BALTIMORE CITY

MS4 ANNUAL REPORT

Reporting Period: July 1, 2016 to June 30, 2017

CATHERINE E. PUGH
MAYOR

BALTIMORE CITY
DPW
DEPARTMENT OF PUBLIC WORKS

RUDOLPH S. CHOW, P. E.
DIRECTOR

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1 Introduction

This report includes the progress of compliance for the period of Fiscal Year (FY) 2017, in association with Baltimore City's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit (Permit Number: 11-DP-3315, MD0068292). The current permit was issued on December 27, 2013. Annual report periods follow the City's fiscal calendar: July 1 to June 30. This Annual report has been formatted to match the reporting requirements as listed in Part V of the permit.

1.1 Permit Administration

Designation of individual to act as a liaison between the City and the Maryland Department of Environment (MDE) for the implementation of this permit:

Kimberly L. Grove, P.E.
Chief, Office of Compliance and Laboratories
3001 Druid Park Drive, Rm 232
Baltimore, MD 21215
410-396-0732
Kimberly.grove@baltimorecity.gov

Two organization charts (as of June 30, 2017) are provided in Appendix A of this report:

- City agency organization chart with designations of MS4 permit condition responsibilities.
- DPW organization chart.

In December 2016, Catherine Pugh took office as the Mayor of the City of Baltimore. Also in FY 2017, new directors were appointed for the Departments of Transportation (Michelle Pourciau) and Recreation and Parks (Reginald Moore). Baltimore Housing (a quasi-federal government agency) was re-organized and split into a local government agency (Baltimore City Department of Housing and Community Development, DHCD) and a federal government agency (Housing Authority of Baltimore City). Michael Braverman was appointed the Commissioner of DHCD.

Within the Department of Public Works, the Bureau of Solid Waste was re-organized by dissolving some of the Divisions currently organized by function and reassembling them geographically. The Routine Services, Special Services and Property Management Divisions were disassembled and re-organized into four new divisions, each assigned to a quadrant of the City: Northwest, Northeast, Southwest and Southeast. By shrinking the responsible area and increasing the range of resources available, Quadrant Chiefs obtained the ability to better respond to sanitation problems involving multiple issues.

1.2 Legal Authority

The City maintained adequate legal authority in accordance with NPDES regulations 40 CFR 122.26(d) (2) (i) during FY 2017.

2 Implementation Status

Table 2-1 is a summary of the status for implementing the components of the stormwater management program that are established as permit conditions.

Table 2-1: Summary of Implementation Status

Permit Condition	Component	Due	Status as of June 30, 2017
Part IV.C. Source Identification	GIS Data	Annual report	Baltimore City transitioned the source identification to the MS4 Geodatabase. See Table 2-2 for details.
Part IV.D.1 Stormwater Management	Identification of problems and modifications of ESD to MEP	Annual report	No problems identified during this reporting period.
	Modification to ordinances to eliminate impediments to ESD to MEP	Annual report	No modifications were initiated during this reporting period.
Part IV.D.2 Erosion and Sediment Control	Responsible personnel certification 3 / year	Annual Report	The City's program was replaced by MDE's on-line program.
	Inventory of projects > 1 acre	Initial 4/1/14 then quarterly	Included in Appendix C.
Part IV.D.3 Illicit Discharge Detection and Elimination	Alternative program for MDE submittal	12/27/14	The City is using the same alternative analysis (Ammonia Screening) as reported since 1998. Results are discussed in Section 5.3. Results are provided in Appendix I.
	Annual visual surveys of commercial / industrial areas	Annual	See Section 5.3.
Part IV.D.4 Trash and Litter	Inventory and evaluation all solid waste operations	12/27/14	Submitted part of *Public Outreach Strategy for trash and Litter Programs for the City of Baltimore*, submitted February 20, 2015.
	Public education and outreach strategy	12/27/14	See Section 5.5.
	Evaluation of effectiveness of education program	Annual Report	See Section 5.5.
Part IV.D.5 Property Management and Maintenance	NOIs and SWPPPs submitted for NPDES stormwater general permit coverage for industrial permits	6/30/14	NOIs and SWPPPs were submitted for the City's solid waste facilities, fleet maintenance facilities, and wastewater treatment plants.
	Alternative maintenance program	12/27/14	No alternative maintenance program is being proposed.

Permit Condition	Component	Due	Status as of June 30, 2017
Part IV.D.6 Public Education	Maintain a compliance hotline for water quality complaints	Annual Report	2 new customer service requests to 3-1-1 system were added in November 2014. See Sections 5.2 and 5.3.
Part IV.E.1 Watershed Assessment	Detailed watershed assessments of entire City	12/27/18	Updated assessments for Baltimore Harbor and North Lower Branch of Patapsco Watersheds continued.
Part IV.E.2 Restoration Plans	Impervious surface assessment consistent with MDE methods = baseline	12/27/14	MDE approved the baseline impervious area on July 28, 2015. See Section 6 for more details.
	Restoration of 20% of City's impervious surface area	12/27/18	
	Restoration Plan for each WLA approved by EPA prior to the effective date of the permit	12/27/14	
	Restoration Plan for of subsequent TMDL WLA	One year of approval	*Implementation Plan for the Middle Branch / Northwest Branch TMDL in Baltimore City was submitted on January 4, 2016. MDE provided comments on April 1, 2016. Comments are addressed in Section 6.6.3.*
Part IV.E.4. TMDL Compliance	Annual assessment to evaluate the effectiveness of the City's restoration plans	Annual Report	See Section 6.
Part IV.F. Assessment of Controls	Continue assessments	Annual Report	See Appendices C and F-G.
Part IV.G. Program Funding	Fiscal analysis of the capital, operation, and maintenance expenditures necessary to comply with all conditions of this permit	Annual Report	See Section 4 and Appendix H.

In Fiscal Year 2017, Baltimore City continued the migration of the source identification data to a prescribed geodatabase, per MDE's NPDES MS4 Geodatabase Design and User's Guide, dated March 2015. A summary of the migration efforts are provided in Table 2-2. The geodatabase also included rules for completed records related to mandatory fields. As a short-term solution to complete the database, Baltimore City used designated values as a "null" value. These values are listed in Appendix B.

Table 2-2: Summary of MDE Geodatabase Migration

Title	Type	Status	Notes
Permit Administration			
Permit Info	AT	Complete	
Source Identification			
Outfall	F - PT	Partial	Outfall inventory in progress.
Outfall Drainage Area	F - PG	Complete	
BMP POI	F - PT	Partial	See schedule in Table 2-3.
BMP	AT	Partial	See schedule in Table 2-3.
BMP Drainage Area	F – PG	Partial	See schedule in Table 2-3.
Impervious Surface	AT	Complete	Based on WIP Progress Tables (Appendix K)
Monitoring Site	F - PT	Complete	
Monitoring Drainage Area	F	Complete	
Alt BMP Line	F - L	Complete	
Str Rest Protocols	AT	Complete	
Shoreline Management Practices	AT	NA	
Alt BMP Point	F – PT	NA	Septic systems are not relevant to Baltimore City.
Alt BMP Poly	F – PG	Complete	Street sweeping shown as 8-digit and frequency. Tree planting for FY 17 only shows trees planted up to December 2016.
Rest BMP	F – PT	Complete	Includes redevelopment projects
Management Programs			
Stormwater Management	AT	Complete	
BMP Inspections		Complete	
Alt BMP Line Inspections	AT	Complete	See Appendix G.
Alt BMP Point Inspections	AT	NA	Septic systems are not relevant to Baltimore City.
Alt BMP Poly Inspections	AT	Complete	Street Sweeping inspections completed same day by supervisors; weight tickets are recorded same day. Tree planting is spot checked by Tree Baltimore.
Rest BMP Inspections	AT	Complete	
Erosion Sediment Control	AT	Complete	
Quarterly Grading Permits	AT	Complete	
Quarterly Grading Permit Info	AT	Complete	
Responsible Personnel Certification Information	AT	NA	Referred to MDE on-line training.
IDDE	AT	Complete	Based on PST investigations completed in FY 2016
Municipal Facilities	F – PT	Complete	
Chemical Application	AT	Complete	
Restoration Plans and Total Maximum Daily Loads			

Title	Type	Status	Notes
County Wide Watershed Assessments	AT	Complete	
Local Stormwater Watershed Assessments	AT	Pending	Still pending method of assessing current loads for PCBs and bacteria. Anticipate for FY 2018
Assessment of Controls			
Chemical Monitoring	AT	Complete	
Local Concern	AT	NA	
Biological Monitoring	AT	Complete	
Program Funding	AT	Complete	
Narrative Files	AT	Complete	

Note: F – PT= Feature class with point type shape files; F – PG= Feature class with polygon type shape files; F – L: Feature class with line type shape files; AT = Associated Table

Past MS4 annual reports concentrated on reporting constructed and inspected BMPs which provided qualitative control and therefore would be counted in reference to the City's baseline impervious area or restoration goal. This methodology did not provide the full picture of all BMPs that have been installed in the City as part of private development. Given the challenges of depending on as-built plan submittals from developers, a work group of MS4 managers continue to evaluate alternative as-built certification processes in order to accurately account for BMPs within a jurisdiction. The proposed methodology was submitted to MDE in December 2016.

The FY 2016 Annual Report (Table 2-3) estimated that 711 BMPs were approved between 2005 and 2015. During FY 2017, DPW continued to update the MS4 geodatabse (Appendix C) for both as-built submittals and those approved project plans. Until an alternative methodology for as-built plans is approved, only those facilities with approved as-built plans show an implementation status of "Complete". Redevelopment projects which included impervious area removal were not included in the Geodatabase but will be incorporated for the FY 2018 Annual Report.

3 Narrative Summary of Data

3.1 Stream Impact Sampling

DPW continued the Stream Impact Sampling program, which now includes monthly sampling at 33 outfall or stream locations. A new station- JF 11.5 in the Jones Falls watershed was added in January 2016. The sampling at the Central & Lancaster station had to be suspended after December 2016 because construction in the area blocked access to the station; sampling will resume there as soon as the station is accessible. The SIS program was initiated in 1997; the results are available on-line at the City's website and updated quarterly. The sampling program includes sampling results for nutrients, sediment, bacteria, metals and other health indicators. The results of the sampling events for this reporting period are included in Appendix D.

3.1.1 Nutrient Monitoring

During FY 2017, 366 samples were analyzed for nutrients as part of the City's SIS program. Table 3-1 shows the evaluation of historic nutrient analysis (2009 through the reporting period), following a concept that the State used in its Maryland Water Quality Inventory, 1993-1995. A water quality level was assigned for each station's sample sets compared to a prescribed threshold for each parameter: "normal" if the percentage was less than 11%; "elevated" if it was between 11% and 25%; and "high" if it was greater than 25%. This assignment is color coded for the cumulative data set in Table 3-1.

Five (5) stations showed no results above the prescribed threshold for total phosphorus (0.1 mg/L); 4 of these stations also showed no results above the prescribed threshold for total nitrogen (3.0 mg/L). A total of 16 stations showed no results above the prescribed threshold for total nitrogen; 11 of those stations have had similar results for the last 3 reporting periods (July 2014 to June 2017). This means that one-third of the SIS stations have shown three years of sampling results below 3.0 mg/ L for total nitrogen.

Four (4) stations showed sampling results in FY 2017 for total phosphorus which resulted in the water quality level assignment for the cumulative data set to change from high to elevated, indicating an improvement of water quality. Twenty-one (21) stations showed the portion of results for FY 2017 being lower than the cumulative set through FY 2016, also indicating an improvement of water quality.

Comparing the percentage of samples exceeding the prescribed threshold for FY 2017 to the cumulative set through FY 2016, the following 7 stations showed results that could indicate worsening conditions:

- Chinquapin Run (Back River, Herring Run sub-watershed): The sampling results (increased total nitrogen and total phosphorus) appear to continue from FY 2016, when a sanitary sewer overflow (SSO) was identified. Corrective actions for the SSO stated in May 2016 but abatement was not finally confirmed until June 2017. In addition to the abatement actions, DPW has proposed a re-alignment of the contributing sanitary sewer interceptor, plus a stream restoration project. Construction of this proposed project is scheduled for FY 2018.
- Hamilton (Back River, Moores Run sub-watershed): The sampling results showed an increase of sampling events above the threshold for total nitrogen; however, the geometric mean of the

results decreased from FY 2016 (3.58 mg /L) to FY 2017 (3.09 mg /L). Furthermore, as shown in the Section 3.1.2.1 of this report, the annual geometric means of the e. coli counts have generally gone down at this station since FY 2012.

- Powder Mill (Gwynns Run watershed): Although this station has shown two years of results all being below the threshold for total nitrogen, the amount of samples above the threshold for total phosphorus has remained the same since FY 2016. The geometric mean for the results since June 2014 have just been below 0.10 mg /L for total phosphorus; the maximum total phosphorus result for this station in FY 2017 was only 0.14 mg / L. A stream restoration and sanitary pipe rehabilitation project is scheduled for this location in FY 2018.
- Gwynns Run Carroll Park (Gwynns Run watershed): The sampling results showed an increase of sampling events above the threshold for total phosphorus. Although the geometric mean of the results increased from FY 2016 (0.08 mg /L) to FY 2017 (0.107 mg /L), the overall trend of this station is improving since 2011 when total phosphorus measurements were on the order of 0.5 mg /L.
- Linwood and Elliot (Baltimore Harbor watershed): For a second consecutive year, this station encountered all sampling results above the threshold for total nitrogen; however, the geometric mean of the results decreased from FY 2016 (4.58 mg /L) to FY 2017 (3.66 mg /L). Although the portion of samples with results above the threshold for total phosphorus increased in FY 2017, the geometric mean per fiscal year has steadily decreased from FY 2015 (0.12 mg / L) to FY 2017 (0.11 mg / L).
- Lakewood & Hudson (Baltimore Harbor watershed): Also known as Harris Creek. This station has shown an increased in the portion of sampling results above the threshold for both nutrients. Since 2009, the 10-foot stormwater tunnel has encountered several failures and subsequent major respairs, specifically in the portion underneath Monument Street. Although the portion of samples with results above the threshold for total phosphorus increased in FY 2017, the geometric mean per fiscal year has decreased from FY 2015 (0.12 mg / L) to FY 2017 (0.09 mg / L).
- Waterview Avenue (Baltimore Harbor watershed): The sampling results showed an increase of sampling events above the threshold for total nitrogen; however, the geometric mean of the results decreased from FY 2016 (2.65 mg /L) to FY 2017 (2.61 mg /L) and remain below the threshold of 3.0 mg / L.

Table 3-1: Summary of Nutrient Analysis for SIS Program

Station	Percent of Samples Total Phosphorus >=0.1 mg/L			Percent of Samples Total Nitrogen >=3 mg/L		
	1/2009 – 6/2017	7/2016 – 6/2017	1/2009 – 6/2016	1/2009 – 6/2017	1/2009 – 6/2017	1/2009 – 6/2017
Back River Watershed Herring Run Sub-watershed						
PERRING PKWY	17%	0%	19%	4%	10%	3%
MT. PLEASANT GC	25%	0%	29%	8%	0%	9%
CHINQUAPIN RUN	27%	60%	22%	26%	40%	24%
TIFFANY RUN	13%	0%	14%	3%	0%	4%
HARFORD RD.	18%	10%	19%	5%	0%	5%
WRIGHT AVE.	25%	20%	26%	1%	0%	1%
PULASKI HWY.	13%	0%	14%	6%	0%	6%
Back River Watershed Moores Run Sub-watershed						
MARY AVE.	36%	0%	41%	15%	10%	16%
HAMILTON AVE.	38%	55%	35%	50%	73%	47%
RADECKE AVE.	22%	9%	24%	11%	9%	12%
BIDDLE ST. & 62ND ST.	33%	10%	36%	1%	0%	1%
Jones Falls Watershed						
SMITH AVE.	24%	8%	27%	3%	0%	4%
WESTERN RUN	24%	17%	26%	3%	0%	4%
STONY RUN	22%	8%	24%	26%	17%	28%
JF 11.5 [1]	89%	92%	83%	94%	92%	100%
LOMBARD ST.	29%	17%	31%	6%	0%	7%
Gwynns Falls Watershed						
POWDER MILL	33%	42%	31%	10%	0%	12%
PURNELL DR.	23%	9%	25%	1%	0%	1%
DEAD RUN DNST.	29%	8%	32%	1%	8%	0%
GWYNNS FALLS PKWY.	32%	8%	35%	10%	8%	10%
GRUN HILTON ST.	33%	8%	37%	10%	8%	11%
GF HILTON ST.	26%	0%	30%	0%	0%	0%
MAIDENS CHOICE	26%	17%	27%	6%	0%	6%
GRUN CARROLL PARK	57%	58%	56%	47%	42%	48%
WASHINGTON BLVD.	26%	17%	27%	2%	0%	3%
Baltimore Harbor Watershed						
LINWOOD & ELLIOTT [2]	51%	60%	49%	87%	100%	84%
LAKEWOOD & HUDSON [2]	39%	36%	40%	76%	82%	74%
CENTRAL & LANCASTER [3]	48%	50%	48%	16%	17%	16%
LIGHT ST.	39%	33%	40%	14%	17%	13%
WARNER & ALLUVION	48%	42%	49%	18%	17%	19%
WATERVIEW AVE.	28%	8%	30%	14%	25%	13%

Station	Percent of Samples Total Phosphorus >=0.1 mg/L			Percent of Samples Total Nitrogen >=3 mg/L		
	1/2009 – 6/2017	7/2016 – 6/2017	1/2009 – 6/2016	1/2009 – 6/2017	1/2009 – 6/2017	1/2009 – 6/2017
JANEY RUN	29%	8%	33%	11%	0%	12%
Patapsco River Watershed						
REEDBIRD AVE.	31%	8%	34%	9%	0%	10%
[1] Sampling began at JF 11.5 in January 2016.						
[2] Sampling began at LINWOOD & ELLIOTT and LAKEWOOD & HUDSON in March 2013.						
[3] No samples have been collected at the CENTRAL & LANCASTER station since January 2017 because access to the station has been blocked by construction.						
Key						
	Normal: <= 11% of Samples					
	Elevated: Between 11-25% of Samples					
	High: >25% of Samples					

3.1.2 Bacteria Monitoring

3.1.2.1 E. Coli Monitoring

DPW measures fecal bacteria with e. coli most probable number (MPN) counts at twenty-four (24) stations. Table 3-2 lists the percentage of surface water dry weather grab samples collected from November 2008 to June 2017, with a reference to the prescribed thresholds for recreation for each freshwater sampling station. A high percentage means that the water is suitable for use for recreation.

Four (4) stations have a history of at least 50% of the e. coli counts below the frequent full body contact rule. One station, Smith Avenue in the Jones Falls watershed, has the best record with 77% of results below the frequent full body contact rule. Thirteen (13) stations have a history of at least half of the e. coli counts below the infrequent full body contact rule, with 3 of those stations having at least 75% of the counts below that rule.

Some stations remain at a high risk for recreation. Six (6) stations have had their counts below the frequent full body contact rule less than 10% of the time:

- Chinquapin Run: results are impacted by an SSO previously discussed in Section 3.1.1 of this report. FY 2017 geometric mean was on the order of 1,868 MPN/ ml, which is less than measured in FY 2016.
- Gwynns Run Hilton Street: results show a steady increase over the last 4 years. Measurements spiked in January. FY 2017 geometric mean was on the order of 1,197 MPN/ ml.
- Gwynns Run Carroll Park: results are consistent with measurements in FY 2014 and 2015, but increased from FY 2016. Three measurements exceeded 24,196 MPN/ ml. Two leaking sanitary sewer pipes were found and repaired in this station's drainage area in October and November

2016. FY 2017 geometric mean was on the order of 8,964 MPN/ ml. This station has the highest recorded concentrations.

- Washington Boulevard: results showed a significant increased since FY 2016. FY 2017 geometric mean was on the order of 5,206 MPN/ ml.
- Hamilton: results are consistent with measurements in 2015, but increased from FY 2016. FY 2017 geometric mean was on the order of 1,165 MPN/ ml.
- JF 11.5: this is an added station, located at the outfall of the structured sanitary sewer overflow. FY 2017 geometric mean was on the order of 6,474 MPN/ ml.

Appendix E contains three sets of bar graphs for each SIS station for each fiscal year from FY 2010 through FY 2017: the geometric mean of the sample counts; the percentage of sample counts that were at or below the frequent full body contact rule; and the percentage of sample counts that were at or below the infrequent full body contact rule. The percentage of counts at or below the infrequent full body contact rule has decreased for each of the past three fiscal years at the Redecke Avenue station: decreasing from 70% down to 18%.

Table 3-2: Summary of E. Coli Sampling for SIS Program

Station Name	Percent <= Frequent Full Body Contact Recreation (235 MPN/100 ml)			Percent <= Infrequent Full Body Contact Recreation (576 MPN/100 ml)		
	11/2008 – 6/2017	7/2016 – 6/2017	11/2008 – 6/2016	11/2008 – 6/2017	7/2016 – 6/2017	11/2008 – 6/2016
Back River Watershed Herring Run Sub-watershed						
PERRING PKWY	30%	30%	29%	49%	50%	49%
MT. PLEASANT GC	35%	40%	35%	48%	60%	46%
CHINQUAPIN RUN	26%	10%	29%	48%	30%	51%
TIFFANY RUN	48%	60%	47%	67%	60%	68%
HARFORD RD.	28%	40%	27%	52%	50%	52%
WRIGHT AVE.	33%	40%	32%	52%	50%	52%
PULASKI HWY.	43%	40%	43%	64%	60%	65%
Back River Watershed Moores Run Sub-watershed						
MARY AVE.	6%	20%	4%	17%	20%	17%
HAMILTON AVE.	9%	9%	9%	20%	18%	20%
RADECKE AVE.	13%	18%	13%	36%	18%	38%
BIDDLE ST. & 62ND ST	31%	20%	33%	52%	50%	52%
Jones Falls Watershed						
SMITH AVE.	77%	83%	76%	84%	92%	83%
WESTERN RUN	28%	50%	24%	60%	75%	58%
STONY RUN	54%	50%	55%	82%	75%	83%
JF 11.5 [1]	6%	8%	0%	6%	8%	0%
Gwynns Falls Watershed						
POWDER MILL	22%	33%	20%	47%	42%	48%

Station Name	Percent <= Frequent Full Body Contact Recreation (235 MPN/100 ml)			Percent <= Infrequent Full Body Contact Recreation (576 MPN/100 ml)		
	11/2008 – 6/2017	7/2016 – 6/2017	11/2008 – 6/2016	11/2008 – 6/2017	7/2016 – 6/2017	11/2008 – 6/2016
PURNELL DR.	25%	25%	25%	54%	42%	56%
DEAD RUN DNST.	52%	58%	51%	77%	83%	77%
GWYNNS FALLS PKWY.	59%	75%	57%	73%	75%	73%
GRUN HILTON ST.	9%	8%	9%	27%	42%	25%
GF HILTON ST.	41%	50%	40%	63%	75%	61%
MAIDENS CHOICE	36%	42%	35%	60%	58%	61%
GRUN CARROLL PARK	2%	0%	3%	2%	0%	3%
WASHINGTON BLVD.	2%	0%	3%	12%	0%	14%
[1] Sampling began at JF 11.5 in January 2016.						

DPW measures fecal bacteria with enterococci most probable number (MPN) counts at nine (9) stations. Samples for enterococci counts are collected at these stations twice per month. Table 3-3 lists the percentage of surface water dry weather grab samples collected from November 2008 to June 2017, with a reference to the prescribed thresholds for recreation for each sampling station.

Some stations remain at a high risk for recreation. Four (4) of the stations showed results at or below the frequent full body contact rule for less than 10% of the counts; the station at Linwood & Elliot also showed counts at or below the infrequent full body contact rule for less than 10% of the counts.

Comparing the counts from FY 2017 to the accumulation of counts through FY 2016, four stations (4) had a large increase (improving water quality) in the percentage of counts at or below the frequent full body contact rule; and one station (Lakewood & Hudson) had a decrease with 0% for FY 2017 compared to the historic level of 12%. Five (5) stations had a large increase in the percentage of counts at or below the infrequent full body contact rule.

Appendix E contains three sets of bar graphs for each SIS station for each fiscal year from FY 2010 through FY 2017: the geometric mean of the sample counts; the percentage of sample counts that were at or below the frequent full body contact rule; and the percentage of sample counts that were at or below the infrequent full body contact rule. Light Street station had its best year to date in FY 2017 with 73% of counts at or below the frequent full body contact rule.

Table 3-3: Summary of Enterococci Sampling for SIS Program

Station	Percent <= Frequent Full Body Contact Recreation (104 MPN/100 ml)			Percent <= Infrequent Full Body Contact Recreation (500 MPN/100 ml)		
	1/2009 – 6/2017	7/2016 – 6/2017	1/2009 – 6/2016	1/2009 – 6/2017	7/2016 – 6/2017	1/2009 – 6/2016
Patapsco River Watershed						
REEDBIRD AVE.	48%	68%	45%	71%	86%	69%
Baltimore Harbor Watershed						
WATERVIEW AVE.	27%	41%	25%	63%	73%	61%
WARNER & ALLUVION	7%	14%	6%	31%	50%	29%
LIGHT ST.	46%	73%	42%	74%	91%	72%
CENTRAL & LANCASTER [1]	11%	38%	8%	38%	62%	36%
LAKEWOOD & HUDSON [2]	9%	0%	12%	24%	29%	22%
LINWOOD & ELLIOTT [2]	1%	0%	1%	8%	5%	9%
JANEY RUN	36%	36%	36%	62%	64%	62%
Jones Falls Watershed						
LOMBARD ST.	9%	9%	9%	37%	59%	34%

[1] We were not able to sample at CENTRAL & LANCASTER mid-February through June 2017 because of construction in the area.

[2] Sampling began at LINWOOD & ELLIOTT and LAKEWOOD & HUDSON in March 2013.

3.1.3 Biological and Habitat Monitoring

DPW collected macroinvertebrate samples in the spring of 2017; the results will be included in the FY 2018 Annual Report. Instead, DPW will present the results for the macroinvertebrate samples collected in the spring of 2016. DPW uses a combination of fixed and random sampling. There are 8 fixed stations, two of which are associated with the long-term discharge characterization of Moores Run. The results for those two stations are discussed in Section 3.2.2 of this report. For the random sampling, one of three watersheds is completed each year. During the spring of 2016, random sampling was completed in the Back River watershed.

Table 3-4 presents the benthic index of biotic integrity (BIBI) scores for 6 fixed stations from 2002 through 2016. All six stations were rated as "very poor" for their 2016 samples; and all six stations had a decrease in their BIBI score compared to the previous year.

Table 3-4: Macroinvertebrate BIBI Scores for Fixed Stations

Year	Gwynns Falls Watershed		Jones Falls Watershed			Back River Watershed
	Station 250 Dead Run	Station 430 Maidens Choice Run	Station 880 Stony Run	Station 949 Stony Run	Station 1053 Stony Run	Station 1235 Biddison Run
2002	1.7	NS	NS	NS	1.3	NS
2003	1.0	NS	NS	NS	1.0	3.3
2004	1.0	NS	NS	NS	1.0	1.3
2005	1.0	NS	NS	NS	1.3	1.9
2006	1.7	NS	NS	NS	NS	1.3
2007	NS	NS	NS	NS	1.0	1.3
2008	NS	NS	NS	NS	1.0	1.6
2009	1.3	NS	NS	NS	1.3	1.0
2010	1.3	1.0	1.3	1.7	2.3	1.9
2011	2.3	1.7	1.3	1.0	1.7	1.3
2012	1.0	1.0	1.0	1.0	1.0	1.6
2013	1.0	1.0	1.0	1.0	1.0	2.1
2014	1.7	1.3	1.7	1.3	2.0	1.9
2015	2.3	1.7	1.3	1.3	1.3	2.4
2016	1.0	1.3	1.0	1.0	1.0	1.9

DPW sampled 15 random stations in the Back River watershed in 2016. The BIBI scores for these 15 samples ranged from 1.0 through 1.9; all of which are rated as “very poor”. Random sampling was performed in the Back River watershed in 2004, 2007, 2010, 2013 and 2016. Figure 3-1 graphically shows the distribution of the BIBI scores for each of those 5 years. The curve representing the distribution of the 2016 samples is one of the worst of the 5 years, and shows an overall decrease in quality compared to the last set of random samples collected in 2013. This is consistent with the trend of the BIBI scores encountered at the fixed sites.

The BIBI, embeddedness, epifaunal and habitat scores for all fixed station and random station samples from 2016 are listed in the *Biological Monitoring* table of the *MDE NPDES MS4 Geodatabase* (Appendix C of this report).

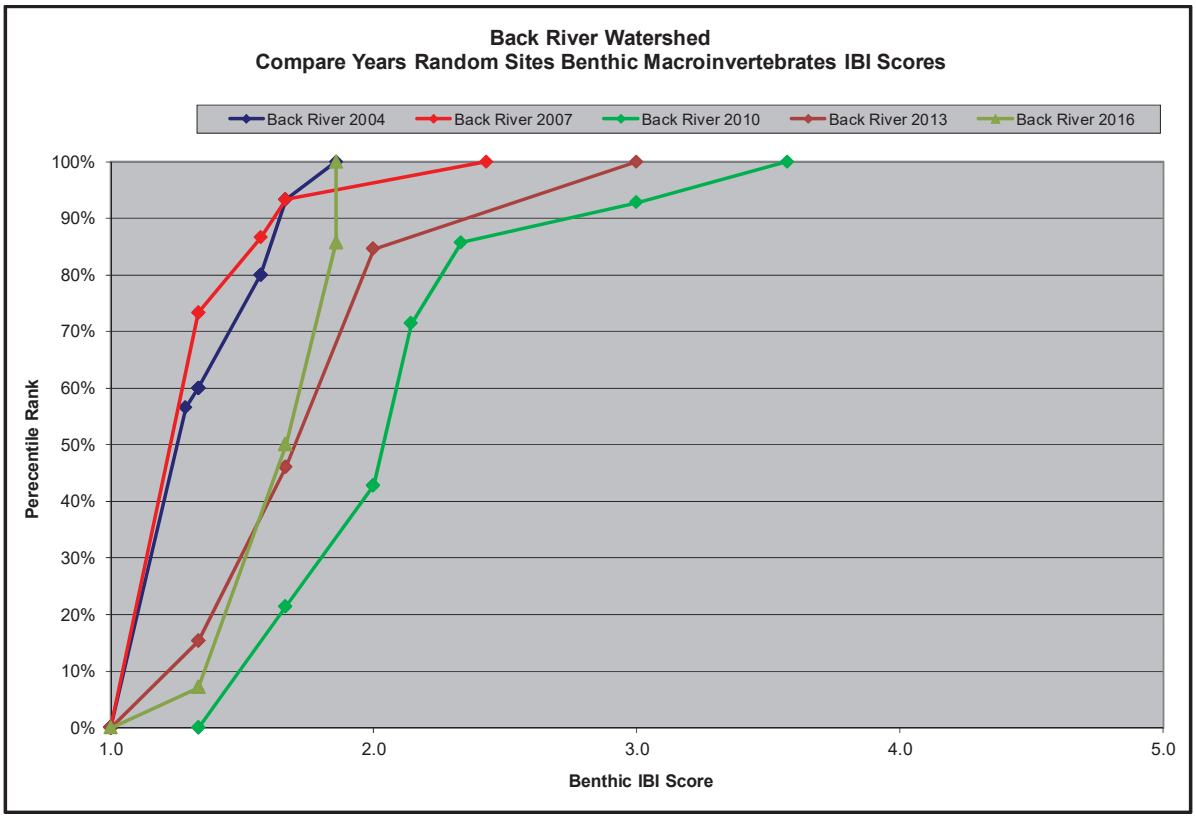


Figure 3-1: BIBI Scores for Macroinvertebrate Samples Random Sampling in the Back River Watershed

3.2 Watershed Assessment at Moore's Run

3.2.1 Chemical Monitoring

During this reporting period, 10 storm events 11 base flow events were monitored at Hamilton Avenue, the outfall station associated with the long-term discharge characterization for the Moores Run. Eleven (11) storm events and 11 base flow events were monitored at Radecke Avenue, the in-stream station associated with the long-term discharge characterization for the Moores Run. For the storm on June 19, 2017, the automated sampler at Hamilton Avenue did not work properly: the ascending limb of the storm was not sampled. Consequently, there was one fewer storm event monitored for Hamilton Avenue compared to Radecke Avenue. DPW only monitored eleven storms in FY 2017; not twelve (12) as required by the permit. The permit allows for use of baseline sampling if there is an extended period of dry weather. October 2016 had very little rainfall: only 0.63 inches of rain was recorded at the National Weather Service station at the Maryland Science Center. There were only four days with measured rainfall, ranging from 0.03 to 0.39 inch, in that month. November 2016 also had very little rainfall: only 0.14 inch of rain prior to the storm event on November 29, which DPW did sample. The results of the monitoring events are provided in Appendix C.

DPW did not analyze the base flow samples from July 26, 2016, or storm samples from July 28, 2016, for total petroleum hydrocarbons (TPH). DPW changed its protocol to have base flow and storm samples analyzed for TPH beginning with samples collected on August 23, 2016. An EMC for total Kjeldahl

nitrogen (TKN) and total phosphorus was not calculated for the Hamilton Avenue station for the storm on September 27, 2016, due to an accident at the lab with the samples.

In addition to these monitoring events, these two locations were monitored as part of the Ammonia Screening program. The results of that monitoring are included in Appendix D of this Annual Report.

3.2.2 Biological Monitoring

DPW collects macroinvertebrate samples at two fixed locations for the long-term discharge characterization of the Moores Run. Every sample from 2002 through 2016 at both stations has been rated as "very poor". The BIBI, embeddedness, epifaunal and habitat scores for all fixed station and random station samples from 2016 are listed in the *Biological Monitoring* table of the *MDE NPDES MS4 Geodatabase* (Appendix C of this report).

Table 3-5: Macroinvertebrate BIBI Scores for Fixed Stations Moores Run Watershed

Year	Station 1367 on Moores Run	Station 1659 on Moores Run Tributary
2002	1.3	1.3
2003	1.3	1.7
2004	1.0	1.0
2005	1.3	1.3
2006	1.7	1.7
2007	1.3	1.3
2008	not sampled	1.7
2009	1.3	1.3
2010	1.3	1.7
2011	1.3	1.7
2012	1.7	1.0
2013	1.3	1.3
2014	1.7	1.3
2015	1.3	1.0
2016	1.7	1.0

3.2.3 Habitat Assessment

DPW performed a habitat assessment survey of the upper Moores Run watershed on June 8, 2017. The results, along with eleven other assessments completed from May 18, 2005 through June 9, 2016, are included in Appendix F of this report. Segment 4 of the Moores Run main stem had lower scores for the FY 2017 assessment compared to the FY 2016 for every category, except for "Pool/Glide/Eddy Quality", "Channel Alteration" and "Riparian Vegetative Zone". This continues a trend for this segment for decreases in scores for three years for "Instream Habitat" (decline from 12 down to 5); "Epifaunal Substrate" (decline from 13 down to 3); "Velocity/Depth Diversity" (decline from 12 down to 6); and "Riffle/Run Quality" (decline from 8 down to 0).

