BALTIMORE CITY

MS4 ANNUAL REPORT

Reporting Period: July 1, 2017 to June 30, 2018

CATHERINE E. PUGH
MAYOR

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

Table of Contents

1 Introduction 1
1.1 Permit Administration 1
1.2 Legal Authority 1
2 Implementation Status 2
3 Narrative Summary of Data 7
3.1 Stream Impact Sampling 7
3.1.1 Nutrient Monitoring 8
3.1.2 Bacteria Monitoring 10
3.2 Biological and Habitat Monitoring 13
3.3 Watershed Assessment at Moores Run 14
3.3.1 Chemical Monitoring 14
3.3.2 Biological Monitoring 15
3.3.3 Habitat Assessment 16
3.3.4 Geomorphic Monitoring 16
3.3.5 Stormwater Management Assessment at Stony Run 16
4 Expenditures and Proposed Budget 18
4.1 Expenditures and Budgets Related to MS4 Permit Compliance 18
4.2 Stormwater Fee and Stormwater Utility 19
4.2.1 Grants Received by DPW 19
4.2.2 Grant Support by DPW 19
4.3 Capital Projects – Expenditures and Financing 20
5 Enforcement Actions, Inspections and Public Education 21
5.1 Stormwater Management Program 21
5.2 Erosion and Sediment Control 21
5.3 Illicit Discharge Detection and Elimination (IDDE) 22
5.3.1 Routine Field Screening Locations 22
5.3.2 Supplemental Field Screening 22
5.3.3 3-1-1 Customer Service Request for Polluted Water 24
5.3.4 Pollution Source Tracking (PST) 24
5.3.5 FOG Program 25
5.3.6 Exterior Lead Paint Removal Waste Control Program 26
5.3.7 NPDES Industrial Discharge Permits 26
5.4 Property Management and Maintenance 26
5.4.1 Street Sweeping and Trash Reduction 26
5.4.2 Inlet Cleaning 26
5.4.3 Middle Branch Shoreline Cleaning 27
5.4.4 Integrated Pest Management 27
5.4.5 Deicing Materials 27
5.5 Public Education and Outreach 29
5.5.1 Education and Outreach Activities 29
5.5.2 Growing Green Design Competition 30
5.5.3 Workforce Development Programs 31
5.5.4 GROW Center 32
5.5.5 Baltimore Green Registry: Mapping of SWM BMPs Phase 2 33
5.5.6 Effectiveness of Education Program for Trash and Litter 33

6 Water Quality Improvements 36
6.1 MS4 Restoration and TMDL Watershed Implementation Plan (WIP) 36
6.2 Milestone Schedule 36
6.3 Implementation of Projects, Programs, and Partnerships 36
6.3.1 Project Implementation and Tracking 36
6.3.2 Program Implementation and Tracking 36
6.3.3 Partnership Implementation and Tracking 37
6.4 Impervious Area Restoration 37
6.5 Bay TMDL Compliance 38
6.6 Local TMDL Compliance 38
6.6.1 Nutrients and Sediment 38
6.6.2 Bacteria 39
6.6.3 Trash 40
6.6.4 PCB 40

List of Appendices (*italicized text indicates electronic files only*)

Appendix A: Organization Chart

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

Appendix C: *Source Information using MS4 Geodatabase*

Appending D: *Ammonia Screening and Stream Impact Sampling Results*

Appendix E: Total Phosphorus Monitoring Histographs

Appendix F: Total Nitrogen Monitoring Histographs

Appendix G: Bacteria Monitoring Histographs

Appendix H*:* Habitat Monitoring

Appendix I: Hydraulic Model for Moores Run

Appendix J: Hydraulic Model for Stony Run

Appendix K: Financial Assurance Plan

Appendix L: Watershed Protection and Restoration Program Annual Report

Appendix M: "Isolating High Concentration Illicit Discharges in the City of Baltimore for Remediation" report by Ridges to Reefs

Appendix N: Microbial Source Tracking Study, reports by UMBC

Appendix O: Summary of Pollution Source Tracking (PST) Investigations

Appendix P: GROW Center reports

Appendix Q: Progress Status of Milestones

Appendix R: Progress Status of Projects, Programs, and Partnerships for 20% Impervious Surface Restoration

Appendix S: Progress of Chesapeake Bay TMDL

Appendix T: Progress of Local TMDLs for Nutrients and Sediment

1 Introduction

This report includes the progress of compliance for the period of Fiscal Year (FY) 2018, 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, 2018) are provided in Appendix A of this report:

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

Within the Department of Public Works, Lauren Swiecicki, P.E. became the Chief of the Office of Engineering and Construction in April 2018. John Chalmers was approved by the Mayor and City Council as the Head of the Bureau of Solid Waste; he had been previously acting in this position.

