0
Septic Denitrification Systems	13.0	0.0	0.0	1.0
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
Restoration Progress FY14	**21.4**	**0.4**	**251.2**	**1.4**

Restoration in the Gwynns Falls Watershed FY14				
Program	Removal Rate (lb./year)			Equivalent Impervious Acres
	TN	TP	TSS	
Stream Restoration	148.0	134.2	88,548.2	19.7
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	16.2	1.0	1,605.2	1.2
EPS Community Reforestation Program	0.9	0.0	19.8	0.0
Watershed Association Projects	0.1	0.0	8.1	0.0
EPS Big Tree Sale	2.0	0.1	45.6	0.1
BC Rain Barrel Sale	0.7	0.1	70.9	0.1
Septic Connections	4.2	0.0	0.0	0.8
Septic Denitrification Systems	0.0	0.0	0.0	0.0
Redevelopment/Revitalization	64.4	5.6	10,039.4	10.9
Restoration Progress FY14	**236.5**	**141.0**	**100,337.2**	**32.8**

Restoration in the Jones Falls Watershed FY14				
Program	Removal Rate (lb./year)			Equivalent Impervious Acres
	TN	TP	TSS	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	0.0	0.0	0.0	0.0
Watershed Association Projects	11.9	0.4	155.3	0.6
EPS Big Tree Sale	10.4	0.3	122.1	0.5
BC Rain Barrel Sale	1.1	0.1	158.5	0.1
Septic Connections	0.0	0.0	0.0	0.0
Septic Denitrification Systems	4.4	0.0	0.0	1.3
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
Restoration Progress FY14	**27.8**	**0.8**	**435.9**	**2.5**

Restoration in the Back River Watershed FY14				
Program	Removal Rate (lb./year)			Equivalent Impervious Acres
	TN	TP	TSS	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	41.8	6.8	1,195.1	3.0
EPS Community Reforestation Program	0.0	0.0	0.0	0.0
Watershed Association Projects	11.2	0.6	129.7	0.9
EPS Big Tree Sale	2.1	0.1	22.4	0.2
BC Rain Barrel Sale	2.3	0.4	167.9	0.2
Septic Connections	15.8	0.0	0.0	0.4
Septic Denitrification Systems	10.1	0.0	0.0	0.0
Redevelopment/Revitalization	2.9	0.3	197.5	0.5
Restoration Progress FY14	**86.2**	**8.2**	**1,712.6**	**5.2**

Restoration in the Baltimore Harbor Watershed FY14				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	0.0	0.0	0.0	0.0
Watershed Association Projects	27.8	1.8	624.3	2.1
EPS Big Tree Sale	0.7	0.0	9.2	0.1
BC Rain Barrel Sale	0.4	0.1	31.2	0.0
Septic Connections	1,709.8	0.0	0.0	40.6
Septic Denitrification Systems	0.0	0.0	0.0	0.0
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
Restoration Progress FY14	**1,738.7**	**1.9**	**664.7**	**42.8**

Table 10-52: Progress Made in Pollutant Load Reductions and Impervious Area Treated – July 1, 2014 through June 30, 2015 (FY15)

Restoration In Deer Creek Watershed FY15				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	0.0	0.0	0.0	0.0
Watershed Association Projects	0.0	0.0	0.0	0.0
EPS Big Tree Sale	0.0	0.0	0.0	0.0
BC Rain Barrel Sale	0.1	0.0	16.6	0.0
Street Sweeping	0.0	0.0	0.0	0.0
Inlet Cleaning	0.0	0.0	0.0	0.0
Septic Connections	0.0	0.0	0.0	0.0
Septic Denitrification Systems	0.0	0.0	0.0	0.0
Septic Pumpouts	1.8	0.0	0.0	0.3
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
DPW Projects	0.0	0.0	0.0	0.0
Restoration Progress FY15	**1.9**	**0.0**	**16.6**	**0.3**
Restoration In Prettyboy Watershed FY15				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	30.7	0.9	519.6	1.3
Watershed Association Projects	2.9	0.1	49.0	0.1
EPS Big Tree Sale	1.1	0.0	17.8	0.0
BC Rain Barrel Sale	0.2	0.0	21.1	0.0
Street Sweeping	0.0	0.0	0.0	0.0
Inlet Cleaning	0.0	0.0	0.0	0.0
Septic Connections	0.0	0.0	0.0	0.0
Septic Denitrification Systems	0.0	0.0	0.0	0.0
Septic Pumpouts	1.1	0.0	0.0	1.8
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
DPW Projects	0.0	0.0	0.0	0.0
Restoration Progress FY15	**36.0**	**1.0**	**607.5**	**3.2**

Restoration in the Loch Raven Watershed FY15				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	120.0	108.8	71,808.0	16.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	152.9	13.4	12,466.4	22.6
EPS Community Reforestation Program	488.9	15.0	9,100.5	20.1
Watershed Association Projects	94.5	2.9	1,391.4	4.0
EPS Big Tree Sale	22.5	0.7	401.6	1.0
BC Rain Barrel Sale	2.0	0.2	230.3	0.1
Street Sweeping	704.3	281.7	84,517.0	56.3
Inlet Cleaning	26.8	10.7	3,215.5	2.1
Septic Connections	2.7	0.0	0.0	0.4
Septic Denitrification Systems	3.1	0.0	0.0	0.0
Septic Pumpouts	47.7	0.0	0.0	14.6
Redevelopment/Revitalization	26.3	3.5	6,143.4	6.2
DPW Projects	2.1	0.1	121.3	1.6
Restoration Progress FY15	**1,693.8**	**437.0**	**189,395.4**	**145.0**

Restoration in the Lower Gunpowder Watershed FY15				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	225.0	204.0	134,640.0	30.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	355.3	27.4	34,331.1	16.1
EPS Community Reforestation Program	35.1	1.1	1,137.8	1.3
Watershed Association Projects	2.5	0.1	80.2	0.1
EPS Big Tree Sale	4.6	0.1	98.4	0.2
BC Rain Barrel Sale	2.0	0.2	275.0	0.1
Street Sweeping	410.0	164.0	49,201.5	32.8
Inlet Cleaning	28.7	11.5	3,447.2	2.3
Septic Connections	5.5	0.0	0.0	0.0
Septic Denitrification Systems	27.6	0.0	0.0	1.6
Septic Pumpouts	35.3	0.0	0.0	3.2
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
DPW Projects	0.0	0.0	0.0	0.0
Restoration Progress FY15	**1,131.6**	**408.4**	**223,211.2**	**87.7**

Restoration in the Little Gunpowder Watershed FY15				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	0.0	0.0	0.0	0.0
Watershed Association Projects	0.2	0.0	3.8	0.2
EPS Big Tree Sale	3.8	0.1	82.4	0.2
BC Rain Barrel Sale	0.4	0.0	65.6	0.0
Street Sweeping	62.4	25.0	7,485.3	5.0
Inlet Cleaning	2.4	0.9	283.5	0.2
Septic Connections	0.0	0.0	0.0	0.0
Septic Denitrification Systems	10.5	0.0	0.0	0.8
Septic Pumpouts	35.3	0.0	0.0	3.2
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
DPW Projects	0.0	0.0	0.0	0.0
Restoration Progress FY15	**115.0**	**26.0**	**7,920.6**	**9.6**

Restoration in the Bird River Watershed FY15				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	30.5	3.2	1,341.8	2.2
EPS Community Reforestation Program	12.2	0.6	161.6	1.0
Watershed Association Projects	10.8	0.6	195.1	0.9
EPS Big Tree Sale	2.1	0.1	28.3	0.2
BC Rain Barrel Sale	0.8	0.2	68.1	0.1
Street Sweeping	559.1	223.6	67,093.4	44.7
Inlet Cleaning	18.2	7.3	2,183.2	1.5
Septic Connections	142.0	0.0	0.0	8.6
Septic Denitrification Systems	47.2	0.0	0.0	1.3
Septic Pumpouts	3.1	0.0	0.0	0.3
Redevelopment/Revitalization	5.8	0.6	870.8	0.6
DPW Projects	0.0	0.0	0.0	0.0
Restoration Progress FY15	**831.8**	**236.2**	**71,942.3**	**61.4**

Restoration in the Gunpowder River Watershed FY15				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	0.0	0.0	0.0	0.0
Watershed Association Projects	3.9	0.2	67.3	0.3
EPS Big Tree Sale	1.1	0.1	19.4	0.1
BC Rain Barrel Sale	0.1	0.0	7.9	0.0
Street Sweeping	125.6	50.2	15,074.9	10.0
Inlet Cleaning	19.8	7.9	2,377.6	1.6
Septic Connections	0.0	0.0	0.0	0.0
Septic Denitrification Systems	0.0	0.0	0.0	0.0
Septic Pumpouts	0.8	0.0	0.0	0.1
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
DPW Projects	0.0	0.0	0.0	0.0
Restoration Progress FY15	**151.3**	**58.4**	**17,547.1**	**12.1**

All Restoration in the Middle River Watershed FY15				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	0.0	0.0	0.0	0.0
Watershed Association Projects	8.9	0.6	204.4	0.8
EPS Big Tree Sale	0.7	0.0	10.7	0.1
BC Rain Barrel Sale	0.2	0.0	20.2	0.0
Street Sweeping	349.4	139.8	41,931.6	28.0
Inlet Cleaning	26.8	10.7	3,209.6	2.1
Septic Connections	32.9	0.0	0.0	0.8
Septic Denitrification Systems	0.0	0.0	0.0	0.0
Septic Pumpouts	1.6	0.0	0.0	0.1
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
DPW Projects	0.0	0.0	0.0	0.0
Restoration Progress FY15	**420.5**	**151.1**	**45,376.5**	**31.9**

All Restoration in the Liberty Reservoir Watershed FY15				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	6.5	0.2	200.3	0.2
Watershed Association Projects	0.2	0.0	3.2	0.6
EPS Big Tree Sale	0.7	0.0	13.0	0.0
BC Rain Barrel Sale	0.1	0.0	8.8	0.0
Street Sweeping	15.3	6.1	1,839.0	1.2
Inlet Cleaning	0.3	0.1	40.0	0.0
Septic Connections	0.0	0.0	0.0	0.0
Septic Denitrification Systems	0.0	0.0	0.0	0.0
Septic Pumpouts	0.0	0.0	0.0	0.0
Redevelopment/Revitalization	0.0	0.0	0.0	0.0
DPW Projects	14.8	0.8	851.8	0.9
Restoration Progress FY15	**37.9**	**7.2**	**2,956.1**	**2.9**