Approximately 1.7 miles of stream restoration is proposed for Moore's Run as part of the MS4 Restoration and TMDL WIP, as shown in Appendix K of this report.

3.2.4 Geomorphic Monitoring

The U.S. Fish and Wildlife Service (USFW) completed the physical monitoring of the Moore's Run site; the results were included in the FY 2017 Annual Report. DPW initiated a hydrologic and hydraulic (H & H) model of a prescribed reach of stream in FY 2017. The results of the model, including an analysis of the effected of rainfall, discharge rates, stage and continuous flow on channel geometry will be included in the FY 2018 Annual Report.

3.2.5 Stormwater Management Assessment at Stony Run

In 2016, the City contracted USFW to evaluate five stream restoration projects completed within the City to date, including Stony Run. USFW used a stream restoration monitoring methodology to evaluate the stability and functional success of stream restoration projects in Baltimore City. The results of the evaluation are included in Appendix G of this report. The reports indicated several locations that needed repair; DPW has procured the necessary contracted services and obtained all relevant permits for these repairs and will initiate the repairs (starting in Upper Stony Run) in FY 2018.

The physical survey of the stream profile and of permanently monumented cross-sections in the Stony Run were completed in FY 2017, to complement USFW assessment. Furthermore, in FY 2017, DPW initiated an H & H model of the former stream restoration project, known as Upper Stony Run. The results of the model, including an analysis of the effected of rainfall, discharge rates, stage and continuous flow on channel geometry will be included in the FY 2018 Annual Report.

4 Expenditures and Proposed Budget

4.1 Expenditures and Budgets Related to MS4 Permit Compliance

DPW is predominantly responsible for compliance with the City's MS4 permit. Although the efforts of other City agency services are reported in this Annual Report for permit conditions like property maintenance, inspections and enforcement, the expenditure information shown in Table 4-1 is strictly limited to DPW services. Annual expenditures and budgets for FY 2017 and 2018 are summarized in Table 4-2. This information is also included in the geodatabase in Appendix C.

The expenditures and budgets shown in Tables 4-1 and 4-2 do not include debt service payments, to avoid confusion with expenditures made using debt service mechanisms like bonds. This follows a similar format as the Financial Assurance Plan submitted to MDE on July 1, 2016. Debt service payments in FY 2017 were on the order of $3,065,067.

Table 4-1: Fiscal Analysis of FY 2016 Expenditures

Description of Total Annual Cost	FY 2017 Actual
Stormwater management	$1,234,071
Erosion and sediment	$890,364
Illicit detection/elimination (IDDE)	$1,982,331
Trash elimination	$636,849
Property management	$16,552
Inlet cleaning	$4,183,524
Street sweeping	$,4894,960
Road maintenance - other	$0
Public education	$371,321
Watershed assessment	$195,702
Watershed restoration (all projects)	$4,422,224
Chemical monitoring	$166,448
Biological monitoring	$74,793
Physical assessment	$0
Design manual monitoring	$0
TMDL assessment	$52,831
Total NPDES program	**$19,121,968**
Other activities related to stormwater*	$4,452,740
Total Stormwater	**$23,574,708**
Funded by Stormwater Utility	$17,736,113
Funded by W/WW Utility	$1,643,438
Funded by General Fund	$1,604,823
Funded by Other Sources	$2,590,335

Note: "Other activities" include the maintenance and remediation of stormwater infrastructure (collection system).

Table 4-2: NPDES Program Expenditures and Budgets

Fiscal Year	Operations	Capital	Total
FY 2017 (Expenditure)	$15,334,980	$3,786,990	$19,121,970
FY 2018 (Budget)	$16,623,903	$40,323,893	$56,947,796
Total	$31,958,883	$44,110,883	$76,069,766

4.2 Stormwater Fee and Stormwater Utility

The Stormwater Utility is an enterprise fund, established in 2013, to protect the use of revenue received from the stormwater restoration fee and other miscellaneous. The predominant source of revenue for the stormwater utility is the stormwater restoration fee. Other sources of revenue are as follows:

- Plans review fees for stormwater management and erosion and sediment control
- Penalty fines for stormwater management and erosion and sediment control
- Fees in lieu of on-site stormwater management (quantitative and qualitative control)

The stormwater restoration fee was established in the City Code in June 2013; the first bills were issued in September 2013. The fee structure and rate was established to remain constant for four years (FY 2014 through 2017). The required reporting, as prescribed by MDE, is included in Appendix H of this report. Note that the stormwater fee expenditure for capital projects includes the payment of debt service mechanisms.

4.2.1 Grants Received by DPW

In May 2017, DPW was awarded $100,000 from the Maryland Department of Natural Resources Community Resiliency Grant Program. The funding will be used to construct three ESD projects in the Cherry Hill neighborhood (WIP Project #E30, treating approximately 1.2 acres of impervious surface and helping to reduce flooding

4.2.2 Grant Support by DPW

DPW used the stormwater utility fund to provide $100,000 direct funding, matched by $128, 088 from the Chesapeake Bay Trust, for the following projects:

- **Civic Works Baltimore Center for Green Careers ($30,000)** – delivery of a comprehensive, certification-based occupational and essential skills training in stormwater management to one pilot cohort of 8 underserved Baltimore City residents facing significant barriers to employment over 12 months.
- **Govans Presbyterian Church ($68,907)** – installation of a bioretention facility that will treat approximately 0.62 impervious acre, in addition to education and outreach to the congregation.
- **Episcopal Church of the Holy Covenant ($54,444)** – installation of two rain gardens that will treat 0.15 impervious acre, in addition to education and outreach to the congregation and local community.
- **TreeBaltimore ($74,737)** - community-based effort to plant 100 street trees within the Berea neighborhood of the Harris Creek watershed area of east Baltimore City.

In addition to the direct funding listed above, DPW provided thirteen (13) letters of support to non-profits and academic institutions for grant applications that would improve water quality in Baltimore City.

4.3 Capital Projects – Expenditures and Financing

The capital improvements for the stormwater management include projects specifically listed in the Appendix K of this report, plus the capital projects to remediate or replace stormwater infrastructure. These projects are funded by a combination of the stormwater utility, county transportation bonds, general obligation bonds, and grant funding. The capital costs listed in Appendix H include both the expenditure for contracted services, capitalization of in-house efforts, and the payment of debt service for capital contracted expenditures from previous years. The stormwater utility is responsible for paying the principle, interest, and administrative costs related to these bonds.

In addition to the State Revolving Loan Fund, the City was invited by the U.S. EPA to apply for $200 M in credit assistance to improve its water, wastewater and stormwater infrastructure. Only 12 projects in 9 states were selected to apply for loans under US EPA's Water Infrastructure Finance and Innovation Act (WIFIA) program. The City's application included stormwater projects that are listed in Appendix K of this Report.

5 Enforcement Actions, Inspections and Public Education

5.1 Stormwater Management Program

Programmatic and implementation information for the period of this Annual Report (July 1, 2016 to June 30, 2017) is as follows:

- Number of Concept Plans received: 175
- Number of Site Development Plans received: 135
- Number of Final Plans received: 135
- Number of Redevelopment projects received: 71
- Numbers of Stormwater exemptions issued: 150

DPW received and approved as-built drawings for 14 stormwater management BMPs between July 1, 2016 and June 30, 2017. The required data for these BMPs are in Appendix C of this report. A summary of waivers and variances for this time period is provided in Table 5-1.

Table 5-1: Summary of waivers and variances

Description	**Requested**	**Granted**
Quantitative Control Waiver	22	22
Qualitative Control Waiver	0	0
Quantitative and Qualitative Waiver	11	11
Redevelopment Waiver	71	71
Phased Development Waiver	0	0
Administrative Waiver	0	0
Variance	0	0
Total	**104**	**104**

No changes to the City's ordinance or code related to the stormwater management program (Article 7, Division II) were pursued during this time.

During this reporting period, 157 inspections of ESD treatment practices and structural stormwater management facilities were conducted as part of preventive maintenance inspections. Of those inspections. A total of 3 facilities required one or more follow-up inspections. Of the facilities inspected, 2 of the inspections resulting in identifying a facility that was removed. The removed facilities were installed prior to 2000, and were not reported in the BPM inspection tables, because mandatory fields require us to provide information that cannot be reported.

5.2 Erosion and Sediment Control

The City added a new customer service request for erosion and sediment control in 2014. Complaints are reported via phone, internet or mobile phone application and tracked through the 3-1-1 system. During FY 17, a total of 157 service requests were received.

During this reporting period, 2,766 inspections were conducted for compliance with approved erosion and sediment control plans. A total of 5 violation notices were issued by the City, resulting in a sum of $16,200 received as penalty fines and 3 stop work orders. The summary information regarding earth disturbances exceeding one acre are included in Appendix C of this report.

No changes to the City's ordinance or code related to the erosion and sediment control program (Article 7, Division III) were pursued during this time.

5.3 Illicit Discharge Detection and Elimination (IDDE)

5.3.1 Routine Field Screening Locations

DPW conducts an MDE-approved alternative to IDDE: ammonia screening (AS) and stream impact sampling (SIS) to initiate pollution source tracking (PST) investigations. The AS and SIS sampling locations are included in the geo-reference data provided in Appendix C. As noted in Section 3.1, the station at Central & Lancaster was suspended and the station at JF 11.5 was added this fiscal year. The monitoring results from the surveys for the AS and SIS programs for FY 2017 are included in Appendix D of this report. These monitoring results, plus historic data, are also available on-line at the City's DPW website.

5.3.2 Supplemental Field Screening

5.3.2.1 East Harbor Storm Drain Ammonia Survey

The Baltimore Harbor Storm Drain Survey concluded in early 2017 with sample locations in east Canton through Dundalk. Twenty-two (22) stormwater assets were visited, mostly storm drain manholes. The area surveyed consisted primarily of commercial and industrial land use. Most outfalls were either inaccessible or below tidal waters. No PSTs were initiated for ammonia during this time; all high ammonia values were accompanied by low enterococci bacteria values. Two (2) PST investigations were initiated based on high chlorine values that led to potable water leaks. These illicit discharges are included in the number of illicit discharges reported in Section 5.3.4.

5.3.2.2 Blue Water Baltimore Outfall Screening

The civic organization Blue Water Baltimore (BWB) performs some screening at storm drain outfalls. When BWB finds a water quality issue at an outfall, they report it to OCAL, and request an investigation. During FY 2017, OCAL initiated 22 PSTs in response to BWB water quality complaints. During these PSTs, OCAL found 9 potable water discharges and 3 sanitary sewer discharges at Western Run and Herring Run. These illicit discharges are included in the number of illicit discharges reported in Section 5.3.4.

5.3.2.3 Ridge to Reefs Illicit Discharge Project

DPW assisted Ridges to Reef on an illicit discharge project, supported by the Chesapeake Bay Trust Watershed Assistance Grant. The purpose of the project was to test new equipment in the field, specifically a Turner Designs Aquafluor handheld fluorometer that could test for optical brighteners. Blue Water Baltimore also supported the project, as discussed in Section 5.3.2.2. DPW used the proposed equipment along with current methodologies used as part of the AS program. Results of by all users were compiled and it was determined that the results of the flourometer could be used as a

supplemental indicator of illicit discharges, especially when there are possible water chemistry interferences with the ammonia nitrogen test. The project resulted in the donation of the equipment to DPW. The final project report will be included in the FY 2018 Annual Report.

5.3.2.4 Microbial Source Tracking

The City contracted with the University of Baltimore and the University of Maryland Baltimore County (UB/UMBC) to perform microbial source tracking. During FY 2017, two sets of samples were collected- on March 23, 2017 and May 18, 2017- within the storm drain network and submitted for analysis. There were eight (8) samples collected on each date. This project will completed by June 2018. All results and an analysis of the usefulness of microbial source tracking will be presented in the FY 2018 Annual Report.

5.3.3 3-1-1 Customer Service Request for Polluted Water

Complaints are reported via phone, internet or mobile phone application and tracked through the 3-1-1 system. Complaints that are designated with the type "WW Waterway Pollution Investigation" are initially assigned to the Water Quality Monitoring and Inspections Section of OCAL. During FY 2017, a total of 178 service requests were received. Forty-three (43) resulted in a pollution source tracking investigation. Twelve (12) of these investigations led to the discovery of an illicit discharge or activity that was removed or corrected:

- Three (3) dry weather sanitary sewer overflows (SSO) from the public system;
- One repair to a contractor's pump-around equipment that was being used during the repair of a sanitary sewer line;
- One replacement of a sanitary sewer manhole stack that had been damaged during a storm;
- Two (2) potable water system leaks;
- One clean-up of a private sump pump;
- One stop work order and clean-up of unauthorized in-door lead paint removal operation;
- One clean-up of spilled motor oil at an automotive service lot; and
- Two (2) enforcements of proper sediment and erosion controls at construction sites.

Three (3) of these investigations led to the discovery of an illicit discharge, but the repairs were not completed by the end of FY 2017:

- one (1) potable water system leak;
- one (1) private sanitary sewer discharge; and
- one (1) improper control of sediment and erosion at a construction site.

These illicit discharges are included among those further discussed in Section 5.3.4.

5.3.4 Pollution Source Tracking (PST)

DPW initiates PST investigations based on the results of field screening, 3-1-1 customer service requests or requests from other programs (such as Blue Water Baltimore, MDE or EPA). During FY 2017, a total of 206 PST investigations were conducted: 178 PST investigations were initiated during FY 2017 and the others were a continuation of PST investigations initiated prior to FY 2017. The PST investigations

resulted in mobilizing to 1,211 locations in the open channel and storm drain system to conduct water quality chemical analyses, make observations, drop dye, etc. As a result of the PST investigations, the following illicit discharges were identified and abated, with further details provided in Appendix I:

- Fifty-three (53) dry weather sanitary sewer overflows (SSOs) from the public sewer; nine (9) of these were designated as sanitary discharge of unknown origin (SDUOs) at some point during their investigations;
- Eleven (11) sewage inputs from private properties to the storm drain system; eight (8) of these were designated as sanitary discharge of unknown origin (SDUOs) at some point during their investigations;
- Fifteen (15) drinking water transmission losses; and
- Nineteen (19) with other types of illicit discharge:
    - Nine (9) related to constructions sites where erosion and sediment controls needed to be corrected;
    - Six (6) related to projects in which City-owned sanitary sewer or potable water infrastructure was being repaired;
    - Two (2) involving proper clean-up and containment of used motor oil at automotive service lots; and
    - Two (2) involving improper containment of wastes from interior paint removal operations.

Additionally, twenty-two (22) illicit discharge sources were located and await further repairs:

- Five (5) sanitary sewage inputs from private properties; four (4) of which were designated as SDUOs at some point during their investigations;
- One (1) SSO, which began as an SDUO;
- Fifteen (15) drinking water transmission losses; and
- One (1) for sediment laden discharge from a construction that has sediment and erosion controls, but still some sediment laden discharge would come off the site. The incident was referred to OCAL's sediment and erosion control inspectors to enforce.

There are five (5) on-going investigations for which a pollution source has not yet been identified:

- Three (3) discharges that suggest that the source is coming from the sanitary sewer network; and
- Two (2) with high chlorine levels suggesting the source is from drinking water transmission losses.

5.3.5 FOG Program

In November 2013, DPW initiated an inspection program to reduce fats, oils and grease (FOG) within the sanitary sewer system. The FOG Program has a two-pronged approach that manages FOG from both the private and public sides of the property line by:

- Requiring all food services establishments (FSE) that have the potential to discharge FOG-laden wastewater to have an adequate grease control device (GCD), and
- Reducing build-up of fats, oils and grease in the sewer lines using a commercial grade degreaser.

FOG education efforts are focused on both residents and owners of FSEs. Flyers were included with water bills. Outreach at festivals and community meetings included distribution of education materials. All education materials are available on the City's DPW website.

The DPW - Pollution Control Section performs the inspections and educates FSEs about FOG best management practices. There were 3,999 inspections of FSEs during FY 2017: this is an increase of 10% compared to the 3,623 inspections during FY 2016. During FY 2017, 1,404 FSEs (35%) were found not to be in compliance. There were 1,948 notices of violation (NOV) issued to the 1,404 FSEs were found not to be in compliance. Thirty (30) FSEs were issued consent agreements. A breakdown by type of NOV is included in Appendix I of this Annual Report.

In FY 32015 Annual Report, the City reported that there were 144 Baltimore City Public Schools that needed to install GCDs. The State Board of Public Works approved funding for renovations at 32 out of those 144 schools in early September 2016. The Pollution Control Section confirmed that GCDs were installed in 9 of those 32 schools during FY 2017. Approval for renovations (which includes installation of GCDs) for the remaining 112 schools was still pending at the time of this report. The City will report on the progress of funding and installing GCDs in those schools in the FY 2018 Annual Report.

5.3.6 Exterior Lead Paint Removal Waste Control Program

This program is administered by the DPW - Pollution Control Section. During FY 2017, there were 287 permitted sites. Inspectors made 265 site visits and issued 55 stop work notices requiring corrective action. There were no documented illegal discharges to the storm drain system.

5.3.7 NPDES Industrial Discharge Permits

The City has fourteen (14) municipal facilities covered under the NPDES Industrial Discharge Permit, as listed in Table 5-2. During FY 2015, NOIs for these facilities and updated stormwater pollution prevention plans (SWPPPs) were submitted to MDE. Permit conditions related to staff training and routine inspections are managed by the responsible agency. DPW implemented an internal environmental compliance audit program in FY 2016, which consisted of site walkthrough inspections and SWPPP audits. In addition to the internal environmental compliance audit program, a geodatabase was created to monitor each facility's last quarterly inspection and SWPPP trainings.

Table 5-2 – Summary of NPDES Permitted Municipal Facilities

Facility Name	Agency	Address	State	SIC Description
Reedbird Landfill	DPW	701 Reedbird Ave	12SW0252	Sector L.3 – Landfills and Land Application Sites
Bowley's Lane Sanitation Yard	DPW	6101 Bowleys Lane	12SW0254	Sector L – Landfills and Land Application Sites
Quarantine Road Municipal Landfill	DPW	6100 Quarantine Rd	12SW0257	Sector L – Landfills and Land Application Sites

Facility Name	Agency	Address	State	SIC Description
Northwest Transfer Station	DPW	5030 Reisterstown Road	12SW1307	Sector L – Landfills and Land Application Sites
Quarantine Road Landfill	DPW	5701 Quarantine Rd	12NE0684	Sector L – Landfills and Land Application Sites
Northeastern Substation	DGS	4325 York Rd	12SW0702	Sector P – Land Transportation and Warehousing
Western Substation	DGS	239 N Calverton Rd	12SW0703	Sector P – Land Transportation and Warehousing
Middletown Fueling Station	DGS	410 Front St	12SW0704	Sector P – Land Transportation and Warehousing
Northwestern Substation	DGS	4410 Lewin Ave	12SW0705	Sector P – Land Transportation and Warehousing
Fallsway Substation	DGS	201 Fallsway	12SW0707	Sector P – Land Transportation and Warehousing
Mechanic Shop	DGS	6400 Pulaski Hwy	12SW0708	Sector P – Land Transportation and Warehousing
Central Garage	DGS	3800 E Biddle St	12SW2123	Sector P – Land Transportation and Warehousing
Patapsco WWTP	DPW	3501 Asiatic Ave	12SW0629	Sector T – Treatment Works
Back River WWTP	DPW	8201 Eastern Avenue	12SW0630	Sector T – Treatment Works

5.4 Property Management and Maintenance

5.4.1 Street Sweeping and Trash Reduction

5.4.1.1 Street Sweeping Operations

In FY 2017, the mechanical street sweepers operated by DPW- Bureau of Solid Waste removed 11,902 tons of debris while sweeping 110,593 miles of street surface. This is a decrease in both tonnage and mileage, however the tonnage per mile decreased by 1 percent indicating a decrease in material loading to the streets, potentially due to the other trash reduction strategies described in the following sections. Street sweeping tonnage and mileage is listed by frequency and 8-digit watershed in the MS4 geodatabase (Appendix C). The efficiency of the street sweeping operations, specifically in the expanded areas, is still hindered by the coordination of parked vehicles. New parking sign installation began in the summer of 2017. Evaluation of the impacts of the signs, and subsequent parking enforcement, will be included in the FY 2018 MS4 Annual Report.

5.4.1.2 Municipal Trash Can Program

The City launched a city-wide Municipal Trash Can program, with nearly 171,000 cans distributed to households beginning in March 2016 and ending in FY 2017. The purpose of the program was to provide an incentive to residents to improve water management and prevent litter. Preliminary data showed an increase in municipal waste collections, while recycling remained the same. Anecdotally, area reconnaissance showed an improvement of alley cleanliness. Further evaluation will be included in the

FY 2018 Annual Report. A description of the education and outreach are discussed in Section 5.5.6 of this report.

5.4.1.3 Small Haulers Program

In April 2017, the City initiated a small haulers program at the Northwest Transfer Station, off of Reisterstown Road, to offer haulers an additional, convenient location to dispose of their waste loads. Prior to this program, small haulers had only one option: Quarantine Road landfill, located in the southern part of the City. This lack of options appeared to be related to numerous illegal dumping of trash and larger debris on vacant lots.

In the process of advertising this new service to small haulers, the City also encouraged unpermitted haulers to register and receive permits, and provided them with information for how to do so. Although this program just began on April 1st and is still in the early stages, we have already seen many small haulers taking advantage of it. Over the course of only 3 months, approximately 3,171 tons of waste has been collected at the Northwest Transfer Station and 5,535 paying small haulers have used the facility. The revenue collected from this program is eligible for increasing enforcement efforts within the City. Although the City is monitoring the small haulers programs at both locations to determine the customer base (diverted vs. new), preliminary 3-1-1 data has shown a decrease in illegal dumping service requests in the areas around the transfer station.

5.4.1.4 Mayor's Transformation Zones

As part of the City's coordinated effort for a violence reduction strategy in Baltimore, four (4) transformation zones were identified in February 2017 for concentrated municipal services and cross-agency support:

- Monument Street,
- Tri-District,
- Park Heights, and
- Penn/North Zones.

The Bureau of Solid Waste initiated expedited response times for service requests, including cleaning and boarding of vacant properties, cleaning of dirty streets and alleys, cutting high grass and weeds, proactive rat abatement services, and graffiti removal of gang-related tagging.

5.4.2 Inlet Cleaning

In May 2016, DPW completed the installation of screens and inserts for 414 inlets which would improve the efficiency of inlet cleaning and street sweeping by preventing trash and debris from entering the storm pipe system. Modified inlets will be installed in five neighborhoods: McElderry Park, Oliver, Baltimore-Linwood, Franklin Square, and Carrollton Ridge. The neighborhoods were selected based on the 3-1-1 service requests for choked inlets and dirty streets. The modifications were only being made to a portion of the 1,092 inlets located within the selected neighborhoods, based on inlet type and the proximity to routine street cleaning routes. Each of the inlets were inspected by DPW staff at least quarterly to gauge the need for cleaning.

Routine preventive inlet cleaning all inlets in these five (5) neighborhoods was initiated using contracted services to allow time DPW the ability to gauge the work effort (crew size and efficiencies) to create positions and procure equipment. The first work order was completed in July 2016. As of May 22, 2017, 1,128 inlets were assigned for cleaning for a total of 26.21 tons of debris collected.

5.4.3 Integrated Pest Management

During FY 2017, the Department of Transportation (DOT) applied 7.5 gallons of Lesco Prosecutor Pro herbicide, which contained 22.5 pounds of glyphosate acid. This is a decrease of 27.5 gallons (82.5 pounds of glyphosate acid) compared to the amount applied during FY 2016. The DOT representative noted that they had received fewer requests to apply herbicide during FY 2017.

During FY 2017, the Department of Recreation and Parks (BCRP) applied 6.5 gallons of concentrated glyphosate (Round Up equivalent), which contained 19.5 pounds of glyphosate acid. This is a decrease of 101.5 gallons (304.5 pounds of glyphosate acid) compared to the amount applied during FY 2016. BCRP has six (6) Public Agency Applicators who are certified by MDA (4 in Horticulture and 2 in Parks). All have attended MDA approved trainings to maintain their certifications. All registered (not certified) applicators are re-registered annually with MDA as per the State process.

Between the two departments, there were 42 pounds of glyphosate acid applied during FY 2017 compared to 429 pounds applied during FY 2016.

The Baltimore City Public Schools System reports that no herbicides were applied on school properties during FY 2017.

5.4.4 Deicing Materials

DOT applied 10,672 tons of sodium chloride during FY 2017. This is a 49% reduction from the 20,994 tons that were applied during FY 2016. In FY 2017, there were 5 storm events for which DOT applied road salt. The snowfall total recorded at BWI for FY 2017 was only 3 inches.

5.5 Public Education and Outreach

5.5.1 Education and Outreach Activities

A summary of outreach events is provided in the following table:

Table 5-3: Summary of Outreach Activities for FY 2017

Description	Details
Public Presentations on the MS4 WIP	• 28 presentations were given to communities where MS4 projects are to be located • SDC 7788 - Stormwater Project – September 22, 2016 • ER 4028 - Stream Restoration Project – January 26, 2017 • ER 4031 – Stream Restoration Project – January 25, 2017 • ER 4097 - Stream Restoration Project – March 7, 2017
School presentations providing information on trash reduction, recycling, rats, and storm drains, related to the health of the harbor	• 33 Presentations • 14 Schools • 1,035 Students • Post-presentation testing
Community events where DPW provided educational materials on environmental topics	• African American Festival – July 2 -3, 2016 • Artscape – July 15 – 17, 2016 • Mayor's Back to School Rally – August 6, 2016 • Dam Jam – August 20, 2016 • Book Festival – September 23 – 25, 2016 • Kingdom Life Church Resource Fair – October 12 & 26, 2016 • 40th District Community Leadership Forum – January 7, 2017 • BMORE Beautiful Kickoff – March 8, 2017 • Senior Law Day – April 22, 2017 • Mayor's Spring Cleanup – April 29, 2017 • Flowermart – May 6, 2017 • Big Truck Day – May 13, 2017 • Caregivers Conference – May 25, 2017 • Mayor's Call to Action – June 10, 2017 • 45th District Town Hall – June 17, 2017 • Youth Summer Block Party Tour – (various times throughout the year) • Various community meetings (various times throughout the year)

Description	Details
	• Various senior centers (various times throughout the year) • Various Community Action Centers (various times throughout the year)
Incentives related to trash reduction	• Oyster shell recycling becomes available to the general public at Sisson Street Yard in May 2016. By the end of the summer season we collected almost 500 pounds of shells, enough to provide homes for 35,000 oyster spat. • Christmas tree mulching (Saturdays in January) • Household Hazardous Waste collections (First Friday/Saturdays; July-October 2015, April-June 2016) • Discount Recycle Bin sales/Free Paper Shredding (April, June 2016) • Recycle Bin Sale (Big Truck Day, May 2016) • Continued to provide disposal service for the Water Wheel, a public-private project at the Jones Falls outfall to the Inner Harbor.

Baltimore's stormwater restoration fee has a credit program which includes a fee reduction for participation in registered stormwater participation events. These include community clean-ups, stream and harbor clean-ups, tree plantings, and installation of community BMPs. Outreach efforts and information promoting these types of trash reduction efforts and BMP installations have included posting on the Clean Water Baltimore web site (which was replaced in early 2017 with an updated DPW web site) and DPW's Facebook page, providing flyers at DPW attended events, reminders sent to City Council members for distribution, and at community and partner meetings attended by DPW liaisons. The results of the registered stormwater participation events, as reported to DPW, are as follows:

- 28 stormwater participation events completed
- 1,016 volunteers participated
- 9.6 tons of trash collected
- 87 trees planted and/or maintained[1]

DPW's Communications Office highlights the work of stormwater participation events through social media (Facebook and Twitter.) DPW also provided outreach materials for stormwater participation credits to participants in the Mayor's Fall 2016 and Spring 2017 Clean-ups.

[1] Trees are reported as afforestation.

5.5.2 Growing Green Design Competition

In 2015 the "Baltimore City Growing Green Design Competition: Vacant Lots Transformed" awarded funding to six projects for the design and implementation of innovative concepts for retrofitting vacant lots, creating community spaces, and reducing and treating stormwater. The competition was an opportunity to pilot the Green Pattern Book and test community-based stormwater management projects. In FY17 the Chesapeake Bay Trust, in partnership with DPW and the Office of Sustainability, contracted Tetra Tech to create signage for each of the award winning sites. The signage will be installed in the Fall of 2017.

5.5.3 Stormwater Advisory Committee

In 2014, DPW established the Stormwater Advisory Committee (SWAC) to be advisory to the Director of the Department. Applications for membership were accepted and members were chosen to represent specified stakeholder groups including nonprofit organizations, business and development groups, religious groups, citizen groups, and others. Certain City agency representatives served as ex-officio members. This group worked for two years on stormwater-related issues and provided valuable input. One of the notable accomplishments of the committee was the creation of revised stormwater remediation fee regulations.

The SWAC was discontinued in early 2017 in order to transition into the newly established Stormwater Remediation Fee Oversight Committee, which was established by City Council Resolution 17-0014R. This Committee reports to the Judiciary and Legislative Investigations Committee of the City Council. Similar to the SWAC, its members include representatives from various stakeholder groups and City agency representatives serve as ex-officio members. This Committee is charged with the review, assessment and communication of various items related to the stormwater remediation fee, stormwater fund, and stormwater projects. The Committee plans to periodically review documents such as the MS4 Annual report, the Financial Assurance Plan, quarterly reports, and other items. It will also assist with communicating this information to the public and to stakeholders. DPW has been working with the Chair of the Judiciary and Legislative Investigations Committee to organize this committee and will be participating in its meetings, the first of which is scheduled for August 2017.

5.5.4 Workforce Development Programs

5.5.4.1 Baltimore City Water Industry Career Mentoring Program

In January 2015, DPW and the Mayor's Office of Employment Development, together with the Chesapeake Water Environment Association (CWEA), launched the Baltimore City Water Industry Career Mentoring Program. The program had two goals: (1) educating local young adults about the water industry and its career opportunities; and (2) developing a pipeline of future workers with the right skills to fill entry-level positions in the field. The mentoring program targeted City residents between the ages of 18 and 24 who had their high school diploma or GED, but were unemployed or underemployed, and not engaged in post-secondary education or job training. DPW continued this effort for a third year with 15 of the program participants hired by DPW or private employer. In November 2017, the program was re-branded as Y-H20—the Youth Water Mentoring Program, which will serve as a national model for other cities.

5.5.4.2 National Green Infrastructure Certification Program (NGICP)

DPW coordinated with the Water Environment Federation and 14 partner organizations to develop the National Green Infrastructure Certification Program (NGICP). The purpose of the NGICP was to set national certification standards for green infrastructure construction, inspection, and maintenance workers. Designed to meet international best practice standards, the certification advances the establishment of sustainable communities by promoting green infrastructure as an environmentally and economically beneficial stormwater management option, supporting the development of proficient green workforces, and establishing a career path for skilled green infrastructure workers. Baltimore participated on both the technical advisory group and strategic advisory group, in addition to actively developing both the training curriculum and exam questions. In FY 2017, Baltimore hosted two training sessions and exams for the region.

5.5.5 GROW Center

Baltimore City generates a great deal of waste from trees and limbs that have been cut and removed from our parks and streets, as well as waste from demolished houses and renovated roadways. Currently, this material is either stored at Camp Smallwood (tree debris) or taken to landfills (building debris). As a means for repurposing this waste for greening and stormwater management projects, the City is exploring the creation of "GROW Centers". GROW stands for Green Resources and Outreach for Watersheds, and will be a place that links existing community greening networks to a much needed source of free/low cost materials and technical expertise for stormwater management installation and vacant lot revitalization. The GROW Centers would provide the following services:

- Materials for purchase. Mulch, bricks, crushed concrete, wood products, salvaged building materials and other quality-controlled materials that would be free and/or available for purchase by city residents and non-profits to use in micro-practice installation such as rain gardens, community gardens, and permeable paths and walkways. Trees, plants and quality-controlled materials like bio-soils will also be available in manageable volumes.
- Education and training. Experts will provide advice and guidance on green infrastructure projects, including hands-on training sessions, workshops, and educational classes on design, the proper use of the materials, securing funds and resources, and maintenance.

In March 2017, DPW received a $100,000 grant from the US Forest Service (USFS), which will be used to 1) prepare a feasibility study and business plan for GROW Centers, and (2) test and refine the delivery model of GROW Centers through a second round of "pop up" GROW Center events in the community. DPW was also selected by the Shriver Center at the University of Maryland, Baltimore County to receive a Peaceworker Fellow. The Fellow will be providing assistance in the development of the GROW Centers.

5.5.6 Baltimore Green Registry: Mapping of SWM BMPs Phase 2

In July 2016, DPW awarded $26,386 to the Baltimore Neighborhoods Indicators Alliance (BNIA) for Phase 2 of the Baltimore Green Registry: Mapping of Stormwater Management BMPs. The goal of Phase 2 was to create an interactive resource tool for urban water quality and community-based efforts on improving water quality for timely monitoring, research and more coordinated activities, while strengthening the relationship between improving urban waters and community revitalization. In

addition to the upgraded restoration BMP data from this Annual Report (including ESD locations found infeasible for construction), Phase 2 will include the ability for user-based / crowd-sourced data acquisition and editing. Concurrently with this effort, the mapping tool was upgraded to include mapping urban forest patches and street trees, an effort funded by the US Forest Service.

5.5.7 Clean Drain Campaign

On March 16, 2017, DPW launched the Clean Drain Campaign, in coordination Ridges to Reefs, Interfaith Partners for the Chesapeake, and Lori A. Lilly Environmental Solutions. The Clean Drain Campaign was a one-month campaign to raise the awareness of Baltimore residents about proper disposal practices for cooking fats, oils, and grease (FOG); wet wipes; and other household waste, while raising funds for a local food pantries. A total of 713 City residents pledged to put FOG in the trash and keep wipes out of toilets, triggering cash donations to their selected local food pantry. Money for the donations came from the Chesapeake Bay Trust and Walmart; food donations were from MOM's Organic Market. Educational materials developed and tested for the initiative have been retained on DPW's website.

5.5.8 Flood ALERT System upgrade

During FY 2017, DPW upgraded its Flood ALERT (Automated Local Evaluation in Real Time) system and provided training to City staff. The features of the upgraded system allow real-time monitoring (tabular and chart formats) of the City's flood ALERT rain and stream gauges, in addition to nearby USGS gauges. In FY 2018, DPW, the Department of Planning, and the Mayor's Office of Emergency Management will establish thresholds for alerts / notifications for gauges along the Jones Falls and its tributaries, which are prone to flooding and property damage.