1.2 Legal Authority

The City maintained adequate legal authority in accordance with NPDES regulations 40 CFR 122.26(d) (2) (i) during FY 2018.

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, 2018
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 D.
	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	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, 2018
Part IV.D.6 Public Education	Maintain a compliance hotline for water quality complaints	Annual Report	2 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 were submitted to MDE on December 14, 2018; however the public comment period for the documents was extended to January 16, 2019.
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 6.4 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	Local and Bay TMDLs for nutrients and sediments were conditionally approved by MDE on May 9, 2018; see Section 6.5 and 6.6.1 for outstanding information and revised progress estimations. Bacteria TMDL implementation plan was approved by MDE on May 9, 2018. A modified implementation schedule, per the modified Consent Decree, was submitted to MDE on June 28, 2018. See Section 6.6.2 for progress. A modified PCB implementation schedule was submitted to MDE on September 14, 2018. See Section 6.6.4 for progress.

Permit Condition	Component	Due	Status as of June 30, 2018
	Restoration Plan for 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. A clarification memo was submitted to MDE on September 14, 2018. See Section 6.6.2 for progress.
Part IV.E.4. TMDL Compliance	Annual assessment to evaluate the effectiveness of the City's restoration plans	Annual Report	See Section 3 and 6.
Part IV.F. Assessment of Controls	Continue assessments	Annual Report	See Section 3.2 and Appendices C and H-J.
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 C and K-L.

In Fiscal Year 2018, Baltimore City completed 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 is 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	Complete	Outfall inventory in progress. Any updates will be included in FY 2019.
Outfall Drainage Area	F - PG	Complete	
BMP POI	F - PT	Complete	
BMP	AT	Complete	
BMP Drainage Area	F – PG	Complete	
Impervious Surface	AT	Complete	Based on WIP Progress Tables (Appendix R)
Monitoring Site	F - PT	Complete	
Monitoring Drainage Area	F	Complete	
Alt BMP Line	F - L	Complete	
Str Rest Protocols	AT	Complete	

Title	Type	Status	Notes
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. Inlet cleaning is shown as City wide. Tree planting for FY 18 only shows trees planted up to December 2017.
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. Inlet cleaning is tracked using Cityworks; disposal (documented by weight tickets) is performed after drying of material. 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 2018.
Municipal Facilities	F – PT	Complete	
Chemical Application	AT	Complete	
Restoration Plans and Total Maximum Daily Loads			
County Wide Watershed Assessments	AT	Complete	
Local Stormwater Watershed Assessments	AT	Pending	Still pending method of assessing current loads for PCBs and bacteria.
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

During FY 2018, DPW continued to update the MS4 geodatabase (Appendix C) for both as-built submittals and those approved project plans. Although MDE issued a memo related to an alternative methodology for as-built plan approvals, only facilities installed as a result of development (as listed as Partnerships in Table M-3) after were included in the "MS4 geodatabase. A summary of as-built approvals for development projects are shown in Table 2.3. The redevelopment projects completed prior to 2010 will be included in the City's revised baseline, scheduled to be submitted in 2019.

Table 2-3: Summary of As-built Projects Approved from Partnerships as of July 30, 2018

BMP Class	Pre-2010		Post-2010		Total	
	No. BMPs	ISR (ac)	No. BMPs	ISR (ac)	No. BMPs	ISR (ac)
ESD	58	31.7	256	277.35	314	309.05
Structural	87	202.7	94	187.5	181	390.2
Total	**145**	**234.4**	**266**	**464.85**	**495**	**699.25**

Note: BMP = best management practices / facilities; ISR = Impervious surface restoration

3 Narrative Summary of Data

3.1 Stream Impact Sampling

DPW continued the Stream Impact Sampling (SIS) program, which now includes monthly sampling at 32 outfall or stream locations. 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.

The station at Central & Lancaster has been inaccessible after construction of a new bridge in January 2017. DPW will identify a replacement location within that storm sewer system of that same outfall in FY 2019. The stations at Tiffany Run and at Harford Road were temporarily inaccessible between October 2017 and February 2018 due to construction; only 7 samples were collected from those locations in FY 2018.

The SIS program attempts to grab samples during dry weather to avoid any influence of wet weather events (increase in loading from surfaces or decrease in concentration due to dilution); however, almost 5% of the sampling events occurred during or within 24 hours of a rain event. Figure 3-1 demonstrates the increase in daily rainfall from FY 2017 and FY 2018, as measured at a rain gauge in the Inner Harbor.