All Restoration in the Lower North Branch Patapsco Watershed FY15				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	16.4	0.6	692.8	0.7
Watershed Association Projects	0.6	0.0	10.8	0.0
EPS Big Tree Sale	4.4	0.1	75.7	0.2
BC Rain Barrel Sale	2.2	0.2	298.5	0.2
Street Sweeping	433.0	173.2	51,957.2	34.6
Inlet Cleaning	69.1	27.6	8,293.0	5.5
Septic Connections	3.3	0.0	0.0	0.4
Septic Denitrification Systems	11.6	0.0	0.0	1.0
Septic Pumpouts	33.1	0.0	0.0	5.1
Redevelopment/Revitalization	9.8	0.0	90.4	1.2
DPW Projects	0.0	0.0	0.0	0.0
Restoration Progress FY15	**583.5**	**201.7**	**61,418.4**	**48.9**

Restoration in the Gwynns Falls Watershed FY15				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	33.3	3.4	1,666.8	5.7
EPS Community Reforestation Program	11.6	0.3	261.7	0.5
Watershed Association Projects	12.2	0.4	278.1	0.5
EPS Big Tree Sale	2.5	0.1	55.5	0.1
BC Rain Barrel Sale	2.5	0.3	364.5	0.1
Street Sweeping	901.4	360.5	108,162.4	72.1
Inlet Cleaning	108.4	43.4	13,004.7	8.7
Septic Connections	4.2	0.0	0.0	0.8
Septic Denitrification Systems	0.0	0.0	0.0	0.0
Septic Pumpouts	10.0	0.0	0.0	2.4
Redevelopment/Revitalization	26.3	1.8	2,504.1	2.5
DPW Projects	19.5	1.9	2,754.1	2.4
Restoration Progress FY15	**1,131.9**	**412.1**	**129,051.9**	**95.8**

Restoration in the Jones Falls Watershed FY15				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	21.5	0.6	264.5	0.9
Watershed Association Projects	10.2	0.3	127.0	0.5
EPS Big Tree Sale	2.5	0.1	55.5	0.1
BC Rain Barrel Sale	2.0	0.2	136.8	0.1
Street Sweeping	466.2	186.5	55,943.1	37.3
Inlet Cleaning	61.3	24.5	7,360.3	4.9
Septic Connections	0.0	0.0	0.0	0.0
Septic Denitrification Systems	1.7	0.0	0.0	0.5
Septic Pumpouts	15.1	0.0	0.0	6.5
Redevelopment/Revitalization	4.1	0.4	517.2	0.3
DPW Projects	0.0	0.0	0.0	0.0
Restoration Progress FY15	**584.6**	**212.6**	**64,404.4**	**51.1**

Restoration in the Back River Watershed FY15				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	11.1	2.6	213.1	4.3
EPS Community Reforestation Program	8.1	2.0	209.1	0.5
Watershed Association Projects	7.7	0.4	96.0	0.7
EPS Big Tree Sale	1.7	0.1	18.8	0.1
BC Rain Barrel Sale	2.2	0.4	156.4	0.2
Street Sweeping	1,520.7	608.3	182,485.3	121.7
Inlet Cleaning	138.9	55.6	16,672.1	11.1
Septic Connections	0.0	0.0	0.0	0.0
Septic Denitrification Systems	3.8	0.0	0.0	0.3
Septic Pumpouts	1.9	0.0	0.0	0.2
Redevelopment/Revitalization	0.9	0.1	107.5	0.2
DPW Projects	6.7	1.0	405.9	1.0
Restoration Progress FY15	**1,703.7**	**670.5**	**200,364.2**	**140.3**

Restoration in the Baltimore Harbor Watershed FY15				
Program	**Removal Rate (lb./year)**			**Equivalent Impervious Acres**
	TN	**TP**	**TSS**	
Stream Restoration	0.0	0.0	0.0	0.0
Shoreline Management	0.0	0.0	0.0	0.0
SWM Retrofit/Conversions	0.0	0.0	0.0	0.0
EPS Community Reforestation Program	39.5	2.3	1,136.9	2.4
Watershed Association Projects	0.1	0.0	12.2	0.0
EPS Big Tree Sale	6.1	0.3	76.5	0.5
BC Rain Barrel Sale	0.5	0.1	43.4	0.1
Street Sweeping	943.0	377.2	113,165.9	75.4
Inlet Cleaning	56.1	22.4	6,731.2	4.5
Septic Connections	0.0	0.0	0.0	0.0
Septic Denitrification Systems	0.0	0.0	0.0	0.0
Septic Pumpouts	1.1	0.0	0.0	0.1
Redevelopment/Revitalization	6.0	1.8	886.5	1.6
DPW Projects	6.4	0.4	189.1	1.5
Restoration Progress FY15	**1,058.8**	**404.5**	**122,241.7**	**86.1**

Table 10-53 summarizes the data from Table 10-50 by watershed, while Table 10-54 summarizes the data from Table 10-51 by watershed. Table 10-55 summarizes the impervious cover treated during FY2015 by watershed.

Table 10-53: Pollutant load Reductions and Impervious Area Treated by Watershed Through FY2013

Watershed	Removal Rate (lb./year)			Equivalent Impervious Acres
	TN	TP	TSS	
Deer Creek	7.4	0.2	192.4	0.3
Prettyboy	296.1	11.0	8,312.6	10.5
Loch Raven Reservoir	3,092.5	1,574.3	1,062,818.2	283.6
Lower Gunpowder Falls	2,165.0	1,716.2	1,137,747.7	262.1
Little Gunpowder Falls	18.9	0.7	716.8	0.8
Bird River	2,609.8	1,832.0	1,194,847.7	293.2
Gunpowder River	218.7	38.3	70,719.9	28.6
Middle River	2,719.3	1,516.5	5,777,900.7	292.1
Liberty Reservoir	6.3	0.1	149.5	0.3
Patapsco River	388.5	223.1	151,400.9	39.6
Gwynns Falls	1,524.8	249.2	977,309.1	122.6
Jones Falls	1,565.0	762.0	511,825.8	191.6
Back River	5,602.3	3,094.8	10,364,718.5	716.4
Baltimore Harbor	2,598.7	1,088.7	3,667,703.7	646.2
Restoration Progress through FY2013	**22,813.3**	**12,107.1**	**24,926,363.5**	**2,887.9**

Table 10-54: Pollutant load Reductions and Impervious Area Treated by Watershed FY2014

Watershed	Removal Rate (lb./year)			Equivalent Impervious Acres
	TN	TP	TSS	
Deer Creek	1.2	0.0	28.7	0.1
Prettyboy	33.7	1.0	574.1	1.5
Loch Raven Reservoir	228.4	6.8	4,143.0	11.1
Lower Gunpowder Falls	32.6	0.4	398.1	1.6
Little Gunpowder Falls	4.5	0.1	81.8	0.3
Bird River	60.9	7.5	1,101.0	2.3
Gunpowder River	47.5	2.1	560.8	1.4
Middle River	84.1	6.2	1,673.3	12.7
Liberty Reservoir	1.1	0.0	27.4	0.0
Patapsco River	21.4	0.4	251.2	1.4
Gwynns Falls	236.5	141.0	100,337.2	32.8
Jones Falls	27.8	0.8	435.9	2.5
Back River	86.2	8.2	1,712.6	5.2
Baltimore Harbor	1,738.7	1.9	664.7	42.8
Total FY2014	**2,604.6**	**176.4**	**111,989.8**	**115.7**

Table 10-55: Pollutant load Reductions and Impervious Area Treated by Watershed FY2015

Watershed	Removal Rate (lb./year)			Equivalent Impervious Acres
	TN	TP	TSS	
Deer Creek	1.9	0.0	16.6	0.3
Prettyboy	36.0	1.0	607.5	3.2
Loch Raven Reservoir	1,693.8	437.0	189,395.4	145.0
Lower Gunpowder Falls	1,131.6	408.4	223,211.2	87.7
Little Gunpowder Falls	115.0	26.0	7,920.6	9.6
Bird River	831.8	236.2	71,942.3	61.4
Gunpowder River	151.3	58.4	17,547.1	12.1
Middle River	420.5	151.1	45,376.5	31.9
Liberty Reservoir	37.9	7.2	2,956.1	2.9
Patapsco River	583.5	201.7	61,418.4	48.9
Gwynns Falls	1,131.9	412.1	129,051.9	95.8
Jones Falls	584.6	212.6	64,404.4	51.1
Back River	1,703.7	670.5	200,364.2	140.3
Baltimore Harbor	1,058.8	404.5	122,241.7	86.1
Total FY2014	**9,482.3**	**3226.7**	**1,136,453.9**	**776.3**

10.5 Progress in Meeting Impervious Surface Restoration Requirements

The amount of impervious cover that needs to be addressed in Baltimore County was calculated based on the guidelines provided in the document *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated (MDE, 2014)*. In order to assure consistency between MS4 regulated jurisdictions MDE has determined that the base year of 2002 impervious cover be used to determine how many acres of impervious cover will need to be addressed. The implementation of the MDE 2000 Stormwater Design Manual was initiated in 2002 by local jurisdictions. The revised Design Manual required management of the 1st inch of runoff for quantity control and included groundwater recharge volume and water quality volume reductions. Chapter 5 of the manual included many Environmental Site Design (ESD) practices that are now required for new development and redevelopment projects. MDE considers that any approvals of stormwater plans for development approved in 2002 and thereafter will meet the highest required stormwater management requirements.

Baltimore County did not have an impervious surface area (ISA) delineated specifically for 2002 as a starting point. The County had to compile an impervious surface from previous years and county permits in order to create the 2002 ISA baseline. Planimetric data including roads and building footprints were compiled for the years 1996, 1997, and 2001 into one surface. Using the Counties permit data, 2003 aerial photography, and the Counties ISA from 2005, the new surface layer was refined by adding or subtracting impervious area based on the permit data and verified by the 2005 ISA and the 2003 photography.

Not all impervious surface areas fall under the jurisdiction of the county. Impervious areas which the County is not responsible for are areas associated with land that is owned and managed by the State of Maryland, Federal government, and the City of Baltimore. In addition to these areas, agricultural lands and its associated impervious surface do not fall under the counties responsibility. It was necessary to determine the amount of impervious controlled by each sector listed above and subtract that amount of impervious cover from the total impervious cover in the county. The detail of the calculations will be described in the Baltimore County Impervious

Cover Analysis that will be submitted to MDE once the final quality assurance/quality control is completed and the Baltimore County NPDES – MS4 permit is re-issued. The results of the analysis are presented in Table 10-56.