5.5.9 Effectiveness of Education Program for Trash and Litter

Public education and outreach is an essential strategy to achieve the long-term, sustained prevention of trash entering our streams and waterways. Whereas DPW is the responsible party for implementing and providing solid waste services, public education and outreach requires partnerships to be effective. Partnerships involve voluntarily actions and/or cooperation by State, federal, private, non-profits, and community groups and residents, and can be both structural and non-structural practices.

5.5.9.1 Municipal Can Program

As described in Section 5.4.1, the City completed the roll-out of the Municipal Trash Can program in July 2017. During the distribution period, DPW provided extensive education and outreach to help residents understand the program, how to properly manage their waste, and the benefits of the cans for reducing litter and rats. Outreach consisted of mailers, flyers (in English and Spanish), community meetings, social media and press coverage, and an FAQ section on the DPW website. In a Baltimore Sun article from January 18, 2017, residents note that they are seeing less trash, and rats, after the cans were delivered. Also, the Municipal Trash Can Program was named "2017 Project of the Year" by the American Public Works Association (APWA) Mid-Atlantic Chapter.

5.5.9.2 B'More Beautiful

BMORE Beautiful is a City-led peer to peer beautification program that launched April 2017 in conjunction with the Mayor's Spring Cleanup. BMORE Beautiful is an enhanced version of Clean Corps, which encouraged residents to engage in activities to reduce trash and litter in their communities. The newly enhanced program expands on trash reduction by working with residents to improve the overall aesthetic of their neighborhood.

BMORE Beautiful is intended to be a citywide initiative; however for one year it will be piloted in 23 neighborhoods. The participating neighborhoods are:

- 4x4
- Belair Edison
- CARE
- Carrollton Ridge
- Charles Village
- Curtis Bay
- Glen Oaks
- Greektown
- Hampden
- Highlandtown
- McElderry Park
- Mondawmin
- Mosher
- Oliver
- Park Heights
- Parklane
- Patterson Park
- Penn-North
- Pigtown
- Rosemont
- Sandtown Winchester
- Waverly
- BoChK

During the pilot year, the City will engage residents in these neighborhoods to make a BMORE Beautiful pledge. In exchange for the signed pledge, participants will receive a BMORE Beautiful Kit that includes a trash grabber, reusable bag, durable gloves, safety vest, and information about city services & resources.

Each participating neighborhood has a trained Block Captain. During the reconstruction of the program, the Block Captains were invited to participate in a series of focus groups that aimed to develop a beautification program that (1) address the needs of the residents, (2) identify resources needed to support residents in their efforts (3) improve communication between residents and the city. These community leaders are trained to follow the ROLE model. Under the ROLE model captains are responsible for:

- Recruiting neighbors to sign the pledge and participate in BMORE Beautiful.
- Organizing ongoing beautification and cleaning activities;
- Leading others to change their negative behaviors regarding neighborhood cleanliness; and
- Educating neighbors on how to comply with City Code requirements, and how they can make simple changes to keep the neighborhood beautiful.

Block Captains are eligible to apply small grants that will help piloted neighborhoods achieve their beautification goals. City officials will measure the pilot's success by gathering community perception

surveys, collecting before and after photographs to demonstrate change, cleanliness score cards, and analyzing 311 data.

Since the launch, BMORE Beautiful has achieved the following:

- 1 Neighborhood Block Captain Training
- 19 Baseline Community Surveys
- 10 Community Cleanups
- 3 Beautification Projects

5.5.9.3 Anti-Litter Campaign Research

In FY 2017, Trash Free Maryland published a report entitled "Litter Behavior in Baltimore City: A Formative Focus Group Study". The study was conducted by Opinion Works to explore behaviors and attitudes related to littering among City residents and Port employees, with the goal of helping to inform a public outreach campaign that will motivate targeted audiences to pick up litter when they see it. In FY2016, DPW worked with federal, state, and local NGOs to secure funding for the focus group study.

"Recovery", whether of individuals, neighborhoods, or the City, was a reoccurring theme of the neighborhood focus groups. Based on these results, Trash Free Maryland will be targeting messaging and education to recovery centers and methadone clinics in FY 2018. For the Port focus group, the sense of pride in work place was strong. In FY 2017, one of the Port lease holders is testing a text message app, logos, workplace ambassadors, and operational changes to reduce litter. DPW will be working with Trash Free Maryland and other partners to continue testing the results of the focus groups and the applicability City-wide.

5.5.9.4 Mayor's Fall and Spring Clean-ups / Community Pitch-ins

The Mayor's Spring and Fall Clean-ups are opportunities for residents to organize community clean-ups and beautification projects. The purpose of the clean-ups is to collect litter and trash. DPW provides bags to residents, coordinates dumpsters, and picks up the trash from each location. In FY17:

- 460 communities participated
- 8,430 residents volunteered
- 424.04 tons of trash was collected

DPW also coordinates the Community Pitch-in program, which provides up to 4 dumpsters/year to community groups. In FY17, 616 requests were made for dumpsters, with 1,850.5 tons of debris collected. These events focus on larger debris collection, like old furniture and other material that is likely to be dumped.

6 Water Quality Improvements

6.1 MS4 Restoration and TMDL Watershed Implementation Plan (WIP)

The City submitted its WIP to MDE on December 22, 2014. The public comment period associated with the WIP ended on January 30, 3015, due to a request to extend the public comment period in consideration of the holiday season. The City received over 200 comments during the public comment period; the comments and the City's response were summarized in a Comment Response Document.

Comments were received from MDE on March 23, 2015. A revised calculation of the baseline impervious area, with supporting GIS files and responses to the specific MDE comments, was submitted to MDE on June 30, 2015. MDE approved the baseline impervious area and 20% restoration goal of 4,291 acres on July 28, 2015. The WIP was revised based on public and MDE comments. Both the revised WIP and Comment Response Document were submitted to MDE on August 24, 2015 and posted on the Cleanwater Baltimore website. The proposed restoration plans cited in Section 6 of this Annual Report refer to the revised WIP and MDE approved baseline impervious area.

6.2 Milestone Schedule

The WIP included programmatic and project milestones as part of an accountability framework for restoring the Chesapeake Bay. The proposed milestone schedule and status as of June 30, 2017, related to the Chesapeake Bay TMDL, are included in Appendix J.

6.3 Implementation of Projects, Programs, and Partnerships

6.3.1 Project Implementation and Tracking

The progress status of the projects listed in the WIP is provided in Appendix K of this Annual Report, specifically Table K-1. The original plan scope, cost and schedule are shown in addition to the current projections. Most of the projects continued through the design phase during Fiscal Year 2017; 2 initiated the construction phase and 3 were completed. The current projections are based on the progress of the design at the time of this report. Each of the current proposed projects, with specific locations, is included in the restoration BMPs tables of the georeference database in Appendix C.

Several of the ESD projects listed in Table M-1 include multiple locations. During FY 2016 and 2017, DPW visited approximately 507 potential projects for these project types. All of the locations were in the right-of-way or on public property, typically under the control of government agency outside of DPW. Only 353 of the locations were approved by the local government agencies. Usually, the reason for the disapproval was a conflict with the proposed use of the space to serve the public needs (such as a conflict with a proposed active recreation field). Of the remaining locations, only 235 were found to be feasible, with utility conflicts being the most prevalent conflict for constructability. Finally, only 52 locations were able to treat more than 0.3 acre of impervious area per facility, relating to cost-benefit efficiency for both construction and maintenance. This ratio of feasibility compared (10%) is consistent with the experience that DPW encountered with the Watershed 263 project in 2009 and echoes the challenges and practicality of installation of ESD practices in an urban environment. All of the visited

locations, included the results of the feasibility evaluation, will be included in the Baltimore Green Registry mapping tool, described in in Section 5.5.4 of this report.

A total of thirty-one (31) projects were removed or postponed from the list based on the feasibility of the project completion by the end of this permit period. The specific reasons for removal or postponement are included the "Notes" section of the table. Postponed projects are scheduled for completion for the next MS4 permit.

MDE has noted that the City has used conservative nutrient reduction efficiencies for the projects and has suggested using a higher efficiency similar to Stormwater to the MEP, as listed in the MAST program. However, the City will continue to use an efficiency assigned to "Micro-bioretention (C/ D soils)" as listed in the supporting documents for the on-line Maryland Assessment Scenario Tool (MAST).

6.3.2 Program Implementation and

The progress status of the programs listed in the WIP is provided in Appendix K of this Annual Report, specifically Table K-2. Street sweeping operations decreased in FY 2017; however the ton / mile ratio appears to have increased, possibly indicating the effect of the municipal trash can program and corresponding outreach and education. Current program implementation and corresponding georeference database records are reported as based on frequency and geographic distribution of the operation (weight and tonnage by watershed) in the georeference database in Appendix K.

In the past, inlet cleaning was reported based on complaint response, not necessarily meeting the criteria of quarterly cleaning. In May 2016, the City initiated a routine inspection and pro-active cleaning program for the 5 neighborhoods where inlet modifications were installed. In June 2016, the City also initiated pro-active cleaning of inlets along interstate highway I-83 and I-295. The expenditures for inlet cleaning listed in Table 4-1 include both the complaint-driven and pro-active cleaning. Only the results of this routine inlet cleaning program for the 5 neighborhoods are included in Table K-2.

Although the City's IDDE program identified and abated many illicit discharges, only the disconnections of illicit connections are listed in Table K-1. These connections were confirmed as existing prior to 2010. The equivalent impervious area restoration was calculated using the same calculation for septic system connections to a WWTP, as listed in the "Accounting for Stormwater Wasteload Allocations and Impervious Area Treated" guidance document by MDE, dated August 2014. The City plans to work with MDE to revise this credit for direct sanitary discharges to the storm system since this type of discharge would have a higher, direct pollutant loading than a septic system discharging through groundwater migration. The nutrient reductions for IDDE are based on the "Recommendations of the Expert Panel to Define Removal Rates for the Elimination for Discovered Nutrient Discharges from Grey Infrastructure", dated November 10, 2014. The calculations are included in Appendix I of this report. Furthermore, the City initiated collaboration with Baltimore County to quantify the impervious area restoration credit for other illicit discharges; the results of the collaboration will be submitted separately to MDE for approval and will be considered in future Annual Reports.

6.3.3 Partnership Implementation and Tracking

The progress status of the partnerships listed in the WIP is provided in Appendix K of this Annual Report, specifically Table K-3. The migration of the georeference database was the main focus of FY 2017 efforts; all BMPs with approved plans and estimated status of "completed", implemented to meet development requirements, were simply listed in the Table under development, using conservative pollutant removal efficiencies for pond and bioretention retrofits. The majority of these projects have approved as-built documentation; some have been inspected but are pending approval of an alternative as-built process. The City continues better define these facilities by type and geography (watershed) as part of the georeference database, included in Appendix C.

6.4 Impervious Area Restoration

The progress status of implementation of proposed projects, programs, and partnerships of the WIP is provided in Appendix K. Since most of the projects are still in the design phase, the majority of the impervious area restoration is provided by programs, specifically street sweeping. Although the proposed projects were reduced based on feasibility, about 385 acres of impervious restoration projects are already in design or completed by the end of FY 2017. Based on the tables listed in the Appendix K, the current impervious acre restoration achieved within this permit period is estimated as 3,953 acres. This is equivalent to 92% of the current permit goal. The City is still on track for meeting the impervious area restoration goals by the end of the permit period.

6.5 Bay TMDL Compliance

The current status of implementation of proposed projects, programs, and partnerships were input into the Maryland Assessment Scenario Tool (MAST) to evaluate compliance with the Bay TMDL. The output from this model included in Appendix L. An estimation of the pollutant removals using MDE's Guidance Document is also provided in Appendix L. IDDE practices were not available in the current MAST.

6.6 Regional TMDL Compliance

6.6.1 Nutrients and Sediment

An estimation of the nutrient and sediment removals, based on the current implementation status, using MDE's Guidance Document is provided in Appendix M. Currently, records for inlet cleaning are not geographically referenced so the estimated reduction per watershed (regional TMDL comparison) is not accurate. This accuracy will be improved pending modifications of the data collection for this program. As street sweeping and inlet cleaning are continuous activities, the removal estimates for these activities will be shown as a historic trend to account for any impacts due education, outreach, or enforcement.

IDDE efforts for sanitary direct connections were incorporated into the estimation for nutrient and sediment removal. In the WIP, the City proposed a re-evaluation of the baseline load allocations for sediment based on a feasibility analysis. Coordination with MDE was initiated in FY 2016 and continued in FY 2017.

6.6.2 Bacteria

The results of the City's routine stream sampling program of e.coli at monitoring stations in non-tidal waters are shown in Appendix E for the Jones Falls, Back River, and Gwynns Falls watersheds. There are no stream sampling stations in the Lower North Branch Patapsco watershed. A comparison of the historic monitoring results with the prescribed thresholds for frequent and infrequent full body contact recreation is provided in Section 3.1 of this Annual Report.

The City is under a consent decree in Civil Action No. JFM-02-1524 for unpermitted discharges from the wastewater collection system. A modification to the consent decree was lodged on June 1, 2016 in the United States District Court for the District of Maryland by the U.S. Department of Justice, the U.S. Environmental Protection Agency, and the Maryland Department of the Environment. The modification was approved on October 6, 2017. The City plans to issue a revised bacteria TMDL implementation plan for public comment by June 2018, which will incorporate the schedule approved in this modified consent decree.

The City has continued to make significant capital investments in rehabilitating the sanitary sewer system. This capital investment, in combination with IDDE operations listed in Section 5.3 and public education efforts, prevent bacteria loadings. Further information on these efforts is provided in quarterly Consent Decree reports, posted on the City's website.

6.6.3 Trash

On January 5, 2015, EPA approved the report entitled "*Total Maximum Daily Loads (TMDL) of Trash and Debris for the Middle Branch and Northwest Branch Portions of the Patapsco River Mesohaline Tidal Chesapeake Bay Segment, Baltimore City and County, Maryland*". In compliance with the MS4 permit, the City developed the "Baltimore City Trash TMDL Implementation Plan", submitted to MDE on January 4, 2016, to present strategies to meet the TMDL waste load allocations. In addition to the trash reduction efforts noted in the previous sections of this report, progress on the milestone schedule for the trash TMDL is included in Appendix J of this report.

6.6.4 PCB

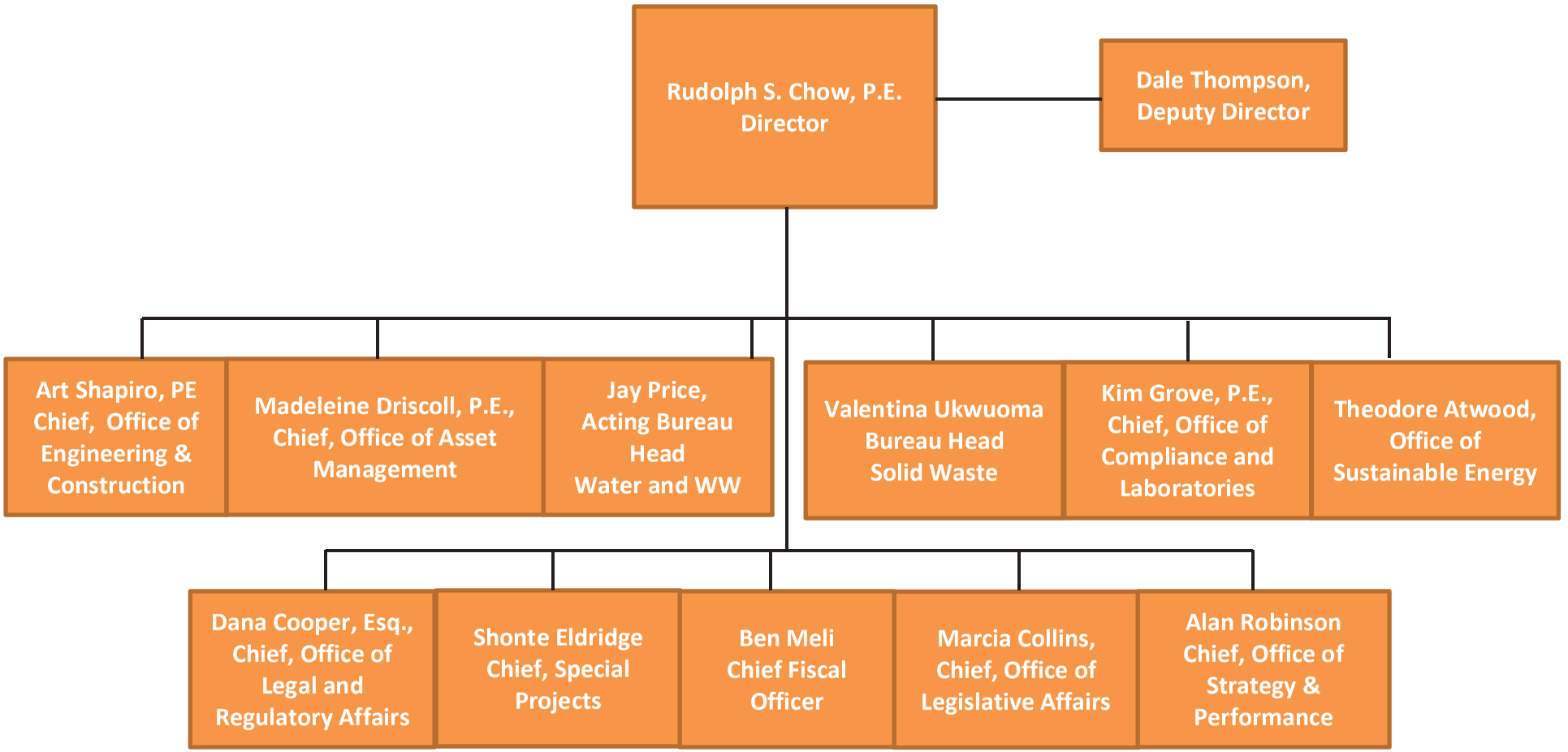
The MS4 WIP included a vague schedule for implementation to address PCB waste load allocations. The City has continued discussions with MDE to better define the allocations and methodologies for progress assessments. Furthermore, the City has initiated collaboration with USGS and Baltimore County on PCB monitoring. The City plans to issue a revised PCB TMDL implementation plan for public comment by June 2018, which will incorporate the results of these collaborations and discussions.

Appendix A: Organization Chart

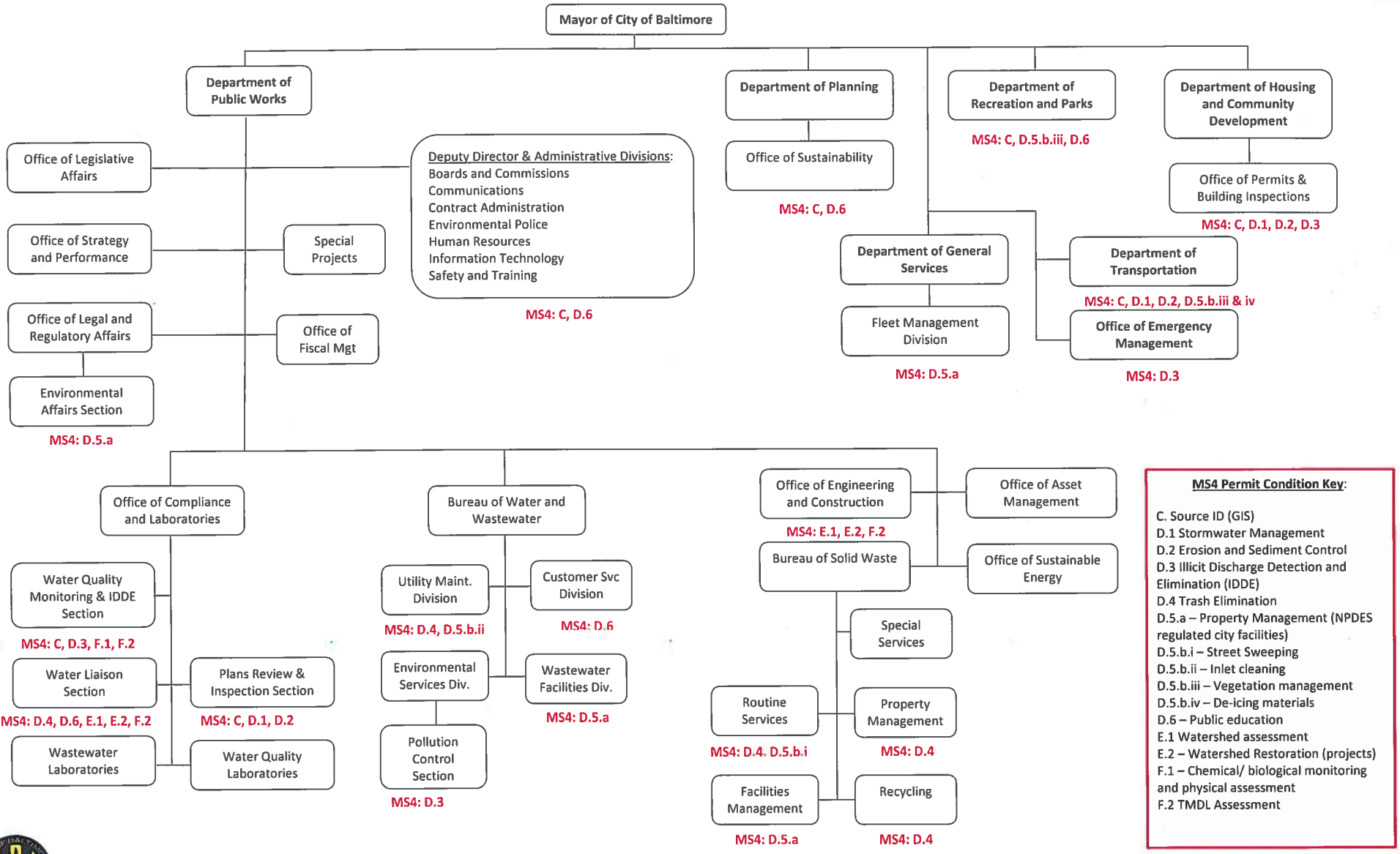
STEPHANIE RAWLINGS-BLAKE
MAYOR

Department of Public Works Organization Chart*

BALTIMORE CITY
DPW
DEPARTMENT OF PUBLIC WORKS
RUDOLPH S. CHOW, P. E.
DIRECTOR



*Note: Reflects organization structure as of June 30, 2016.



MS4 Permit Condition Key:

C. Source ID (GIS)
D.1 Stormwater Management
D.2 Erosion and Sediment Control
D.3 Illicit Discharge Detection and Elimination (IDDE)
D.4 Trash Elimination
D.5.a – Property Management (NPDES regulated city facilities)
D.5.b.i – Street Sweeping
D.5.b.ii – Inlet cleaning
D.5.b.iii – Vegetation management
D.5.b.iv – De-icing materials
D.6 – Public education
E.1 Watershed assessment
E.2 – Watershed Restoration (projects)
F.1 – Chemical/ biological monitoring and physical assessment
F.2 TMDL Assessment

Catherine E. Pugh
Mayor

City of Baltimore Organization Chart in Reference to MS4 Permit Conditions as of June 30, 2016

Appendix B: Summary Table of Null Values in the MS4 Geodatabase

Summary of Null Values Used on MDE Geodatabase

Table	Field	Value	Comments	Schema
Biological Monitoring	EVENT_TIME	12:00	Not recorded in field report.	
	FIBI	-999	FIBI is not done; it is not required for this permit.	X
	EMBEDDEDNESS	-999	Not recorded in field report.	
Chemical Monitoring	WATER_TEMP	-999	Not recorded in field report.	
	pH	-999	Not recorded in field report.	
	BOD_dt	-999	Not recorded in field report.	
	BOD_EMC0	-999	Not recorded in field report.	
	BOD_EMC_dt	-999	Not recorded in field report.	
	TSS_dt	-999	Not recorded in field report.	
	TSS_EMC0	-999	Not recorded in field report.	
	TSS_EMC_dt	-999	Not recorded in field report.	
	TPH_dt	-999	TPH is not done	
	TPH_EMC0	-999	TPH is not done	
	TPH_EMC_dt	-999	TPH is not done	
BMPPOI	IMP_ACRES	-999	Data not shown on as-built plans	
	APPR_DATE	1/1/1900	Data not shown on as-built plans	
	BUILT_DATE	1/1/1900	Data not shown on as-built plans	X
RestBMP	IMP_ACRES	-999	For projects not constructed	
	BUILT_DATE	1/1/1900	For projects not constructed	
	PE_ADR	-999	For projects not constructed	
	PROJECTED_IMPL_YR	9999	For projects not constructed	
	IMPL_COST	-999	Missing data or data was not recorded	
BMP	BMP_DRAIN_AREA	-999	Data not shown on as-built plans	
	BUILT_DATE	1/1/1900	Data not shown on as-built plans	
AltBMPPoly	IMPL_COST	-999	Missing data or data was not recorded	
AltBMPLine	MAX_DUR_CREDIT	-999	Will be provided in FY 2017	
Outfall	DIM_OUTFALL	-999	Missing data	
	HT_OUTFALL	-999	Missing data	
	WT_OUTFALL	-999	Missing data	
BMP_Inspections	REINSP_DATE	1/1/1900	For facilities which have been removed	X
IDDE	LAST_RAIN	1/1/1900	Data was not recorded at sampling time	
	SCREEN_TIME	1200	Data was not recorded at sampling time	
	WATER_TEMP	-999	Data was not recorded at sampling time	
	AIR_TEMP	-999	Data was not recorded at sampling time	
	ALGAEGROW	N	Data was not recorded at sampling time	
	ODOR	SE	Data was not recorded at sampling time	
	DEPOSITS	N	Data was not recorded at sampling time	
	VEG_COND	N	Data was not recorded at sampling time	
	STRUCT_COND	N	Data was not recorded at sampling time	
	EROSION	N	Data was not recorded at sampling time	
NarrativeFile	MDE_STATION_ID	-999	Document is not associated with a monitoring site.	X

Note: Schema indicates MDE plans to change the field to optional in next generation of database.

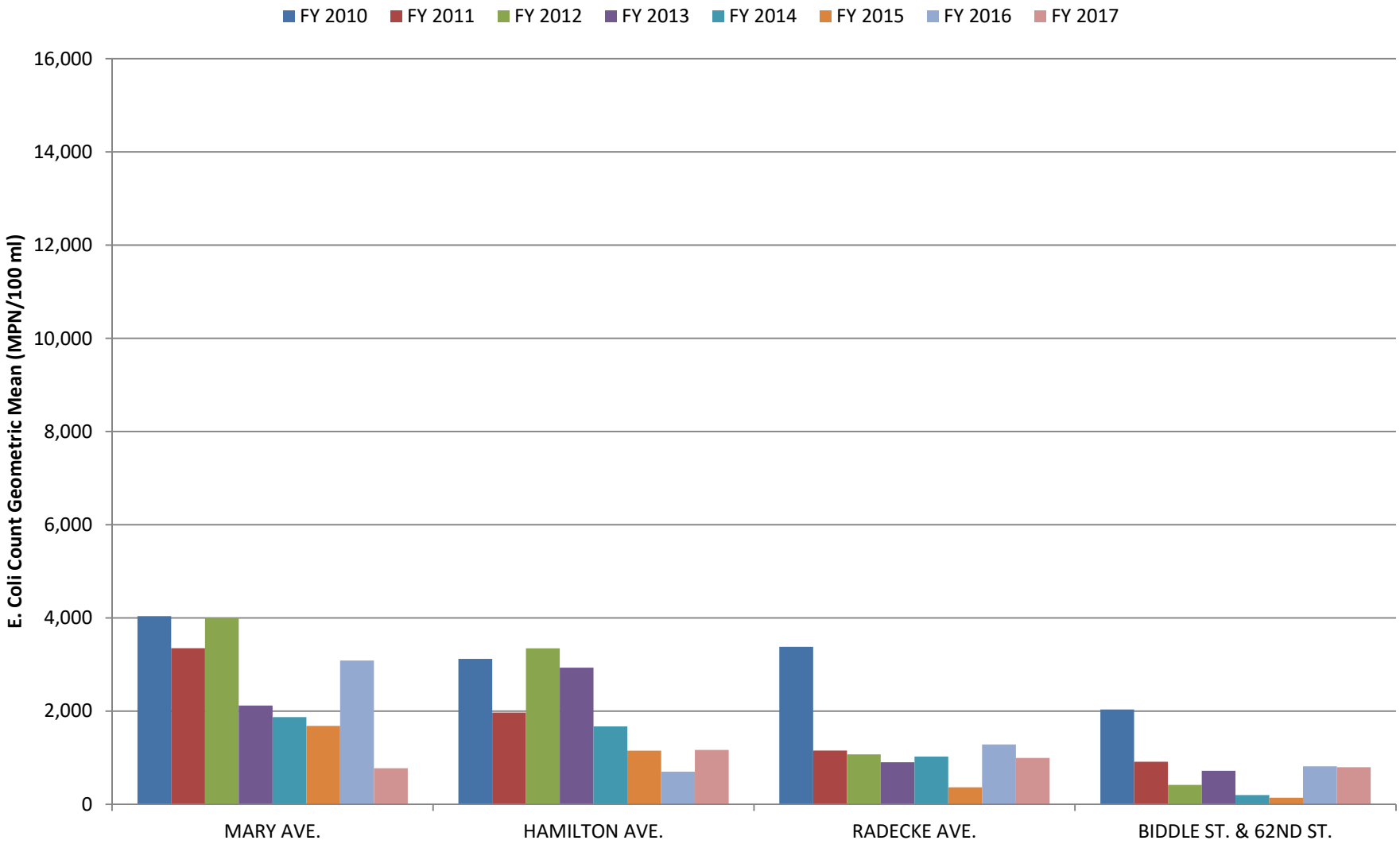
Appendix C: Source Information using MS4 Geodatabase (*electronic files only*)

Appending D: Ammonia Screening and Stream Impact Sampling Results (*electronic files only*)

Appendix E: Bacteria Monitoring Histographs

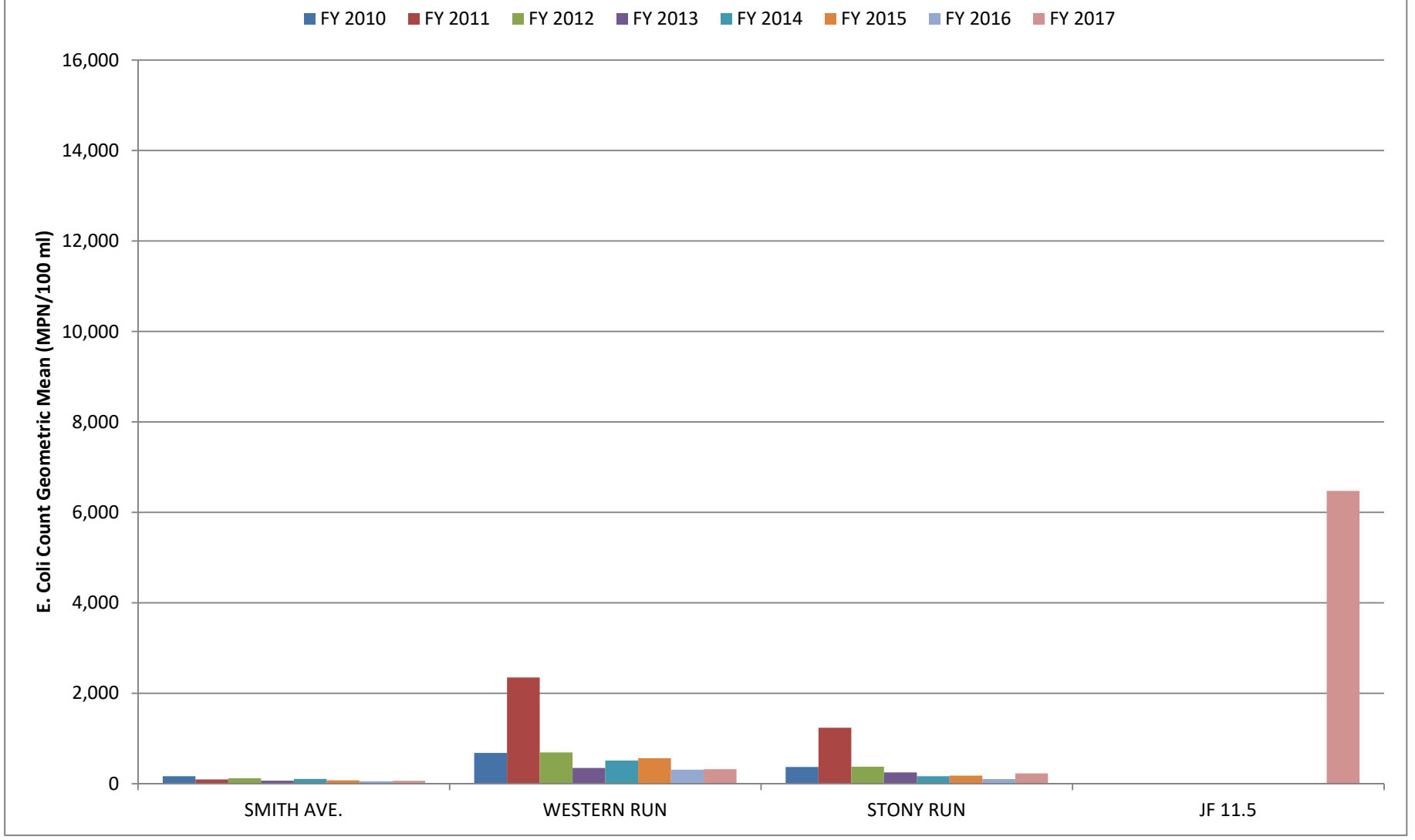
Moores Run SIS Dry Weather E. Coli MPN Count Geometric Means by Fiscal Year

Please note: from COMAR 26.08.02.03-3 the criteria is that the Steady State Geometric Mean Indicator Density be less than or equal to 126 MPN/100 ml for freshwaters.