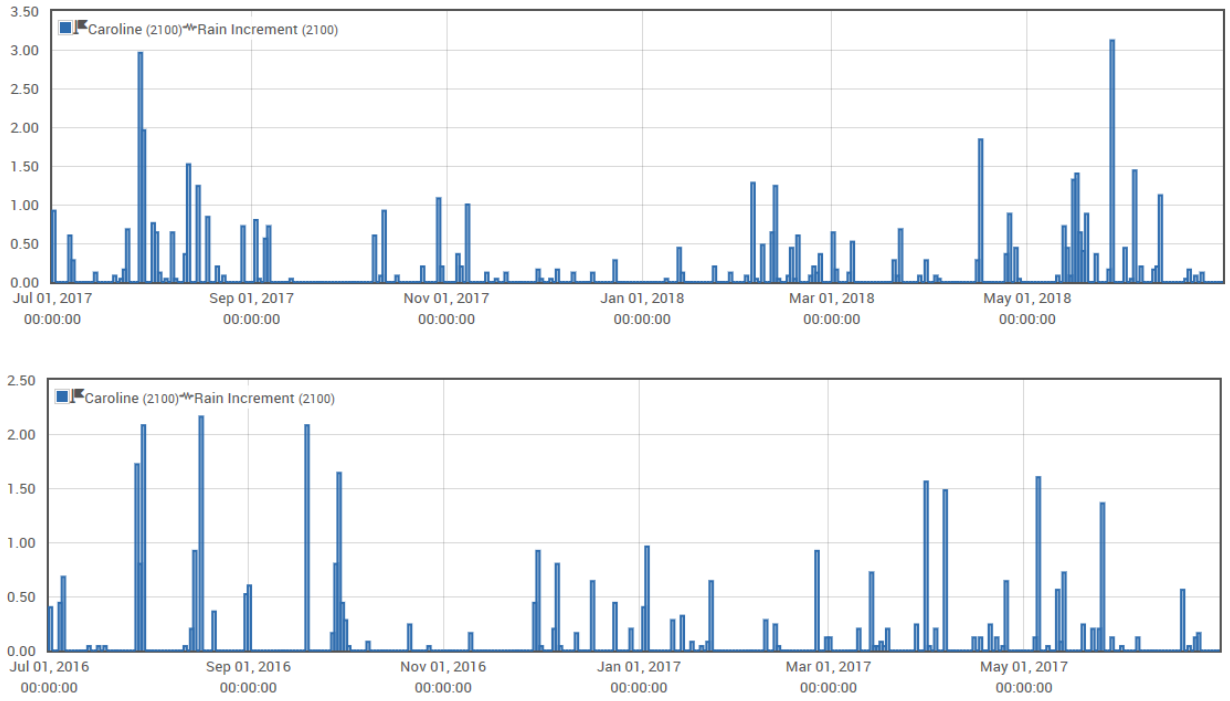


Figure 3-1: Daily Rainfall for FY 2017 and 2018

3.1.1 Nutrient Monitoring

During FY 2018, 367 samples were analyzed for nutrients as part of the 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.

Appendix E contains graphs of the annual results (percent of samples in relation to threshold and geometric mean for total phosphorus) for each station from FY 2010 to FY 2018. All but three (3) of the stations (JF 11.5, Linwood & Elliot, and Powder Mill) had lower percentages of samples at or above the total phosphorus threshold (0.1 mg /L) for FY 2018 compared to their percentages over the history of sampling. Nine (9) stations (7 in the Gwynns Falls watershed) had no total phosphorus results above the threshold in FY 2018. The graphs for the total phosphorus show a peak in geometric means occurred in FY 2011 and 2012, then a sharp decrease in FY 2013 followed by steady pattern since FY 2015 with a slight decrease, except for Gwynns Falls watershed stations. The graphs for the percent at or above threshold for total phosphorus also show the highest percentage for most of the stations occurring in FY 2012 and 2013. Although 12 stations showed an increase of percentage of samples at or above the threshold since FY 2017, only three of those stations (Gwynns Run Carroll Park, Powder Mill, and JF 11.5) had geometric means above the threshold of 0.1 mg / L. Another station (Linwood & Elliot) showed a geometric mean above 0.1 mg / L, increasing since FY 2017, but the percentage of samples at or above the threshold had decreased since FY 2017.