Table 10-56: Baltimore County Impervious Area by Watershed – Calculated for 2002

Watershed	Total Imp. Cover	Ag Imp. Cover	Federal Imp. Cover	State Imp. Cover	City Imp. Cover	SWM Imp. Cover	County Imp. Cover
Deer Creek	166.2	49.8	0.0	25.3	0.0	0.0	91.1
Prettyboy Reservoir	460.7	121.3	0.0	26.6	2.9	0.0	309.9
Loch Raven Reservoir	6257.1	588.8	5.1	643.7	25.1	55.5	4939.0
Lower Gunpowder Falls	2277.2	139.0	0.0	207.8	1.7	33.3	1895.3
Little Gunpowder Falls	614.8	80.8	0.0	95.3	0.0	4.2	434.5
Bird River	2508.9	32.4	0.0	289.8	6.2	123.6	2057.0
Gunpowder River	359.8	12.4	0.0	35.4	0.0	9.8	302.2
Middle River	1328.9	3.9	0.0	287.6	0.0	9.2	1028.2
Upper Western Shore	**13973.6**	**1028.4**	**5.1**	**1611.5**	**35.9**	**235.5**	**11057.2**
Liberty Reservoir	524.4	38.4	0.0	117.8	20.1	0.5	347.6
Patapsco River	4112.8	29.8	18.6	691.1	2.1	51.3	3320.0
Gwynns Falls	6138.5	0.7	80.4	729.7	0.9	73.6	5253.2
Jones Falls	3508.8	28.8	3.6	495.8	3.3	30.9	2946.4
Back River	5526.0	9.2	3.3	617.0	5.6	95.8	4795.0
Baltimore Harbor	3000.8	0.0	0.6	355.6	0.0	3.1	2641.6
Patapsco/ Back River Totals	**22811.3**	**106.9**	**106.5**	**3006.9**	**32.1**	**255.1**	**19303.8**
County-Wide Totals	**36784.9**	**1135.3**	**111.6**	**4618.3**	**68.0**	**490.6**	**30361.0**
% of Total Imp. Cover		**3.1**	**0.3**	**12.6**	**0.2**	**1.3**	**82.5**

To meet the current NPDES permit requirement Baltimore County must provide restoration for impervious land areas that are equal to or greater than 20% of the County's urban impervious cover. Twenty percent of 30,361. acres is 6,072 acres.

Using the guidance provided by *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* (MDE, August 2014) the impervious area treated was calculated for each restoration program. The results are presented in Table 10-50 for progress made through fiscal year 2013, along with the pound of nitrogen, phosphorus and sediment reduced, by watershed, by restoration program. The same information is presented in Table 10-51 for fiscal year 2014 (July 1, 2013 – June 30, 2014). Note that programs that receive only annual credit are presented in table that summarizes the most recent reporting year, in this case FY2015 (Table 10-52).

Table 10-57 shows that Baltimore County has addressed 3,779.9 acres of impervious surface or 12.4% of the impervious surface for which Baltimore County has responsibility through FY2015. In FY2015 the county addressed 776.3 acres of impervious surface. This includes the annual practices of street sweeping, storm drain cleaning, and OSDS pump-outs. In FY 2014 115.7 acres of impervious surface were addressed, excluding the annual practices. This results in a total of 892 acres of impervious surface being addressed during the first two years of the MS4

permit or 14.8% of the required amount of impervious surface to be addressed (3,036 acres of impervious surface). This would indicate that the county is lagging in meeting the 20% impervious surface restoration requirement. Table 10-58 indicates the amount of impervious surface that will be addressed through projects that are either in design or construction and expected to be completed prior to the end of the permit along with the projected annual programs that will be conducted in the final reporting year for the permit.

Table 10-57: Impervious Area Treated Through June 30, 2015

Watershed	BC Impervious	Through 2013	Equivalent Impervious Acres Addressed Under Current Permit				All Imp. Restoration	
			FY 2014	FY 2015	Total	%	Total	Percent
Deer Creek	91.1	0.3	0.1	0.3	0.4	0.4%	0.7	0.8%
Prettyboy	309.9	10.5	1.5	3.2	4.7	1.5%	15.2	4.9%
Loch Raven Reservoir	4,939.0	283.6	11.1	145.0	156.1	3.2%	439.7	8.9%
Lower Gunpowder Falls	1,895.3	262.1	1.6	87.7	89.3	4.7%	351.4	18.5%
Little Gunpowder Falls	434.5	0.8	0.3	9.6	9.9	2.3%	10.7	2.5%
Bird River	2,057.0	293.2	2.3	61.4	63.7	3.1%	356.9	17.4%
Gunpowder River	302.2	28.6	1.4	12.1	13.5	4.5%	42.1	13.9%
Middle River	1,028.2	292.1	12.7	31.9	44.6	4.3%	336.7	32.7%
Liberty Reservoir	347.6	0.3	0.0	2.9	2.9	0.8%	3.2	0.9%
Patapsco River	3,320.0	39.6	1.4	48.9	50.6	1.5%	90.2	2.7%
Gwynns Falls	5,253.2	122.6	32.8	95.8	128.6	2.4%	251.2	4.8%
Jones Falls	2,946.4	191.6	2.5	51.1	53.6	1.8%	245.2	8.3%
Back River	4,795.0	716.4	5.2	140.3	145.5	3.0%	861.9	18.0%
Baltimore Harbor	2,641.6	646.2	42.8	86.1	128.9	4.9%	775.1	29.3%
Restoration Progress through June 30, 2015	**30,361.0**	**2,887.9**	**115.7**	**776.3**	**892.0**	**2.9%**	**3,779.9**	**12.4%**

Table 10-58: Projection of Impervious Surface Addressed for Cumulative Projects Over the Remaining Three Years of the MS4 Permit.

Watershed	Capital Projects!	Reforestation!	OSDS*	DPW!	Redevelopment! &	Watershed A$		Big Tree & Rain Barrel Sales $		Total	
						Annual	3 years	Annual	3 years	Annual	3 years
Deer Creek	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.03	0.09	0.26	0.32
Prettyboy	0.00	3.34	0.00	0.20	0.00	0.80	2.40	0.00	0.00	4.34	5.94
Loch Raven	125.00	9.76	0.81	11.60	0.00	3.80	11.40	0.61	1.83	151.58	160.4
Lower Gunpowder	88.77	10.15	0.81	0.00	0.00	0.05	0.15	0.14	0.42	99.92	100.3
Little Gunpowder	193.50	0.00	0.26	0.00	0.00	0.10	0.30	0.11	0.11	193.97	194.2
Bird River	0.00	1.03	2.73	0.00	0.00	0.45	1.35	0.09	0.09	4.3	5.20
Gunpowder River	0.00	0.00	0.20	0.00	0.00	0.45	1.35	0.04	0.04	0.69	1.59
Middle River	0.00	0.29	0.20	2.10	2.07	0.55	1.65	0.04	0.04	5.25	6.35
Liberty	0.00	4.56	0.00	0.00	0.00	0.30	0.90	0.00	0.00	4.86	5.46
Patapsco River	103.89	1.84	0.62	0.50	0.00	0.10	0.30	0.14	0.14	107.09	107.29
Gwynns Falls	136.26	2.20	0.39	0.00	11.44	0.25	0.75	0.10	0.10	150.64	151.14
Jones Falls	243.30	0.73	0.46	0.00	1.89	0.55	1.65	0.24	0.24	247.17	248.27
Back River	132.16	0.57	0.23	1.10	0.00	0.80	2.40	0.19	0.19	135.05	136.65
Baltimore Harbor	256.68	0.00	10.14	0.00	7.67	1.05	3.15	0.17	0.17	275.71	277.81
Total	**1,279.56**	**34.70**	**16.85**	**15.5**	**23.07**	**9.25**	**27.75**	**1.9**	**3.46**	**1,380.8**	**1,400.9**

! Based on projects under design or construction
* Projected sanitary sewer hook-ups and denitrifying system installation based on FY14 and FY15 progress
& There are likely to be more redevelopment projects than are currently accounted for
$ Based on the average of FY14 and FY15 progress

Based on cumulative restoration projects that are in the either design or construction, and the three year projections for Watershed Association projects and the Big Tree and Rain Barrel Sales programs, the County will achieve an additional 1,400 acres of impervious surface restoration. Other programs that are only credited on an annual basis with only the last year counting for imperious surface restoration, are projected to provide 790 acres of impervious surface restoration credit (Table 10-59).

Table 10-59: Annual Practice Impervious Surface Restoration Credit Projected for the Last Year of the MS4 Permit.

Watershed	Street Sweeping	Storm Drain Cleaning	OSDS Pump-Outs	Total
Deer Creek	0.00	0.00	0.48	0.48
Prettyboy	0.00	0.00	1.50	1.5
Loch Raven	75.25	1.94	23.01	100.2
Lower Gunpowder	43.60	2.23	6.23	52.06
Little Gunpowder	8.20	0.10	4.11	12.41
Bird River	50.05	1.88	0.63	52.56
Gunpowder River	9.00	0.90	0.11	10.01
Middle River	27.00	1.77	0.06	28.83
Liberty	3.35	0.02	3.45	6.82
Patapsco River	72.70	6.48	5.06	84.24
Gwynns Falls	141.95	7.97	3.05	152.97
Jones Falls	43.55	4.31	8.28	56.14
Back River	144.55	12.50	0.12	157.17
Baltimore Harbor	69.60	5.42	0.06	75.08
Total	**688.8**	**45.52**	**56.15**	**790.47**

It is clear, based on the forgoing analysis that Baltimore County will need to identify and implement additional restoration projects to meet the 20% impervious surface restoration requirement of the NPDES – MS4 permit.

10.6 Progress in Meeting Local TMDLs and the Chesapeake Bay TMDL

10.6.1 Local TMDLs

The local TMDL Implementation Plans have now been developed and were submitted to MDE for review and approval with the 2014 annual report. A May 29th, 2015 letter included comments on not only the 2014 annual report, but also the 22 TMDL Implementation Plans submitted with the 2014 annual report. The comments were derived from the review of the plans by both the Water Management Administration and the Science Services Administration. Responses to these comments are provided separately. Revised TMDL Implementation Plans are submitted with this report as appropriate.

Starting with this report we will detail the progress made in meeting the load reductions and interim milestones for each of the local TMDLs. The local TMDL progress reporting will be grouped by broad pollutant type; bacteria (Section 10.6.1.1), nutrients and sediment (Section 10.6.1.2), and toxics (Section 10.6.1.3). The Trash TMDL Implementation Plan is being submitted to MDE for review and approval with this annual report. Future annual reports will report on progress in trash load reductions, however, the reporting will be in Section 6 which covers the trash and litter programs.