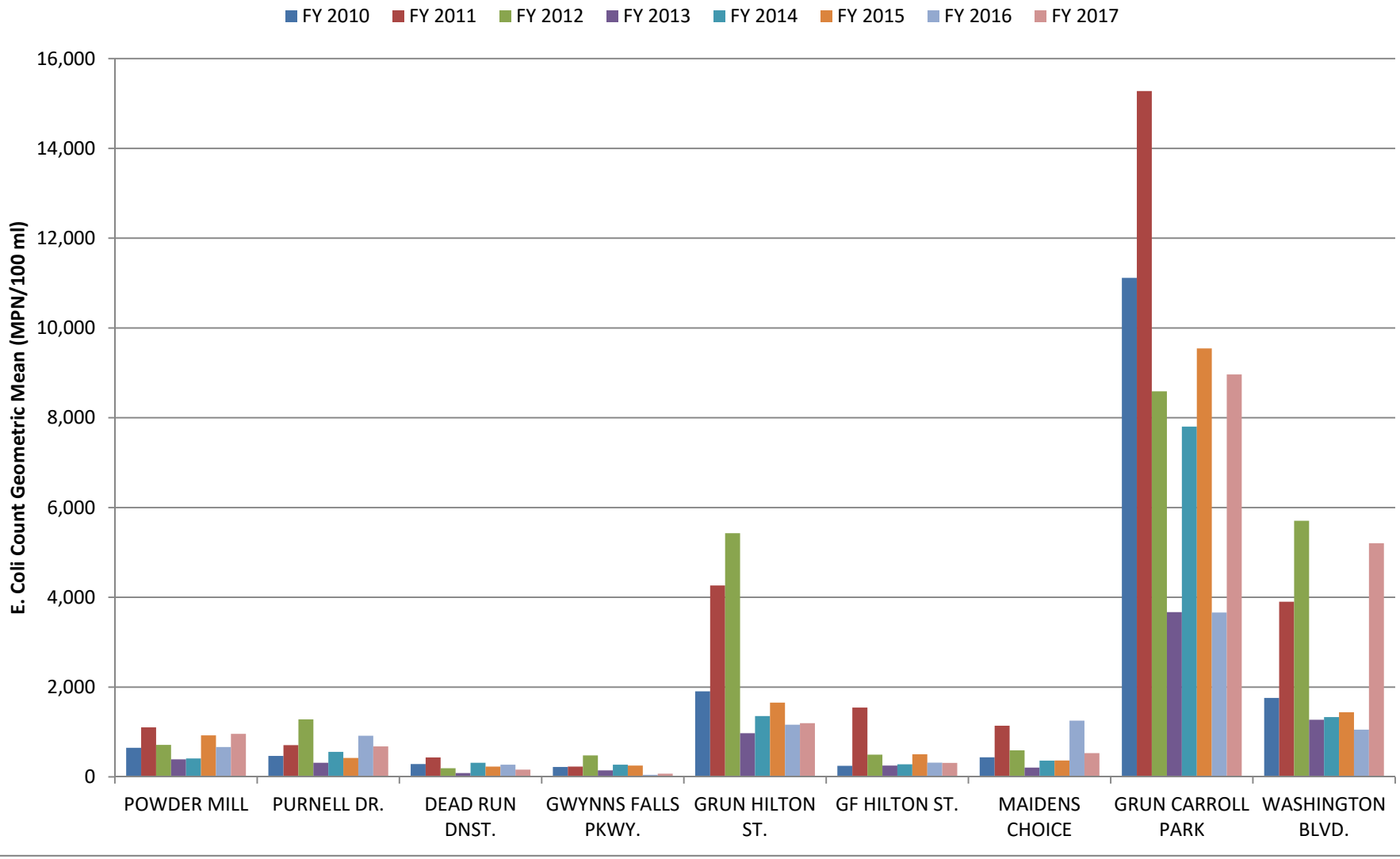
Jones Falls SIS Dry Weather E. Coli MPN Count Geometric Means by Fiscal Year

Please note: from COMAR 26.08.02.03-3 the criteria is that the Steady State Geometric Mean Indicator Density be less than or equal to 126 MPN/100 ml for freshwaters.



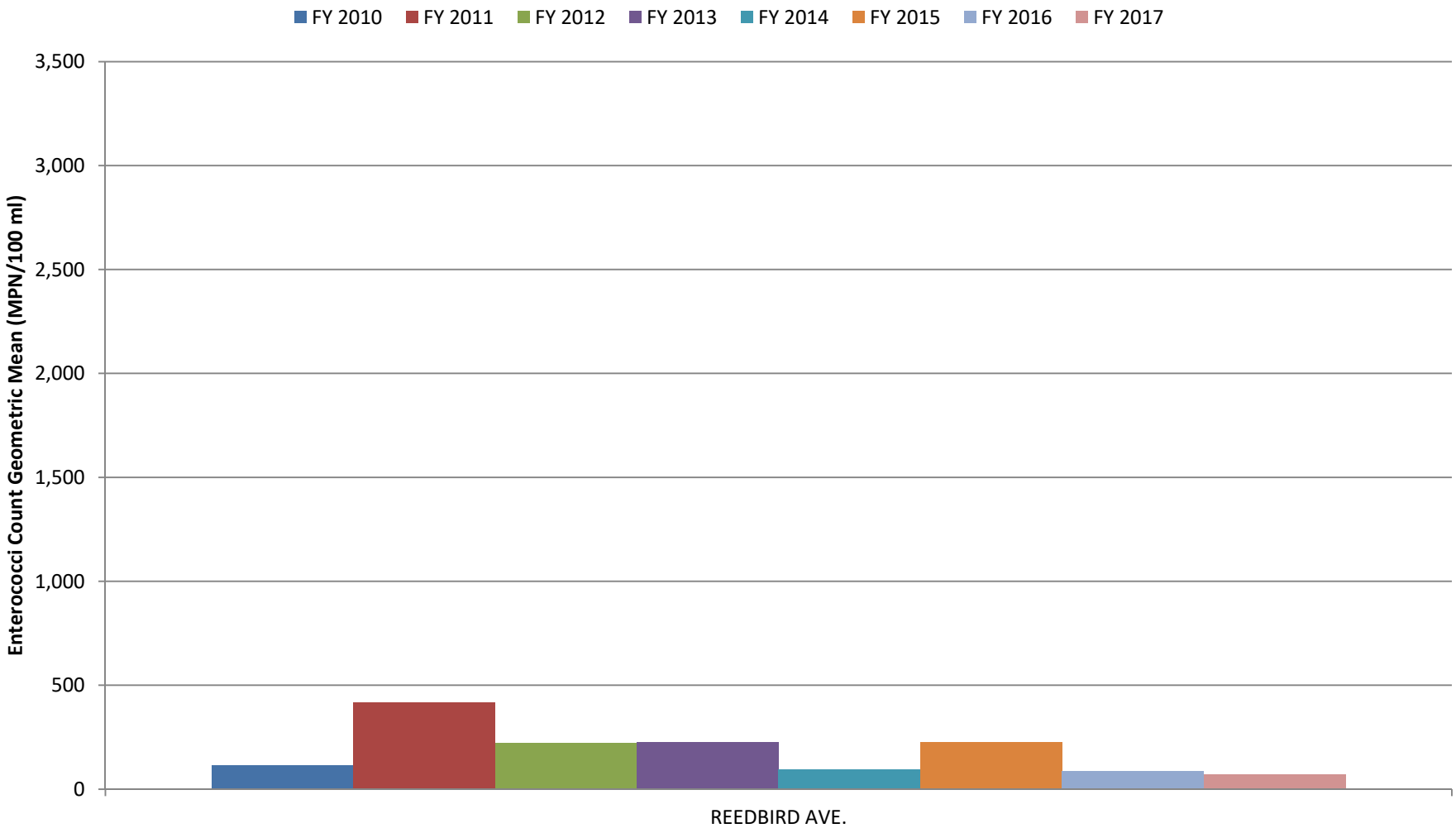
Gwynns Falls SIS Dry Weather E. Coli MPN Count Geometric Means by Fiscal Year

Please note: from COMAR 26.08.02.03-3 the criteria is that the Steady State Geometric Mean Indicator Density be less than or equal to 126 MPN/100 ml for freshwaters.



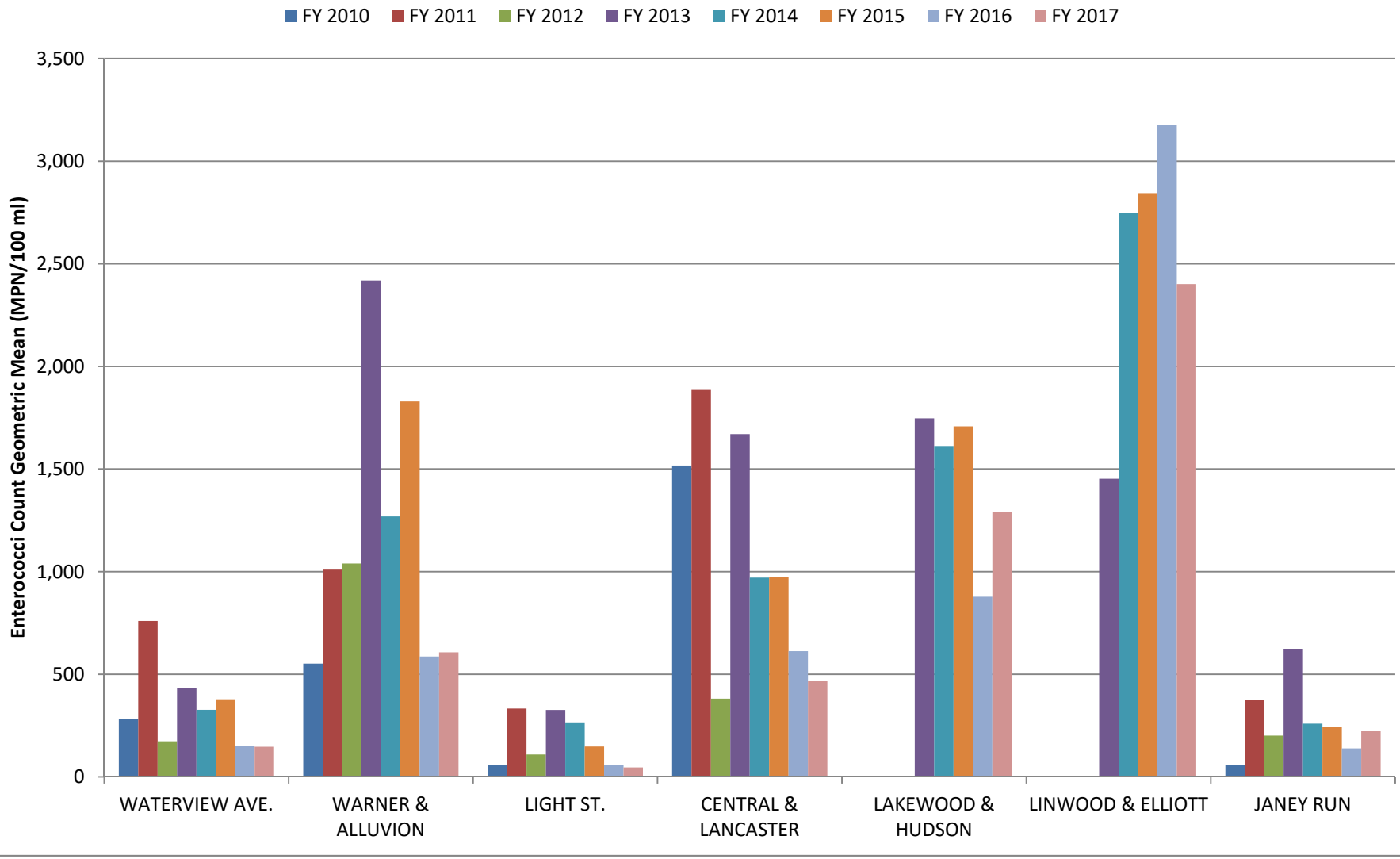
Patapsco River SIS Dry Weather Enterococci MPN Count Geometric Means by Fiscal Year

Please note: from COMAR 26.08.02.03-3 the criteria is that the Steady State Geometric Mean Indicator Density be less than or equal to 35 MPN/100 ml for marine waters.



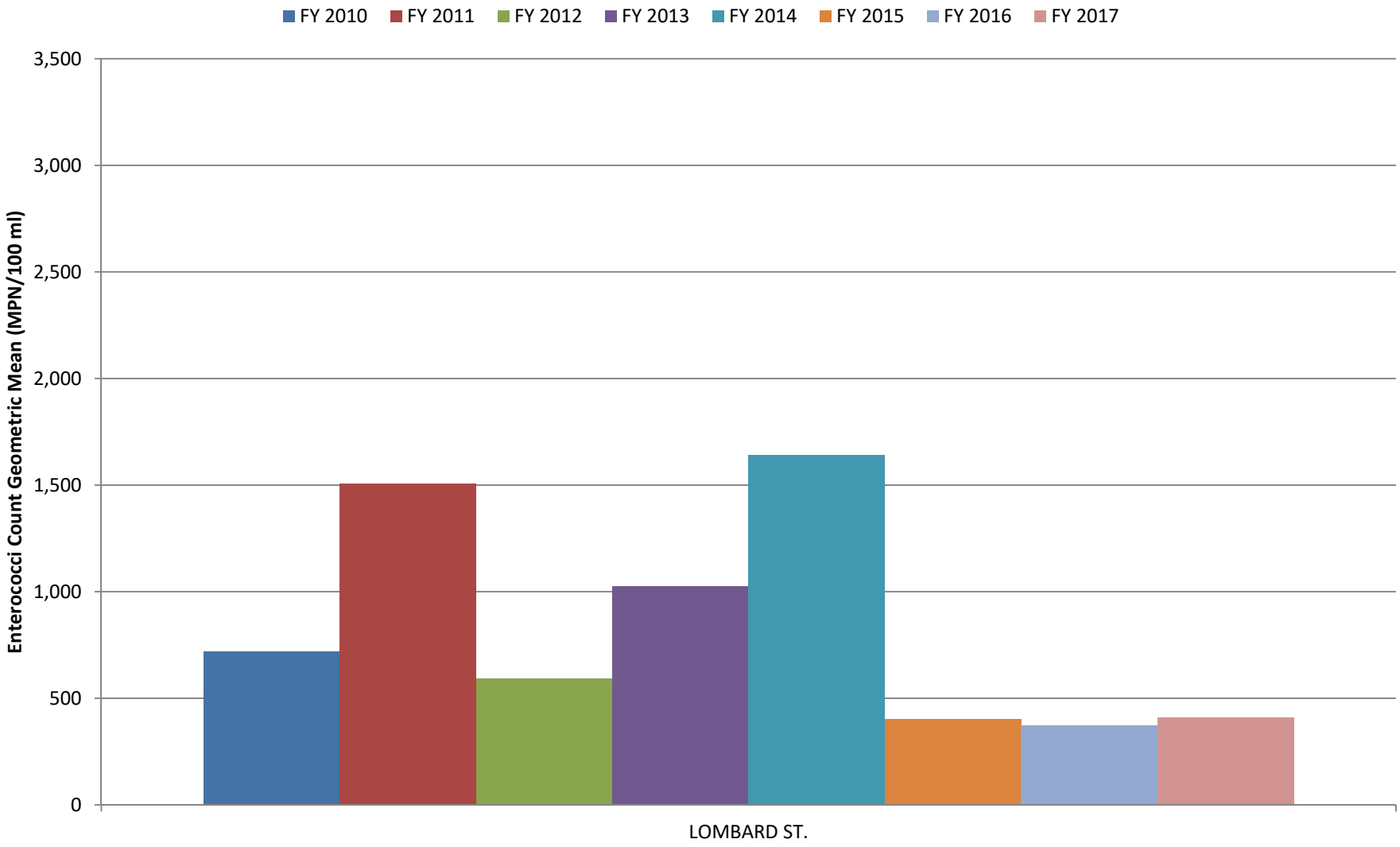
Harbor SIS Dry Weather Enterococci MPN Count Geometric Means by Fiscal Year

Please note: from COMAR 26.08.02.03-3 the criteria is that the Steady State Geometric Mean Indicator Density be less than or equal to 35 MPN/100 ml for marine waters.



Jones Falls SIS Dry Weather Enterococci MPN Count Geometric Means by Fiscal Year

Please note: from COMAR 26.08.02.03-3 the criteria is that the Steady State Geometric Mean Indicator Density be less than or equal to 35 MPN/100 ml for marine waters.



Appendix F: Habitat Monitoring

	Moores Run above Radecke Ave. Segments											
	1	2	3	4	5	6	7	8	9	10	11	Tributary
Parameter												
Instream Habitat												
2005-05-18	16	16	16	4	16	16	16	16	13	16	1	13
2006-05-01	15	16	15	4	15	15	15	14	13	14	1	13
2007-04-02	15	14	16	4	15	11	15	14	13	15	1	15
2008-05-05	15	15	17	4	15	11	11	15	14	14	1	12
2009-04-30	12	14	13	13	13	15	15	15	13	15	3	10
2010-03-24	16	16	18	5	12	17	16	16	13	15	1	15
2011-03-03	17	18	18	6	17	14	14	16	15	15	1	14
2012-06-28	18	16	18	5	15	11	11	10	10	15	2	13
2013-09-03	13	17	16	15	14	14	14	17	14	16	2	12
2014-08-21	15	15	14	12	8	8	15	16	8	13	5	13
2016-06-09	16	17	17	8	17	7	15	16	14	15	1	10
2017-06-08	16	13	17	5	16	13	16	10	10	15	1	10
Epifaunal Substrate												
2005-05-18	16	16	16	1	16	16	15	16	13	16	1	14
2006-05-01	14	15	15	4	15	15	14	14	10	14	0	14
2007-04-02	15	14	15	5	15	10	12	10	10	14	0	10
2008-05-05	14	14	17	4	14	10	8	12	11	14	0	12
2009-04-30	10	12	11	11	11	15	13	14	13	15	10	7
2010-03-24	15	14	17	8	11	12	14	11	11	10	7	15
2011-03-03	16	17	17	8	16	14	13	9	12	10	6	13
2012-06-28	12	15	15	8	14	10	14	9	9	10	6	13
2013-09-03	13	16	16	6	10	11	14	15	9	10	8	11
2014-08-21	14	16	13	13	8	8	16	14	8	15	6	13
2016-06-09	15	15	17	10	15	6	8	10	11	10	8	11
2017-06-08	16	14	15	3	14	10	11	8	8	11	8	11
Velocity/Depth Diversity												
2005-05-18	8	10	14	6	8	8	8	10	8	9	11	8
2006-05-01	8	10	10	6	11	8	8	11	10	10	6	8
2007-04-02	10	13	12	6	6	8	8	10	9	10	6	10
2008-05-05	8	12	15	6	11	9	9	12	8	9	6	8
2009-04-30	11	11	13	8	10	15	14	15	13	15	2	10
2010-03-24	10	15	14	8	10	11	13	8	12	10	11	15
2011-03-03	10	10	10	11	10	10	14	15	15	10	12	10
2012-06-28	7	14	10	6	10	8	8	13	9	10	1	11
2013-09-03	7	14	10	6	12	8	11	14	7	10	12	10
2014-08-21	8	12	9	12	8	10	10	9	7	10	11	12
2016-06-09	8	14	14	9	16	10	10	15	12	13	11	9
2017-06-08	8	7	14	6	9	10	10	8	7	10	11	8
Pool/Glide/Eddy Quality												
2005-05-18	5	7	12	13	10	8	10	15	12	3	13	1
2006-05-01	5	7	10	16	10	8	10	11	12	3	8	1
2007-04-02	5	7	11	16	11	10	9	10	11	4	10	1
2008-05-05	8	14	12	17	12	12	10	14	13	3	8	1
2009-04-30	9	10	13	12	7	9	13	12	11	11	13	5
2010-03-24	8	12	12	13	11	8	13	10	11	9	13	3
2011-03-03	14	14	13	17	14	13	14	15	15	13	15	3
2012-06-28	8	16	6	15	8	7	8	13	10	11	8	11
2013-09-03	8	10	8	14	11	9	14	13	9	9	14	4
2014-08-21	8	13	7	14	7	8	10	9	8	9	13	11
2016-06-09	8	14	16	13	12	8	8	11	12	12	11	7
2017-06-08	11	16	8	17	8	0	13	8	7	10	10	6
Riffle/Run Quality												
2005-05-18	11	13	11	3	12	12	13	14	10	14	2	7

Parameter	Moores Run above Radecke Ave. Segments											
	1	2	3	4	5	6	7	8	9	10	11	Tributary
2006-05-01	11	13	11	2	11	13	13	14	12	14	2	7
2007-04-02	13	15	13	2	13	13	12	14	13	15	0	8
2008-05-05	13	13	13	1	15	15	14	14	13	13	1	6
2009-04-30	18	12	15	1	6	13	16	15	8	11	1	8
2010-03-24	12	12	13	1	13	13	13	13	11	10	2	9
2011-03-03	15	17	18	14	17	13	15	15	15	15	1	11
2012-06-28	10	14	15	0	15	10	11	12	10	12	0	7
2013-09-03	6	9	10	0	6	8	10	13	6	12	1	6
2014-08-21	6	14	10	8	8	11	12	9	9	12	0	7
2016-06-09	11	14	14	2	13	8	10	11	8	12	1	6
2017-06-08	12	12	14	0	13	10	11	8	8	11	0	6
Embeddedness (%)												
2005-05-18	50	50	50	0	60	70	50	50	70	50	0	50
2006-05-01	50	50	50	0	60	60	60	60	60	50	0	50
2007-04-02	60	60	50	75	60	60	60	50	60	50	0	50
2008-05-05	40	50	50	0	50	60	50	50	50	50	0	50
2009-04-30	10	50	50	70	50	30	20	20	30	20	0	70
2010-03-24	40	40	40	0	40	30	30	30	40	40	0	40
2011-03-03	50	50	50	50	50	60	50	50	50	50	0	50
2012-06-28	30	30	30	0	50	50	30	50	50	20	0	30
2013-09-03	50	50	50	40	50	60	50	50	50	50	0	60
2014-08-21	50	40	50	50	60	50	40	50	50	50	50	50
2016-06-09	50	50	50	50	30	75	50	50	50	50	0	50
2017-06-08	30	50	20	NA	30	60	40	60	60	40	0	50
Embeddedness												
2005-05-18	11	11	11	0	9	7	11	11	7	11	0	11
2006-05-01	12	11	11	0	9	9	10	10	10	11	0	11
2007-04-02	10	10	11	3	10	9	10	11	10	11	0	13
2008-05-05	13	13	13	0	13	8	13	13	13	13	0	12
2009-04-30	19	11	12	7	11	14	16	16	14	17	0	7
2010-03-24	14	14	14	0	14	14	13	14	13	13	0	14
2011-03-03	14	14	14	14	14	9	14	14	14	14	0	14
2012-06-28	14	14	14	0	11	10	14	10	10	17	0	14
2013-09-03	11	11	11	13	11	9	11	11	11	11	0	13
2014-08-21	11	12	11	11	8	11	12	11	11	11	11	11
2016-06-09	11	11	11	11	13	6	11	11	11	11	0	11
2017-06-08	14	11	17	NA	14	9	13	9	9	13	0	11
Trash Rating												
2005-05-18	11	8	4	8	9	8	11	7	5	7	9	11
2006-05-01	8	11	11	10	10	11	8	12	3	9	18	11
2007-04-02	8	8	7	12	11	10	9	10	5	10	18	15
2008-05-05	8	8	3	8	6	6	5	5	3	8	18	13
2009-04-30	8	8	3	9	9	8	9	8	8	10	13	6
2010-03-24	8	8	3	8	13	8	8	10	7	11	12	13
2011-03-03	6	6	8	6	13	9	10	6	7	12	18	8
2012-06-28	8	6	7	3	13	13	10	13	12	11	16	14
2013-09-03	6	7	10	13	13	14	10	7	6	12	18	7
2014-08-21	10	6	10	15	13	8	10	10	10	12	18	6
2016-06-09	14	8	3	16	11	10	8	8	6	9	15	7
2017-06-08	7	7	6	11	7	7	6	6	7	7	16	8
Channel Alteration												
2005-05-18	16	16	16	16	16	16	16	16	17	17	1	13
2006-05-01	16	16	16	16	16	16	16	16	17	14	1	13
2007-04-02	16	16	16	16	16	16	16	16	16	15	1	15

Parameter	Moores Run above Radecke Ave. Segments											Tributary
	1	2	3	4	5	6	7	8	9	10	11	
2008-05-05	17	17	17	17	16	17	17	17	17	15	1	13
2009-04-30	15	16	16	17	16	16	16	16	16	17	1	12
2010-03-24	18	18	18	18	16	17	18	17	18	15	2	15
2011-03-03	17	17	17	17	16	17	17	17	17	15	1	15
2012-06-28	18	18	18	15	15	16	17	18	18	18	1	14
2013-09-03	18	18	18	16	17	18	18	18	18	18	1	14
2014-08-21	18	18	17	17	16	18	18	17	18	18	1	18
2016-06-09	17	17	17	16	17	17	17	16	16	16	2	15
2017-06-08	17	17	18	17	16	18	18	18	18	16	2	15
Bank Vegetative Protection												
2005-05-18	11	12	15	15	15	15	18	16	17	11	2	8
2006-05-01	11	13	16	16	14	16	16	16	17	10	2	8
2007-04-02	12	12	16	16	14	14	16	14	16	10	2	10
2008-05-05	14	14	17	15	15	16	13	12	17	10	2	8
2009-04-30	20	18	18	20	16	13	19	15	14	13	1	20
2010-03-24	18	18	17	17	14	18	16	16	18	14	2	15
2011-03-03	17	16	15	17	14	13	15	16	16	13	2	16
2012-06-28	17	16	14	14	17	17	16	16	17	13	2	17
2013-09-03	15	17	17	10	15	18	14	15	16	12	2	16
2014-08-21	18	17	12	13	15	15	12	10	10	11	2	6
2016-06-09	18	17	13	16	16	17	14	12	16	10	2	18
2017-06-08	12	16	17	12	17	14	16	17	15	16	2	18
Condition Of Banks												
2005-05-18	18	18	14	18	18	14	16	17	16	8	20	18
2006-05-01	18	13	14	18	18	14	16	17	15	16	20	18
2007-04-02	18	14	15	18	13	14	15	16	14	15	20	16
2008-05-05	18	17	16	16	18	14	15	16	18	16	20	18
2009-04-30	17	12	13	11	17	10	10	18	15	11	20	5
2010-03-24	18	17	16	16	15	17	14	17	18	15	20	18
2011-03-03	18	16	15	16	16	14	15	16	16	16	20	14
2012-06-28	16	17	15	17	18	15	14	16	16	18	20	18
2013-09-03	18	18	17	14	16	14	14	17	16	18	20	16
2014-08-21	14	8	10	9	10	8	10	9	9	12	20	15
2016-06-09	18	16	13	14	17	15	13	15	15	17	18	16
2017-06-08	17	14	17	12	16	12	12	15	13	17	18	16
Riparian Vegetative Zone												
2005-05-18	7	7	9	12	6	6	9	11	10	9	2	2
2006-05-01	7	7	10	14	6	6	8	11	10	6	2	2
2007-04-02	7	4	8	15	6	6	11	11	10	6	2	2
2008-05-05	8	9	12	15	6	6	7	15	12	7	2	2
2009-04-30	2	4	8	13	5	4	7	10	16	16	5	4
2010-03-24	10	7	10	15	10	6	8	15	16	3	2	6
2011-03-03	4	8	8	12	8	4	9	10	7	4	2	7
2012-06-28	14	14	8	17	10	12	14	18	19	11	2	4
2013-09-03	6	6	11	14	10	5	6	10	16	9	4	3
2014-08-21	4	6	14	9	14	7	9	18	16	11	1	5
2016-06-09	10	11	16	18	14	18	15	18	18	17	4	6
2017-06-08	16	11	20	20	13	13	17	15	15	14	2	6

Scoring Color Code

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

Appendix G: Baltimore City, Maryland 2015 Stream Restoration Monitoring Summary by USFW

- *Main Report*
- *Appendices A to F (electronic files only)*

Draft BALTIMORE CITY, MARYLAND
2015 STREAM RESTORATION MONITORING SUMMARY

By: Sandra L. Davis, Ben J. Hutzel, Mark A. Secrist and Richard R. Starr

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Stream Habitat Assessment and Restoration
Coastal Program
U.S. Fish and Wildlife Service
Chesapeake Bay Field Office

CBFO-S16-05

Prepared in cooperation with:
City of Baltimore, Department of Public Works, Bureau of Water and Wastewater

Annapolis, MD
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TABLE OF CONTENTS

LIST OF PHOTOGRAPHS

I. INTRODUCTION

The U.S. Fish and Wildlife Service, Chesapeake Bay Field Office (Service) and the City of Baltimore (City) entered into a cooperative agreement (Agreement 51410-1902-5119) to enhance cooperation and coordination to allow for the conservation, enhancement, and restoration of stream and riparian habitats in the Baltimore City watershed. These habitats are scarce and often impaired, and their conservation and restoration are critical for the Federal Trust Resources, such as migratory birds and anadromous fish.

As part of this agreement, the Service used a stream restoration monitoring methodology to evaluate the stability and functional success of stream restoration projects in Baltimore City. Monitoring is critical in evaluating whether the project achieved its restoration objective(s). Restoration monitoring will also provide data to improve restoration designs, and increase the success of restoration projects. The methodology (Davis et al. 2014) is rapid, visually based assessment that can be used regardless of the design approach (i.e. regenerative storm conveyance, sand berm seepage systems, Natural Channel Design, among others).

Five stream restoration projects were monitored by the Service in 2016. Sites 1 and 2 are stream restoration projects on Stony Run. Site 1 is Upper Stony Run, and is approximately 2,500 linear feet in length and is located between Northern Parkway and Wyndhurst Avenue. This project was completed in September 2006. Site 2, Middle Stony Run is approximately 2,740 linear feet and is located between Wyndhurst Avenue and the confluence of Stony Run with the East Branch of Stony Run. This project was completed in March 2007. Site 2 is immediately downstream of Site 1.Site 3, Biddison Run, is a 1,485 linear foot stream restoration project completed in 2006. The project is located in the Bowley's Lane Landfill between Moravia Road and Herring Run. Prior to restoration, Biddison Run was causing erosion of the landfill cap and exposing waste deposits. Site 4 is Maidens Choice stream restoration. This site is a 2,400 linear foot project that was completed in 2009. The project site is located between Beechfield Ave. and Yale Ave.Western Run is Site 5. The 2,100 linear foot project stream restoration project was completed in 2010. It is located between Green Spring Avenue and Cross Country Boulevard.

Service prepared a summary for each restoration project monitored. The summary includes the restoration objectives, assessment results, and general and site-specific issues, causes, and recommendations for each stream restoration site.

II. METHODOLOGY

A. Rapid Stream Restoration Monitoring Protocol

The Service used a Rapid Stream Restoration Monitoring protocol (Davis et al. 2014) to assess five stream restoration projects in Baltimore City. The rapid monitoring survey visually evaluates the stability and qualitative functional success of the vertical stability, lateral stability, riparian condition and physical structures installed in a restoration project. Parameters that evaluate vertical stability, lateral stability, and riparian condition are based the document: *A*

Function-Based Framework for Stream Assessment and Restoration Projects, (Harman et al. 2012). The framework is illustrated by a functional pyramid, which is a five-level hierarchical framework that categorizes stream functions and the parameters that describe those functions. The stability of the physical structures (i.e. log vane, cross vane) are evaluated using parameters based on a combination of stream functional and structural measures. The rapid methodology uses these function-based parameters to identify restoration success and recommend further action. Recommended future actions always include the rapid assessment protocol, but may include other, more intensive survey monitoring, remediation and/or repair.

The rapid stream restoration monitoring protocol consists of eight main components: A) design approach, B) bankfull determination, C) limits of investigation, D) rapid stream restoration monitoring form, E) evaluation parameter definitions, F) monitoring procedures, G) limited stream measurements, and H) monitoring/restoration thresholds. An example data sheet and the evaluation attribute table portions of the rapid stream restoration protocol can be found in Appendix F.

B. Constraints

In addition to the rapid stream restoration monitoring protocol forms and evaluation attributes, the Service used all available as-built surveys and design reports to assess the five restoration projects. All stationing is taken from the as-built surveys provided by the City. In some cases, complete assessment and design reports were not available for use in conjunction with the protocol. However, this did not hinder the Service's ability to monitor the restoration success.

III. MONITORING RESULTS AND RECOMMENDATIONS

As part of the rapid monitoring protocol, the Service assessed the vertical stability, lateral stability, riparian condition and instream structures (i.e. log vanes, w-weir) for the entire restoration area for the Upper and Middle Stony Run, Biddison Run, Maidens Choice and Western Run restoration projects. The monitoring reaches started and ended at the point where the restoration had no visible influence on the stream, and included areas in the reach that are currently stable. The assessment includes problem identification, as well as information about the severity, implication, apparent cause of the problem, and recommended corrective actions (if any). Representative photographs were taken at each station evaluated.

All detailed assessment results and photographs are located in Appendices A – E. However, the Service has summarized the restoration objectives, assessment results, and general and site-specific issues, causes, and recommendations for each stream restoration site in Sections A through E below.

A. Upper Stony Run Monitoring Summary

The Upper Stony Run was identified in need of restoration due to active bank erosion and channel widening. Prior to restoration, the site was predominately a Rosgen F stream type with active bank erosion. While the Service did not have a full copy of the Stony Run Restoration

Design report produced by STV Incorporated, the Service did have a portion of the report, as well as the as-built surveys. The report listed the goals of the restoration as:

1. End excessive bank erosion by restoring floodplain areas.
2. Dissipate energy at storm drain outfalls.
3. Create flood storage areas in the form of wetlands in the floodplain.
4. Improve water quality and habitat potential.
5. Enhance aesthetic values of the natural channel corridor.

The stream restoration was completed in September of 2006. On February 4, 2016, the Service conducted monitoring of approximately 2,500 linear feet of Upper Stony Run. The monitoring was conducted between Northern Parkway and Wyndhurst Avenue, and includes an approximately 85 linear foot tributary located at Station 05+75. Monitoring was conducted using the Service's *Rapid Stream Restoration Monitoring Protocol* (Davis et al. 2014). All raw data and photographs from the monitoring are included in Appendix A.

Approximately 70 percent of the study area in Upper Stony Run is stable, with no significant lateral or vertical adjustment (photo 1). The Rosgen stream type is either a C3/4 or B3/4. Lateral bank scour and erosion is the predominant issue in areas that are under adjustment. With few exceptions (listed below), the lateral instability is minor, and caused by structures not functioning properly due to incorrect design and planform placement. Improper structure design and placement affect the stream in two ways. First, if the structure is not placed correctly in the stream's planform, flow will not be directed away from the banks. Lateral erosion is the result (photo 2). Second, incorrect structure design will result in lateral and vertical adjustments. The most common issues in the study site are vane arms that are too flat, and cross overs that are greater than one-third the channel width. This results in scour on the upstream vane arms and deposition along the downstream vane arms (photo 3). Although nearly all of the structures in Upper Stony Run are either designed and/or placed improperly, these flaws are not currently causing immediate or system-wide failure. Therefore, the Service recommends continued rapid restoration monitoring of the study reach.