Appendix F contains graphs of the annual results (percent of samples in relation to threshold and geometric mean for total nitrogen) for each station from FY 2010 to FY 2018. Only nine (9) stations had a higher percentages of samples at or above the total nitrogen threshold (3 mg /L) for FY 2018 compared to their percentages over the history of sampling; only 4 of those stations (Tiffany Run, Hamilton, Powder Mill and Linwood & Elliot) had percentages above 25% (high). Stations at JF 11.5 and Lakewood & Hudson also had high percentages of samples above the threshold, but the percentage had decreased compared to both FY 2017 and the history of sampling. Thirteen (13) stations had no total nitrogen results above the threshold in FY 2018. The graphs for total nitrogen show a cyclical pattern for the geometric mean with peaks occurring in FY 2014 and 2016. Although 18 stations showed an increased geometric mean of nitrogen from FY 2017 to 2018; the values did not exceed those for FY 2014, except at Linwood and Elliot station. Only four (4) stations showed geometric mean concentrations above 3.0 mg /L in FY 2018: Hamilton; JF 11.5; Lakewood & Hudson; and Linwood & Elliot. Further discussion of these results in relation to the local TMDL implementation plans are provided in Section 6.6.1 of this Annual Report.

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

Station	Percent of Samples Total Phosphorus >=0.1 mg/L			Percent of Samples Total Nitrogen >=3 mg/L		
	1/2009 – 6/2018	7/2017 – 6/2018	1/2009 – 6/2017	1/2009 – 6/2018	7/2017 – 6/2018	1/2009 – 6/2017
Back River Watershed Herring Run Sub-watershed						
PERRING PKWY	15%	0%	17%	3%	0%	4%
MT. PLEASANT GC	23%	0%	25%	8%	10%	8%
CHINQUAPIN RUN	24%	0%	27%	24%	10%	26%
TIFFANY RUN[3]	12%	0%	13%	5%	33%	3%
HARFORD RD. [3]	17%	0%	18%	5%	17%	5%
WRIGHT AVE.	24%	20%	25%	1%	0%	1%
PULASKI HWY.	11%	0%	13%	5%	0%	6%
Back River Watershed Moores Run Sub-watershed						
MARY AVE.	35%	30%	36%	15%	10%	15%
HAMILTON AVE.	37%	36%	38%	54%	82%	50%
RADECKE AVE.	19%	0%	22%	10%	0%	11%
BIDDLE ST. & 62ND ST.	32%	20%	33%	1%	0%	1%
Jones Falls Watershed						
SMITH AVE.	24%	17%	24%	3%	0%	3%
WESTERN RUN	24%	17%	24%	3%	0%	3%
STONY RUN	21%	8%	22%	24%	8%	26%
JF 11.5 [1]	93%	100%	89%	93%	92%	94%
LOMBARD ST.	29%	25%	29%	7%	17%	6%
Gwynns Falls Watershed						
POWDER MILL	35%	50%	33%	13%	33%	10%
PURNELL DR.	21%	0%	23%	1%	0%	1%
DEAD RUN DNST.	26%	8%	29%	2%	8%	1%
GWYNNS FALLS PKWY.	31%	25%	32%	11%	17%	10%
GRUN HILTON ST.	32%	25%	33%	9%	0%	10%
GF HILTON ST.	24%	8%	26%	0%	0%	0%
MAIDENS CHOICE	25%	17%	26%	5%	0%	6%
GRUN CARROLL PARK	56%	50%	57%	44%	17%	47%
WASHINGTON BLVD.	25%	17%	26%	2%	0%	2%
Baltimore Harbor Watershed						
LINWOOD & ELLIOTT [2]	52%	55%	51%	90%	100%	87%
LAKEWOOD & HUDSON [2]	37%	27%	39%	73%	64%	76%
LIGHT ST.	36%	9%	39%	12%	0%	14%
WARNER & ALLUVION	47%	36%	48%	17%	9%	18%
WATERVIEW AVE.	25%	0%	28%	14%	9%	14%
JANEY RUN	29%	27%	29%	10%	9%	11%

Station	Percent of Samples Total Phosphorus >=0.1 mg/L			Percent of Samples Total Nitrogen >=3 mg/L		
	1/2009 – 6/2018	7/2017 – 6/2018	1/2009 – 6/2017	1/2009 – 6/2018	7/2017 – 6/2018	1/2009 – 6/2017
Patapsco River Watershed						
REEDBIRD AVE.	30%	27%	31%	9%	9%	9%
[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 were collected at TIFFANY RUN and HARFORD RD stations between October and February because access to the stations was blocked.						
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 that are in non-tidal waters. In 2017, the water quality criteria for bacteria indicators were changed in COMAR 26.08.02.03-3 as follows:

- Geometric mean (GM) for e. coli for 90+ days must be less than 126 MPN / 100 ml
- Less than 10% of single sample results of e. coli may be greater than the standard threshold value (STV) of 410 MPN / 100 ml
- Dissolved oxygen must be greater than 5 mg /L
- pH must be between 6.5 and 8.5
- Water temperature may not exceed 90°F (32° C) for Class I and 75°F (23.9°C) for Class IV waters

The most notable changes were the simplification of the STV; full-body contact thresholds are no longer used. Previous MS4 annual report evaluations with respect to the former full-body contact thresholds are no longer applicable. Table 3-2 lists the results of SIS sampling for e.coli with respect to this water quality criteria Appendix G contains graphs of the annual geometric mean for e. coli for each station from FY 2010 to FY 2018.