10.6.1.1 Bacteria TMDLs

Seven watersheds have Bacteria TMDLs (Prettyboy Reservoir, Loch Raven Reservoir, Liberty Reservoir, Lower North Branch of the Patapsco River, Gwynns Falls, Jones Falls, and Back River (only the Herring Run portion). The initial focus of each the Bacteria TMDL Implementation Plan is to provide monitoring for better resolution of subwatersheds with high bacteria counts, to continue monitoring at the Bacteria Trend Monitoring sites, to continue to implement the requirements of the sanitary sewer Consent Decree, and to develop education and outreach for pet waste bacteria sources. The bacteria monitoring is detailed in Section 9.4.2. The County has completed the first year of the subwatershed bacteria prioritization monitoring and will conduct another round of subwatershed monitoring in 2016. The results of the 2015 subwatershed prioritization monitoring will be presented in the next report and should provide an initial assessment of where bacteria concentrations are the highest.

The progress in meeting the sanitary sewer Consent Decree in relation to the bacteria monitoring is detailed in Section 7.6.2. Currently Baltimore County has a Request for Proposals published for the development of education and outreach materials with a closing date of December 16, 2015. The expectation is that a firm(s) will be selected and have a contract executed sometime in the late winter/early spring of 2016. One of the assignments will be the development of a pet waste education and outreach program. The consultant is also tasked with assessing the effectiveness of the education and outreach program and determining pollutant load reductions as a result of implementing the pet waste education and outreach program.

The trends in the bacteria concentrations for all of the Bacteria TMDL watershed are presented in relation to sanitary sewer repairs if applicable is presented in Table 10-60. The concentrations presented are the geometric means for the seasonal (May 1st – September 30th) dry weather flow. This data was selected for presentation as it represents the most likely condition under which

human recreational contact will occur. Most people will not enter the streams during the colder months nor during times of high water flow as occurs during and immediately after storm events. Section 10 presents the monitoring data for each site under all flow conditions.

Table 10-60: Seasonal Dry Weather Results and Sanitary Sewer System Repairs

Station	Geometric Mean (MPN)			Sanitary Sewer Project Status		% Change Relative to MDE Geometric Mean	
	MDE	2010-2014	2014	Completed	Future	2010-2014	2014
PRE-1	287	315	294	NA	NA	+9.8%	+2.4%
PRE-2	134	153	140	NA	NA	+14.2%	+4.5%
PRE-3	751	240	335	NA	NA	-98.0%	-55.4%
LOC-1	1,080	505	1,043	0	0*	-53.2%	-3.4%
LOC-2	611	384	334	0	2	-37.2%	-45.3%
LOC-3	491	350	258	0	0*	-28.7%	-47.5%
LOC-4	224	148	434	0	0*	-33.9%	-40.2%
LOC-5	168	126	121	NA	NA	-25.0%	-28.0%
LOC-6		85	167	NA	NA		
LIB-1	200	113	86	?	?	-43.5%	-57.0%
LIB-2	172	118	159	?	?	-31.4%	-7.6%
LIB-3	607	437	554	?	?	-28.0%	-8.7%
LIB-4	278	132	173	?	?	-52.5%	-37-8%
LIB-5	427	298	216	?	?	-30.2%	-49.4%
PAT-1	231	278	102	10	1,108	20.3%	-55.8%
PAT-2	117	97	33	9	624	-17.1%	-71.8%
PAT-3	119	107	27	4	361	-10.1%	-77.3%
PAT-4	93	64	33	3	1	-31.2%	-64.5%
PAT-5	134	97	34	NA	NA	-35.1%	-74.6%
GWY-1	35,290	1,526	855	75	150	-95.7%	-97.6%
GWY-2	373	349	314	5	2	-6.4%	-15.8%
GWY-5	636	313	175	75!	150!	-50.8%	-72.5%
GWY-6	743	304	298	1	0	-59.1%	-59.9%
GF-B-8#	NA	NA	NA	6	6		
GF-B-10#	NA	NA	NA	69	149		
JON-1	372	642	706	City	City	+72.6%	+89.8%
JON-2	139	87	113	27	234	-37.4%	-18.7%
JON-3	501	422	549	2	78	-15.8%	-9.6%
JON-4	872	378	305	1	13	-56.7%	-65.0%
JON-5	2,394	264	372	City	City	-89.0%	-84.5%
HER-1	591	503	426	2	265	-14.9%	-27.9%
Biddle	1,920	596	461	0	2	-69.0%	-76.0%
Pulaski	616	528	580	2	274	-14.3%	-5.8%

NA – There are no Baltimore County sanitary sewer systems upstream of the monitoring site
* - The sanitary sewer rehabilitation, repair, replacement plans are not complete yet

Only three stations of the 31 stations exhibited increases in the seasonal dry weather bacteria concentrations relative to the MDE monitoring that was used to develop the bacteria TMDLs.

These three were consistent for both the average over the 5 years of monitoring and in comparison with the monitoring results for 2014. One station exhibited mixed results with the long term average showing a decrease relative to MDE results, but the 2014 indicated an increase. The balance of the stations (27) showed a decrease in the bacteria concentrations by varying amounts; those showing greater than a 25% decrease are highlighted in green. Six of the stations (19%) displayed a geometric mean in the 2014 data that met the water quality standard of 126 MPN for *E. coli*.

10.6.1.2 Nutrient and Sediment TMDLs

Each of the Reservoir watersheds (Prettyboy, Loch Raven, and Liberty) have TMDLs for phosphorous based on the water quality standards for chlorophyll a and hypoliminion dissolved oxygen within the reservoirs. Loch Raven and Liberty reservoirs also have TMDLs for sediment based on the rate of in-filling of the reservoirs. It should be noted that while it is worthwhile to decrease the rate of reservoir infilling in order to preserve the drinking water supply; there is no water quality standard related to the sediment infill of reservoirs.

Three additional watersheds have sediment TMDLs (Lower North Branch of the Patapsco River, and Jones Falls) based on impacts to the aquatic biological community. In addition, Baltimore Harbor has a TMDL for nutrients (both nitrogen and phosphorus) that require nutrient reductions from the Lower North Branch of the Patapsco River, Gwynns Falls, Jones Falls, and Baltimore Harbor direct drainage watersheds. Back River also has a nutrient (nitrogen and phosphorus) TMDL. A summary of the local TMDLs and percent reduction is presented in Table 10:61.

Table 10-61: TMDL Reduction Requirements for Nutrient and Sediment TMDLs

Watershed	Phosphorus		Sediment		Nitrogen	
	#s	%	#s	%	#s	%
Prettyboy	286.1	15%	NA	NA	NA	NA
Loch Raven	2,946.1	15%	716,600		NA	NA
Liberty	3,971.0	49%	2,662,886	38%	NA	NA
LNB Patapsco River	4,633		1,491,236	21.2%	13,843	
Gwynns Falls	5,938		5,539,803	36.4%	33,757	
Jones Falls	7,508		4,378,000	21.9%	14,479	
Baltimore Harbor	1,370		NA	NA	4,615	
Total Baltimore Harbor	19,449	15%	NA	NA	66,694	15%
Back River	653.3	15%	NA	NA	17,821.3	15%

The Baltimore Harbor nutrient TMDL has an overall 15% reductions for nitrogen and phosphorus from urban stormwater sources. To achieve these reductions, the restoration actions are spread over four watersheds. Since three of these watersheds have reductions associated with sediment impacts to the aquatic community and since most restoration actions that reduce sediment also reduce nitrogen and phosphorus, Baltimore County used the sediment TMDL Implementation Plans to determine how much nitrogen and phosphorus would be reduced and adjusted from that baseline if additional reductions were needed.

TMDL Implementation Plans were submitted for each of these TMDLs December 23, 2014. Implementations actions to achieve these local TMDL pollutant reductions, with the exception of Liberty Reservoir, are directly applicable to meeting the Chesapeake Bay TMDL after accounting for delivery factors. Restoration actions with the Liberty Reservoir do not count toward meeting the Bay TMDL as the Watershed Model for the Bay TMDL indicates zero

delivery of pollutants from within Liberty watershed to the bay based on the lack of flow over the Liberty reservoir dam.

The TMDL Implementation Plans accounted for the changes in the amount of urban load due to development, and the amount of restoration actions since the development of each TMDL and adjusted the loads based on the Chesapeake Bay Program loading rates to determine new baseline load reductions needed. These loads are reflected in Table 10-61. The new baseline date for all plans was July 1, 2013. Therefore restoration actions and other reductions that have occurred since that date can be credited toward meeting the reductions needed (ie. fiscal years 2014 and 2015). Load reductions have been summarized by watershed for Fiscal Years 2014 and 2015 in tables 10-51 and 10-52, above respectively. Since the timeline for meeting the reductions for nutrients and sediment were set to coincide with meeting the Bay TMDL reduction targets for nutrients and sediment in 2025, there are 11 fiscal years prior to meeting the deadline, we assumed a steady pace target rate of 9% reduction per year, therefore the target for this second year is 18%. Table 10-62 below summarized Baltimore County's progress in meeting the local nutrient and sediment TMDLs. Those watershed pollutant reductions that are one or exceed the target of 18% reduction are highlighted in green, those that miss the target are highlighted in orange. In the case of Liberty Reservoir both the phosphorus and sediment are highlighted in red due to progress being less than 5%.

Table 10-62: Progress in Meeting the Local Nutrient and Sediment TMDLs to date

Watershed	Target Load Reduction	FY2014 Reductions	FY2015 Reductions	2011 Fert. Use Act	Total Reductions	% of Target
Phosphorus						
Prettyboy	286.1	1.0	1.0	106.9	108.9	38.1%
Loch Raven	2,946.1	6.8	437.0	1,644.1	2,087.9	70.9%
Liberty*	3,971	0.0	7.2	154.9	162.1	4.1%
LNB Patapsco	4,633	0.4	201.7	489.7	1,284.6	27.7%
Gwynns Falls	5,938	141.0	412.1	1,082.5	1,635.6	27.5%
Jones Falls	7,508	0.8	212.6	723.2	936.6	12.5%
Baltimore Harbor	1,370	1.9	404.5	47.5	453.9	33.1%
Total Baltimore Harbor	19,449	144.1	1,230.9	2,713	4,088	21.0%
Back River	653.3	8.2	670.5	857.2	1,535.9	235.1%
Nitrogen						
LNB Patapsco	13,843	21.4	583.5	3,430.2	4,035.1	29.4%
Gwynns Falls	33,757	236.5	1,131.9	7,582.2	8,950.6	26.5%
Jones Falls	14,479	27.8	584.6	5,065.9	5,678.3	39.2%
Baltimore Harbor	4,615	1,838.7	1,058.8	1,724.2	4,621.7	100.1%
Total Baltimore Harbor	66,694	2,124.2	3,358.8	17,802	23,285	34.9%

Back River	17,821.3	86.2	1,703.7	3,540.4	5,330.3	29.9%
Sediment						
Loch Raven	716,600	4,143	189,395	NA	193,538	27.0%
Liberty*	2,662,886	27	2,956	NA	2,983	0.2%
LNB Patapsco	1,491,236	251	61,418	NA	61,669	4.1%
Gwynns Falls	5,539,803	100,337	129,052	NA	229,389	4.1%
Jones Falls	4,378,000	436	64,405	NA	64,841	1.5%

* The Liberty Reservoir watershed nutrient and sediment TMDLs are on a different schedule for completion, as the Liberty Reservoir watershed has no effect on restoration of the Chesapeake Bay. The target for completion of the phosphorus and sediment reductions for the Liberty Reservoir watershed is 2030. This would be an annual target of 6.25% reduction.