Station Specific Issues and Recommendations:

- 08 + 50 – 08+80: This area is laterally and vertically unstable. The width/depth ratio is too large for the drainage area, causing excess aggradation on the right bank, in the form of a large point bar. In addition, there is currently a debris jam directly over the cross over in Cross Vane 4 (Station 08 +50). The debris jam is exasperating the instability by directing flow toward the right bank, resulting in the start of a cut-off channel (photo 4). The debris jam should be removed.
- 11+ 40 – 12+22: The reach is laterally unstable on the left bank due to effects from an outfall located at Station 11+50. A wetland area was designed around the outfall to increase storm flow retention; however, its capacity is too small to contain the flow from the outfall, particularly during storm events. As a result, there is a channel cutting through the wetland and flowing directly into Stony Run. This channel is directing stormflow directly into the left bank (photo 5). The Service recommends redesigning or

armoring the outfall to reduce stormwater effects. In addition, supplemental riparian planting on the left bank will help eliminate lateral adjustment.

- 14+62 – 15 + 10: The reach is vertically unstable. The channel was designed over wide to accommodate the road crossing; the stream is depositing sediment along right bank in order to reform the correct width/depth ratio.
- 24+87 – 25+50: Approximately 15 linear foot of left bank downstream of cross vane 21 (Station 24+87) has a high BEHI rating. The lateral erosion is caused by improper placement of cross vane 21 (photo 2). Currently the high clay content of the bank, as well as the surface protection provided by mature vegetation is keeping the bank from getting worse. The Service recommends continued rapid monitoring of this area for one year. If the erosion gets more severe, either plantings (if possible) or armoring should be considered.
- 26+97 – 27+75: The right bank downstream of cross vane 23 (Station 26+97) has a very high BEHI rating (photo 6). The stream has no access to its floodplain in this section due to the valley narrowing, however, improper placement of cross vane 23 is exasperating the issue by directing stream flow into the right bank. This section of Upper Stony Run may be out of the original restoration design area, however, it is included because it is affected by the restoration.

Photo 1. Upper Stony Run. Stable reach at station 24+25.

Photo 2. Upper Stony Run. Lateral bank erosion due to improper structure placement at station 25+50.

Photo 3. Upper Stony Run. Cross vane at station 25+95 showing typical structure issues and results: scour on upstream of vane arm and deposition along downstream vane arms.

Photo 4. Upper Stony Run. Station 08+70 showing debris jam and start of cutoff channel on right bank.

Photo 5. Upper Stony Run. Station 12+00 showing right bank erosion.

Photo 6. Upper Stony Run. Right bank erosion at station 27+40.

B. Middle Stony Run Monitoring Summary

Middle Stony Run was identified in need of restoration as part of the Parsons Brinkerhoff and Clear Creeks Consulting *Middle Stony Run Stream Restoration Findings Report* (2004). Due to its highly urbanized watershed and impervious surface, and subsequent stormwater runoff, stream bank and streambed erosion were identified as a significant issues in Stony Run. The report listed five objectives:

1. Correct stream stability problems to reduce sediment and nutrient loading from channel sources.
2. Improve in-stream habitat.
3. Protect public infrastructure.
4. Protect public and private property.
5. Reduce the need for future channel maintenance.

The stream restoration was completed March 2007. On January 21, 2016, the Service conducted monitoring on approximately 2,740 linear feet of Middle Stony Run. The project area is located from Wyndurst Avenue to the confluence of Stony Run and the East Branch of Stony Run. Monitoring was conducted using the Service's *Rapid Stream Restoration Monitoring Protocol*

(Davis et al. 2014). All raw data and photographs from the monitoring are included in Appendix B.

In order to preserve public and private property, and due to its narrow valley, Middle Stony Run is a B3/4 stream type. The study reach from station 0+00 to 24+27 consists of alternating rock structures (cross vanes and j-hooks) and constructed riffles. The remainder of the study area, from station 24+27 to 27+41, consists of modified boulder cascades and boulder step-pool series.

Due to the amount of structures present in the restoration, Middle Stony Run is approximately 90 percent stable, with only localized minor lateral erosion, and no excess scour or deposition in the bed through the riffles. However, in many sections the stream appears overwide, with field measured width/depth ratios of approximately 22.5 to 26. This width/depth ratio is too high to transport the sediment through the reach. This excess sediment is affecting the stream in two ways. First, at station 09+60 – 11+85, station 17+33 – 19+40 and station 22+60 – 24+27, deposition has redirected stream energy toward the stream banks and has caused minor lateral erosion (photo 7). Second, the excess sediment affects bedform diversity and in-stream habitat by preventing the development of pool habitat. With only a few exceptions, the pools in the study reach are filling in, and are not functioning as intended (photo 8). Despite these issues, the areas of vertical and lateral instability in Middle Stony Run are localized and minor; although the stream is too wide to transport its sediment load properly, the sediment load itself is not excessive enough to cause system-wide failure. Therefore, the stream restoration achieves most of its objectives, and rapid restoration monitoring should continue.

Station Specific Issues and Recommendations:

- 13+35: Significant lateral erosion on left bank causing failure of left arm of cross vane 6 (photo 9). Plant riparian area to help stabilize the bank and install monumented cross section to monitor change for one year. If erosion continues repair may be needed.
- 14+14 – 15+24: Lateral erosion on right bank is causing failure of right arms of cross vane 7 (photo10) and cross vane 8 (photo 11). Continue rapid restoration monitoring and supplement existing riparian through planting. If erosion continues repair may be needed.

Photo7. Middle Stony Run. Excess sediment causing bar formation and lateral erosion downstream of vane arm at station 10 + 90.

Photo 8. Middle Stony Run. Cross vane 14 at station 25+40 showing shallow pool.

Photo 9. Middle Stony Run. Left bank erosion causing failure of cross vane 6 left vane arm at station 13+35.

Photo 10. Middle Stony Run. Right bank erosion showing failure of cross vane 7 right vane arm at station 14+30.

Photo 11. Middle Stony Run. Right bank erosion causing failure of cross vane 8 right vane arm at station 14+61.

C. Biddison Run Monitoring Summary

The Biddison Run stream restoration was identified in need of restoration because the channel had rerouted into an adjacent capped landfill. Additionally, upstream urbanization caused instability in the project reaches. The stream was not in equilibrium and had degraded, aggraded, and meandered into its banks, causing erosion of the landfill cap and exposing and transporting solid waste deposits. Fish passage from Herring Run to Moravia Road was not possible because of debris blockages and an eroded channel bottom at the concrete box culvert crossing the stream. While the Service did not have full copy of the design report, the Service did have a copy of an abbreviated final report as well as the original as-built survey. This report listed five project objectives:

1. Stabilize the streambanks of Biddison Run to prevent the continued bank erosion and exposure and deposition of landfill waste in the channel. .
2. Construct the stream channel to a stable dimension, pattern and profile so that sediment produced by the watershed will be effectively transported downstream, eliminating excessive erosion and aggradation.
3. Reestablish habitat for fish, vegetation and macroinvertebrates that has been degraded.

On January 21, 2016, the Service conducted monitoring of the site using the Service's *Rapid Stream Restoration Project Monitoring Protocol* (Davis et al. 2014). All raw data and photographs from the monitoring are included in Appendix C.

The project area between station 0+00 and 15+00, approximately 80 percent of the project area, is under system-wide adjustment. The primary adjustment is excessive sediment deposition (photos 12 - 16). There are two potential causes of the excessive sediment deposition. The first is an under estimate of sediment supply being delivered to the project area. In the Biddison Run final design report, it is stated that "the project addresses the issue of source control by stabilizing the banks of the stream, using bioengineering and gabion retaining walls. Additionally, other sources of sediment within the flood prone area between structures were addressed by providing re-vegetation, a stable dimension, plan and profile for the stream. Never the less some sediment will continue to be transported through this project area from unstable reaches upstream." While accurate, the vast amount of sediment being delivered to the site may have been underestimated given the amount of sediment deposition occurring within the project area. Secondly, it appears that the channel is over-wide, which can reduce stream energy and sediment transport competency. The channel design width (measured from the plan set) ranges between 40 to 45 feet. However, based on the US Fish and Wildlife Service Piedmont Regional Curve (McCandless and Everett 2002) and the Baltimore County Urban Regional Curve, the typical width for a stream with a 1.3mi^2 drainage area ranges between 16 and approximately 27 feet. Furthermore, the Service measured existing channel widths in multiple locations where the channel evolved, through aggradation, to a stable width. In these locations, the Service measure channel widths of approximately 20-30 feet.

The excessive sediment deposition has affected the project's longitudinal profile by shallowing the pools and reducing bedform diversity and instream habitat. Second, it has partially buried stream structures, affecting their ability to provide lateral stability protection and the development of pool habitats. Currently, the channel is narrowing in most areas and the majority of the structures show deposition around the vane arms.

It is likely that the project area will continue to have system-wide adjustments in the future because of the excessive deposition. However, exact adjustments are difficult to predict. Below is a list of recommendations, by station, advising what actions should be taken to ensure stream stability. The actions range from detailed monitoring to repair. ***One bank requires immediate attention. It is a failing left bank (Photo 15) at station 07+70 – 08+35.*** The channel is adjusting laterally towards the capped landfill and has now developed a 4 – 6 foot tall vertical bank. If erosion continues, there could be a significant increase in sediment supply input. The erosion may also flank the downstream structure and jeopardize the integrity of the downstream portion of the project. The Service recommends installing a monumented cross section to

monitor change for one year. If the lateral adjustment continues, the bank may need to be armored (see "Station Specific Issues and Recommendations" below).

Station 13+45 to 15+00 (the end of the project reach) is stable. There are no repair recommendations. Rapid-based monitoring should continue for this project area.

Station Specific Issues and Recommendations:

- 01+70 – 02+20: Install monumented cross section to monitor change.
- 06+50 – 07+10: Install monumented cross section to monitor change.
- 07+25: Visually inspect annually. Adjust vane arm if erosion continues.
- 05+30 – 05+60: Install monumented cross section to monitor change. Currently deposition is causing stress on the right bank (station 05+30 – 05+60). Replant bank.
- 07+70 – 08+35: Install monumented cross section to monitor change for 1 year. If the change is severe, consider installing imbricated rock wall.
- 09+30 – 09+50: Plant with live stakes.
- 08+40 – 08+80: Visually inspect annually. Adjust vane arm if erosion continues.
- 12+80: Install monumented longitudinal profile to monitor change.

Photo 12. Biddison Run. Excessive sediment deposition at station 00+00.

Photo 13. Biddison Run. Excessive sediment deposition in front of imbricated wall station 01+60.

Photo 14. Biddison Run. Scour behind structure vane arm at station 07+40.

Photo 15. Biddison Run. Major bank erosion on right bank of station 07+70 – 08+35.

Photo 16. Biddison Run. Depositional fan at end of project (looking upstream).

D. Maidens Choice Monitoring Summary

The Maidens Choice Stream Restoration was identified in need of restoration as part of the U.S. Army Corps of Engineers, Baltimore District – Gwynns Falls Ecosystem Restoration Phase 1 Study (March 2009). While the Service did not have a copy of this report, the Service did have a copy of the *Operation, Maintenance, Repair Replacement and Rehabilitation (OMRR&R) Manual for Gywnns Falls MC-10 Ecosystem Restoration* (COE 2010). This report listed five project objectives:

1. Eliminate/minimize bank erosion from 30-foot high valley walls to improve water quality and reduce woody debris recruitment.
2. Reconnect channel to its floodplain to attenuate storm flows and maintain channel stability.
3. Improve riparian habitat through reforestation of open and mowed fields.
4. Daylight piped tributary into a stable channel form.
5. Replace failing wall by high school to prevent future erosion.

On January 13, 2016, the Service conducted monitoring of the site using the Service's *Rapid Stream Restoration Project Monitoring Protocol* (Davis et al. 2014). All raw data and photographs from the monitoring are included in Appendix D.

The project area between Station 01+00 and 19+00, approximately 78 percent of the project area, is under system-wide adjustment. The primary adjustment is excessive sediment deposition (photos 17 - 21). There are two potential causes of the excessive sediment deposition. The first is an under estimate of sediment supply being delivered to the project area. The COE 2010 states that there is a limited sediment supply being delivered to the project area. This is not completely accurate given the amount of sediment deposition occurring within the project area. Since deposition occurs at the farthest upstream portion of the project area, the source of sediment is not just from the eroding streambanks within the project area. For this to occur, the sediment would have to be coming from upstream sources. The second cause is the channel dimension design criteria. It appears that the channel is over-wide, which then can reduce stream energy and sediment transport competency. The channel design width (measured from the plan set) ranges between 40 to 45 feet. However, based on the US Fish and Wildlife Service Piedmont Regional Curve (McCandless and Everett 2002) and Baltimore County Urban Regional Curve, the typical width for a stream with this drainage area ranges between 25 and 32 feet. Furthermore, in more than one location the Service measured existing channel widths where the channel had evolved, through aggradation, to a stable width. In these locations the Service measure channel widths of approximately 30 feet.

The excessive sediment deposition has affected the project in two specific ways. First, it has redirected stream flow and stream energy towards the streambanks and has caused accelerated lateral erosion in various locations within the project area. Second, it has partially buried stream structures, affecting their ability to provide lateral stability protection and hindering the development of pool habitats. The effectiveness of the stream structures within this same project area was also reduced because of their locations along the stream profile. Almost all of the structures were placed too far upstream. If they were placed farther downstream, stream velocity vectors could have been redirected away from the streambanks and towards the next downstream structure. Instead, streambank erosion has occurred downstream of almost all stream structures.

It is likely that the project area (station 01+00 and 19+00) will continue to have system-wide adjustments in the future as a result of the excessive deposition. However, exact adjustments are difficult to predict. Below are a list of recommendations, by station, advising what actions should be taken to ensure stream stability. The actions range for detailed monitoring to repair. ***There is one structure that requires immediate action. It is a j-hook structure (photo 22) at Station 17+75.*** The vane arm has been flanked and rocks within the vane arm have become dislodged. Accelerated streambank erosion is moving towards a 30 foot high vertical and raw embankment. If erosion reaches this embankment, there could be a significant increase in sediment supply input. The safety of the house located on top of the embankment would also be jeopardized.

Station 19+20 to 24+50 (the end of the project reach) is stable. There are no repair recommendations. Rapid-based monitoring should continue for this project area.

Station Specific Recommendations:

- 01+00 – 02+00: Regrade and plant scour area on landward side of left vane arm.
- 02+25 – 03+25: Install monumented cross section to monitor change. Currently deposition is causing stress on left bank (station 02+50 – 03+25) but willow plantings are halting erosion.
- 03+25 – 03+60: Regrade bank and replant.
- 05+00 – 06+00: Install monumented cross section to monitor change. Currently deposition is causing stress on the right bank (station 05+30 – 05+60). Replant bank.
- 06+00 – 07+00: Rebuild and relocate cross vane to approximately station 06+25.
- 07+75 – 08+40: Install monumented cross section to document change.
- 08+40 – 08+80: Replant riparian and install monumented cross section to monitor change.
- 09+75 – 10+25: Install monumented cross section to monitor change.
- 10+25 – 10+75: Install monumented cross section to monitor change.
- 10+75 – 11+00: Regrade and replant bank.
- 11+00 – 11+50: Install monumented cross section to monitor change.
- 17+75 – 18+30: Rebuild and relocate J-hook to approximately station 18+20.

•18+30 – 19+25: Regrade and replant bank.
•00+00 – 19+25: Install monumented longitudinal profile.
•05+00 – 11+00: Stop mowing riparian buffer area on left bank.

Photo 17. Maidens Choice. Excessive sediment deposition.

Photo 18. Maidens Choice. Excessive sediment deposition.

Photo 19. Maidens Choice. Station 06+00. Stream structure with pool filled in with sediment.

Photo 20. Maidens Choice. Station 06+00. Stream structure right arm buried from sediment.

Photo 21. Maidens Choice. Station 17+25 flanked J-hook.

E. Western Run Monitoring Summary

The Western Run Stream Restoration was identified in need of restoration as part of the Greenman-Pedersen and Parsons Brinckerhoff *Western Run Stream Assessment* (August 2004). This report listed five project objectives:

1. Investigate, catalog, and document existing stream conditions.
2. Create a database and GIS mapping of findings.
3. Analyze stream restoration and stabilization needs.
4. Prioritize restoration areas.
5. Prepare concept restoration sketches and preliminary cost estimates for high priority restoration areas.
6. Prepare a report documenting and ranking restoration needs.

On January 21, 2016, the Service conducted monitoring of the site using the Service's *Rapid Stream Restoration Project Monitoring Protocol* (Davis et al. 2014). All raw data and photographs from the monitoring are included in Appendix E.

The project area between station 00+00 and 22+50, approximately 90 percent of the project area, is under system-wide adjustment. The project area was identified as a Rosgen Gc stream type in the 2004 assessment by Greenman-Pedersen and Parsons Brinckerhoff with 80% of the banks exhibiting some form of instability. Lateral bank erosion (photos 22 - 23) is occurring throughout the entire reach, while excessive sediment deposition is occurring from station 12+50 to 22+50 (photos 22 - 25).

Currently the area from 00+00 to 12+50 is a Rosgen F3/4 stream type, which lacks access to its floodplain causing an increased stress on the banks during storm events. Prior to restoration, the reach had several locations where the stream banks had been armored with gabion baskets to prevent bank erosion. Some of the gabion baskets are starting to fail. As part of the restoration, an imbricated rock wall was installed at one location and rock toes at several other locations to prevent bank erosion. The imbricated rock wall is being undermined by channel scour and beginning to fail at one location. The banks behind all of the rock toes are eroded on the downstream one-half of the toes and are failing.

The reach from station 12+50 to 22+50 has excessive sediment deposition occurring. There can be two potential causes of the excessive sediment deposition. The first is an under estimate of sediment supply being delivered to the project area. In the 2004 assessment report by Greenman-Pedersen and Parsons Brinckerhoff, the sediment supply to the reach was not mentioned. Sediment from an upstream source is the likely supply for most of the deposition

given the amount occurring within the project area. The second cause is the channel dimension design criteria. It appears that the channel is over-wide, which then can reduce stream energy and sediment transport competency. The design cross sections for stations 16+84, 17+22, and 17+56 have a bankfull width measured on the plans from 28- 32 feet and an average depth of 1.0 - 1.25 feet. This gives a width/depth ratio of 22.4 – 25.6, which is too high to transport the existing sediment load for the reach. A width/depth ratio of 12-16 would be appropriate to transport the existing sediment load in the system. The excessive sediment deposition has affected the project in two specific ways. First, it has redirected stream flow and stream energy towards the streambanks and has caused accelerated lateral erosion in various locations within the project area. Second, it has partially buried stream structures affecting their ability to provide lateral stability protection and the development of pool habitats.

It is likely that the entire project area (station 00+00 to 22+50) will continue to have system-wide adjustments in the future as a result of bank erosion and excessive deposition. However, exact adjustments are difficult to predict.

Below are a list of failing structures and details on the type(s) of failure:

Structure Failures:

- Constructed Riffle 1: The structure has failed on the left bank at station 02+88 and is causing erosion on the left bank.
- Imbricated Rock Wall 02+32 – 03+78: The structure is failing around station 03+25. The toe of the structure has eroded and the wall is collapsing.
- Rock Toe 1 10+88 – 11+63: The soil lifts and live stakes above the rock toe are failing.
- Rock Vane 1 12+50: The structure has failed on the left bank at station 12+50 and is causing erosion on the left bank.
- Rock Toe 3 13+58 – 14+52: The structure is failing on the downstream one-third with severe bank erosion behind the structure.
- Cross Vane 1: This structure was not built.
- Cross Vane 16+25: The structure is buried with sediment deposition on the left half of the channel and is not functioning properly.
- Rock Toe 4 16+92 – 18+26: The structure is failing on the downstream one-third with severe bank erosion behind the structure. The upstream one-half of the structure is buried by sediment.
- Rock Toe 6 18+35 – 18+88: The structure is failing on the downstream one-third with moderate bank erosion behind the structure.
- Rock Toe 7 19+57 – 20+59 : The branch layers of the structure did not survive and there is moderate bank erosion behind the structure.

General Recommendations:

The area from 00+00 to 12+50 is currently a Rosgen F3/4 stream type and is undergoing lateral adjustment. The 2009 restoration project was not successful in stopping the lateral adjustment and bank erosion. To increase lateral stability in the reach from station 0+00 - 12+50, Western Run will need to be reconnected to a floodplain and converted to a Rosgen B stream type. Given the lateral constraint of roads on both sides of the reach, this may be difficult. Without the floodplain reconnection, the banks may need to be stabilized using a harder approach with more structures such as rock-imbricated walls and rock instream structures.

The reach from station 12+50 to 22+50 has both excessive sediment deposition and lateral instability occurring. The 2009 restoration created a C stream type that had a connection to its floodplain, but failed to transport the high sediment load coming into the reach from the watershed. As a result, the channel has aggraded, covering some of the structures and causing bank erosion behind other structures. To correct the lack of sediment transport, the width depth ratio of the channel needs to be reduced and the planform adjusted.

Although all of the structures in the 2009 restoration could be repaired as previously designed, they would like fail again due to the lack of floodplain in the upper section and the high sediment supply in the lower sections. The Service recommends that the 2009 restoration be redesigned and implemented to address those issues.

Photo 22. Western Run. Lateral bank erosion.

Photo 23. Western Run. Lateral bank erosion causing structure flanking on left bank.

Photo 24. Western Run. Excessive deposition covering cross vane 2.

Photo 25. Western Run. Excessive deposition filling the channel and causing left bank lateral erosion.

IV. Conclusion

The majority of both Upper Stony Run and Middle Stony Run are vertically and laterally stable, with localized areas of vertical and/or lateral instability. Biddison Run, Maidens Choice, and Western Run are suffering from system-wide vertical and/or lateral adjustments and instability. Although the magnitude of adjustments in the five streams vary (localized versus system-wide), the cause is the same. All streams suffer from excess sediment due to either an underestimate of sediment input or incorrect restoration design criteria. Both of these causes affect the sediment transport capacity and competency through the streams.

Sediment transport capacity is typically defined as the amount of sediment that a stable riffle cross section can pass at bankfull flows. This information is unique to the stream system and is important to understand when developing restoration plans. If a stream system is receiving sediment from upstream, it must have the ability to transport that amount through the project area in order to maintain dynamic equilibrium, or not aggrade or degrade. The size of sediment that a stable riffle cross section can pass at bankfull flows is referred to as the stream's sediment transport competency. This information is valuable as it allows a designer to understand the stream dimension and channel shear stress necessary to entrain different sized particles in order to achieve "competency". This is important parameter to assess when determining a streams vertical stability. If a stream is unable to pass all of the supplied sediment, it would be aggrading which would mean it is vertically unstable. In addition, excess deposition and/or aggradation can cause lateral instability, in the form of bank erosion, by directing flows toward the stream banks.

In order for a stream restoration to have sufficient sediment capacity and competency, and therefore not aggrade or degrade, the restorations must be designed to allow the sediment to be properly passed downstream, without excess deposition or erosion. The proper design criteria (i.e. stream dimensions such as width/depth ratio) are crucial in providing conditions conducive to sediment capacity and competence. In addition, the proper design and placement of structures within the design provide additional lateral and vertical protection.

All of the stream restoration projects assessed had some degree of incorrect design criteria (particularly a high width/depth ratio, which results in excess deposition) and incorrect design and placement of instream structures. The overall and site-specific recommendations in Sections A-E of this report will assist the City in either remedying the problems identified, or monitoring the rate of change over time. In addition to the site-specific recommendations, the Service recommends continuing rapid assessments of the five restoration projects on a yearly basis to monitor for additional change.

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LITERATURE CITED

1.Davis S., R. Starr, and C.Eng. 2014. Rapid Stream Restoration Monitoring Protocol. U.S. Fish and Wildlife Service, Annapolis, MD. CBFO-S14-01.

2. Greenman-Pedersen, Inc. and Parsons Brinckerhoff. 2004. Western Run Stream Assessment. Baltimore, MD.

3.Harman, W.,R. Starr, M. Carter, K. Tweedy, M. Clemmons, K. Suggs, C. Miller. 2012. A Function-Based Framework for Stream Assessment and Restoration Projects. U.S. Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds. Washington, D.C. EPA 843-K-12-006.

4.McCandless, T.L. and R.A. Everett. 2002. Maryland stream survey: Bankfull discharge and channel characteristics in the Piedmont hydrologic region. U.S. Fish and Wildlife Service, Annapolis, MD. CBFO-S02-02.

5. Parsons Brinckerhoff and Clear Creeks Consulting. 2004. Middle Stony Run Stream Restoration Findings Report (30% Submission). Baltimore, MD.

6.U.S. Army Corps of Engineers. 2010. Operation, Maintenance, Repair Replacement and Rehabilitation (OMRR&R) Manual for Gywnns Falls MC-10 Ecosystem Restoration. U.S. Army Corps of Engineers, Baltimore District, Baltimore, MD.

Appendix H: Watershed Protection and Restoration Program Annual Report Table for FY 2016
(electronic files only)

Appendix I: Illicit Discharge Detection and Elimination

PST ID	PST Name	Location Description	Watershed	PST Comments	Complainant	Investigation Date	PST Discharge Classification
2284	2420 Smith Ave 21227	2420 Smith Ave 21227	Gwynns Falls	Water main break causing heavy red sediment to flow into stream.	Citizen	7/6/2016	Other
2290	303 S. Eaton St (Cityworks ID#250399)	303 S. Eaton St (5-Star Automotive)	Harbor	Citizen complaint of oil runoff from automotive lot. We spoke with owner (Leo) and he stated that a costumer left an unsealed container of oil on the lot over a weekend and overflowed during a storm. He will attempt to clean the oil residue from the adjacent alley.	Citizen	7/2/2016	Other
2291	Nelson Precast Cement	2501 West Lexington Ave	Gwynns Falls	Property is covered in cement and cement mud going out into the street. Found during ammonia screening. ESC inspector L. Boddy investigated and instructed to the owner he has to clean up the area and properly control his property. need to follow up.	OCAL	7/14/2016	Other
2293	Herring Run Trail @ Belair Rd Missing Sanitary Cover (Cityworks ID#251959)	300 feet northwest of Belair Rd. on the trail on the northside Belair Rd.	Back River	Citizen reported strong sewage odor on the Belair Rd bridge at the Herring Run. OCAL investigated and found sanitary lines flowing clear and no chemical indication of sewage in the Herring Run. A sanitary manhole cover was found off and reinstalled. The odor in the area was strong with the cover off.	Citizen	7/14/2016	Other
2296	Belvedere & Loch Raven	5700 Loch Raven Blvd	Back River	Construction site at corner of Belvedere and Loch Raven discharge large amout of muddy water into street and turned stream very turbid. referred to ESC investigators.	OCAL	7/20/2016	Other
2298	889 Hollins St.	889 Hollins St.	Harbor	Construction site discharging water from hose into inlet. Workers onsite stated it was water from pressure washing the inside of the building. Referred to Pollution Control Section. Maurice Conway investigated and found company pressure washing lead paint from interior of building. Company not permitted to do so. Stop work was issued until proper permits were acquired. All discharge waste must be collected and removed by a waste hauler. Pollution Control had sample analysted for total lead the result is 3.4 mg/L local limits is 6.81 for lead. Followup found no further discharges.	Citizen	7/23/2016	Other
2307	Bob's Mt. Washington Auto Service	5742 Falls Rd	Jones Falls	Citizen reported that under the auto mechanic's shop there was an tank the shop used to store discarded oil after oil changes. That the tank is now leaking out of the ground, directly into the sewer that feeds into the Jones Falls. (My husband spotted this morning and called 311). OCAL's PCA discussion with the owner, found that several other agencies (City, MDE and Coast Guard) had already responded to complaint. Owner claims that an oil tank on the property was vandalized, causing oil to spill all over the property and nearby storm drain inlet. Owner allowed PCA to view documents of oil spill cleanup, by ACE Enviromental and citation from US Coast Guard. Overall lot is not well maintained. There are signs of several vehicles, leaking various fluids. This shop is an excellent candidate for Hot Spot education.	Citizen	7/21/2016	Other
2313	Newkirk St & Keith Ave Bypass Pump Leak	2207 S Newkirk St.	Harbor	Spinello is performing bypass pumping of the sanitary. One of their hoses was leaking onto the street and into the storm drain. Complainant also stated 2 large SSOs occurred the morning of 8/13/16 in which a hose broke.	Citizen	8/16/2016	Other
2316	13-19 S. Chapel St. Sediment	13-19 S. Chapel St.	Harbor	Sediment in street. No controls on site. Referred to ESC inspectors.	OCAL	8/25/2016	Other
2322	2943 Rosalind Ave Sinkhole	2943 Rosalind Ave	Jones Falls	Sinkhole in street from collapsed storm drain pipe caused by water main break. Water main break was repaired.	OCAL	9/8/2016	Other
2333	2621 Western Run Dr (#261467)	2621 Western Run Dr	Jones Falls	Sanitary stack sheared off during high stream flows on or around 8/1/16. This was reported to the city by a citizen and a SR was created. Then it went no where in the way of repair. Alice V. reported the issue to OCAL via 311 on 9/24/16. NM contacted OAM whom did not know of the issue. Carlos E. is taking the lead to coordinate a repair. It appears debris or rocks got into the 21" line and it is partially holding (See photo). Manhole was repaired by Anchor.	Blue Water Baltimore	9/24/2016	Other
2354	200 E. Fort Ave	On Williams Ave side	Harbor	Water leaking from curb pipe. Citizen complaint said pipe is always leaking and ground is always wet. We found that Lucy the dog was peeing and pooping on the roof and the owner was washing it off into the gutter.	Citizen	10/18/2016	Other
2375	Horners Lane Siphon Underdrain	Drain is on the left side of stream looking upstream.	Back River	OCAL was contacted by OEC for assistance. They discovered an unknown pipe discharging water under the siphon on the left (south) side. We were able to push the camera up the line 21' but it was full of fine sediment. We believe it is an under-drain. The concern is that when they install the Geo-tubes under the siphon for support they will block the pipe. Lab results conclude potable water. Water leak was found.	City	11/9/2016	Other
2411	Guilford Reservoir Sediment		Jones Falls	Heavy sediment discharging from outfall at Linkwood Rd and Stoney Ford Rd. Source is construction at the Guilford Reservoir. The hose connection to the filter bag broke free. ESC inspector C. Brown inspected site and told the contractor to stop work until a new filter bag was installed and a secondary filtration was installed.	Citizen	1/4/2017	Other
2412	3901 St Paul St Sediment	3901 St Paul St	Jones Falls	Construction behind residence had no sediment controls. W. Greenberge had contractor place controls on site.	OCAL	1/5/2017	Other
2424	1122 Whitelock St. Sediment from Core Drilling	1122 Whitelock St.	Jones Falls	Sediment from Core Drilling entering storm drain. Discharging from 1901 Falls Rd oufall. W. Greenberg visited site crew installed a hay bale in front of inlet and cleaned up the sediment from the road	Citizen	1/19/2017	Other
2425	Druid Lake sediment	2700 Madison Ave	Jones Falls	Wachs was pumping out a vault. As they were the discharge water was eroding the soil under the overpass. The crew was directed to extend the hose to the inlet that is next to the pilar. they complied and stopped work.	OCAL	1/19/2017	Other
2460	3811 Canterbury Rd (Ambassador Apts) Garage Renovation	Ambassador Apartments Parking Garage	Jones Falls	Staff responded to a complaint from Balt. Co about white discharge from an outfall into the Stony Run. We found that the discharge was not active, however, enough staining in the pipe remained and it was tracked to the Ambassador Apts. at 3811 Canterbury Rd. They have been undergoing renovation in their parking garage, including heavy power washing of painted surfaces. We spoke with the foreman of the project who was very cooperative and he explained the catchment controls that he had in place. We collectively found why it was not working and devised a plan for them to proceed with a different approach. They will contact us to confirm if their new procedure will eliminate the discharge from the storm drain. Contractor has begun using a tank to collect and remove all wash water from the job site. No wash water will enter the storm drain system.	Baltimore County	4/28/2017	Other