None of the stations meet all of the water quality criteria; however, two stations (Mt. Pleasant Golf Course and Dead Run) show the greatest potential for meeting the criteria, meeting all of the criteria except for STV. The majority of the stations showed a decrease in the geometric mean of e.coli since FY 2017, especially the station at Chinquapin Run following SSO abatement actions in 2017. All of the stations met the dissolved oxygen criteria. The temperature criteria was met at all of the stations except Tiffany and Harford. The pH criteria was met in most of the stations; all of the stations in the Jones Falls watershed exceeded the maximum range of pH. Further discussion is provided in Section 6.6.2.

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

Station	Class	E. Coli (MPN/100 ml)			Min. DO (mg/L) FY 2018	Max. Temp (°C) FY 2018	pH Range FY 2018		
		GM FY 2017	GM FY 2018	% > STV					
Back River Watershed Herring Run Sub-watershed									
PERRING PKWY	IV	650	290	55%	9.26	22.89	7.02	to	8.78
MT. PLEASANT GC	IV	389	126	42%	8.41	23.40	7.22	to	8.36
CHINQUAPIN RUN	IV	1,868	207	42%	8.71	23.05	7.21	to	8.46
TIFFANY RUN	IV	309	177	25%	8.73	26.08	7.68	to	8.89
HARFORD RD.	IV	411	351	37%	8.96	27.10	7.64	to	9.00
WRIGHT AVE.	IV	584	291	58%	8.36	24.04	6.42	to	8.01
PULASKI HWY.	IV	294	163	42%	8.86	26.26	6.85	to	8.4
Back River Watershed Moores Run Sub-watershed									
MARY AVE.	I	775	1,508	67%	8.55	22.49	6.80	to	8.13
HAMILTON AVE.	I	1,165	1,550	83%	7.74	23.21	7.19	to	8.19
RADECKE AVE.	I	996	694	75%	8.34	23.55	7.29	to	8.21
BIDDLE ST. & 62ND ST.	I	795	840	75%	7.83	24.72	6.02	to	8.08
Jones Falls Watershed									
SMITH AVE.	I	63	71	25%	7.42	25.83	6.35	to	9.08
WESTERN RUN	I	320	326	33%	9.25	24.18	6.96	to	9.36
STONY RUN	IV	229	182	33%	7.47	22.55	6.96	to	9.61
JF 11.5	IV	6,474	2,054	83%	8.58	21.27	6.57	to	8.83
Gwynns Falls Watershed									
POWDER MILL	I	958	321	42%	8.34	22.00	7.36	to	8.6
PURNELL DR.	I	679	816	58%	7.38	25.09	7.51	to	8.33
DEAD RUN DNST.	IV	162	106	17%	8.63	23.65	7.58	to	8.47
GF PKWY.	I	72	414	50%	8.91	17.16	7.13	to	8.92
GRUN HILTON ST.	I	1,197	1,245	75%	8.42	24.29	7.81	to	8.54
GF HILTON ST.	I	312	292	25%	9.82	24.81	7.21	to	8.79
MAIDENS CHOICE	I	528	338	50%	8.31	24.32	7.83	to	8.39
GRUN CARROLL PARK	I	8,964	5,703	83%	6.54	20.83	7.69	to	8.37
WASHINGTON BLVD.	I	5,206	2,721	75%	8.23	24.98	7.82	to	8.4

3.1.2.2 Enterococci Monitoring

DPW currently measures fecal bacteria with enterococci most probable number (MPN) counts at eight (8) stations. Samples for enterococci counts are collected at these stations twice per month. In 2017, the water quality criteria for bacteria indicators were changed in COMAR 26.08.02.03-3 as follows:

- Geometric mean (GM) for enterococci for 90+ days must be less than 35 MPN / 100 ml
- Less than 10% of single sample results of e. coli may be greater than the standard threshold value (STV) of 130 MPN / 100 ml
- Dissolved oxygen must be greater than 5 mg /L
- pH must be between 6.5 and 8.5
- Water temperature may not exceed 90°F (32° C) for Class I and 75°F (23.9°C) for Class IV waters

The most notable changes were the simplification of the STV; full-body contact thresholds are no longer used. Previous MS4 annual report evaluations with respect to the former full-body contact thresholds are no longer applicable. Table 3-3 lists the results of SIS sampling for enterococci with respect to this water quality criteria Appendix G contains graphs of the annual geometric mean for e. coli for each station from FY 2010 to FY 2018.