Baltimore County is currently on target to meet the nutrient load reductions for meeting local TMDLs. The only watershed that missed the reduction target is Jones Falls for phosphorus, where only a12.5% reductions was achieved. In fact, the Jones Falls reductions are based on the Baltimore Harbor TMDL and based on the reductions achieved in the other watersheds draining to Baltimore Harbor from Baltimore County (21% reduction for phosphorus overall), we are on track to meet the Baltimore Harbor TMDL reductions by 2025.

For the sediment TMDLs, we are missing the targets for in the three watershed that have a sediment TMDL based on impacts to the biological community and in the Liberty Reservoir watershed for which the sediment TMDL is based on the rate of infill of the reservoir.

It should be noted that the higher reductions in in FY 2015 are due, in part, to the inclusion of annual practices, such as, street sweeping and inlet cleaning in the load reductions. These annual practices are anticipated to continue at the present rate of load reductions. Next years' report will include the actual reductions under FY 2016 achievements and the FY2015 will be modified to reflect only those practices that are cumulative in nature. The higher loads reductions in FY2015 are also reflective of the increased pace of restoration in Baltimore County.

Based on the project that are currently in design, under construction, or completed but have not yet had as-builts approved; Baltimore County has calculated the anticipated load reductions over the next two years. These load reductions are presented in Table 10-63 along with the anticipated percentage of necessary reductions achieved. The target reduction through the end of fiscal year 2017 is 36% for the local TMDLs. Those reductions that make the target are highlighted in green, while those that miss are highlighted in orange.

Table 10-63: Anticipated Pollutant Load Reductions for Local TMDLs through FY2017

Watershed	Target Reduction	Reduction through FY15	Projected Reductions FY16-FY17	Total Reductions through FY17	% Reduction
Phosphorus					
Prettyboy	286.1	108.9	3	111.9	39.1%
Loch Raven	2,946.1	2,087.9	892	2,979.9	101.1%
Liberty	3,971	162.1	5	167.1	4.2%
LNB Patapsco	4,633	1,284.6	724	2,008.6	43.4%
Gwynns Falls	5,938	1,635.6	855	2,490.6	41.9%
Jones Falls	7,508	936.6	1,697	2,633.6	35.1%

Baltimore Harbor	1,370	453.9	1,026	1,479.9	108.0%
Total Baltimore Harbor	19,449	4,088	4,301	8,389.0	43.1%
Back River	653.3	1,535.9	831	2,366.9	362.3%
Nitrogen					
LNB Patapsco	13,843	4,035.1	1,108	5,143.1	37.2%
Gwynns Falls	33,757	8,950.6	1,725	10,675.6	31.6%
Jones Falls	14,479	5,678.3	2,167	7,845.3	54.2%
Baltimore Harbor	4,615	4,621.7	1,542	6,163.7	133.6%
Total Baltimore Harbor	66,694	23,285	6,542	29,827.0	44.7%
Back River	17,821.3	5,330.3	1,263	6,593.3	37.0%
Sediment					
Loch Raven	716,600	193,538	774,648	968,186	135.1%
Liberty	2,662,886	2,983	3,153	6,136	0.2%
LNB Patapsco	1,491,236	61,669	924,295	985,964	66.1%
Gwynns Falls	5,539,803	229,389	1,469,035	1,698,424	30.7%
Jones Falls	4,378,000	64,841	1,285,877	1,350,718	30.9%

Over the next two years, restoration progress for nutrients and sediment should be expected to meet 36% of the targeted pollutant reduction goal. In most cases, Baltimore County will reach those goals. Liberty Reservoir watershed will still significantly miss the target. Loch Raven Reservoir watershed will meet and exceed the total target load reduction for phosphorus and sediment. Only future monitoring in the reservoir will determine if the water quality standards have been met.

10.6.1.3 Toxics TMDLs

Toxic local TMDLs include mercury (Prettyboy and Loch Raven Watersheds), chlordane (Back River and Baltimore Harbor) and PCBs (Back River, Baltimore Harbor, and Jones Falls (Lake Roland)). The initial focus of the toxics TMDL Implementation Plans is to conduct monitoring to better target efforts to identify sources.

Mercury: For the mercury TMDLs, Baltimore County is awaiting the results for the 2014 MDE fish tissue monitoring prior to developing monitoring plans. The results of previous fish tissue monitoring indicated that the levels of mercury are below the action level. In fact, Liberty Reservoir has been delisted. Baltimore County is waiting to see if the 2014 results confirm the earlier results. The Healthy Air Act passed by Maryland in 2007 placed stricter mercury air emissions, which have significantly reduced mercury deposition to the reservoir surface and to the watershed.

Chlordane: The TMDL Implementation Plans for Chlordane indicated working with MDE to develop a coordinated fish tissue and bioaccumulation monitoring plan. Baltimore County met once MDE in 2015 to discuss the value of a fish tissue monitoring plan and a bioaccumulation monitoring plan. Baltimore County is still exploring the value of this type of monitoring. The fish tissue monitoring will determine when the endpoint is reached, while the bioaccumulation studies would help target subwatersheds for additional evaluation of sources of chlordane.

Chlordane usage has been banned since 1987, so the monitoring would be looking for historic contamination sites.

PCBs: Similar to the chlordane, PCBs are a banned substance, however, unlike chlordane the use of PCBs may still be occurring through old electrical transformers, PCBs in hydraulic fluid, and in old building materials. PCBs continue to be deposited from the air throughout the world, which may currently be the major source of PCBs. As with chlordane, Baltimore County is exploring fish tissue and bioaccumulation monitoring to target remediation efforts. Based on the literature and the findings from MDE, the bioaccumulation monitoring may not give consistent results and needs to be further evaluated prior to developing a monitoring program.

Baltimore County has explored in situ remediation options that appear to have utility in remediation of sediments, which is the major repository of PCBs from historic contamination. The PCBs in sediment have not been assigned a load reduction, but remediation of sediment may be a more cost effective restoration mechanism than finding and treating PCBs in the watershed.

10.6.2 Chesapeake Bay TMDL

The Chesapeake Bay TMDL was developed in December 2010 and refined in July 2011. The CB TMDL is based on a series of interlinked models. The Watershed Model provides the pollutant loading input into the Chesapeake Bay from the various land uses, septic systems, and point sources. The agricultural sources of pollutant loads will not be addressed in this annual report, nor will actions taken by the State of Maryland or the federal government. For future reports an attempt will be made to include actions taken by the agriculture section, the State of Maryland, and the federal government.

Progress made in meeting the Chesapeake Bay TMDL may be viewed in two fashions; progress in meeting the 2-year milestones (Section 10.6.2.1) and overall load reductions (Section 10.6.2.2).

10.6.2.1 Progress in Meeting the 2-year Milestones

Baltimore County submitted its Phase II Watershed Implementation Plan (WIP) to MDE on July 2, 2012. To view the Baltimore County Phase II WIP, see:
http://www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Documents/FINAL_PhaseII_Report_Docs/Final_County_WIP_Narratives/Baltimore_County_WIPII_2012.pdf

Urban Stormwater Load Reduction Progress – Restoration Milestones: The Baltimore County proposal for the first two sets of 2-year milestones for urban stormwater source nutrient reductions in the Phase II WIP are presented in Table 10-64. This table displays the individual strategies, by milestone years and the proposed amount of action to take place. The expected nitrogen and phosphorus reductions that will result from implementation are presented in Tables 10-65 and 10-66, respectively. The nitrogen and phosphorus reductions are expressed as delivered load.

Table 10-64: 2-year Milestone Targets for Each Restoration Strategy

Strategy	Type*	Units	July 1, 2011 – June 30, 2013 (1st 2-Year Milestones)	July 1, 2013 – June 30, 2015 (2nd 2-Year Milestones)	Total at end of the 2nd 2-year milestone
Stream Restoration	C	feet	63,174	25,800	88,974
Shoreline Erosion Control	C	feet	5,190t	13,067	18,257
SWM Retrofit/Conversions	C	acres	669	675	1,344
Street Sweeping	A	Pounds	Current Rate	Current Rate	Current Rate
Storm Drain Cleaning	A	Pounds	Current Rate	Current Rate	Current Rate
Nutrient Management 1998	A	acres	6,125	NA	
SSO Elimination	C	NA	20% reduction	20% Reduction	40% Reduction
Upland Reforestation	C	acres	20	144	164
Riparian Buffer Reforestation	C	acres	10	45	55
Urban Tree Canopy Planting	C	trees	1,400	1,100	1,500
Redevelopment	C	acres	200	200	400
Watershed Association Projects	C	Pounds	Current Rate	Current Rate	Current Rate

Table 10-65: Expected Nitrogen Reductions through the First 2-Year Milestones

		Nitrogen Reduction		
Strategy	**Type***	**July 1, 2011 – June 30, 2013**	**July 1, 2013 – June 30, 2015**	**Total at end of the 2nd 2-year milestone**
Stream Restoration (Interim Rate)	C	7,165	2,926	10,091
Shoreline Erosion Control	C	830	2,090	2,920
SWM Retrofit/Conversions	C	1,268	1,279	2,547
Street Sweeping	A	4,238	4,238	4,238
Storm Drain Cleaning	A	734	734	734
Nutrient Management 1998	A	4,565	0	4,565
SSO Elimination	C	230	230	460
Upland Reforestation	C	85	612	697
Riparian Buffer Reforestation	C	57	257	314
Urban Tree Canopy Planting	C	59	46	105
Redevelopment	C	915	915	1,830
Watershed Association Projects	C	155	155	310
Total Reductions		***20,301***	***13,511***	***28,811***

Table 10-66: Expected Phosphorus Reductions through the First 2-Year Milestones

		Phosphorus Reduction		
Strategy	**Type***	**July 1, 2011 – June 30, 2013**	**July 1, 2013 – June 30, 2015**	**Total at end of the 2nd 2-year milestone**
Stream Restoration (Interim Rate)	C	4,225	1,725	5,950
Shoreline Erosion Control	C	571	1,438	2,009
SWM Retrofit/Conversions	C	165	1,279	1,444
Street Sweeping	A	1,620	1,620	1,620
Storm Drain Cleaning	A	284	284	284
Nutrient Management 1998	A	204	204	204
SSO Elimination	C	76	76	152
Upland Reforestation	C	3	22	25
Riparian Buffer Reforestation	C	4	18	22
Urban Tree Canopy Planting	C	2	2	4
Redevelopment	C	106	106	212
Watershed Association Projects	C	15	15	30
Total Reductions		***7,275***	***6,789***	***11,956***

The actual implementation of the restoration strategies through FY2014 is presented in Table 10-67. Also included in this table is the percent of target achieved for each strategy. In a number of cases the tracking mechanism has not been developed, but actions have occurred. The table presents the actions completed in the first 2-year milestone period and those completed during the second 2-year milestone period. Included in the Table is the completed, the amount remaining, and the % of the target achieved.