2462	Linkwood Rd & Ridgemede Rd Outfall	4000 Linkwood Rd	Jones Falls	Evidence of cement discharge.	Citizen	5/15/2017	Other
1041	West Garrison Ave & Greenspring Ave Water Leak	Problem is located at intersection of W. Garrison Ave & Greenspring Ave.	Jones Falls	Water is entering the line at a joint. It's 12 feet downstream from storm drain manhole D15QQ1040MH. There is a water valve cover on the surface that is very close to where the potable water is entering the line. Flow is 40 GPM. Followup on 3/17/16 found problem still active created L2L WO and sent to J.McComos at OAM. Surface leak formed and UMD fixed problem.	OCAL	10/30/2014	Potable Water
2116	2628 Longwood Water Leak	At the corner of 2628 Longwood St & Piedmont Ave	Gwynns Falls	High chlorine (0.53 mg/l) recorded during watershed survey, on 7/30/15. The problem was tracked to a subsurface water main break at the corner of 2628 Longwood St & Piedmont Ave. Follow up on 4/11/17 found maintenance had repaired the problem.	OCAL	7/30/2015	Potable Water
2145	35th St. & Tivoly Ave Water Main	1539 35th St.	Back River	Potable water found entering storm drain through cracks in the manhole wall as well as entering from north branch inlet connection. Located Leak and Refereed to construction on 10/15/15.	OCAL	9/29/2015	Potable Water
2192	901 N. Newkirk St Water Leak	901 N. Newkirk St., near bay door in front of building.	Back River	Armistead Creek at Wright Ave. sampling site was very turbid with high ammonia (0.33 mg/l) during the watershed survey. The problem was tracked to a broken water valve at 901 N. Newkirk St. The property manager stated that the City started working the problem around Dec. 23, and haven't seen anyone working on repairs since. Approx. 10-15 GPM with a lot of sediment. City located leaking valve to be repaired. Followup needed. Followed up on 3/2/16, problem is still active. 12/15/16 Follow up visit, the problem has been fixed.	OCAL	1/6/2016	Potable Water
2283	3442 Keswick Rd Water Main Leak (BWB#20160627-SR-01)	3442 Keswick Rd	Jones Falls	BWB reported high fluoride (0.6mg/L) during outfall sampling on 6/27/16. OCAL investigation found city water leaking into storm drain in 3400 block of Keswick Rd. on 6/29/16. CCTV inspection found city water leaking into storm drain at 3442 Keswick Rd. Referred to Leak Detection group of Asset Mngt. Created 2nd repair WO on 3/3/2017. On 3/10 found that water maintenance had repaired leak on 3/7.	Blue Water Baltimore	6/27/2016	Potable Water
2286	Greenspring & Springarden Water Leak	Southeast corner of Greenspring Ave & Springarden Dr, in front of MTA bus stop	Jones Falls	OCAL received a complaint of a possible sanitary sewer overflow from a manhole at Greenspring Ave & Springarden Dr. Investigation found that the overflow was potable water from a leaking water valve, approx 2 GPM.	Citizen	7/8/2016	Potable Water
2346	5604 Hamlet Ave (Water Leak)	Inlet connection from SW corner of intersection of Hamlet Ave & Bayonne Ave	Back River	High Chlorine reported (0.26mg/L) during Back River survey on 10/14/16. High Chlorine tracked to water main leaking into storm drain inlet connection at Hamlet Ave & Bayonne Ave at approximately 50GPM. Referred to OAM leak detection. Confirmed repair on 2/28/17.	OCAL	10/14/2016	Potable Water
2367	3600 Pulaski Hwy Water Leak	3600 Pulaski Hwy Water Leak	Patapsco	Large volume of water discharging from water meter.	OCAL	10/24/2016	Potable Water
2368	3500 Pulaski Hwy Water Leak	On the sidewalk at, 3500 Pulaski Hwy	Harbor	Small water leak from large water meter. According to W/O # 353458, the meter was repaired on 11/18/16.	OCAL	11/2/2016	Potable Water
2398	4728 Parkside Dr Water Leak (BWB-20161119-HR-02)	Storm drain on the North side of intersection of Parkside Dr & Elison Ave	Back River	BWB complaint of high Fluoride (1.20 mg/L) reported during their outfall sampling on 11/19/16. Investigation on 12/02/2016 found a city water leak on the corner of Parkside Dr & Elison Ave. Leak to Locate work order created. Follow up on 7/5/17 found repairs have been made and leak stopped.	Blue Water Baltimore	11/19/2016	Potable Water
2408	1114 Somerset Ave Water Leak	1114 Somerset Ave	Harbor	Discharge from pipe in rear of property. Sump pump at rear of property discharging chlorinated water. Resident say water is constantly flowing into sump basin. potential leak in front of residence. Water bill does not indicate leak after meter. L2L located a leak and city did some work. resident says water problem increased after work was done. sent to L2L again to have 1114-1124 done.	OCAL	12/21/2016	Potable Water
2409	2109 E North Ave Water Leak	Alley behind 2109 E North Ave	Harbor	Water main break occurred in the process of repairing a house sewer connection. The water line was documented to have been repaired on 12/7, however, we found it to still be an active leak. CSR for exterior water leak created. Water leak reported again after previous SR was wrongfully closed. Several CSRs have been made for this location by citizens as well. Follow up on 3/7/17 found the leak still active. There is still an open work order for this location in Cityworks. Follow up on 5/26 found the water no longer leaking.	OCAL	12/21/2016	Potable Water
2418	Gleneagle & Glennor Water Main Break	Gleneagle Rd & Glennor Rd	Back River	City Works complaint about grey/greenish water at Chinquapin Run at Woodbourne Ave. The problem was tracked to a water main break at Gleneagle Rd & Glennor Rd. The water main break was reported several times, by residents in the area. SR# 17-00020287. WO# 273408 & 378486	Blue Water Baltimore	1/11/2017	Potable Water
2435	3206 Glenmore Rd Water Leak	3206 Glenmore Rd	Back River	Water leak at sidewalk. Property owner service line to property line. His plumber stated that is where his responsibility ended. Since it is another 2 feet to the water meter. The city claims it is the property owners responsibility. Repaired.	OCAL	1/31/2017	Potable Water
2472	316 St Dunstans Fire Hydrant Flushing	316 St Dunstans Rd	Jones Falls	Outfall discharging reddish brown sediment, during ammonia survey. The sediment was tracked to water main contractor, flushing a fire hydrant at 316 St. Dunstans. Contractor stated there will be several fire hydrant flushings, while repairing and replacing the water lines, in the area.	OCAL	6/7/2017	Potable Water
2297	Maplewood Apts	Maplewood Apts. in court starting at 934 Belgian Ave.	Back River	High ammonia was recorded during watershed survey. The problem was tracked to Maplewood Apartment sanitary leak. Contractor at site repairing the sanitary, informed us that the work will be completed, by end of the day.	OCAL	7/20/2016	Private
2420	732 E 36th St Sump Pump (Cityworks SR#273779)	Alley in rear of 732 E 36th St	Jones Falls	A cityworks pollution investigation request was recieved on 1/12/17 for discolored water discharging from a residential sump pump. We investigated the home on 1/13/17 and from that the sump basin was full of sediment. The property owner was instructed to clean the sump basin of bebris and monitor it for any further sediment build up.	Citizen	1/12/2017	Private
2466	Spiniello Discharge at Stafford St & Wellesley St	Stafford St & Wellesley St	Gwynns Falls	Notice 54" outfall at Gwynns Falls Park at Wilkens discharge was dark brown. It was track to Stafford St & Wellesley St, where contractor Spiniello pumping our their work pit into the nearby storm drain inlet. Spiniello crew stopped the illicit discharge during our arrival, stating that they were done with the pumping of the work pit.	OCAL	5/18/2017	Private
453	131 N. Clinton (Formerly 3302 Esther 24 Inch Drain)	3302 Esther Place 24 inch lateral drain from north at the bottom of the storm drain.	Harbor	The drain appears to be discharging sewage. It also appears that part of the storm drain is collapsed. SDUO found an illicit connection at 131 N. Clinton St. and referred it to HCD. 9/1/16 Dye tests of bathroom fixtures, were negative in the storm drain, but present in the sanitary. Problem is abated.	OCAL	9/18/2009	SDUO, Private

761	Fait & Grundy	Storm drain manhole on the northwest corner of Fait Ave. & Grundy St.	Harbor	High ammonia (0.37 mg/l) was recorded during Harbor Bacteria sampling. New manhole construction has been requested in storm drain on Grundy for CCTV access (3/2016). On 4/21/16 it was found that a 10" drain in the Foster-Fleet Alley is connected to the storm drain mainline on Grundy. The drain has a suspicious connection that appears to be from 3926 Foster. A test of that residence will be conducted when contact with home owner is established. Dye test of 3926 Foster on 4/27/16 confirmed that it is connected to the 10" drain leading to Grundy St. This is a source leading to the Fait & Grundy SDUO. Additional investigation is required to determine if other homes are connected to the 10" drain along Grundy. 3926 Foster was removed from the 10" drain on 7/1/16. The storm drain line on Grundy will require flushing before further follow ups. On 8/12/16 the storm drain on Grundy St was flushed extensively from 718 Grundy to Fait St. Followup on 9/21 found manhole and pipe are completely dry.	OCAL	11/30/2012	SDUO, Private
2088	224 E. 39th St.	224 E. 39th St.	Jones Falls	High ammonia found in storm drain at 3810 Juniper Rd. High ammonia continues to inlet at NW corner of 39th & Juniper. The manhole at 224 E 39th St. is low. We see a pipe about 8 ft from manhole at 224 E. 39th St.. Can see debris below 6" pipe. Suspect either direct house connection to storm drain or leaking lateral house connections. Further inspection revealed choked/broken lateral in the city right of way. Repair was completed on 5/4/16. CCTV shows pipe is free flowing but has a few disjoints. Need to dye test house again to confirm problem is abated. Followup on 11/14/16 pipe looks worse then ever. Grey scum has formed in pipe and ammonia is 20 mg/L. 2/1/17 Dye test of cleanout showed no dye in storm, left dye in cleanout for a 24 hr test. No dye seen the following day. 2/7/17 we repeated the cleanout dye test two more times and dye was absent in the storm. Dye testing from the house showed dye present in the clear water pipe in the storm drain. House connection is in fact leaking into adjacent clear water pipe into the storm main. 2/9/17 dye was deployed in the cleanout for 4 days and was absent in storm. 3/8/17 met with Plumbers whom located entry point into the clearwater pipe which was near the cleanout. They suspected the exit from the sewer pipe was near the cleanout. The cast iron pipe was good then there are 2 small sections of clay pipe before the y of the cleanout. They suspect this is leaking. Homeserv's contractor Prime Plumbing repaired the pipe and cleanout from the cast to the city line. Followup dye tests showed no dye in the storm. ABATED!!!!	OCAL	7/28/2015	SDUO, Private
2303	2024 Fleet St	Fleet St & Castle St	Harbor	High ammonia and high bacteria found during the East Harbor Storm Drain Survey. Extensive dye testing was done in the surrounding area including all nearby sanitary mains and some residences. No dye ever showed in the storm drain. On 3/23/17 DNA analysis was used to determine if high values were a result human or canine fecal contamination. The results were in favor of human waste so further investigation continued. On 4/20/17 high ammonia was found at an upstream manhole that previously tested low. After entry, staff found a 6" pipe approximately 27' upstream from Fleet St & Castle St discharging sewage. A positive dye test was performed from 2024 Fleet St. On 4/21/17 CCTV inspection of sanitary main on Castle St found that the mapped house connection from 2024 Fleet St was absent. On 5/15 contractors relocated the connection to the sanitary line. On 5/17 the house connection was dye tested from the cleanout and dye immediately appeared in the downstream sanitary manhole. Sampling is still needed at Fountain & Castle. Downstream site at Fountain & Castle has tested low in ammonia on two separate occasions. Problem abated.	OCAL	7/20/2016	SDUO, Private
2369	3802 Juniper Rd	Front of 3802 Juniper Rd along the road	Jones Falls	We went to this location to see if we could find out how the sewage entered the storm drain line from a SSO event in 7/23/15. However, we found the storm drain line was high in ammonia (0.79 ppm) & bacteria (1732.8 mpn) so we began an investigation. 3804 Juniper and 224 39th st Problems.	OCAL	10/26/2016	SDUO, Private
2373	3807 Bank St	3807 Bank St.	Harbor	High ammonia (1.44 mg/L) reported during Harbor Ammonia Screening with bacteria sampling on 11/02/16. First day of investigation tracked high ammonia to 3800 Block of Bank St. Several citizens informed us that a sanitary line had choked and caused water to fill basements along the block the night before and UMD had cleared the line. All sanitary lines were flowing free while we were onsite. Follow up with CCTV in the storm to see if a leak is active. On 11/10/2016 staff performed a positive dye test from the bathroom of 3807 Bank St (business named "Top This.."). Dye was seen entering the storm drain below a connected pipe and not seen in sanitary along Bank St. On 11/18/16 OCAL confirmed that the property's wastewater was directly connected to the storm drain on Bank st. This was done by passing a push camera through sanitary cleanouts within the building and ending in the storm drain. The path of the sanitary lateral was marked on the road including depth. The main sanitary was also marked and available connection located. (Gary-Property Owner (Top This, Inc)). A follow up dye test on 1/04/2017 confirmed abatement after the lateral connection was removed from the storm drain and relocated to the sanitary mainline.	OCAL	11/2/2016	SDUO, Private
2390	2109 E North Ave Illicit Plumbing	2109 E North Ave rear porch	Harbor	Grey water noticed flowing from alley while sampling for another PST (Lakewood & Hudson (West Branch) 110416). Grey water led us to choked and overflowing house connection. An SSO (#4592) was reported, the overflow was stopped and lateral cleaned. While on the property, the residents informed us that the landlord had disconnected the plumbing under the rear porch allowing wastewater to flow onto the backyard. Also the washing machine discharges from another pipe into the backyard. Follow up on 12/21 found that the external plumbing has multiple defective joints allowing additional wastewater to leak onto deck and yard.Owner: Iqbal Tirmizi 631-466-0674Follow up on 1/13/2017 found that repairs had been made to plumbing to stop the illicit discharge. Dye test not possible, resident unavailable.	OCAL	11/22/2016	SDUO, Private

2423	4518 Wakefield Rd	4518 Wakefield Rd	Gwynns Falls	Two uncharted pipes. 4 or 6 inch pipe at 63 ft from D01QQ_059MH. 12 inch pipe at 69 ft. Dye deployed in house and was present in two incoming pipes. 03/22/17 located cleanout (7 ft east of walk, 9 ft north of sidewalk). On 4/28/17 dye was deployed in the home and in the cleanout. Only the dye deployed in the home was present in the storm drain. Owner contact info: 703-395-9922 Raphael Property manager: 240-906-0996 Amy. 6/13/17 met plumber whom cctv'd connection. He pushed a blockage out with his camera. After this we were not able to get dye to show in the storm and the flow stopped. It is believed that this was the cause to the problem. We will continue to monitor this location. (OCAL cctv used). Follow up on 7/12/17 found a trickle in the downstream storm drain with low ammonia. Followup an 7/17/17 found Trickle with low ammonia. Closing SDUO.	OCAL	1/5/2017	SDUO, Private
633	Mannasota & Parkside	Outfall underneath the Mannasota Ave. & Parkside Dr. bridge	Back River	Ammonia high during follow up to Mannasota & Nicholas SDUO. High ammonia not associated with Mannasota & Nicholas SDUO. Sewage leaking into storm but cannot dye test sanitary because in has a very large volume. This was supposed to be lined but contractor lined the wrong segment of line. It is unclear when lining of this segment will be performed. Around 6/29/16 contractors lined the sanitary main on Mannasota between Shamrock and Parkside. As of 9/21 the ammonia results were low and there is no scum on the wall. 9/22 bacteria results conclude abatement.	OCAL	8/9/2011	SDUO, SSO-Subsurface
847	Bloom St	Underdrain for sanitary northwest of side of 36" storm drain below at 502 Bloom St	Jones Falls	Observed waste water contamination by David Flores at outfall J236. Problem was tracked to a 6" under drain for sanitary line (S25II_025G1), inside 36" storm drain on Bloom St. Sewage is escaping the sanitary system and entering the storm drain by way of the under drain. Waste Water Engineers had the sanitary assest S25II_025G1 and the manholes at each ends lined. But the lining did not abate the problem. On October 30, 2015, OCAL successfully dye tested the sanitary to narrow/pinpoint the location of sewage is ex-filtrating from the sanitary asset S25II-025G1 and entering the under drain below it. A plastic half gallon jug about 1/3 full of water was tethered into the 501 Gold St. sanitary manhole (S25II_025MH) with a spool of nylon cord tied to it. The nylon cord was slowly released from the spool, allowing the jug to flow downstream along the sanitary current for 371 feet to the next downstream sanitary manhole (S25II_023MH) at 500 Bloom St. The jug was retrieved and a dye bag was attached. With the nylon cord still attached at Gold St., the jug and dye bag were pulled back upstream in 5 feet increments. Shortly after the dye was held in place, an identified surge of water flowed through the storm drain system at Bloom St. After 16 minutes of dye deployment the identified surge of water stopped and the dye was present in the storm drain. Due to this test, it is concluded that sewage is escaping the sanitary system around five feet upstream from the sanitary manhole at Bloom St. A segment of sanitary pipe was replaced upstream of the manhole and into the manhole on 12/10/15. Follow up dye testing and ammonia values indicate that sewage is still leaving the system and entering the underdrain on Bloom St. Positive dye test on 3/2/16 in sanitary line flowing from the west is evident of additional sewage leaks. 2/27/17 followup dye test to manhole replacement on 2/24 confirm NO dye present in storm from either underdrain. 2/28/17 no dye present from dye test, underdrain ammonina low, discovered possible upstream problem at Division.	Blue Water Baltimore	7/22/2013	SDUO, SSO-Subsurface
959	Charles & Lanvale (6 Inch Pipe) SDUO	SW Corner of N Charles St & W Lanvale St	Jones Falls	Sewage is entering storm drain system from a 6" pipe on south wall of manhole. Problem found while confirming repairs to previous problem at Charles & Lanvale. 2/10/16 Pipe segment will be pipe burst by Anchor Construction but due to gas leak work is on hold until BGE has repair complete. Point repair made during week of 5/9/16 did not resolve the SDUO. Still active on 5/12/16. Sanitary mainline has been referred for CIPP.	OCAL	6/6/2014	SDUO, SSO-Subsurface
1093	2500 Block W. Coldspring Ln.	2500 Block of W Coldspring Lane, between Pall Mall Rd and Fenney Ave.	Jones Falls	Sewage is escaping the system on W. Coldspring Ln, between Pall Mall and Fenney Ave and appears in the storm drain system at a 15" collapsed storm drain inlet pipe at 2426 W. Coldspring. Also the storm drain mainflow is escaping the system and reappear. 2/18/2016 Water main leak stopped and dye is still appearing in the storm. Need to do further dye testing to isolate the asset that is leaking. CCTV inspection on 4/8/16 found a broken sanitary pipe segment 212' downstream from manhole 13II1017MH (W. Coldspring & Finney). 4/21/16 point repair was made done on the sanitary. 4/22/16 positive follow up dye tests confirmed that there are multiple problems on this sanitary system, that were not eliminated with the point repair. Follow up dye test on 6/30/16 after sanitary main lining (2518 & 2508 Coldspring) was absent from the storm drain when deployed at Coldspring & Finney and at Coldspring & Pall Mall. As of 8/15/16 after receiving and reviewing the Lab result from 7/28 this investigation and SDUO are considered closed. The lab results are conducive to ground water in Maryland and the Bacteria values do not indicate a sewage problem.	OCAL	2/10/2015	SDUO, SSO-Subsurface

2250	2900 Block of Woodland Ave	2900 Block of Woodland Ave.	Jones Falls	Strong smell of sewage at Woodland and Laurel. Entered manhole and looked up the line. Can only see up to the inlet pipe then beyond the pipe is filled with gravel. ALL the sanitary pipes in the area along the line are flowing fine. There are sections of sanitary pipe that have CIPP lining. Suspect leaking house lateral pipe. View pre and post lining cctv to ensure laterals were cut in the main. Staff has been finding house connections along Woodland Ave that are leaking into the storm drain. As of 10/5/16 OAM is going to have CCTV performed on laterals and taken necessary repair actions. CCTV inspection of 2924 Woodland Ave identified a 6" connection to the storm drain with possible sewage infiltration at this address. A dye test of the property's cleanout confirmed that the sanitary house connection was leaking. However, it was entering the storm drain through a nearby joint and not the 6" connection. This property is currently abandoned and therefore not an active SSO. This leak will be referred to OAM. (2924 was originally entered as a separate PST record #2262. That record was deleted. On 3/8/17 2928 was dye tested and determined to be leaking. 2924 is now occupied and was transferred to a SSO. Request was sent to OAM to have 2924 & 2928 lined based on the pattern of the HC leaking between the CO and the main. Repair work completed. On 6/28-29/2017 storm drain segment D11OO1029G1 (2916-2932 Woodland Ave) underwent heavy cleaning for further CCTV investigation. On 7/5/2017 an attempt to inspect the line failed as the CCTV system was not working correctly and requires repair. CCTV follow up on 8/09/2017 found that; the leak from 2928 appeared to be dry in the storm drain, the leak from 2924 was abated (dye test test confirmed), and a new leak was found in the house connection from 2918 Woodland (dye test confirmed). At this time no clean out was found on the property of 2918 so the dye test was performed in a bathroom sink.	OCAL	5/5/2016	SDUO, SSO-Subsurface
2300	3200 Block of Bancroft (BWB-20160726-WR-05)	Inside storm drain at 3213 Bancroft Rd	Jones Falls	Blue Water Baltimore report: 20160726-WR-05: Exceeded threshold for Ammonia (6.18 mg/L). High optical brighteners (19.15 ppm). Suspected sewage contamination. Outfall is located underneath the Bancroft Road bridge, between Cross Country Blvd. and Western Run Drive. GPS coordinates are (39.365479, -76.692952). Utility Maintenance cctv revealed several fractures in the sanitary. Sanitary bypass is setup until repairs are made. As of 9/20 repairs completed and outfal is dry	Blue Water Baltimore	7/26/2016	SDUO, SSO-Subsurface
2315	4500 Block of Wakefield Rd	4506 Wakefield Rd	Gwynns Falls	Sanitary at 4506 crusted over with grease and 4500 was swirling above bench. UMD cleared line and now sanitary pipe is at 100 percent but below the bench. Dye tested sanitary while holding and absent in storm after one hour. CCTV performed of storm and only see seeps at the joints. It is possible the laterals are leaking. SSO located at 4506. Still finding high ammonia in the storm system. Follow up on 7/12/17 found trickle of flow in storm drain at 4516 Wakefield with low ammonia	OCAL	8/23/2016	SDUO, SSO-Subsurface
2348	2402 Talbot Rd SSO# 4547	In woods behind address at base of hill.	Gwynns Falls	Sewage overflowing in to adjacent storm drain pipe. Discharging into stream at the Windsor Mill Rd Trailhead. As of 11/4 no work has been done by UMD to abate the problem and OAM has not initiated contractors. 11/14/16 NM contacted OAM to get a status. Met S. Lampo and C. Espinosa in field at location to show problem. They are contacting Savin to investigate and perform cctv of the storm and sanitary pipe. C. Espinosa made the call that since the exact leaking asset has not been identified then the is NOT an SSO and in fact an SDUO. 11/15 Savin located broken pipe. OAM created a new SSO. 12/10 RE Harrington completed the repair to the sanitary pipe dye test confirmed abatement.	Citizen	10/18/2016	SDUO, SSO-Subsurface
2384	5400 Block Purlington Way	5400 Purlington Way	Jones Falls	Sewage possibly entering storm at several locations. Need to have storm and sanitary cleaned due to heavy root infiltration. Unable to pass camera. 12/28 CCTV done on some storm and sanitary. Storm was not cleaned yet and unable to pass Sanitary was done cleaned. Roots still present in sanitary could not pass at a couple locations. UMD cleaned and cleared roots from sanitary and storm main lines. camera is able to fully pass. 1/31/17 dye deployed in top sanitary manhole and was absent in all storm manholes and inlet. March 2017 two house connections (5415 SSO#4746, 5407 SSO#4745) were found to be leaking, these were identified as SSOs. Turned over to OAM with repair recommendations. 3/12 OAM agreed to have repairs completed as suggested. Point repair at 5407 and CIPP at 5415. Followup Dye testing showed no dye in storm. Monitoring ammonia in the inlet at Taplow. Due to the low bacteria and Fecal DNA indicator results, as of 6/19/17 it is determined that this SDUO has been resolved.	OCAL	11/15/2016	SDUO, SSO-Subsurface
2226	5801 Greenspring Rd SSO# 4225	5801 Greenspring Rd	Jones Falls	Followup visit on 3/17 for SSO # find joints in the right channel of sanitary manhole leaking into the storm drain inlet pipe. 3/18/16 notified UMD and OAM of the problem. On 4/20/16 NM spoke to Diego at OAM for an update. On 5/5/16 contractor finished rehabbing manhole. Followup visit finds outgoing pipe is leaking again. On 5/10/16 met Diego in field to explain problem. On 5/16/16 RE Harrington contractor installs 19 ft of new outgoing pipe. Followup dye testing show sewage is still leaking in the storm from the manhole. Hole found in the invert section of manhole probably from bypass. OAM is getting contractor to make repairs. Contractor REH repaired hole on 6/10/16. Follow up on 6/16 found small amount of discharge from seem in inlet pipe. Need to revisit when conditions dry out (rained in morning). Road was marked for CIPP lining in the in flowing pipe. Follow up dye test on 6/30/16 was absent in storm drain inlet connection after one hour. Manhole believed to still be leaking. OCAL pushed OAM to completely replace the manhole. A precast MH was installed on 10/18/18. Followup on 11/14/16 inlet pipe is dry. Problem abated.	OCAL	3/17/2016	SSO-Subsurface
2252	2910 Woodland Ave SSO# 4328 & 4531	2910 Woodland	Jones Falls	6 inch pipe entering storm main appear to be discharging sewage. Rocks and debris in pipe. sewage in pipe. Dye present after deploying dye in cleanout. CCTV shows partial collapse in lateral at 40 ft and large disjoint at 33 ft. Met E. Pinder on scene. Turned over to construction. Construction replaced 10 feet of pipe. Followup done while pit was still open and found lateral not leaking. A few months later while doing followup on 2904 we found lateral leaking again turned over to OAM. Following repairs a dye test on 12/14/2016 found lateral no longer leaking.	OCAL	5/11/2016	SSO-Subsurface

2254	2904 Woodland Ave SSO# 4331	2904 Woodland Ave	Jones Falls	Residential lateral leaking into storm between cleanout and main. Dye test of cleanout shows active. Visual estimate 25% flow loss in lateral, 0.07 GPM (est. 400 GPD). Turned over to UMD and OAM. CCTV shows offset joints. CIPP was installed but contractor stopped 8 ft short of the cleanout. Point repair done on lateral from cleanout to CIPP. Following repairs dye test on 12/14/16 found that lateral is no longer leaking.	OCAL	5/10/2016	SSO-Subsurface
2304	Park Heights & Manhattan (SS0# 4454)	Park Heights Ave & Manhattan Ave.	Jones Falls	High ammonia (1.25 mg/l) recorded at the Merville ammonia survey site. Problem was tracked to a choked sanitary manhole at Park Hgts Ave & Manhattan Ave. Utility Maintenance relieved the choked while at site.	OCAL	8/3/2016	SSO-Subsurface
2305	1500 N Chapel St (SSO#4476)	1500 Block of N Chapel St	Harbor	High ammonia (2.09mg/L) reported during Harbor Ammonia Screening on 8/3/16. Investigation led to a 22" sanitary main leaking from the 1500 Block of N Chapel St. The wastewater was entering the storm drain system through an uncharted 18" brick pipe at approximately 30GPM. OAM has contracted Savin for further inspection on 8/22/16. Savin contractors found a hole in the sanitary line segment just upstream of the manhole at Oliver & Chapel. The hole was repaired and following dye test was negative on 8/26/16.	OCAL	8/3/2016	SSO-Subsurface
2306	4022 Pulaski Hwy	4022 Pulaski Hwy	Harbor	High ammonia (3.12 mg/l) was recorded at the Linwood & Elliott site, during a watershed survey. The high ammonia was tracked to a choked sanitary at 4022 Pulaski Hwy.	OCAL	8/3/2016	SSO-Subsurface
2310	Central & Bank 080416	Northwest corner of Central Ave. and Bank St.	Harbor	Sanitary mainline choke found while investigating high ammonia at Central & Lancaster (Central &Lancaster 080416). Ammonia in storm drain was still much higher above the area of the choke so we could not conclude that this choke was the cause of high ammonia. Contacted UMD and they cleared the line.	OCAL	8/4/2016	SSO-Subsurface
2317	1999 Belair Rd (SSO #4487)	Belair Rd & Ravenwood Ave	Harbor	High ammonia observed in the storm drain along Wolfe St while following up on the abatement of another SSO. The ammonia was tracked to a choked sanitary main at Belair Rd & Ravenwood Ave. Wastewater was leaving the sanitary and entering the storm drain through a pipe segment joint in front of 1999 Belair Rd. The choke relieved itself while waiting for UMD and the overflow stopped. UMD will still clean and inspect the line for cause of overflow.	OCAL	8/26/2016	SSO-Subsurface
2318	3404 Glen Ave SSO# 4490 (BWB-20160829-WR-02)	3404 Glen Ave	Jones Falls	BWB reported that 20160829-WR-02 outfall: Exceeded threshold for Ammonia (11.05 ppm). This outfall was obviously sewage-contaminated, and seems likely to be the result of an illegal connection. There is a lot of toilet paper and other wastewater debris around this outfall, and lots of sewage fungus growing in the area downstream of the outfall. GPS Coordinates: (39.362185, -76.683672). OCAL's investigation found a choked sanitary, with an uncharted engineered overflow structure at 3404 Glen Ave. OCAL CCTV the storm drain to document the uncharted overflow structure. The overflow structure was reported to OAM.	Blue Water Baltimore	8/29/2016	SSO-Subsurface
2319	Glen Ave & Clover Rd SSO #4496 (BWB-20160829-WR-02)	Intersection of Glen Ave & Clover Rd	Jones Falls	BWB reported that 20160829-WR-02 outfall (Cross Country Blvd & Bland Ave) Exceeded threshold for Ammonia (11.05 ppm). OCAL initially found a choked sanitary at 3404 Glen Ave causing an SSO. The ammonia remained high in the storm drain upstream of the SSO so another PST was initiated at Glen & Clover. A sewage seep was found in the manhole around the pipe of the northwest branch and also infiltrating at the first segment joint of the 30" main branch and the NW branch. A positive dye test from the sanitary main confirmed an SSO of the main line. UMD construction will attempt repair. It is still a concern that the lateral from 3500 Glen my also be leaking at its connection to the main. Repair to the main line must be made before confirming an issue at the house connection. OAM assigned contractors to make repairs to the mainline around 12/1/2016. Follow up dye test on 12/7/16 by OCAL found that the mainline nor the house lateral (3500 Glen) were leaking. Problem abated.	Blue Water Baltimore	8/29/2016	SSO-Subsurface
2332	4506 Wakefield Rd SSO# 4515	4506 Wakefield Rd	Gwynns Falls	Lateral leaking into storm drain manhole. Anchor repaired lateral connection by replacing pipe from property line to main.	OCAL	9/23/2016	SSO-Subsurface
2350	4722 York Rd (SSO# 4536)	In the front lawn of 4722 York Rd.	Back River	High ammonia recorded at the North Hill-Alameda survey site. The problem tracked to a choked sanitary manhole at 4722 York Rd, causing a sanitary sewer overflow-subsurface.	OCAL	10/13/2016	SSO-Subsurface
2400	245 N Monastery (Alley) (SSO# 4610)	245 N Monastery Ave (Alley)	Gwynns Falls	High ammonia recorded at the Culver & Hilton sampling site, on 12/6/16. On 12/8/16 OCAL found the sanitary line servicing the 100-200 blocks of Monastery Ave & Culver St., was choked at the 245 N. Monastery Ave. The clogged sanitary line caused a subsurface SSO, into the nearby storm drain system. 12/14/16 Follow up visit, ammonia is low, at 0.13 mg/l, no other indicators for sewage contamination; so the problem is abated.	OCAL	12/6/2016	SSO-Subsurface
2401	York Rd & E Coldspring Ln (SSO#4609)	East side of intersection of York Rd & E Coldspring Ln	Back River	High ammonia reported during Back River survey at Northhill-Alameda (1.17mg/L) and 35th st & The Alameda (0.95mg/L) on 12/8/16. Investigation led to a choked sanitary line at York Rd & E Coldspring Ln. The wastewater was seen entering the storm drain through a pipe in a manhole on the NE corner of the intersection. UDM responded and cleared the line. The wastewater infiltration stopped immediately.	OCAL	12/8/2016	SSO-Subsurface
2414	4722 York Rd (SSO# 4656)	In the front lawn of 4722 York Rd.	Back River	High ammonia recorded at the North Hill-Alameda survey site. The problem tracked to a choked sanitary manhole at 4722 York Rd, causing a subsurface sanitary sewer overflow.	OCAL	1/11/2017	SSO-Subsurface
2416	4122 Marx (SSO#4657)	In the street at 4122 Marx Ave	Back River	High ammonia recorded at the Prior & Parkside (0.60 mg/l) ammonia survey site. The problem was tracked to a choked sanitary at 4122 Marx Ave.	OCAL	1/11/2017	SSO-Subsurface
2421	York Rd & E Coldspring Ln (SSO#4662)	East side of intersection of York Rd & E Coldspring Ln	Back River	Follow up of Northill-Alameda site after another SSO (4722 York Rd (SSO# 4656)) was resolved found ammonia value still high. A new PST was initiated and the investigation led to a choked sanitary line at York Rd & E Coldspring Ln. The wastewater was seen entering the storm drain through a pipe in a manhole on the NE corner of the intersection. UDM responded and cleared the line. The wastewater infiltration stopped immediately.	OCAL	1/13/2017	SSO-Subsurface
2422	Benninghaus Rd & Ready Ave (SSO#4669)	Intersection of Benninghaus Rd & Ready Ave	Back River	Elevated ammonia (0.29mg/L) reported during Herring Run Survey on 1/18/2017. Investigation led to a choked sanitary mainline causing a subsurface overflow into the storm drain on Benninghaus Rd	OCAL	1/18/2017	SSO-Subsurface