None of the stations meet all of the water quality criteria; however, two stations (Light St. and Reedbird Ave.) show the greatest potential for meeting the criteria. The majority of the stations showed a decrease in the geometric mean of e.coli since FY 2017. Only 5 of the stations met the dissolved oxygen criteria. The temperature criteria was met at all of the stations. Five (5) of the stations exceeded the maximum range of pH. Further discussion is provided in Section 6.6.2.

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

Station	Class	Enterococci (MPN/100 ml)			Min. DO FY 2018	Max. Temp FY 2018	pH Range FY 2018
		GM FY 2017	GM FY 2018	% < STV			
Jones Falls Watershed							
LOMBARD ST.	I	410	288	62	6.96	24.4	6.98 to 7.95
Baltimore Harbor Watershed							
WATERVIEW AVE.	I	147	177	52	7.60	21.83	7.47 to 8.55
WARNER & ALLUVION	I	607	313	81	2.73	25.65	7.39 to 8.53
LIGHT ST.	I	46	57	33	4.26	27.15	6.92 to 7.72
LAKEWOOD & HUDSON [1]	I	1,289	1,022	90	7.59	22.36	8.02 to 8.97
LINWOOD & ELLIOTT [1]	I	2,401	2,304	95	2.54	24.47	7.12 to 8.30
JANEY RUN	I	225	101	33	6.73	30.09	6.88 to 8.80
Patapsco River Watershed							
REEDBIRD AVE.	I	72	100	33	6.09	29.62	6.71 to 7.90

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

3.2 Biological and Habitat Monitoring

DPW collected macroinvertebrate samples in the spring of 2018; the results will be included in the FY 2019 Annual Report. Instead, DPW will present the results for the macroinvertebrate samples collected in the spring of 2017. 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 2017, random sampling was completed in the Jones Falls watershed.

Table 3-4 presents the benthic index of biotic integrity (BIBI) scores for 6 fixed stations from 2002 through 2017. Five out of six of the stations had an improved score from 2016 to 2017; the sixth station stayed the same with the lowest possible score of 1.0 for BIBI. One station rated "fair" with a score of 3.0; two stations rated "poor" with scores of 2.0 and 2.7; and three stations rated "very poor" with scores of 1.0, 1.3 and 1.7.

Table 3-4: Macroinvertebrate BIBI Scores for Fixed Stations

	Gwynns Falls Watershed		Jones Falls Watershed			Back River Watershed
Year	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
2017	2.7	2.0	1.3	1.0	1.7	3.0

DPW sampled 20 random stations in the Jones Falls watershed in 2017. The BIBI scores for these 20 samples ranged from 1.0 through 2.7: eleven samples between 1.0 and 1.7, which are rated as "very poor"; and nine samples between 2.0 and 2.7, which are rated as "poor". Random sampling was performed in the Jones Falls watershed in 2002, 2005, 2008, 2011, 2014 and 2017. Figure 3-2

graphically shows the distribution of the BIBI scores for each of those 6 years using box-and-whisker plots. The box representing the distribution of the 2017 samples is one of the better of the 6 years, with the highest lower quartile value, and highest average of the six sets.

The BIBI, embeddedness, epifaunal and habitat scores for all fixed station and random station samples from 2017 are listed in the *Biological Monitoring* table of the *MDE NPDES MS4 Geodatabase* (Appendix C of this report).