Table 10-67: 2-year Milestone Progress on Restoration Strategies and Percent of Target Achieved

Strategy	Type*	Unit	Combined Target	First 2-year Milestone Complete	Second 2-year Milestone Complete	Total Completed	Remaining	% Target
Stream Restoration (Interim Rate)	C	Feet	88,974	9,600	6,573	16,173	72,801	18.2%
Shoreline Erosion Control	C	Feet	18,257	5,710	0	5,710	12,547	31.3%
SWM Retrofit/Conversions	C	Acres	1,344	305.4	326.9	632.3	711.7	47.0%
Street Sweeping	A	Pounds	Current Rate	Current Rate	Current Rate	NA	NA	NA
Storm Drain Cleaning	A	Pounds	Current Rate	Current Rate	Below Historic Rate	Below Historic Rate	NA	NA
Fertiliser Use Act of 2011	A	Acres	91,200	0	108,287	108,287	0	100.0%
SSO Elimination	C	Pounds	40% reduction	20% reduction	Need to develop tracking mechanism			
Upland Reforestation	C	Acres	164	39.6	74.9	114.5	49.5	69.8%
Riparian Buffer Reforestation	C	Acres	55	10	17.8	27.8	27.2	50.5%
Urban Tree Canopy Planting	C	Trees	1,500	2,046	1,426	3,472	-1,972	231.5%
Redevelopment	C	Acres	400	133.4	41.5	174.9	225.1	43.7%
Watershed Association Projects	C	Pounds	Current rate	> Current Rate	~ Same as Historic Rate	> 2010 Rate	> 2010 Rate	> 2010 Rate

** Not analyzed for FY2014, will be included in next years' report

Tables 10-68 and 10-69 show the progress made by strategy in reduction nitrogen and phosphorus delivered loads, respectively. The load reductions are expressed in delivered loads.

Table 10-68: Progress in the Reduction of Nitrogen by Strategy for the First Two Sets of 2-year Milestone Periods (Delivered Load, #s)

Strategy	Type*	Combined Target	First 2-year Milestone Complete	Second 2-year Milestone Complete	Total Completed	Remaining	% Target
Stream Restoration (Interim Rate)	C	10,091	1,660	250.3	1,910.3	8,180.7	18.9%
Shoreline Erosion Control	C	2,920	909.5	0.0	909.5	2,010.5	31.1%
SWM Retrofit/Conversions	C	2,547	1,725	695.0	2,420.0	127.0	95.0%
Street Sweeping&	A	4,238	0	4,511.4	4,511.4	-273.4	106.5%
Storm Drain Cleaning&	A	734	0	365.7	365.7	368.3	49.8%
Fertilizer Use Act of 2011*	A	4,565	0	23,345	23,345.0	-18,780.0	511.4%
SSO Elimination**	C	460	230	230	460.0	0.0	100.0%
Upland Reforestation	C	697	168	234.1	402.1	294.9	57.7%
Riparian Buffer Reforestation**	C	314	40.2	71.6	111.8	202.2	35.6%
Urban Tree Canopy Planting	C	105	87.7	48.1	135.8	-30.8	129.3%
Redevelopment***	C	1,830	434.1	200.0	634.1	1,195.9	34.7%
Watershed Association Projects	C	310	623.8	142.5	766.3	-456.3	247.2%
Total Reductions		***28,811***	***5,878.3***	***30,093.7***	***35,972.0***	***-7,161.0***	***124.9%***
2017 Reduction Target		***123,608***				***87,636***	***29.1%***

* Expert Panel Report for Urban Nutrient Management indicates a 4.5% reduction in nitrogen for urban pervious cover, effective with the full implementation of the Fertilizer Use Act of 2011.
** The Sanitary Sewer Consent Decree implementation is on track for completion within the timeframe specified by the Decree.
& Annual Practice, only most recent year counts

Table 10-69: Progress in the Reduction of Phosphorus Strategy for the First Two Sets of 2-year Milestone Periods (Delivered Load, #s)

Strategy	Type*	Combined Target	First 2-year Milestone Complete	Second 2-year Milestone Complete	Total Completed	Remaining	% Target
Stream Restoration (Interim Rate)	C	5,950	571.4	289.8	861.2	5,088.8	14.5%
Shoreline Erosion Control	C	2,009	571	0	571	1,438	28.4%
SWM Retrofit/Conversions	C	1,444	329	58.5	387.5	1,056.5	26.8%
Street Sweeping&	A	1,620	0	1,943.3	1,943.3	-323.3	120.0%
Storm Drain Cleaning&	A	284	0	157.3	157.3	126.7	55.4%
Fertiliser Use Act of 2011*	A	204	0	4,546	4,546	-4,342	2228.4%
SSO Elimination**	C	152	76	76	152.0	0.0	100.0%
Upland Reforestation	C	25	5.4	7.5	12.9	12.1	51.6%
Riparian Buffer Reforestation	C	22	5.6	10.0	15.6	6.4	70.9%
Urban Tree Canopy Planting	C	4	2.8	1.6	4.4	-0.4	110.0%
Redevelopment	C	212	51.4	31.2	82.6	129.4	39.0%
Watershed Association Projects	C	30	28.9	7.6	36.5	-6.5	121.7%
Total Reductions		***11,956***	***1641.5***	***7,128.8***	***8,770.3***	***3,185.7***	***73.4%***
2017 Reduction Target		***13,616***				***4,845.7***	***64.4%***

*Expert Panel Report for Urban Nutrient Management indicates a 25% reduction in phosphorus for urban pervious cover, effective with the full implementation of the Fertilizer Use Act of 2011.
** The Sanitary Sewer Consent Decree implementation is on track for completion within the timeframe specified by the Decree.
& Annual Practice, only most recent year counts

As can be seen from Table 10-68 and 10-69, Baltimore County has achieved 125% of the nitrogen target and 73% of the phosphorus target through the first two sets of 2-year milestones. See below for additional reductions that were not included in the original Baltimore County WIP, including difference in the Watershed Model projection of acres of disturbance from construction and the closure of several quarries. There are a significant number of projects that are currently in construction, in design, or ready for construction during the next year. A number of these projects will be used to address the shortfall in the first two sets of 2-year milestones, while the balance will be used to meet the next set of 2-year milestones.

Additional Pollutant Load Reductions Not Specified in the Baltimore County Watershed Implementation Plan or the 2-Year Milestones

While Baltimore County has not achieved its' 2-year milestone targets through the actions identified in the Baltimore County Watershed Implementation Plan, additional reductions have been achieved through other actions; specifically reductions through an overestimate of the amount of land development in the Chesapeake Bay Watershed Model as reflected in MAST and conversion of operating quarries to development with subsequent reductions due to the termination of the associated discharge permits and a lower land use load with stormwater treatment.

Reductions due to overestimate of the amount of land under development: The Chesapeake Bay Watershed Model predicts a certain number of acres to be under development on an annual basis. This data is reflected in the Maryland Assessment Scenario Tool (MAST) based on the July 2011 model run. The actual acres of disturbance is based on the grading permits issued by Baltimore County (acres of disturbance due to State projects are not captured). Table 10-70

displays the actual versus the predicted acres of disturbance, and the difference between the two by watershed.

Table 10-70: Actual Acres of Disturbance versus Predicted Acres of Disturbance (FY2015)

Watershed	Number of Permits	Acres of Disturbance	Model Acres of Disturbance	Difference
Upper Western Shore				
Deer Creek	0	0.0	9.34	-9.3
Prettyboy Reservoir	0	0.0	35.65	-35.7
Loch Raven Reservoir	21	70.2	415.87	-345.7
Lower Gunpowder Falls	10	25.2	212.18	-187.0
Little Gunpowder Falls	3	14.2	16.97	-2.8
Bird River	13	78.1	179.08	-101.0
Gunpowder River	1	1.8	8.57	-6.8
Middle River	10	25.8	0.00	25.8
UWS Totals	**58**	**215.3**	**877.66**	**-662.4**
Patapsco/Back River				
Liberty Reservoir	3	3.17	50.92	-47.8
Patapsco River	15	61.09	237.64	-176.6
Gwynns Falls	28	94.76	331.85	-237.1
Jones Falls	33	36.75	152.77	-116.0
Back River	21	14.3	95.90	-81.6
Baltimore Harbor	4	8.45	0.00	8.5
P/B Totals	**89**	**311.2**	**869.08**	**-650.6**
County Totals	**162**	**433.8**	**1,746.7**	**-1,312.9**

County-wide there were 1,313 fewer acres of disturbance than predicted by the Chesapeake Bay Watershed Model and reflected in MAST. Using the watershed specific per acre loading rates due to construction for nitrogen, phosphorus, and sediment the difference between the model loading and the actual loading was calculated. This difference reflects a reduction in the amount of nitrogen, phosphorus, and sediment loadings in Baltimore County. Tables 10-71 and 10-72 display the analysis for nitrogen and phosphorus, respectively.