2434	3406 Wabash Ave (SSO#4711)	3406 Wabash Ave	Gwynns Falls	High ammonia (0.38mg/L) reported during the Gwynns Falls survey on 2/7/17. Investigation led to a sanitary line segment on Wabash Ave that was loosing water. A dye test showed that the flow in the sanitary line was finding its way into the storm drain at Liberty Heights and Dukeland St despite the lack of a mapped storm drain line in that direction. On 2/9/2017 staff duplicated dye test and was able to observe sewage entering the storm drain by way of a 6" underdrain below the SW corner of Liberty Heights Ave & Dukland St. UMD responded and cleared a choke restoring flow back through the suspect line segment. The integrity of the sanitary line is still in question and needs further investigation.	OCAL	2/7/2017	SSO-Subsurface
2441	Hollins St & S Warwick Ave	100 Block of S Warwick Ave	Gwynns Falls	A large sanitary mainline choke was found while investigating high ammonia along the Gwynns Run storm drain system that leads to Carroll Park. It is possible that the sanitary line was overflowing into the storm drain. Due to multiple sanitary line segments holding water and limited access to the main storm drain extreme efforts, such as lengthy dye tests, traffic direction and pipe walks would have been necessary to prove infiltration. The decision was made to immediately contact UMD and have the choke relieved to stop any possible environmental impact. UMD responded within 30 minutes and began clearing the choke. Follow up on 2/17/17 found that the sanitary line was choked again. WQMI staff entered the storm drain main on Warwick to try to find sewage infiltration. None was found, however, there was a section just south of Hollins with steps that could not be passed. Overflow into the storm drain can not be concluded. By the afternoon UMD had cleared the line. They suspect that there is a break in the lower portion of the line, CCTV inspection has been requested.	OCAL	2/15/2017	SSO-Subsurface
2443	Artaban Pl	Artaban Pl	Gwynns Falls	Sewage infiltrating from unmapped sanitary pipe. Manholes are not holding. Choke located with jetter in the unmapped line at 200ft. This line needs to have cctv completed. Did not report as SSO since was unable to identify leaking asset. Called R. Johnson whom sent Ricco out with the jetter.	OCAL	2/23/2017	SSO-Subsurface
2458	E Coldspring Ln & York Rd (SSO #4832)	West side of intersection of E Coldspring Ln & York Rd	Back River	High ammonia value (1.40mg/L) reported at Northhill-Alameda site during ammonia survey on 4/20/17. Original survey crew began investigation and then another crew finished and found a choked sanitary line on the west side of the intersection of E Coldspring Ln & York Rd. Sanitary overflow was infiltrating the storm drain through an inlet connection. UMD arrived and cleared the sanitary line. Follow up on 4/26 found the sanitary lines flowing free and no wastewater entering the storm drain.	OCAL	4/20/2017	SSO-Subsurface
2475	115 N Kossuth (Alley) SSO# 4910	Alley at 115 N Kossuth St	Gwynns Falls	High ammonia recorded at Culver & Hilton sampling site, during ammonia survey. Problem was tracked to a choked sanitary manhole in the alley at 115 N Kossuth St, causing a subsurface sanitary sewer overflow.	OCAL	6/13/2017	SSO-Subsurface
2476	Nieman 061417	Storm drain manhole at Nieman Ave & Harriet Ave	Gwynns Falls	High ammonia was recorded at the Nieman sampling site. During the investigation the ammonia was very high, at 2.80 mg/l, but the Enterococci low, at 731. Did noticed that the sanitary manhole at 2400 Harriet Ave was recently choked, but there is still a lot of grease and debris causing a partial blockage. Requested mainline cleaning of sanitary 311 ID: 17-00355681, Request ID: 292047	OCAL	6/13/2017	SSO-Subsurface
2287	1112 Bryn Mawr SSO# 4407	Backyard of 1112 Bryn Mawr Rd., at stream	Jones Falls	High ammonia (2.00 mg/l) was recorded at the Bellemore survey site. The investigation found that choked sanitary manhole at 1112 Bryn Mawr Rd was choked. The choked caused sewage to escape the system through a fractured sanitary pipe, about 2 feet upstream of manhole. The discharge into stream is approximately, 5.0 GPM.	OCAL	7/7/2016	SSO-Surface
2308	1700 Moreland Ave (SSO#4462)	Alley behind 1700 Moreland Ave	Gwynns Falls	OAM requested assistance locating the source of an SSO (#4451) that has been reported numerous times in the alley behind 1700 Ruxton Ave. A moderate flow of wastewater was flowing from cracks in the road surface. Previous efforts by UMD have found no chokes or leaks from nearby sanitary line. OCAL found a choked sanitary main one block east of the where the sewage was surfacing. It is believed that the wastewater was traveling through a conduit line from the choke and exiting behind 1700 Ruxton. UMD cleared the choke and the overflow stopped.	City	8/8/2016	SSO-Surface
2341	Mt Olivet Ln SSO# 4534 & 4538	In woods beyond the dead end of Mount Olivet Ln	Gwynns Falls	Hole at 9 o'clock at bell housing 3 inches by 4 inches. Discharge 5 -10 GPM. Also manhole and casing leaking from side at 0.25gpm. Anchor repaired broken pipe. The leaking manhole and casing continue to leak post repair.	OAM	10/11/2016	SSO-Surface
2343	2905 Woodland Ave SSO#4529	2905 Woodland Ave	Jones Falls	Overflowing Cleanout	OCAL	10/4/2016	SSO-Surface
2349	2402 Talbot Rd Lateral SSO# 4548	In wood behind address off the SWcorner of the house at lower part of hill.	Gwynns Falls	Sewage leaking from joints in clay pipe lateral. R. Johnson discovered this while working on main problem. UMD replace about 12ft of pipe. No longer leaking.	City	10/18/2016	SSO-Surface
2362	1112 Bryn Mawr SSO# 4571	Behind house in the stream	Jones Falls	Sewage discharge from manhole in stream at a rate of 10 GPM. CCTV showed rocks inline.	OCAL	11/1/2016	SSO-Surface
2363	3729 Greenmount Ave Cleanout (SSO# 4565)	Front yard of 3729 Greenmount Ave	Jones Falls	Staff noticed wastewater debris in front yard of home while performing another PST investigation in the area. Evidence of overflow reported and UMD responded, however, they were unable to clear the house connection due to damage between the cleanout and the mainline within the owner's property. UMD referred problem to housing. Repair was completed by Anchor (SC944)	OCAL	10/28/2016	SSO-Surface
2374	2518 Druid Park Drive SSO# 4541	End of alley (between 2522 &2518) on hillside.	Jones Falls	High ammonia at Union Ave sampling site. Tracked to location where there had been a previous SSO. It appears that this is reoccurring based on Citiworks comments and visual evidence. Referred to UMD R. Foster for cleanup and repair.	OCAL	11/7/2016	SSO-Surface
2376	6231 Walther Ave Glenmount Elementary/Middle School SSO# 4573	Manhole located in driveway behind the school.	Back River	High ammonia (0.90 ppm) received at Mary Ave sample site & tracked to a surcharging sanitary manhole at Glenmount Elementary/Middle School. UMD attempt to relieve it & they couldn't not, so the vacuumed it out & and it just filled back up. The CCTV determined that there was a rock blocking the line a couple feet down from the manhole. UMD Construction Mgmt was called to remove the obstruction from the line and they determine that since it was on private (Baltimore City Public Schools) property it was their responsibility to resolve the issue. 11/4/16 The schools contractor was out there doing the work. A follow up is required after completion of work. Repair confirmed, low ammonia downstream.	OCAL	11/1/2016	SSO-Surface
2377	2518 Druid Park Drive SSO# 4580	Hole on hillside behind 2518 Druid Park Dr.	Jones Falls	Sewage discharging from hole. Discovered while driving by location.	OCAL	11/9/2016	SSO-Surface

2385	2403 Talbot Rd SSO# 4593	2403 Talbot Rd	Gwynns Falls	Overflowing manhole in street. Found while drive-by.	OCAL	11/22/2016	SSO-Surface
2389	2109 E North Ave (SSO #4592)	Rear of 2109 E North Ave at cleanout	Harbor	Grey water noticed flowing from alley while sampling for another PST (Lakewood & Hudson (West Branch) 110416). Grey water led us to choked and overflowing house connection. Overflow was stopped and lateral cleaned. UMD observed damage on the city side and turned over to construction. This home was also found to have disconnected plumbing allowing wastewater to discharge into yard. Separate SDUO initiated, SDUO ID#: 16HB04.	OCAL	11/22/2016	SSO-Surface
2391	403 Old Orchard Rd SSO# 4597	Behind 403 Old Orchard Rd at base of hill at the stream	Gwynns Falls	Broken sanitary pipe crossing stream, behind 403 Old Orchard Rd. Anchor replaced section of line on 11/30. followup dye test on 11/30 showed dye seeping from ground below vc pipe in between pvc coupling and manhole. Followup dye test on 12/1 showed no leaks. Followup on 12/5 showed construction was complete and a a concrete casing surrounding the pipe was constructed	Citizen	11/29/2016	SSO-Surface
2393	2518 Druid Park Drive SSO# 4600	Hole on hillside behind 2518 Druid Park Dr.	Jones Falls	Sewage discharging from hole in hillside.	OCAL	11/30/2016	SSO-Surface
2404	2781 Wilkens Ave (SSO#4620)	Sanitary manhole on east bank of Gwynn's Falls south of Wilkens Ave Bridge	Gwynns Falls	Received cityworks complaint about sanitary foam coming out of the ground on 12/13/16 (using address 2812 Wilkens Ave). Investigation found evidence of sewer overflow. SSO report made and UMD cleared the debris on 12/14/16.	Citizen	12/13/2016	SSO-Surface
2405	2801 Frederick Ave (SSO#4621)	West bank of Gwynn's Falls south of Frederick Ave bridge	Gwynns Falls	Evidence of sewer overflow observed while investigating cityworks complaint in the area. SSO report filed and UMD cleared the debris.	OCAL	12/13/2016	SSO-Surface
2452	2403 Talbot Rd SSO#4784	2403 Talbot Rd Corner of Clifton & Talbot	Gwynns Falls	Manhole is holding. UMD unable to relieve line. Possible collapse. Repair work completed	OCAL	3/29/2017	SSO-Surface
2453	340 S. Augusta Ave SSO#4785	340 S. Augusta Ave rear of property	Gwynns Falls	Overflowing house connection	OCAL	3/29/2017	SSO-Surface
2456	Hilton Parkway & Edmondson Ave SSO 4819	600 N. Hilton St	Gwynns Falls	25 GPM	OCAL	4/11/2017	SSO-Surface
2463	Gwynns Falls Park at Wilkens Ave SSO# 4874	Northeast corner of Gwynns Falls Park at Wilkens Ave and Hurley Ave., about 200 feet downstream of Frederick Ave bridge.	Gwynns Falls	Overflowing buried sanitary manhole at park has created a pond of sewage, approximately 20 GPM.	OCAL	5/16/2017	SSO-Surface

Appendix J: Progress Status of Milestones

- Table J-1: MS4 and TMDL WIP Milestones [Ref. MS4 Restoration and TMDL WIP, part 5, dated August 2015]
- Table J-2: Trash TMDL Implementation Milestones [Ref. Implementation Plan for the Middle Branch/Northwest Branch Trash TMDL in Baltimore, Part 7.1, dated January 2016]

Table J-1: Progress Status of MS4 and TMDL WIP Milestones for FY 2017

Program Milestones	Status
Begin working with 3 neighborhoods on stormwater planning	Complete as part of MS4 WIP implementation, BMORE Beautiful initiative, Green Network plan development, and GROW Center research.
Increase staff by 2 FTE by hiring or contracting for community outreach.	Initiated: one community planner position was created but not filled; Peaceworker was hired. Additional staff were hired in the Office of Communications and Community Affairs.
Complete an analysis of city-owned facilities for possible impervious removal and sw retrofits.	Complete.
Create an MOU with Baltimore Office of Promotion and the Arts (BOPA) to incorporate art into stormwater projects.	Complete.
Project Milestones (construction initiated)	
Complete watershed assessment report for Lower North Branch of the Patapsco and Baltimore Harbor.	Initiated. Full assessment reports will be included in the FY 2018 report.
1.8 miles of stream restoration.	800 LF completed. Another 2.8 miles of construction was initiated in FY 2017.
9 acres of regenerative step pool conveyance.	Final project design decreased to only 6 acres. Design completed but construction was delayed due to access. Construction is planned to begin in FY 2018.
5.8 acres of impervious removal and greening projects.	0.9 acre completed. The remaining acreage was delayed due to project selection, as described in Section 6.3.1 of this report.
5,000 tree planted	Approximately 2,368 trees were planted in the 2016 planting season; however this data did not include efforts from Baltimore Tree Trust so the amount could be higher.

Table J-2: Progress Status of Trash WIP Milestones for FY 2017

Milestones	Status
Implement Municipal Can Program (FY 2016 to 2017)	Initiated in FY 2016. See Section 5.4.1 and 5.5.9 of FY 2017 MS4 Annual Report for more details.
Develop anti-littering marketing campaign (FY 2016 to 2017)	Initiated in FY 2016. See Section 5.5.9 of FY 2016 MS4 Annual Report for more details.
Work with Baltimore County to develop monitoring program (FY 2016 to 2017)	Initiated in FY 2016. Continued in FY 2017 as a broader discussion with other MS4 communities. Obtained survey protocols from Anacostia TMDL program as a potential basis.
Explore ways to expand / enhance Canoe 'n Scoop and other harbor clean-ups (FY 2016 to 2017)	Continued contracted routine of cleaning of the Middle Branch and installed new booms. Initiated evaluation of weight and content of removed debris; results will be included in the FY 2018 Annual Report.
Prepare feasibility studies for in-line / end-of-pipe debris collectors based on project selection criteria (FY 2016 to 2017)	Continued in FY 2017.
Install Bush Street Debris Collector (FY 2017)	Postponed indefinitely due to historical study requirements.
Initiate Routine Waterways Cleaning Program (FY 17)	Completed for Middle Branch / Casino area. Tributaries will be evaluated in FY 18.
Evaluate Modified Inlet / Proactive Inlet Cleaning program (FY 17)	Complete. Results will be included in the FY 18 Annual Report.
Explore ways to improve Enforcement, including small hauler policies, education, and possible Enforcement Week / Month. (FY 17)	Complete. Small Haulers program modified and a new location was added. Enforcement functions are scheduled to be re-organized and moved from DHCD to DPW- Bureau of Solid Waste in FY 18.
Launch Clean Corps Anti-Litter marketing campaign (FY 17-18)	Research was initiated.

Appendix K: Progress Status of Projects, Programs, and Partnerships for 20% Restoration

- Table K-1: Progress Status of Projects
- Table K-2: Progress Status of Programs
- Table K-3: Progress Status of Partnerships

Table K-1: Progress Status of WIP Projects

MS4 WIP Project ID	BMP Type	Watershed	Location	Drainage Area (ac)	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)			Estimated Capital Cost	Schedule to Start (FY)		Status as of 6/30/2017	NOTES
						TN	TP	TSS		Design	Construction		
Structural / Traditional BMPs													
S01	SW Pond Retrofit	Gwynns Falls	Gwynns Run, Carrolton Park	38	25	132	17	15,525	$505,000	2016	2018		
				23	15	79	10	9,315	$505,000	2017	2018	Under Design	
S02	SW Pond Retrofit	Gwynns Falls	Seton Business Park Park	62	41	214	27	25,169	$795,000	2016	2018		Postponed to next permit.
												Removed	
S03	Pond Retrofit and New Pond	Back River	North Point Road @ Kane and Quad	92	60	317	40	37,260	$3,290,000	2015	2016		Ex. Pond on RCRA site. Retrofit is not practicable.
												Removed	
S04	Wetland / Pond	Back River	Perring Parkway at Cloville (HR-R28B)	23	15	63	13	8,484	$344,000	2016	2018		
				18	12	49	10	6,649	$2,687,000	2017	2018	Under Design	
S05	Wetland / Pond	Back River	Herring Run Park below Shannon at Lyndale (HR-R15C)	31	20	84	17	11,465	$550,000	2016	2018		Conflict with active recreation (BCRP).
												Removed	
S06	Wetland	Back River	Herring Run Park below Shannon at Kavon Ave (HR-R39)	31	20	84	17	11,465	$550,000	2016	2018		Area restricted for horizontal expansion.
												Removed	
S07	Wetland	Back River	Herring Run Park below Parkside at Sinclair (HR-R15A)	100	65	275	56	37,260	$1,600,000	2016	2018		Conflict with active recreation (BCRP).
												Removed	
S08	Wetland	Back River	Chinquapin Run Park between Belvedere and Alameda (CH-R6A)	69	45	190	39	25,795	$1,840,000	2016	2018		Project was removed since A05 changed, also based on feasibility.
												Removed	
S09	Bioretention Area	Baltimore Harbor	Faring Baybrook Park Rec Center (MC-18a)	5	3	17	3	1,702	$160,000	2016	2018		
				5	3	17	3	1,734	$523,300	2016	2018	Under Design	
S10	Bioretention Area	Gwynns Falls	Park Hts Virginia + Homer	3	2	11	2	1,135	$60,000	2016	2018		Postponed until next permit.
												Removed	
S11	Shallow extended detention wetland	Jones Falls	West Coldspring and Brand Ave (LJ-R9)	14	9	46	8	4,624	$212,000	2016	2018		Conflict with active recreation (BCRP).
												Removed	
S12	Shallow wetland	Jones Falls	Woodheights and La Plata (LJ-R38)	6	4	21	3	2,102	$96,000	2016	2018		Postponed until next permit.
												Removed	
S13	Shallow wetland	Jones Falls	Lower Lower Stony Run	0	0	0	0	0	$0				Part of Project A02. Total costs shown in A02.
				31	20	107	17	10,614	$0	2016	2018	Under Construction	
S14	Pond	Jones Falls	DeWees Park	0	0	0	0	0	$0				New project, not part of WIP (August 2015).
				15	10	53	9	5,255	$0	2017	2018	Under Design	
S15	Pond	Jones Falls	Near 2311 Grove Street	0	0	0	0	0	$0				New project, not part of WIP (August

Table K-1: Progress Status of WIP Projects

MS4 WIP Project ID	BMP Type	Watershed	Location	Drainage Area (ac)	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)			Estimated Capital Cost	Schedule to Start (FY)		Status as of 6/30/2017	NOTES
						TN	TP	TSS		Design	Construction		
				14	9	48	8	4,729	$0	2016	2018	Under Design	2015).
			Subtotal Structural / Traditional (WIP):	**475**	**309**	**1,455**	**243**	**181,986**	**$10,002,000**				
			Subtotal Structural / Traditional (Current):	**77**	**50**	**252**	**40**	**28,313**	**$3,715,300**				

Table K-1: Progress Status of WIP Projects

MS4 WIP Project ID	BMP Type	Watershed	Location	Drainage Area (ac)	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)			Estimated Capital Cost	Schedule to Start (FY)		Status as of 6/30/2017	NOTES
						TN	TP	TSS		Design	Construction		
ESD Practices													
E01	Micro-bioretention	Baltimore Harbor	Cloverleaf - northwest of I-895 and Frankfurst Ave (MC-30)	0.5	0.4	2.1	0.34	217	$50,000	2016	2019		Postponed until next permit.
												Removed	
E02	Micro-bioretention	Baltimore Harbor	Bush St. Curb bump-out	0.3	0.2	1.2	0.20	127	$80,000	2011	2016		
				0.3	0.2	1.2	0.19	121	$102,900	2011	2017	Completed	
E03	Micro-bioretention	Baltimore Harbor	Lafayette inner block retrofit.	0.9	0.7	4.0	0.64	411	$240,000	2011	2016		
				0.9	0.7	4.0	0.64	411	$308,900	2011	2017	Completed	
E14	Micro-bioretention	Baltimore Harbor	Bay Brook MS (MC-18b)	0.3	0.3	1.5	0.2	157	$54,000	2015	2016		School scheduled for renovation
												Removed	
E15	Micro-bioretention	Baltimore Harbor	Bay Brook MS (MC-18c)	0.2	0.2	1.1	0.2	115	$46,800	2015	2016		School scheduled for renovation
												Removed	
E16	Micro-bioretention	Baltimore Harbor	Bay Brook MS - parking lot (MC-18d)	0.2	0.2	1.1	0.2	115	$34,800	2015	2016		School scheduled for renovation
												Removed	
E18	Micro-bioretention	Baltimore Harbor	Brooklyn / Curtis Bay	1.1	0.9	5.0	0.8	513	$19,800	2015	2016		2 facilities
				0.9	0.7	4.2	0.7	423	$508,743	2016	2018	Under Design	
E19	Micro-bioretention	Baltimore Harbor	Patterson Park (HA-R5A)	0.3	0.2	1.4	0.2	139	$40,000	2016	2018		Conflict with active recreation (BCRP).
												Removed	
E20	Micro-bioretention	Baltimore Harbor	Ellwood Park (HA-R8)	0.2	0.1	0.7	0.1	72	$21,000	2016	2018		Conflict with active recreation (BCRP).
												Removed	
E21	Micro-bioretention	Baltimore Harbor	Patterson Park Adjunct (HA-R6)	0.8	0.6	3.6	0.6	362	$105,000	2016	2018		Conflict with active recreation (BCRP).
												Removed	
E22	Micro-bioretention	Baltimore Harbor	Patterson Park / Highlandtown / Baltimore Highlands	5.1	4.1	24.1	3.79	2,446	$710,000	2016	2018		15 facilities
				1.6	1.3	7.7	1.22	785	$710,000	2016	2018	Under Design	
E23	Micro-bioretention	Back River	Frankford / Greater Lauraville / Belair-Edison / Cedonia	4.6	3.6	21.6	3.40	2,198	$671,000	2016	2018		32 facilities
				4.8	3.8	22.6	3.55	2,295	$671,000	2016	2018	Under Design	
E24	Micro-bioretention	Back River	Erdman Avenue	1.4	1.2	6.8	1.07	694	$128,000	2016	2018		
				0.5	0.4	2.4	0.37	242	$128,000	2016	2018	Under Design	
E25	Micro-bioretention	Back River	Belair Road	0.3	0.2	1.2	0.20	127	$77,000	2016	2018		
				0.3	0.2	1.2	0.20	127	$77,000	2016	2018	Under Design	

Table K-1: Progress Status of WIP Projects

MS4 WIP Project ID	BMP Type	Watershed	Location	Drainage Area (ac)	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)			Estimated Capital Cost	Schedule to Start (FY)		Status as of 6/30/2017	NOTES
						TN	TP	TSS		Design	Construction		
E26	Micro-bioretention	Jones Falls	Hampden / Remington / Wyman Park	6.3	5.0	29.7	4.67	3,020	$850,000	2016	2018		11 facilities
				1.3	1.0	5.9	0.93	604	$850,000	2016	2018	Under Design	
E27	Micro-bioretention	Gwynns Falls	Howard Park / Grove Park / West Arlington / Fairmount	3.1	2.5	14.9	2.34	1,510	$420,000	2016	2018		14 facilities
				2.9	2.3	13.7	2.15	1,389	$420,000	2016	2018	Under Design	
E28	Micro-bioretention	Gwynns Falls	Hunting Ridge / Rognel Hts / Edmondson Village / Edgewood	3.1	2.5	14.9	2.34	1,510	$420,000	2016	2018		12 facilities
				1.9	1.5	8.9	1.40	906	$420,000	2016	2018	Under Design	
E29	Micro-bioretention	Baltimore Harbor	Sharp-Leadenhall / Federal Hill / Otterbein / S. Baltimore	1.6	1.3	7.4	1.17	755	$215,000	2016	2018		7 facilities
				0.9	0.7	4.2	0.65	423	$280,000	2016	2018	Under Design	
E30	Micro-bioretention	L. N. Branch Patapsco	Cherry Hill	3.1	2.5	14.9	2.34	1,510	$500,000	2016	2018		
				5.4	4.3	25.5	4.02	2,597	$660,000	2015	2018	Under Design	
E31	Micro-bioretention	Baltimore Harbor	Lakeland / Mt. Winans / Westport	1.6	1.3	7.4	1.17	755	$420,000	2016	2018		
				3.3	2.6	15.4	2.43	1,570	$420,000	2016	2018	Under Design	
E32	Micro-bioretention	Baltimore Harbor	McElderry Park / CARE / Milton-Montford / Patterson Place	3.1	2.5	14.9	2.34	1,510	$438,000	2016	2018		
				0.8	0.6	3.6	0.56	362	$520,000	2016	2018	Under Design	
E33	Micro-bioretention	Gwynns Falls	Greater Mondawmin / Walbrook / Rosemont / NW Community Action /	3.1	2.5	14.9	2.34	1,510	$438,000	2016	2018		
				2.1	1.7	10.1	1.59	1,027	$438,000	2016	2018	Under Design	
E34	Micro-bioretention	Jones Falls	Mt. Washington / Glen / Cheswolde / Cross Country	6.3	5.0	29.7	4.67	3,020	$1,350,000	2016	2018		
				2.1	1.7	10.1	1.59	1,027	$950,000	2016	2018	Under Design	
E35	Micro-bioretention	Back River	Cameron Village / Chinquapin Park (upstream to Chinquapin Run)	5.0	4.0	23.8	3.74	2,416	$680,000	2017	2019		
				3.3	2.6	15.4	2.43	1,570	$680,000	2016	2018	Under Design	
E36	Micro-bioretention	Back River	De Wees Park	1.3	1.0	5.9	0.93	604	$180,000	2017	2019		Postponed until next permit.
												Removed	
E37	Micro-bioretention	Back River	Orchard Ridge / Armistead Gardens / Orangeville	6.3	5.0	29.7	4.67	3,020	$630,000	2017	2019		
												Removed	
E38	Micro-bioretention	Jones Falls	Central Park Heights / Towanda Grantley / Lucille Park	3.1	4.0	14.9	2.34	1,510	$513,000	2017	2019		
				1.6	4.0	7.7	1.22	785	$513,000	2016	2018	Under Design	
E39	Micro-bioretention	Gwynns Falls	MorrellPark / Wilhelm Park / Gwynns Falls / Carroll-South Hilton	3.1	6.0	14.9	2.34	1,510	$625,000	2017	2019		
				9.1	6.0	43.4	6.82	4,408	$625,000	2016	2018	Under Design	

Table K-1: Progress Status of WIP Projects

MS4 WIP Project ID	BMP Type	Watershed	Location	Drainage Area (ac)	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)			Estimated Capital Cost	Schedule to Start (FY)		Status as of 6/30/2017	NOTES
						TN	TP	TSS		Design	Construction		
E41	Micro-bioretention	Back River	Clifton Park	0.3	0.2	1.2	0.19	121	$35,000	2017	2019		Conflict with active recreation (BCRP).
												Removed	
E42	Micro-bioretention	Back River	Clifton Park	2.9	2.3	13.7	2.15	1,389	$400,000	2017	2019		Conflict with active recreation (BCRP).
												Removed	
			Subtotal ESD Practices (WIP):	**69**	**60**	**328**	**52**	**33,359**	**$10,391,400**				
			Subtotal ESD Practices (Current):	**44**	**36**	**207**	**33**	**21,070**	**$9,282,543**				
Alternative BMPs (Stream Restoration)-- Drainage Area = Stream Restoration Length (LF)													
A01	Stream Restoration	Gwynns Falls	Leakin Park Stream Restoration at Fairmount Storm Drain	2,080 LF	31	156	141	62,400	$700,000	2010	2014		
				2,080 LF	31	156	141	62,400	$700,000	2010	2014	Completed	
A02	Stream Restoration	Jones Falls	Lower Lower Stony Run	4,500 LF	68	338	306	135,000	$4,030,000	2015	2016		Cost includes S13 and A44. Advertised in August 2016.
				4,600 LF	69	345	313	138,000	$4,199,700	2015	2017	Under Construction	
A03	Stream Restoration	Gwynns Falls	Powder Mill Phase 1	3,900 LF	59	293	265	117,000	$3,420,000	2009	2017		Proposed to align with sanitary improvements.
				3,900 LF	59	293	265	117,000	$4,580,700	2009	2017	Under design	
A04	Stream Restoration	Jones Falls	East Stony Run Project 1	800 LF	12	60	54	24,000	$839,000	2014	2017		
				800 LF	12	60	54	24,000	$1,135,000	2014	2017	Completed	
A05	Stream Restoration	Back River	Chinquapin Run Project 1	2,200 LF	33	165	150	66,000	$3,670,000	2014	2017		Increased length to coincide with sanitary replacement project.
				10,100 LF	152	758	687	303,000	$8,103,000	2014	2017	Under Construction	
A06	Stream Restoration	Back River	Chinquapin Run Project 2	2,600 LF	39	195	177	78,000	$1,772,000	2015	2017		Coincides with A06.
				2,600 LF	39	195	177	78,000	$2,086,000			Under design	
A07	Stream Restoration	Gwynns Falls	Franklintown Culvert	2,400 LF	36	180	163	72,000	$1,700,000	2015	2018		
				2,900 LF	44	218	197	87,000	$3,410,300	2015	2018	Under Design	
A08	Stream Restoration	Back River	Lower Moore's Run Project 2	2,500 LF	38	188	170	75,000	$1,960,000	2015	2018		
				2,500 LF	38	188	170	75,000	$2,144,000	2015	2018	Under Design	
A09	Stream Restoration	Back River	Biddison Run Project 2	3,030 LF	45	227	206	90,900	$3,590,000	2014	2018		Priority slope stabilization shown as A43.
				3,060 LF	46	230	208	91,800	$4,488,000	2014	2018	Under design	
A10	Stream Restoration	Jones Falls	Western Run at Kelly Avenue	800 LF	12	60	54	24,000	$1,324,600	2015	2018		
				2,600 LF	39	195	177	78,000	$2,500,000	2016	2018	Under Design	
A11	Stream Restoration	Jones Falls	East Stony Run Project 2	1,340 LF	20	101	91	40,200	$2,040,000	2015	2018		Postponed due to increased scope of A10.
												Removed	

Table K-1: Progress Status of WIP Projects

MS4 WIP Project ID	BMP Type	Watershed	Location	Drainage Area (ac)	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)			Estimated Capital Cost	Schedule to Start (FY)		Status as of 6/30/2017	NOTES
						TN	TP	TSS		Design	Construction		
A12	Stream Restoration	Back River	Biddison Run Projects 3	3,850 LF	58	289	262	115,500	$1,800,000	2014	2018		Advertised with A09 - Biddison Run Project 2.
				3,850 LF	0	289	262	115,500	$2,250,000	2014	2018	Under design	
A13	Stream Restoration	Back River	Moore's Run Restoration Project 1	2,500 LF	38	188	170	75,000	$1,822,000	2015	2018		
				3,700 LF	0	278	252	111,000	$3,174,000	2016	2018	Under Design	
A14	Stream Restoration	Back River	Moore's Run Restoration Project 2	2,800 LF	42	210	190	84,000	$1,822,000	2015	2018		Will be advertised with A13 - Moore's Run Stream Restoration
				2,800 LF	0	210	190	84,000	$2,402,000	2016	2018	Under Design	
A15	Stream Restoration	Back River	Herring Run stream	2,665 LF	40	200	181	79,950	$2,702,000	2015	2018		Postponed due to increase of A05 scope
												Removed	
A16	Stream Restoration	Jones Falls	Druid Hill Park Stream Project	1,875 LF	28	141	128	56,250	$2,702,000	2015	2018		Postponed due to increased scope of A10.
												Removed	
A17	Stream Restoration	Gwynns Falls	Dead Run (Huntington Ridge)	2,600 LF	39	195	177	78,000	$2,702,000	2015	2018		
				600 LF	0	45	41	18,000	$2,050,000	2017	2018	Under design	
A18	Stream Restoration	Gwynns Falls	Maiden's Choice	2,600 LF	39	195	177	78,000	$2,702,000	2015	2018		Access problems. Project deemed not practicable.
												Removed	
A19	Stream Restoration	Gwynns Falls	Maiden's Choice Tributary (Upland)	2,300 LF	35	173	156	69,000	$2,702,000	2015	2018		
				3,100 LF	0	233	211	93,000	$3,535,000	2017	2019	Under design	
A20	Stream Restoration	Gwynns Falls	Dead Run	2,200 LF	33	165	150	66,000	$2,702,000	2016	2019		
				3,600 LF	0	270	245	108,000	$3,650,000	2017	2019	Under design	
A21	Stream Restoration	Back River	Herring Run Western Branch	2,675 LF	40	201	182	80,250	$2,702,000	2016	2019		
				6,500 LF	0	488	442	195,000	$6,552,000	2017	2019	Under design	
			Subtotal Alternative BMPs (Stream Restoration) (WIP):	**52,215 LF**	**783**	**3,916**	**3,551**	**1,566,450**	**$49,403,600**				
			Subtotal Alternative BMPs (Stream Restoration) (Current):	**59,290 LF**	**527**	**4,447**	**4,032**	**1,778,700**	**$56,959,700**				
Alternative BMPs (Other)													
A22	Regenerative Step Pool Storm Conveyance	Gwynns Falls	Seamon Avenue	20	9	146	13	6,622	$1,168,000	2015	2017		IA reduced based on design.
				20	6	139	11	5,120	$1,416,000	2015	2017	Under design	
A23	IA Removal, afforestation, bioretention	Baltimore Harbor	CARE Communities / McElderry Park / Milton-Montford	3.1	3.75	19.2	4.34	2,852	$496,000	2016	2018		
				1.0	1.17	6.0	1.36	890	$527,000	2016	2018	Under Design	
A24	IA Removal, afforestation	Baltimore Harbor	Harford Hts ES (HA-R19)	0.9	0.60	3.3	0.92	523	$110,000	2016	2018		INSPIRE School- construction conflict
												Removed	

Table K-1: Progress Status of WIP Projects

MS4 WIP Project ID	BMP Type	Watershed	Location	Drainage Area (ac)	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)			Estimated Capital Cost	Schedule to Start (FY)		Status as of 6/30/2017	NOTES
						TN	TP	TSS		Design	Construction		
A25	IA Removal, afforestation, bioretention	Back River	Northwood ES and Rec Center (CH-R2A)	2.4	2.85	14.6	3.30	2,167	$565,000	2016	2018		INSPIRE School- construction conflict
												Removed	
A26	IA Removal, afforestation	Back River	Sinclair Lane ES (HR-R18)	1.9	1.31	7.3	2.03	1,154	$260,400	2016	2018		
				3.0	2.10	11.7	3.24	1,846	$260,400	2016	2018	Under Design	
A27	IA Removal, afforestation	Back River	WEB DuBois (HR-R29A)	0.8	0.53	2.9	0.81	461	$104,200	2016	2018		Postponed to next permit.
												Removed	
A28	IA Removal, afforestation, bioretention	Back River	Various Schools	0.5	0.6	3.1	0.70	456	$120,000	2016	2018		
				0.5	0.6	3.1	0.70	456	$120,000	2016	2018	Under Design	
A29	IA Removal, afforestation, bioretention	Gwynns Falls	Mt. Winans	3.1	3.75	19.2	4.34	2,852	$496,000	2016	2018		
				2.5	3	15.4	3.48	2,282	$496,000	2016	2018	Under Design	
A30	IA Removal, afforestation, bioretention	Back River	Montebello ES (HR-R41A)	0.9	1.05	5.4	1.22	799	$208,000	2016	2018		INSPIRE School- construction conflict
												Removed	
A31	IA Removal, afforestation, bioretention	City-wide	Various Schools	1.5	1.76	9.0	2.03	1,335	$350,000	2016	2018		
				5.2	6.25	32.0	7.24	4,751	$350,000	2016	2018	Under Design	
A32	IA Removal, afforestation, bioretention	Jones Falls	Pimlico ES (LJ-R6)	1.1	1.35	6.9	1.56	1,027	$268,000	2016	2018		INSPIRE School- construction conflict
												Removed	
A33	IA Removal, afforestation, bioretention	Jones Falls	Poly Western HS (LJ-R8C)	1.4	1.65	8.5	1.91	1,255	$328,000	2016	2018		
				1.4	1.65	8.5	1.91	1,255	$328,000	2016	2018	Under Design	
A34	IA Removal, afforestation, bioretention	Baltimore Harbor	Duane Avenue Park - parking lot (MC-21)	0.3	0.35	1.8	0.40	262	$42,000	2016	2018		Current demand for parking lot.
												Removed	
A35	IA Removal, afforestation	Baltimore Harbor	Oliver / Broadway East	4.0	2.8	15.6	4.32	2,461	$496,000	2017	2019		Locations were not practicable.
												Removed	
A36	IA Removal, afforestation	Gwynns Falls	Carrollton Ridge / Shipley Hill / Mill Hill / Pigtown / New Southwest / Union	4.0	2.8	15.6	4.32	2,461	$496,000	2017	2019		
				2.9	2.0	11.1	3.08	1,756	$419,000	2016	2019	Under Design	
A37	IA Removal, afforestation	Baltimore Harbor	Harlem Park / Sandtown-Winchester / Uplands	2.0	1.40	7.8	2.16	1,230	$248,000	2017	2019		
				7.0	4.88	27.2	7.53	4,288	$190,000	2016	2019	Under Design	
A38	IA Removal, afforestation	Baltimore Harbor	Various Schools	2.0	1.40	7.8	2.16	1,230	$248,000	2017	2019		
				7.0	4.88	27.2	7.53	4,288	$190,000	2016	2019	Under Design	