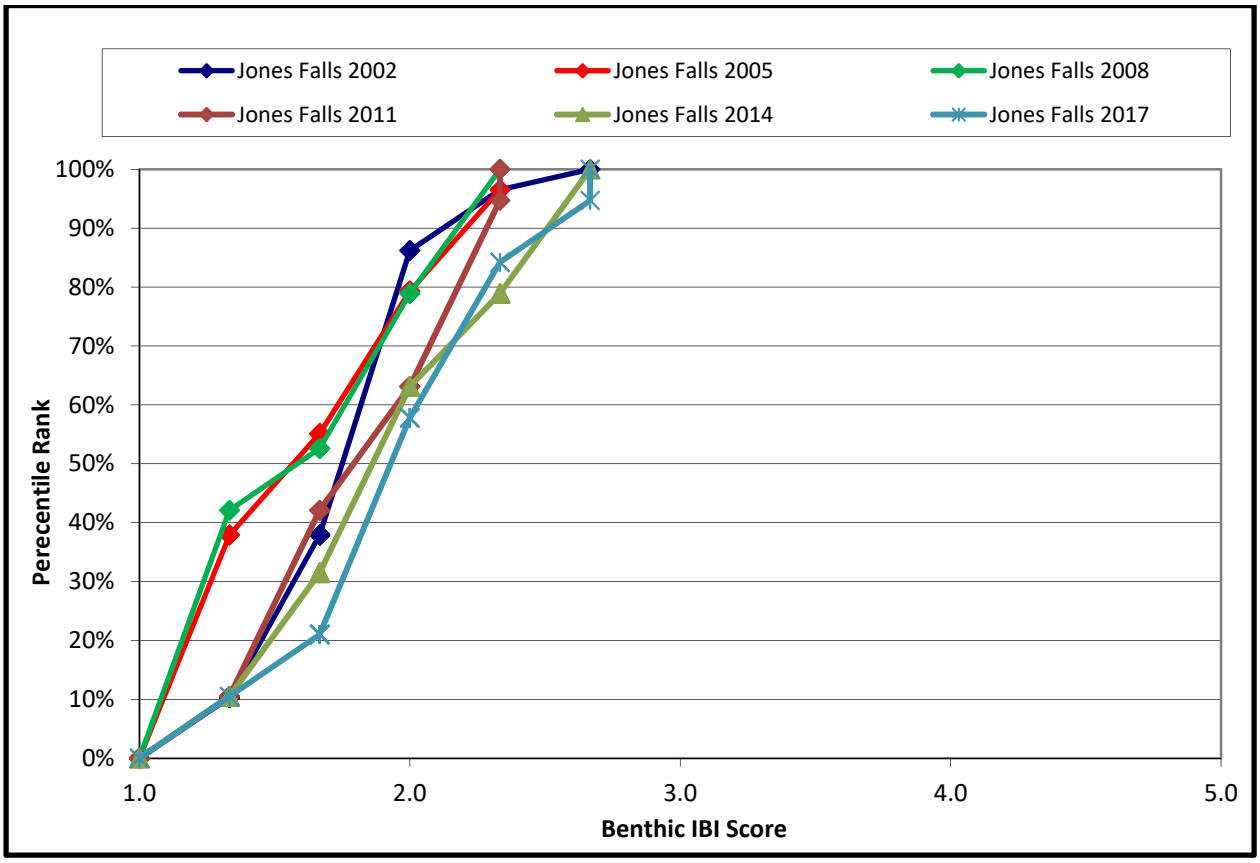


Figure 3-2: BIBI Scores for Macroinvertebrate Samples Random Sampling in the Jones Falls Watershed

3.3 Watershed Assessment at Moores Run

3.3.1 Chemical Monitoring

During this reporting period, nine (9) storm events and twelve (12) base flow events were monitored at Hamilton Avenue, the outfall station associated with the long-term discharge characterization for the Moores Run. Ten (10) storm events and twelve (12) base flow events were monitored at Radecke Avenue, the in-stream station associated with the long-term discharge characterization for the Moores Run. There was one less storm event monitored for Hamilton Avenue compared to Radecke Avenue: during the storm on February 16, 2018, there was a leak in the intake line for the automated sampler at Hamilton Avenue; consequently, samples were not collected there.

DPW only monitored ten (10) storms in FY 2018; not twelve (12) as required by the permit. DPW attempted to sample a storm on August 7, 2017; however, at both stations, the samples that were collected came after the peak of the storm. The permit allows for use of baseline sampling if there is an extended period of dry weather. As shown in Figure 3-1, January 2018 had very little rainfall. There were only two days in that month with measured rainfall that would have been sufficient to create enough runoff to elevate the flow at the monitoring stations to permit sampling. The results of the monitoring events are provided in Appendix C of this report.

Table 3-5: Summary of Data Gaps for FY 2018 Chemical Monitoring

Sample Date	Missing Data	Consequence
8/29/17	TSS for first samples for both stations	TSS EMC not calculated
9/5/17	Radecke Ave. samples analyzed for enterococci	EMC given for enterococci instead of e.coli
10/25/17	BOD for base flow for both stations	No data provided
2/27/18	TSS for base flow for Hamilton Ave	No data provided
4/23/18	pH and temperature for both stations	No data provided
5/22/18	pH and temperature for both stations	No data provided

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 report.

3.3.2 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 2017 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 2017 are listed in the *Biological Monitoring* table of the *MDE NPDES MS4 Geodatabase* (Appendix C of this report).