Table 10-71: Difference between Modeled and Actual Nitrogen Loading Rates Due to Construction

Watershed	Acres of Disturbance	Model Acres of Disturbance	Difference	Model Load Rates N Delivered Load	Model N Load	FY15 Actual N Load	Difference
Upper Western Shore							
Deer Creek	0.0	9.34	-9.3	18.54	173.16	0.00	-173.16
Prettyboy Reservoir	0.0	35.65	-35.7	1.76	62.74	0.00	-62.74
Loch Raven Reservoir	70.2	415.87	-345.7	2.4	998.09	168.48	-829.61
Lower Gunpowder Falls	25.2	212.18	-187.0	9.02	1,913.86	227.30	-1,686.56
Little Gunpowder Falls	14.2	16.97	-2.8	22.88	388.27	324.90	-63.38
Bird River	78.1	179.08	-101.0	14.91	2,607.08	1,164.47	-1,505.61
Gunpowder River	1.8	8.57	-6.8	17.89	153.32	32.20	-121.12
Middle River	25.8	0.00	25.8	17.89	0.00	461.56	461.56
UWS Totals	**215.3**	**877.7**	**-662.4**		**6,359.53**	**2,378.92**	**-3,980.62**

Watershed	Acres of Disturbance	Model Acres of Disturbance	Difference	Model Load Rates N Delivered Load	Model N Load	FY15 Actual N Load	Difference
Patapsco/Back River							
Liberty Reservoir	3.17	50.92	-47.8	0.00	0.00	0.00	0.00
Patapsco River	61.09	237.64	-176.6	4.86	1,154.93	296.90	-858.03
Gwynns Falls	94.76	331.85	-237.1	4.41	1,463.46	417.89	-1,045.57
Jones Falls	36.75	152.77	-116.0	1.77	270.40	65.05	-205.36
Back River	14.3	95.90	-81.6	6.14	588.83	87.80	-501.02
Baltimore Harbor	8.45	0.00	8.5	17.89	0.00	151.17	151.17
P/B Totals	**218.5**	**869.1**	**-650.6**		**3,477.62**	**1,018.81**	**-2,458.81**
County Totals	**433.8**	**1,746.8**	**-1,313.0**		**9,837.15**	**3,397.72**	**-6,439.43**

Table 10-72: Difference between Modeled and Actual Phosphorus Loading Rates Due to Construction

Watershed	Acres of Disturbance	Model Acres of Disturbance	Difference	Model Load Rates P Delivered Load	Model P Load	FY14 Actual P Load	Difference
Upper Western Shore							
Deer Creek	0.0	9.34	-9.3	3.89	36.33	0.00	-36.33
Prettyboy Reservoir	0.0	35.65	-35.7	0.42	14.97	0.00	-14.97
Loch Raven Reservoir	70.2	415.87	-345.7	1.85	769.36	129.87	-639.49
Lower Gunpowder Falls	25.2	212.18	-187.0	4.09	867.82	103.07	-764.75
Little Gunpowder Falls	14.2	16.97	-2.8	4.31	73.14	51.20	-11.94
Bird River	78.1	179.08	-101.0	4.79	857.79	374.10	-483.69
Gunpowder River	1.8	8.57	-6.8	5.10	43.71	9.18	-34.53
Middle River	25.8	0.00	25.8	5.10	0.0	131.58	131.58
UWS Totals	**215.3**	**877.7**	**-662.4**		**2,663.12**	**809.00**	**1,854.12**
Patapsco/Back River							
Liberty Reservoir	3.17	50.92	-47.8	0.00	0.00	0.00	0.00
Patapsco River	61.09	237.64	-176.6	1.25	297.05	76.36	--220.69
Gwynns Falls	94.76	331.85	-237.1	3.43	1,138.52	325.03	--813.22
Jones Falls	36.75	152.77	-116.0	1.16	177.21	42.63	--134.58
Back River	14.3	95.90	-81.6	5.10	489.09	72.93	--416.16
Baltimore Harbor	8.45	0.00	8.5	5.10	0.00	43.10	43.10
P/B Totals	**218.5**	**869.1**	**-650.6**		**2,101.60**	**560.04**	**-1,541.55**
County Totals	**433.8**	**1,746.8**	**-1,313.0**		**4,764.72**	**1,369.04**	**-3,395.68**

As can be seen from the preceding tables, there were 6,400 fewer pounds of nitrogen, and 3,400 fewer pounds of phosphorus. .

Reductions due to closing of quarries and conversion to development: This information was presented in last years' report, but is applicable to the progress made to date in reducing nitrogen and phosphorus. Two quarries have recently closed and are in the process of being developed, this results in pollutant load reductions due to several factors; elimination of nutrients and sediment due to discharges from the quarry that reflect loads due to quarry operations and change in land use with differential nutrient and sediment loading rates. The two quarries are Greenspring Quarry in Jones Falls and Delight Quarry in Gwynns Falls. Information on the two quarries is provided in Table 10-73. Greenspring Quarry had already terminated its discharge

permit and this is reflected in the Chesapeake Bay Watershed Model, however, the discharge permit for Delight Quarry was still in effect at the time of model development.

Table 10-73: Load Reductions Due to Development of Quarries

Quarry	Discharge Permit			Land Use			Total		
	N	P	TSS	N	P	TSS	N	P	TSS
Quarry Loadings									
Greenspring	NA – not in the model			1,291	205	153,515	1,291	205	153,515
Delight	1,244	444	4,164	653	104	176,847	1,897	548	181,011
Development Loadings									
Greenspring	0	0	0	1,066	57	33,649	1,066	57	33,649
Delight	0	0	0	542	29	38,515	542	29	38,515
Difference									
Greenspring	NA – not in the model			-225	-148	-119,866	-225	-148	-119,866
Delight	-1,244	-444	-4,164	-111	-75	-138,332	-1,355	-519	-142,496
Totals	**-1,244**	**-444**	**-4,164**	**-336**	**-233**	**-258,198**	**-1,580**	**-667**	**-262,362**

The effect of changing land use and retirement of discharge permits for these two quarries results in a reduction of 1,580 pounds of nitrogen and 667 pounds of phosphorus. The reduction is actually greater, as these calculations do not take into account the installation of stormwater management on the development sites. Taking into account these two additional reductions Baltimore County will have exceeded its 2-year milestone targets for nitrogen and phosphorus as displayed in Table 10-74.

Table 10-74: Total Reductions in Relation to Target Reductions

Constituent	Target	Restoration	Reduced Grading	Quarry Development	Total Reductions	Remaining
Nitrogen	28,811	35,972	6,439	1,580	**43,911**	**-15,100**
Phosphorus	11,956	8,770	3,395	667	**12,832**	**-876**

Baltimore County has met and exceeded the nitrogen and phosphorus reduction targets for the first two sets of 2-year restoration milestones. The next set of 2-year restoration milestones (FY16-FY17) will be set based on meeting the 60% reduction for nitrogen and phosphorus from the urban stormwater sector. The milestones will be submitted to MDE by January 30, 2016.

Urban Stormwater Load Reduction Progress – Programmatic Milestones: In addition, to restoration 2-year milestones, programmatic milestones were developed as part of the Baltimore County Phase II WIP. The various programmatic milestones and their status are presented in Table 10-75.

Table 10-75: 2-Year Urban Stormwater Programmatic Milestones and Their Status

Target Date	Milestone	Deliverable	Lead Agency	Comments/Status Updates
Reforestation				
2014	Reforestation: Develop a geo-referenced database for planting project implementation and tracking	GIS data layers and project spreadsheets	EPS, SFM	All reforestation and tree planting projects are being tracked using a geo-referenced database. **Complete**
2014-2015	Rural Reforestation: Establish a new "turf-to-trees" planting program for rural residential subdivisions, following previous grant-funded pilot projects	List/maps of planting sites; right-of-entry agreements for landowners; education/outreach materials for discussion with rural landowner groups; updated project maintenance booklet and training workshop	EPS, SFM	This project type for WIP reforestation has been established. EPS has secured contractors, identified several project sites, coordinated with landowners, and awarded contracts for planting. Rural "turf-to-trees" planting is a continuing program and specific projects are developed for each spring and fall planting season. **Complete**
2014-2015	Urban Tree Planting: Develop a street tree planting program in cooperation with DPW	List/maps of approved street tree planting opportunities	EPS, SFM	The WIP planting program includes street tree projects, which require coordination with DPW if located on public road rights-of-way. EPS continues to identify sites and to work with communities on planting projects.
2014-2015	Urban Tree Planting: Develop a reforestation program for private urban "managed grounds"	List/maps of planting sites and agreements with private owners for planting managed grounds (apartments, condos, businesses, institutions)	EPS, SFM	This project type for WIP reforestation has been established. EPS has secured contractors, identified several project sites, coordinated with landowners, and awarded contracts for planting. Urban tree planting on managed grounds is a continuing program and specific projects are developed for each spring and fall planting season. **Complete**
On-Site Disposal Systems (OSDS)				
2014-2015	Investigate households within the URDL that are indicated as being on OSDS to determine the correctness of the designation	Changes in the Metro databases regarding the designation of type of facility on-site.	EPS, GWM	80% Complete
2014	Improve tracking of OSDS connections to the sanitary sewer	Tracking methodology for crediting connection of existing OSDS to sanitary sewer	EPS, GWM, WMM	With OIT assistance, query was developed to determine when existing properties on OSDS are connected to public sewer. **Complete**
Watershed Planning/Restoration Tracking and Reporting				

Target Date	Milestone	Deliverable	Lead Agency	Comments/Status Updates
2014	Develop TMDL Implementation Plans for local TMDLs	Completed TMDL Implementation Plans submitted to MDE	EPS, WMM	22 TMDL Implementation Plans were developed during 2014 with a public comment period from November 8, 2014 – December 8, 2014. Three public informational meetings were held. The plans were submitted to MDE for review and approval December 23, 2014. Two additional TMDL Implementation Plans were developed for Liberty Reservoir phosphorus and sediment. Trash TMDL Implementation currently under development **Complete**
2014	Develop a Trash Reduction Strategy	Completed Trash Reduction Strategy submitted to MDE	EPS, WMM	A Trash and Litter Reduction Strategy was developed after holding three citizen listening sessions and meeting with appropriate Baltimore County Agencies. A public comment period was held (see above) and the strategy was submitted to MDE for review and approval December 23, 2014 **Complete**
2014-2015	Complete 5 additional Small Watershed Action Plans	Completed SWAPs submitted to MDE	EPS, WMM	Two SWAPs were completed in 2014 (Middle Gwynns Falls and Bird River). Liberty Reservoir SWAP and Loch Raven North SWAP were completed in May 2015 Rural Jones Falls SWAP completed December 2015 **Complete**
2014	Complete Baltimore County's Manual on Pollutant Load Calculations, Pollutant Load Reduction Calculations, Tracking, Validation, and Reporting.	Completed manual to be update annually.	EPS, WMM	The manual is currently development to be completed in 2016
Street Sweep/Storm Drain Cleaning				
2014	Complete purchase of additional equipment	New equipment delivered	DPW, BHEM	3 Vacuum Leaf Loaders delivered March 2014 10 Roll-off containers delivered in March 2014 (storage and weighing of street sweeping debris) 3 Sewer Catch Basin Cleaners "Megawind" delivered Aug. 2014 6 Street Sweepers "Elgin Eagle" 3 delivered in March 2014, 3 in Sept. 2014 Began Leaf Vac. Program Oct. 2014

Target Date	Milestone	Deliverable	Lead Agency	Comments/Status Updates
				Operators received training and began Sewer Catch Basin Cleaning Program Nov. 2014 Street Sweeping Contract for Eastern Balto. Co. began May 2014 Enhanced sweeping county wide began Sept. 2014 **Completed**
Storm Drain Retrofits/Public Facility Restoration				
2014-2015	Continue to work with consultants to identify and prioritize storm drain repairs and retrofits	Completed consultants' reports on storm drain outfall conditions and retrofit opportunities.	DPW, BEC, SDDS	Initiated 11 outfall treatment and storm drains rehabilitation projects, in various locations throughout the County; continue with design and construction of rehabilitation work meant to curtail significant sediment pollution in receiving waterways. **On-going**
2014-2015	Continue to assess public facilities subject to the General Permit for Stormwater Discharges Associated with Industrial Activity	Completed assessment reports, restoration/retrofit designs.	DPW, BEC, SDDS	Installed ESD grade SWM at 17 sites and initiated 12SW facilities compliance program; continue with the 12SW permit mandated inspections and with installation of additional SWM BMP's, for assistance with the MS4 implementation countywide; regular monitoring and maintenance on the SWM facilities already in operation. **On-going**

Table 10-76 presents the progress in meeting the second 2-year milestone for onsite disposal systems.