Table K-1: Progress Status of WIP Projects

MS4 WIP Project ID	BMP Type	Watershed	Location	Drainage Area (ac)	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)			Estimated Capital Cost	Schedule to Start (FY)		Status as of 6/30/2017	NOTES
						TN	TP	TSS		Design	Construction		
A39	Aforestation of IA	Gwynns Falls	TreeBaltimore Street Trees	2.0	1.40	19.3	2.29	1,121	$496,000	2017	2019		
				2.0	1.40	19.3	2.29	1,121	$496,000	2016	2019	Under Construction	
A40	Aforestation of IA	Gwynns Falls	TreeBaltimore Street Trees	8.3	5.81	90.2	13.19	6,793	$496,000	NA	2017		
				8.3	5.81	90.2	13.19	6,793	$496,000	NA	2017	Under Construction	
A41	Aforestation of IA	Jones Falls	TreeBaltimore Street Trees	8.3	5.81	90.2	13.19	6,793	$496,000	NA	2018		
				8.3	5.81	90.2	13.19	6,793	$496,000	NA	2018	Pending	
A42	Aforestation of IA	City-Wide	TreeBaltimore Street Trees	4.2	2.91	45.1	6.59	3,396	$248,000	NA	2019		
				4.2	2.91	45.1	6.59	3,396	$248,000	NA	2019	Pending	
A43	Regenerative Step Pool Storm Conveyance	Jones Falls	Lower Lower Stony Run	0	0	0	0	0	$0				Part of Project A02. Total costs shown in A02.
				5	5	44	6	3,080	$0	2015	2017	Under Design	
			Subtotal Alternative BMPs (Other) (WIP):	**72**	**53**	**539**	**85**	**47,250**	**7,739,600**				
			Subtotal Alternative BMPs (Other) (Current):	**78**	**54**	**569**	**88**	**48,114**	**6,032,400**				
			Total Projects (WIP):		**1,205**	**6,238**	**3,930**	**1,829,045**	**$77,536,600**	**84**	**Projects**	**Proposed**	
			Total Projects (Current):		**667**	**5,475**	**4,192**	**1,876,197**	**$75,989,943**	**56**	**Projects**	**Proposed**	
					9	135	20	10,189	$744,000	2	Projects	Pending	
					385	3,901	2,960	1,329,532	$59,704,443	45	Projects	Under Design	
					248	1,319	1,033	459,528	$13,294,700	5	Projects	Under Construction	
					44	221	197	86,931	$2,246,800	4	Projects	Completed	
Summary Information: Current Projects Proposed for MS4 Permit listed by Watershed													
		Back River			295	2,739	2,408	1,066,485		15	Projects	Proposed	
		Baltimore Harbor			21	118	26	15,294		11	Projects	Proposed	
		City-Wide			9	77	14	8,148		2	Projects	Proposed	
		Gwynns Falls			178	1,643	1,155	519,516		17	Projects	Proposed	
		Jones Falls			178	973	602	274,141		12	Projects	Proposed	
		L. N. Branch Patapsco			4	26	4	2,597		1	Projects	Proposed	

Table K-1: Progress Status of WIP Projects

MS4 WIP Project ID	BMP Type	Watershed	Location	Drainage Area (ac)	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)			Estimated Capital Cost	Schedule to Start (FY)		Status as of 6/30/2017	NOTES
						TN	TP	TSS		Design	Construction		
Summary Information: Current Projects Proposed for MS4 Permit listed by BMP Type for Use in TMDL MAST													
	Bioretention Area				3	17	3	1,734					Listed as Bioretention, C/D soils underdrain in MAST.
	Micro-bioretention				36	207	33	21,070					
	Aforestation of IA				16	245	35	18,102					Listed as tree planting in MAST.
	IA Removal, afforestation				14	77	21	12,178					Listed as impervious area removal in MAST.
	IA Removal, afforestation, bioretention				13	65	15	9,634					
	Stream Restoration			59,290	527	4,447	4,032	1,778,700					Listed as stream restoration in MAST.
	Pond Retrofit and New Pond				0	0	0	0					Listed as wet ponds and wetlands in MAST.
	Regenerative Step Pool Storm Conveyance				11	182	16	8,200					
	SW Pond Retrofit				15	79	10	9,315					
	Shallow extended detention wetland				0	0	0	0					
	Shallow wetland				39	207	34	20,598					
	Slope Stabilization				0	0	0	0					
	Wetland				0	0	0	0					
	Wetland / Pond				12	49	10	6,649					
Summary Information: Completed Projects by Watershed													
		Back River			0	0	0	0	$0	0	Projects	Completed	
		Baltimore Harbor			1	5	1	531	$411,800	2	Projects	Completed	
		City-Wide			0	0	0	0	$0	0	Projects	Completed	
		Gwynns Falls			31	156	141	62,400	$700,000	1	Projects	Completed	
		Jones Falls			12	60	54	24,000	$1,135,000	1	Projects	Completed	
		L. N. Branch Patapsco			0	0	0	0	$0	0	Projects	Completed	

Table K-2: Progress Status of WIP Programs

Project No. / Type	Debris Collected	Equivalent Impervious Area Restoration (ac)	Reference Metric		Estimated Pollutant Removal (lbs / yr)			NOTES
					TN	TP	TSS	
Street Sweeping*								
Collection within CY 2012	9,988 tons	2,797	96,000	lane miles	24,471	9,788	2,936,472	Ref: Baltimore's New and Improved Mechanical Street Sweeping Program (October 2013)
Anticipated Increase after City-wide expansion (Peak):	9,109 tons	2,551			22,317	8,927	2,678,046	Ref :Baltimore's New and Improved Mechanical Street Sweeping Program (October 2013)
Sub-total Street Sweeping at full expansion (WIP):	**19,097 tons**	**5,347**	**96,000**	lane miles	**46,788**	**18,715**	**5,614,518**	
Sub-total Street sweeping (Current Annual Total):	11,902 tons	3,333	110,593	lane miles	29,160	11,664	3,499,188	
Street Sweeping - Back River	1,297 tons	363	9,823	lane miles	3,178	1,271	381,318	
Street Sweeping - Baltimore Harbor	3,586 tons	1,004	38,902	lane miles	8,786	3,514	1,054,284	
Street Sweeping -Gwynns Falls	3,894 tons	1,090	34,208	lane miles	9,540	3,816	1,144,836	
Street Sweeping - Jones Falls	2,644 tons	740	24,224	lane miles	6,478	2,591	777,336	
Street Sweeping - L.N. Branch Patapsco	479 tons	134	3,437	lane miles	1,174	469	140,826	
Street Sweeping (Current increase since Dec. 2009)	*3,716 tons*	*1,040*	*40,450*	lane miles	9,104	3,642	1,092,504	*Ref: MS4 Annual Report for CY 2009. Reported tonnage of 8,186 tons. Used for TMDL MAST.*
Street Sweeping (Planned increase since Dec. 2009)	*10,911 tons*	*3,055*	*40,450*	lane miles	26,732	10,693	3,207,834	
Preventive Inlet Cleaning & Debris Collection								
Anticipated Increase after Asset Management (4% Inlets cleaned quarterly):	990 tons	215	1,075	inlets	2,425	970	291,052	Ref: Preliminary Asset Management Program and CIP Schedule for Inlet Screens.
Sub-total Preventive Inlet Cleaning (WIP):		**215**			**2,425**	**970**	**291,052**	
Sub-total Preventive Inlet Cleaning (Current Annual):	26 tons	10.5	1,128	inlets	64	26	7,706	Routine quarterly inlet cleaning initiated May 2016.
Illicit Discharge Detection and Elimination Program								
Sanitary Direct Connection**		**NA**	10	connections	100	18	**NA**	Pending asset management inventory for direct illicit connections.
Sub-total Sanitary Direct Connection***		**3.9**	10	connections	990	180	**NA**	Nutrient reductions per CBP protocol N-5, default values, see Appendix .
Sewage Exfiltration**		**NA**	300	miles lined	5,000	909	**NA**	Lining as part of DPW's capital program for sanitary sewers.
Drinking Water Transmission**		**NA**	60	miles lined / replaced	1,500	273	**NA**	Estimated water line lining / replacement by 2018.
Dry Weather SSO**		**NA**	30	SSOs / yr red	350	64	**NA**	Asset management / FOG program, education, enforcement, and enanced IDDE
Sub-total IDDE (WIP):					**6,950**	**1,264**	**0**	
Sub-total IDDE (Current up to FY 2017):		**3.9**			**990**	**180**	**0**	Calculations will be reported in Annual Report for FY 2017. Not includedd in CB TMDL MAST.

Table K-2: Progress Status of WIP Programs

Project No. / Type	Debris Collected	Equivalent Impervious Area Restoration (ac)	Reference Metric	Estimated Pollutant Removal (lbs / yr)			NOTES
				TN	TP	TSS	
TOTAL Programs (WIP):		**5,562**		**56,163**	**20,949**	**5,905,570**	
TOTAL Programs (Current):		**3,347**		**30,214**	**11,870**	**3,506,894**	

* Varied frequency, see georeference tables.
** Equivalent impervious area restoration conversions and TSS reductions have not been designated at this time. Estimates of nutrient reduction are very conservative in estimates.
*** Equivalent impervious area restoration based on similar permanent credit given for septic system connected to a WWTP (Table 7, MS4 Accounting Guidance, MDE, 2014).

Table K-3: Progress Status of WIP Partnerships

Project No. / Type	Source ID	Watershed	Location	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)		
					TN	TP	TSS
Development							
Impervious area to pervious	DPW Plans Review	City-wide	City-wide	73.8	351	35	29,426
Treatment by ESD	DPW Plans Review	City-wide	City-wide	21.4	102	10	8,539
				273.2	738	41	24,863
Treatment by Traditional	DPW Plans Review	City-wide	City-wide	54.7	260	26	21,805
				283.0	764	43	25,753
			Sub-total Development (WIP):	**150**	**713**	**70**	**59,770**
Sub-total Development (Actual Completed in Jan. 2010 to June 2015):				**556**	**1,502**	**84**	**50,616**
Voluntary - included in the estimate for Development							
Impervious Removal	BWB	Jones Falls	Guilford ES/MS	0.28	0.4	0.1	33
Impervious Removal	BWB	Gwynns Falls	Calvin Rodwell ES	0.13	0.2	0.04	15
Micro-bioretention	BWB	Baltimore Harbor	Library Square	1.1	5.3	0.5	261
IA Removal, Rain Garden	DOT	Baltimore Harbor	200 N. Duncan Street	0.45	2.3	0.5	342

Table K-3: Progress Status of WIP Partnerships

Project No. / Type	Source ID	Watershed	Location	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)		
					TN	TP	TSS
IA Removal, afforestation	DOT	Baltimore Harbor	2300-2400 Eager St	1.5	7.7	1.7	1141
IA Removal, afforestation, bioretention	GGI Design Comp	Gwynns Falls	2306-8 Riggs Street	0.81	4.2	0.9	616
IA Removal, afforestation, bioretention	GGI Design Comp	Back River	CHM Gateway 32nd & Harford	0.18	0.9	0.2	137
IA Removal, afforestation, bioretention	GGI Design Comp	Baltimore Harbor	Day Spring Green Parking 1100 block N. Bradford	0.36	1.8	0.4	274
IA Removal, afforestation	GGI Design Comp	Baltimore Harbor	Druid Heights Peace Park Bloom & Druid Hill Ave	0.15	0.8	0.2	114
IA Removal, afforestation	GGI Design Comp	Baltimore Harbor	Hollins Roundhouse Lots of Art1218-20 W. Lombard	0.06	0.3	0.1	46
IA Removal, afforestation, and rainwater harvesting	GGI Design Comp	Baltimore Harbor	Janes House of Inspiration A-maze-N Lot728 North Avenue	0.20	1.0	0.2	148
IA Removal, afforestation	GGI Design Comp	Baltimore Harbor	Flower Farm1400 block Gay Street	0.75	3.8	0.9	570
Aforestation of IA	Tree Baltimore	Baltimore Harbor	TBD	25.2	10.9	1.6	818

Table K-3: Progress Status of WIP Partnerships

Project No. / Type	Source ID	Watershed	Location	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)		
					TN	TP	TSS
Aforestation of IA	Tree Baltimore	Gwynns Falls	TBD	23.1	10.9	1.6	818
Aforestation of IA	Tree Baltimore	Jones Falls	TBD	19.6	10.9	1.6	818
Aforestation of IA	Tree Baltimore	Back River	TBD	21.0	10.9	1.6	818
			Sub-total Volunteer (WIP):	**95**	**72**	**12**	**6,971**
			Sub-total Volunteer (Actual-Completed):	**0**	**0**	**0**	**0**
SW Fee Credit program							
Treatment BMPs	SAIS	City-wide	City-wide	24.0	206.7	26.5	16,157
Private tree planting (Reforestation on pervious)	SAIS	City-wide	City-wide	7.6	142.6	6.6	1596
				6.1	114.0	5.3	1277
Rain gardens	SAIS	City-wide	City-wide	2.0	17.2	2.2	1,346

Table K-3: Progress Status of WIP Partnerships

Project No. / Type	Source ID	Watershed	Location	Eq. Imp Area Restored (ac)	Estimated Pollutant Removal (lbs / yr)		
					TN	TP	TSS
Rainwater harvesting	SAIS	City-wide	City-wide	0.5	12.4	1.0	485
			Subtotal SW Fee Credit (WIP):	**34.1**	**378.9**	**36.3**	**19,584**
			Subtotal SW Fee Credit (Actual):	**6.1**	**114.0**	**5.3**	**1,277**
			Total for Partnerships (WIP):	**279**	**1,164**	**119**	**86,325**
			Total for Partnerships (Actual Completed 1/2010 -6/2017):	**562**	**1,616**	**89**	**51,893**

Appendix L: Progress of Chesapeake Bay TMDL

- Table L -1: Progress Status of Chesapeake Bay TMDL
- MAST Results for Baseline 2010
- MAST Results for 2017 Loadings
- MAST Results for 2018 Loadings

Table L-1: Progress Status of Chesapeake Bay TMDL

Location	Estimated Pollutant Removal (lbs / yr)			Reference
	TN	TP	TSS	
Chesapeake Bay Loading for Baltimore City	418,243	32,870	22,025,806	Bay TMDL MAST Scenario 2010 Loadings for Baltimore City MS4 Area
Reduction Goal for Urban Stormwater:	84,903	9,960	418,490	Maryland's Phase II WIP for the Chesapeake Bay, Oct. 2012, Executive Summary
	20.3%	*30.3%*	*1.9%*	
Progress based on MAST				
Total Reduction by end of MS4 permit:	67,229	15,479	15,044,692	Based on MAST Scenario file "2010 Baseload" compared to MAST Scenario file "2018 Loadings" using original WIP
% Reduction by end of MS4 Permit:	16.1%	47.1%	68.3%	
Total Reduction (Current):	2,152	15,479	4,421,095	MAST Scenario file "2010 Baseload", Compared to MAST Scenario file "2016 Current", using current progress.
% Reduction (Current):	*0.5%*	*47.1%*	*20.1%*	
Alternative Analysis based on MDE Accounting Guidelines				
Structural/ Traditional BMPs	1,455	243	181,986	Table K-1
ESD Practices	328	52	33,359	Table K-1
Alternative BMPs (Stream Restoration)	3,916	3,551	1,566,450	Table K-1
Alternative BMPs (Other)	539	85	47,250	Table K-1
Street Sweeping at full expansion	46,788	18,715	5,614,518	Table K-2
Inlet Cleaning	2,425	970	291,052	Table K-2
IDDE*	6,950	1,264	0	Table K-2
Partnerships	3,928	282	130,175	Table K-3
Total Reduction by end of MS4 permit:	**66,329**	**25,161**	**7,864,790**	
% Reduction by end of MS4 Permit:	*16%*	*77%*	*36%*	
Total Reduction by Projects (Completed):	221	197	86,931	Table M-1
Total Reduction by Programs (Current):	30,214	11,870	3,506,894	Table M-2
Total Reductions by Partnerships (Current):	1,616	89	51,893	Table M-3
Current Total Reduction Completed:	32,051	12,155	3,645,718	
% Reduction by end of MS4 Permit:	*8%*	*37%*	*17%*	

* Equivalent impervious area restoration conversions and TSS reductions have not been designated at this time. Estimates of nutrient reduction are very conservative in estimates.

2010 Base loadings Baltimore City Summary Results

Help

Description: Baltimore City, Urban Stormwater Sector, 2010 Baseline loadings
Initial Conditions: 2010, revised: 10/2014
Date Created: 12/23/2015 3:30:54 PM

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Total Loads

Load Type	Lbs Nitrogen Edge of Stream	Lbs Nitrogen Delivered	Lbs Phosphorus Edge of Stream	Lbs Phosphorus Delivered	Lbs Sediment Edge of Stream	Lbs Sediment Delivered
Landuse	639,556.6	418,242.7	46,208.1	32,869.7	23,340,166.1	22,025,805.7
Septic	0.0	0.0	0.0	0.0	0.0	0.0
Waste Water and Combined Sewer Output	3,490,488.6	3,488,926.9	95,678.6	93,617.2	1,328,007.9	1,324,138.4
Total:	4,130,045.2	3,907,169.6	141,886.7	126,486.9	24,668,174.0	23,349,944.1

Total Annualized Costs

Sector	Total Annualized Cost
Urban Land	$14,884,124
Septic	
Forest Land	$1,439
Agricultural Land	$0
Animal Manure	$0
Total:	$14,885,563

Land Use Loads

Info on agreement with the Chesapeake Bay Program's Watershed Model

Land Use	Pre-BMP Acres	Post-BMP Acres	Lbs Nitrogen Edge of Stream	Lbs Nitrogen Delivered	Lbs Phosphorus Edge of Stream	Lbs Phosphorus Delivered	Lbs Sediment Edge of Stream	Lbs Sediment Delivered
Sector: Agriculture								
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sector: Forest								
	2,247.7	2,247.7	7,384.8	4,546.9	114.9	67.4	308,983.8	298,309.3
Sector: Urban								
	49,534.8	49,534.8	629,451.9	411,731.5	45,946.8	32,701.3	23,031,180.0	21,727,500.0
Sector: Water								
	251.5	251.5	2,719.9	1,964.3	146.4	101.0	0.0	0.0
Total:	52,034.0	52,034.0	639,556.6	418,242.7	46,208.1	32,869.7	23,340,170.0	22,025,810.0

Septic Loads

Septic Zone	Pre-BMP Systems	Post-BMP Systems	Lbs Nitrogen Edge of Stream	Lbs Nitrogen Delivered
Critical Area	0.0	0.0	0.0	0.0
Within 1000 ft of a perennial stream	0.0	0.0	0.0	0.0
Outside of the Critical Area, not within 1000 ft of a perennial stream	0.0	0.0	0.0	0.0
Total:	0.0	0.0	0.0	0.0

Wastewater Loads

Facility Type	Lbs Nitrogen Edge of Stream	Lbs Nitrogen Delivered	Lbs Phosphorus Edge of Stream	Lbs Phosphorus Delivered	Lbs Sediment Edge of Stream	Lbs Sediment Delivered
CSO	0.0	0.0	0.0	0.0	0.0	0.0
Major Industrial	309,811.9	309,811.9	1,257.2	1,257.2	159,900.8	159,900.8
Major Municipal	3,126,590.5	3,126,590.5	89,728.6	89,728.6	1,054,676.1	1,054,676.1
Minor Industrial	54,086.2	52,524.5	4,692.8	2,631.4	113,431.0	109,561.5
Total:	3,490,488.6	3,488,926.9	95,678.6	93,617.2	1,328,007.9	1,324,138.4

2017 Loadings Baltimore City
Summary Results

Help

Description: Model showing conditions as of end of FY 2017
Initial Conditions: 2010, revised: 10/2014
Date Created: 12/23/2015 3:00:29 PM

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Total Loads

Load Type	Lbs Nitrogen Edge of Stream	Lbs Nitrogen Delivered	Lbs Phosphorus Edge of Stream	Lbs Phosphorus Delivered	Lbs Sediment Edge of Stream	Lbs Sediment Delivered
Landuse	631,522.4	413,056.0	45,217.1	32,178.5	18,436,139.6	17,431,845.5
Septic	0.0	0.0	0.0	0.0	0.0	0.0
Waste Water and Combined Sewer Output	3,490,488.6	3,488,926.9	95,678.6	93,617.2	1,328,007.9	1,324,138.4
Total:	4,122,011.0	3,901,982.9	140,895.7	125,795.7	19,764,147.5	18,755,983.9

Total Annualized Costs

Sector	Total Annualized Cost
Urban Land	$20,762,933
Septic	
Forest Land	$1,439
Agricultural Land	$0
Animal Manure	$0
Total:	$20,764,372

Land Use Loads

Info on agreement with the Chesapeake Bay Program's Watershed Model

Land Use	Pre-BMP Acres	Post-BMP Acres	Lbs Nitrogen Edge of Stream	Lbs Nitrogen Delivered	Lbs Phosphorus Edge of Stream	Lbs Phosphorus Delivered	Lbs Sediment Edge of Stream	Lbs Sediment Delivered
Sector: Agriculture								
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sector: Forest								
	2,247.7	2,247.7	7,384.8	4,546.9	114.9	67.4	308,983.8	298,309.3
Sector: Urban								
	49,534.8	49,534.8	621,417.7	406,544.8	44,955.8	32,010.1	18,127,160.0	17,133,540.0
Sector: Water								
water	251.5	251.5	2,719.9	1,964.3	146.4	101.0	0.0	0.0
	251.5	251.5	2,719.9	1,964.3	146.4	101.0	0.0	0.0
Total:	52,034.0	52,034.0	631,522.4	413,056.0	45,217.1	32,178.5	18,436,140.0	17,431,850.0

Septic Loads

Septic Zone	Pre-BMP Systems	Post-BMP Systems	Lbs Nitrogen Edge of Stream	Lbs Nitrogen Delivered
Critical Area	0.0	0.0	0.0	0.0
Within 1000 ft of a perennial stream	0.0	0.0	0.0	0.0
Total:	0.0	0.0	0.0	0.0

Septic Zone	Pre-BMP Systems	Post-BMP Systems	Lbs Nitrogen Edge of Stream	Lbs Nitrogen Delivered
Outside of the Critical Area, not within 1000 ft of a perennial stream	0.0	0.0	0.0	0.0
Total:	0.0	0.0	0.0	0.0

Wastewater Loads

Facility Type	Lbs Nitrogen Edge of Stream	Lbs Nitrogen Delivered	Lbs Phosphorus Edge of Stream	Lbs Phosphorus Delivered	Lbs Sediment Edge of Stream	Lbs Sediment Delivered
CSO	0.0	0.0	0.0	0.0	0.0	0.0
Major Industrial	309,811.9	309,811.9	1,257.2	1,257.2	159,900.8	159,900.8
Major Municipal	3,126,590.5	3,126,590.5	89,728.6	89,728.6	1,054,676.1	1,054,676.1
Minor Industrial	54,086.2	52,524.5	4,692.8	2,631.4	113,431.0	109,561.5
Total:	3,490,488.6	3,488,926.9	95,678.6	93,617.2	1,328,007.9	1,324,138.4

2018 Loadings Baltimore City Summary Results

Help

Description: Baltimore City, Urban Stormwater Sector, Anticipated loading by the end of MS4 permit period
Initial Conditions: 2010 original
Date Created: 11/17/2011 1:22:33 PM

Download Results | Compare Scenarios

Total Loads

Load Type	Lbs Nitrogen Edge of Stream	Lbs Nitrogen Delivered	Lbs Phosphorus Edge of Stream	Lbs Phosphorus Delivered	Lbs Sediment Edge of Stream	Lbs Sediment Delivered
Landuse	534,493.6	350,928.4	23,674.2	17,391.3	7,035,903.3	6,981,114.2
Septic	85.6	85.6	0.0	0.0	0.0	0.0
Waste Water and Combined Sewer Output	3,490,488.6	3,488,926.9	95,678.6	93,617.2	1,328,007.9	1,324,138.4
Total:	4,025,067.8	3,839,940.9	119,352.8	111,008.5	8,363,911.2	8,305,252.6

Total Annualized Costs

Sector	Total Annualized Cost
Urban Land	$38,997,301
Septic	
Forest Land	$1,201
Agricultural Land	$0
Animal Manure	$0
Total:	$38,998,502

Land Use Loads

Info on agreement with the Chesapeake Bay Program's Watershed Model

Land Use	Pre-BMP Acres	Post-BMP Acres	Lbs Nitrogen Edge of Stream	Lbs Nitrogen Delivered	Lbs Phosphorus Edge of Stream	Lbs Phosphorus Delivered	Lbs Sediment Edge of Stream	Lbs Sediment Delivered
Sector: Agriculture								
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sector: Forest								
	1,875.8	2,035.5	6,702.1	4,068.7	104.0	59.7	282,684.1	268,719.0
Sector: Urban								
	49,906.7	49,747.0	525,071.6	344,895.4	23,423.8	17,230.6	6,753,219.0	6,712,395.0
Sector: Water								
	251.5	251.5	2,719.9	1,964.3	146.4	101.0	0.0	0.0
Total:	52,034.0	52,034.0	534,493.6	350,928.4	23,674.2	17,391.3	7,035,904.0	6,981,114.0

Septic Loads

Septic Zone	Pre-BMP Systems	Post-BMP Systems	Lbs Nitrogen Edge of Stream	Lbs Nitrogen Delivered
Critical Area	5.0	5.0	85.6	85.6
Within 1000 ft of a perennial stream	0.0	0.0	0.0	0.0
Outside of the Critical Area, not within 1000 ft of a perennial stream	0.0	0.0	0.0	0.0
Total:	5.0	5.0	85.6	85.6

Wastewater Loads

Facility Type	Lbs Nitrogen Edge of Stream	Lbs Nitrogen Delivered	Lbs Phosphorus Edge of Stream	Lbs Phosphorus Delivered	Lbs Sediment Edge of Stream	Lbs Sediment Delivered
CSO	0.0	0.0	0.0	0.0	0.0	0.0
Major Industrial	309,811.9	309,811.9	1,257.2	1,257.2	159,900.8	159,900.8
Major Municipal	3,126,590.5	3,126,590.5	89,728.6	89,728.6	1,054,676.1	1,054,676.1
Minor Industrial	54,086.2	52,524.5	4,692.8	2,631.4	113,431.0	109,561.5
Total:	3,490,488.6	3,488,926.9	95,678.6	93,617.2	1,328,007.9	1,324,138.4

Appendix M: Progress of Regional TMDLs for Nutrients

- Table M-1: Progress Status of Back River Nutrient TMDL
- Table M-2: Progress Status of Baltimore Harbor Nutrient TMDL
- Table M-3: Progress Status of Gwynns Falls Sediment TMDL
- Table M-4: Progress Status of Jones Falls Sediment TMDL
- Table M-5: Progress Status of Lower N. Patapsco Sediment TMDL

Table M-1: Progress Status for Nutrient TMDL for Back River

	BMP Type	Location	Estimated Pollutant Removal TN	Estimated Pollutant Removal TP	NOTES
MS4 Baseline Load:			**73,429**	**8,315**	
Reduction Goal:			*15%*	*15%*	
BMPs installed between 2005 and 2010:					
	Stream Restoration	Biddison Run Phase I	113	102	Previous MS4 Annual Reports. 1,500 LF restored.
	Private / Other City BMPs	12 BMPs	24	3	Appendix B of WIP.
		Total removal between 2005 and 2010:	**136**	**105**	
Projects proposed within current MS4 permit:					
		Total Projects (WIP):	3,011	1,895	Table K-1.
		Total Projects (Current Planned):	2,739	2,408	
		Total Projects (Current Completed):	0	0	
Programs proposed within current MS4 permit:					
	Street Sweeping		10,761	4,304	Table K-2, estimated distribution based on Table 1 of WIP. Actual for street sweeping is based on route and weight ticket records.
			3,178	1,271	
	Inlet Cleaning		558	223	
			15	6	
	IDDE		1,599	291	
			228	41	
		Total Programs (WIP):	**12,918**	**4,818**	
		Total Programs (Current):	**3,420**	**1,318**	
Partnerships proposed within current MS4 permit:					
	Development		164	16	Table K-3, and Appendix B data (Table B).
			3	0	
	Voluntary		12	2	Table K-3, estimated distribution based on Table 1 of WIP.
			0	0	
	Stormwater Fee Program		87	8	Table K-3, estimated distribution based on Table 1 of WIP.
			26	1	
		Total Partnerships (WIP):	**263**	**26**	
		Total Partnerships (Current):	**29**	**1**	
Total Reduction by end of MS4 Permit:			16,055	7,357	Per current planned projects, Table K-1
% Reduction by end of MS4 Permit:			22%	88%	
Total Reduction Current Completed:			3,585	1,425	
% Reduction Current Completed:			5%	17%	

Table M-2: Progress Status for Nutrient TMDL for Baltimore Harbor

	BMP Type	Watershed	Location	Estimated Pollutant Removal (lbs / yr) TN	TP	NOTES
MS4 Baseline Load				**260,323**	**28,177**	
Reduction Goal				*15%*	*15%*	
BMPs installed between 2007 and 2010:						
	ESD Practices	Gwynns Falls	Watershed 263 (5 locations)	20.4	3.26	Previous MS4 Annual Reports.
	Stream Restoration	Jones Falls	Lower Stony Run	139	126	Previous MS4 Annual Reports. 1,850 LF restored.
	Stream Restoration	Gwynns Falls	Maiden's Choice	203	184	Previous MS4 Annual Reports. 2,700 LF restored.
	Private / Other City BMPs	Gwynns Falls	4 BMPs	4	1	Appendix B of WIP.
	Private / Other City BMPs	Jones Falls	13 BMPs	84	10	Appendix B of WIP.
	Private / Other City BMPs	Baltimore Harbor	21 BMPs	34	5	Appendix B of WIP.
			Total removal between 2007 and 2010:	484	328	
Projects proposed within current MS4 permit:						
			Total Projects (WIP):	3,415	2,372	Table K-1
			Total Projects (Current Planned):	2,812	1,797	
			Total Projects (Current Completed):	221	197	
Programs proposed within current MS4 permit:						
	Street Sweeping			34,623	13,849	Table K-2, estimated distribution based on Table 1 of WIP.
				25,977	10,391	
	Inlet Cleaning			1,795	718	
				48	19	
	IDDE			5,143	935	
				733	133	
			Total Programs (WIP):	**41,561**	**15,502**	
			Total Programs (Current):	**26,757**	**10,543**	
Partnerships proposed within current MS4 permit:						
	Development			528	52	Table K-3, estimated distribution based on Table 1 of WIP.
				710	70	
	Voluntary			60	10	Table K-3, estimated distribution based on Table 1 of WIP.
				0	0	
	Stormwater Fee Program			280	27	Table K-3, estimated distribution based on Table 1 of WIP.
				84	4	
			Total Partnerships (WIP):	**868**	**89**	
			Total Partnerships (Current):	**794**	**74**	
Total Reduction by end of MS4 Permit:				**45,725**	**17,716**	
% Reduction by end of MS4 Permit:				18%	63%	
Total Reduction Current Completed:				**28,257**	**11,142**	
% Reduction Current Completed:				11%	40%	

Table M-3: Progress Status for Sediment TMDL for Gwynns Falls

	BMP Type	Watershed	Location	Estimated Pollutant TSS (lb)	NOTES
MS4 Baseline Load				**14,410,000**	Listed as 7,205 tons (Table 2 of WIP)
Reduction Goal				*49%*	
Projects proposed within current MS4 permit:					
			Total Projects (WIP):	905,197	Table K-1
			Total Projects (Current Planned):	519,516	
			Total Projects (Current Completed):	62,400	
Programs proposed within current MS4 permit:					
	Street Sweeping			1,403,630	Table K-2, estimated distribution based on Table 1 of WIP.
				1,144,836	
	Inlet Cleaning			72,763	
				1,926	
			Total Programs (WIP):	**1,476,392**	
			Total Programs (Current):	**1,146,762**	
Partnerships proposed within current MS4 permit:					
	Development			14,943	Table K-3, estimated distribution based on Table 1 of WIP.
				82	
	Voluntary			1,450	Table K-3, estimated distribution based on Table 1 of WIP.
				0	
	Stormwater Fee Program			4,896	Table K-3, estimated distribution based on Table 1 of WIP.
				319	
			Total Partnerships (WIP):	21,288	
			Total Partnerships (Current):	401	
Total Reduction by end of MS4 Permit:				**2,402,878**	
% Reduction by end of MS4 Permit:				17%	
Total Reduction Current Completed:				**1,209,564**	
% Reduction Current Completed:				8%	

Table M-4: Progress Status for Sediment TMDL for Jones Falls

	BMP Type	Watershed	Location	Estimated Pollutant TSS (lb)	NOTES
MS4 Baseline Load				**9,466,000**	Listed as 4,733 tons (Table 2 of WIP)
Reduction Goal				*26.3%*	
Projects proposed within current MS4 permit:					
			Total Projects (WIP):	296,825	Table K-1
			Total Projects (Current Planned):	274,141	
			Total Projects (Current Completed):	24,000	
Programs proposed within current MS4 permit:					
	Street Sweeping			1,179,049	Table K-2, estimated distribution based on Table 1 of WIP.
				777,336	
	Inlet Cleaning			61,121	
				1,618	
			Total Programs (WIP):	**1,240,170**	
			Total Programs (Current):	**778,954**	
Partnerships proposed within current MS4 permit:					
	Development			12,552	Table K-3, estimated distribution based on Table 1 of WIP.
				69	
	Voluntary			1,464	Table K-3, estimated distribution based on Table 1 of WIP.
				0	
	Stormwater Fee Program			4,113	Table K-3, estimated distribution based on Table 1 of WIP.
				0	
			Total Partnerships (WIP):	**18,128**	
			Total Partnerships (Current):	**69**	
Total Reduction by end of MS4 Permit:				**1,555,123**	
% Reduction by end of MS4 Permit:				16%	
Total Reduction Current Completed:				**803,023**	
% Reduction Current Completed:				8%	

Table M-5: Progress Status for Sediment TMDL for Lower North Branch Patapsco

	BMP Type	Watershed	Location	Estimated Pollutant TSS (lb)	NOTES
MS4 Baseline Load				**1,220,000**	Listed as 610 tons (Table 2 of WIP)
Reduction Goal				*25.1%*	
Structural / Traditional BMPs					
			Total Projects (WIP):	3,663	Table K-1
			Total Projects (Current Planned):	2,597	
			Total Projects (Current Completed):	0	
Programs proposed within current MS4 permit:					
	Street Sweeping			112,290	Table K-2, estimated distribution based on Table 1 of WIP.
				140,826	
	Inlet Cleaning			5,821	
				154	
			Total Programs (WIP):	**118,111**	
			Total Programs (Current):	**140,980**	
Partnerships proposed within current MS4 permit:					
	Development			1,315	Table K-3, estimated distribution based on Table 1 of WIP.
				0	
	Voluntary			0	Table K-3, estimated distribution based on Table 1 of WIP.
				0	
	Stormwater Fee Program			431	Table K-3, estimated distribution based on Table 1 of WIP.
				0	
			Total Partnerships (WIP):	**1,746**	
			Total Partnerships (Current):	**0**	
Total Reduction by end of MS4 Permit:				**119,857**	
% Reduction by end of MS4 Permit:				10%	
Total Reduction by end of MS4 Permit:				**140,980**	
% Reduction by end of MS4 Permit:				12%	
Total Reduction Current Completed:				**140,980**	
% Reduction Current Completed:				12%	