Table 10-76: Progress in Meeting the First two sets of 2-Year Milestones for OSDS Remediation

Strategy	Target	2011-2013 Milestones	FY2014 – FY2015 Milestones	Total	% of Target
Denitrifying Systems #	80	34	59	93	103.8%
Denitrifying N Reduction (#s)	326	166	176	342	104.9%
Hook-ups to Sanitary Sewer	56	39	140	179	319.6%
Hook-up N Reduction (#s)	882	464	1,964	2,428	275.3%
OSDS Pump-outs	4,500	NA	1,311	1,311	29.1%
Pump-out N Reduction (#s)	268	NA	167	167	62.3%
Total Nitrogen Reduced	**1,476**	**630**	**2,307**	**2,937**	**199.0%**

While we have not achieved some of the OSDS implementation targets in terms of number of pump outs, we have exceeded the number of hook-ups of OSDS to the sanitary sewer and number of denitrifying systems installed. We have also far exceeded the amount of nitrogen reductions, mainly due to the locations of the various improvements being in zones of higher OSDS loading rates and the preponderance of sanitary sewer hook-ups.

11.0 Permit Requirements

G. Program Funding

1. Annually, a fiscal analysis of the capital, operation, and maintenance expenditures necessary to comply with all conditions of this permit shall be submitted as required in PART V below.
2. Adequate program funding to comply with all conditions of this permit shall be maintained. Lack of funding does not constitute a justification for noncompliance with the term of this permit.

PART IV. PROGRAM REVIEW AND ANNUAL PROGRESS REPORTING

A. Annual Reporting

1. Annual progress reports, required under 40 CFR 122.42(c), will facilitate the long-term assessment of Baltimore County's NPDES stormwater program. The County shall submit annual reports on or before the anniversary date of this permit. All information, data, and analyses shall be based on the fiscal year and include:

   c. Expenditures for the reporting period and the proposed budget for the upcoming year.

11.1 SB863 – Financial Assurance Plan Requirements

With the passage of SB863 by the Maryland legislature in the 2015 legislative session and the signature of Governor Hogan on May 12, 2015, the requirement for Phase I MS4 permittees to submit a Financial Assurance Plan became a requirement. This plan is require to be submitted by July 1, 2016 and every two years thereafter. In regards to the financial assurance Plan, SB863 states:

(J) (1) (I) On or before July 1, 2016, and every 2 years thereafter on the anniversary of the date of the issuance of its National Pollutant Discharge Elimination System Phase I Municipal Separate Storm Sewer System permit, a County, including Montgomery County, or municipality shall file with the Department a Financial Assurance Plan that clearly identifies:

1. Actions that will be required of the county or municipality to meet the requirements of its National Pollutant Discharge Elimination System Phase I Municipal Separate Storm Sewer System permit;

2. Projected annual and 5-year costs for the county or municipality to meet the impervious surface restoration plan requirements of its National Pollutant Discharge Elimination System Phase I Municipal Separate Storm Sewer System permit;

3. Projects annual and 5-year revenues or other funds that will be used to meet the costs for the county or municipality to meet the impervious surface restoration plan requirements of its National Pollutant Discharge Elimination System Phase I Municipal Separate Storm Sewer System permit;

4. Any sources of funds that will be utilized by the county or municipality to meet the requirements of its National Pollutant Discharge Elimination System Phase I Municipal Separate Storm Sewer System permit; and

5. Specific actions and expenditures that the county or municipality implemented the previous fiscal years to meet its impervious surface restoration plan requirements under its National Pollutant Discharge Elimination System Phase I Municipal Separate Storm Sewer System permit.

(II) A county or municipality that files a financial assurance plan under subsection (c) (2) of this section shall file on or before July 1, 2016, a financial assurance plan that meets the requirements of paragraph (4) of this subsection.

(2) A financial assurance plans shall demonstrate that the county or municipality has sufficient funding in the current fiscal year and subsequent fiscal year budgets to meet its estimated costs for the 2-year period immediately following the filing date of the financial assurance plan.

(3) A county or municipality may not file a financial assurance plan under this subsection until the local governing body of the county or municipality:

(I) Holds a public hearing on the financial assurance plan; and

(II) Approves the financial assurance plan.

(4) (I) Subject to subparagraphs (II) and (III) of this paragraph, the Department shall make a decision whether the financial assurance plan demonstrates sufficient funding within 90 days after the county or municipality filed the financial assurance plans with the Department.

(II) For a financial assurance plans that is filed on or before July 1, 2016, funding in the financial assurance plan is sufficient if the financial assurance plan demonstrates that the county or the municipality has dedicated revenues, funds, or sources of funds to meet, for the 2-year period immediately following the filing date of the financial assurance plan, 75% of the projected costs of compliance with the impervious surface restoration plan requirements of he county or municipality under its National Pollutant Discharge Elimination System Phase I Municipal Separate Storm Sewer System permit over that 2-year period.

(III) For the filing of a second and subsequent financial assurance plan, funding in the financial assurance plan is sufficient if the financial assurance plan demonstrates tha the county or municipality has dedicated revenues, funds, or sources of funds to meet, for the 2-year period immediately following the filing date of the financial assurance plan, 100% of the projected costs of compliance with the impervious surface restoration plan requirements of the county or municipality under its National Pollutant Discharge Elimination System Phase I Municipal Separate Storm Sewer System permit over the 2-year period.

11.2 Maryland Department of the Environment – Guidance for the Financial Assurance Plan Preparation

Maryland Department of the Environment released draft guidance for the preparation of the Financial Assurance Plan on December 18, 2015, in the form of written guidance and spreadsheets that will need to be populated with data and submitted. MDE plans to finalize the guidance and spreadsheets after a meeting with the NPDES – MS4 Phase I jurisdictions in January 2016.

Baltimore County feels that given the changes required as a result of passage of SB863 that submission of fiscal data beyond FY2016 is premature. Baltimore County is currently in the process of preparing the Financial Assurance Plan as part of the budget for fiscal year 2017, but as yet has insufficient information to submit detail financial information as part of this report. Any information submitted for future year funding would be speculative at this point and would usurp the prerogative of the County Executive and the County Council in the preparation of the budget.

The fiscal year 2016 adopted budget is available on-line and consists of the following components:

FY16 Adopted Operating and Capital Budget:
http://resources.baltimorecountymd.gov/Documents/Budget/16budget/fy16adoptedoperatingcapitalbudget.pdf

FY16 Adopted Operating Budget Supporting Detail:
http://resources.baltimorecountymd.gov/Documents/Budget/16budget/fy16operatingbudgetsuppportingdetail.pdf

FY16 Adopted Capital Budget Supporting Detail:
http://resources.baltimorecountymd.gov/Documents/Budget/16budget/fy16capitalbudgetsupporting.pdf

The operating budget for FY16 is a total of $7,433,270. Table 11-1 presents detail of the FY14 – FY16 operating budgets.

Table 11-1: Summary of Operating Budget for Fiscal Year 2016

Description	Actual 2014	Appropriated 2015	Budget 2016
01 Personnel Services	$5,418,146	$6,067,249	$5,646,462
02 Mileage & Travel	$10,350	$23,000	$22,100
03 Contractual Services	$301,892	$1,483,402	$864,743
04 Rents & Utilities	$261,284	$278,193	$288,088
05 Supplies & Materials	$95,717	107,340	$116,900
07 Grants, Subsidies, Contributions	$229,469	$467,698	$248,719
08 Other Charges	$60,248	$2,500	$246,258
09 Land, Bldg, Other Improvements	$479,643	$0	$0
Total Expenditures	**$6,856,749**	**$8,429,382**	**$7,433,270**
Original General Fund Appropriation	$5,112,590	$5,157,921	$4,926,569
General Fun Approp Trans/Supplement	$124,775	0	
Adjusted General Fun Appropriation	$5,237,365	$5,157,921	$4,926,569
Special Fund Authorization – Fund 005	$677,425	$626,421	$698,451
Special Fund Authorization – Fund 006	$2,557,566	$2,645,040	$1,808,250
Total Expenditure Authorization	$8,472,356	$8,429,382	$7,433,270
Less: Unexpended balance	-$1,615,607		
Expenditure Totals	**$6,856,749**	**$8,429,382**	**$7,433,270**
Authorized Positions – Full Time	84	84	79
Authorized Positions – Part Time	13	11	12
Full Time Equivalents – Total	82.2	96.71	92.69

Table 11-2 provides a summary of the Department of Environmental Protection and Sustainability capital program as passed by the County Council for fiscal year 2016. Only the prior authorizations and fiscal year 2016 information is provided. The capital budget for future years will be provided in the Financial Assurance Plan to be submitted by July 1, 2016.

Table 11-2: Summary of Capital Budget – FY2016 and Prior Authorizations

Title	Prior Authorizations	FY 2016	Total Through 2016
Watershed Restoration	$6,721,234	$831,000	$7,552,234
Lower Gunpowder Watershed	$7,767,159	$200,000	$7,967,159
Gunpowder River Watershed	$2,849,449	$100,000	$2,949,449
Patapsco River Watershed	$1,102,794	$250,000	$1,352,794
Gwynns Falls Watershed	$7,667,428	$1,415,000	$9,082,428
Jones Falls Watershed	$6,945,412	$350,000	$7,295,412
Back River Watershed	$14,704,802	$200,000	$14,904,802
Environmental Management	$9,119,356	$710,000	$9,829,356
Stormwater - Restoration and Retrofit	$10,441,372	$5,377,450	$15,818,822
Stormwater – Planning & Monitoring	$1,056,472	$701,472	$1,757,944
Stormwater – Sustainability	$1,348,400	$66,700	$1,415,100
Community Conservation	$3,744,508	$100,000	$3,844,508
Totals	**$73,468,386**	**$10,301,622**	**$83,770,008**