Table 3-6: Macroinvertebrate BIBI Scores for Fixed Stations Moores Run Watershed

Year	Station 1367 Moores Run	Station 1659 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

Year	Station 1367 Moores Run	Station 1659 Moores Run Tributary
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
2017	1.3	1.7

3.3.3 Habitat Assessment

DPW performed a habitat assessment survey of the upper Moores Run watershed on June 7, 2018. The results, along with twelve other assessments completed from May 18, 2005 through June 8, 2017, are included in Appendix H of this report. Segment 9 of the Moores Run main stem had much lower scores for the FY 2018 assessment compared to the FY 2017, falling down into the poor range for these categories: instream habitat, epifaunal substrate, riffle/run quality and trash rating.

Approximately 1.7 miles of stream restoration is proposed for Moores Run as part of the MS4 Restoration and TMDL WIP, as shown in Appendix R of this report, which should reduce nutrient and sediment loadings. This type of project will also include invasive species removal and other habitat enhancements. Furthermore, sanitary infrastructure rehabilitation and the Back River Headworks project, scheduled to be completed by 2021, should reduce bacteria loadings to this watershed.

3.3.4 Geomorphic Monitoring

The U.S. Fish and Wildlife Service (USFW) completed the physical monitoring of the Moores Run site; the results were included in the FY 2017 Annual Report. DPW completed a hydrologic and hydraulic (H & H) model of a prescribed reach of stream in FY 2018. The results of the model are included in Appendix I of this report. The model was developed using HEC-RAS for a 10-year return period, using USGS data.

3.3.5 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 reports indicated several locations that needed repair. During FY 2018, DPW procured the necessary contracted services and obtained all relevant permits for these repairs; however, repairs along the Stony Run were delayed due to community concerns about the work. DPW continues to work with the community to find a balanced approach to repair the restoration elements of the stream.

The physical survey of the stream profile and of permanently monumented cross-sections in the Stony Run were completed in FY 2017, to complement the USFW assessment. Furthermore, DPW has completed a hydraulic model of the former stream restoration project, known as Upper Stony Run. The discharge rate for the pre-restoration conditions for the 25-year storm was determined using 1981

culvert design analysis and 2004 Hydraulic and Hydrology Study for the Middle Stony Run restoration design by Parsons Brinckerhoff. Although there was a 2001 Hydraulic and Hydrology Study for the Stony Run watershed by EA Engineering, Science and Technology, the study did not include a 25-year storm. The results of the HEC-RAS model are included in Appendix J of this 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 2018 and 2019 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, included in Appendix K of this Annual Report. Debt service payments for the stormwater program in FY 2018 were on the order of $ $1,588,737; approximately 45% of the debt service payment was related to capital expenditures for impervious surface restoration.

Table 4-1: Fiscal Analysis of FY 2018 Expenditures

Description of Total Annual Cost	Actual
Stormwater management	$922,960
Erosion and sediment	$732,434
Illicit detection/elimination (IDDE)	$1,783,615
Trash elimination	$421,987
Property management	$9,859
Inlet cleaning	$4,469,606
Street sweeping	$5,868,388
Road maintenance - other	$0
Public education	$332,996
Watershed assessment	$297,920
Watershed restoration (all projects)	$9,458,883
Chemical monitoring	$84,719
Biological monitoring	$84,719
Physical assessment	$17,486
Design manual monitoring	$0
TMDL assessment	$33,887
Total NPDES program	**$24,519,459**
Other activities related to stormwater*	$12,181,253
Total Stormwater	**$36,700,712**
Funded by Stormwater Utility	$29,151,513
Funded by W/WW Utility	$2,049,091
Funded by Other Sources	$5,500,108

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 2018 (Expenditure)	$14,531,038	$9,988,421	$24,519,459
FY 2019 (Budget)	$16,589,293	$67,299,753	$84,189,046

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) and will remain the same through FY 2019. A rate increase is proposed for FY 2020. The required Watershed Protection and Restoration Program report, as prescribed by MDE, is included in Appendix L 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 March 2018, DPW was awarded $45,000 from the Chesapeake Bay Trust to contract the USGS to operate a water-quality and quantity monitoring site, "Baltimore Harbor Village Blue", at the mouth of the Jones Falls in Baltimore's Inner Harbor for a period of 6 months. The project will increase public awareness of water quality and ecosystem health of the Baltimore Harbor by utilizing real-time water sensors, data integration, and visualization to provide water-quality information to both EPA and partner websites educating the public about water quality in the Baltimore area.

4.2.2 Grant Support by DPW

DPW used the stormwater utility fund to provide $196,000 direct funding[1], matched by $104, 586 from the Chesapeake Bay Trust, for the following projects[2]:

- **Baltimore Tree Trust ($74,993) -** community-based effort to plant 170 street trees within the Berea neighborhood of the Harris Creek watershed area of east Baltimore City.
- **Civic Works Baltimore Center for Green Careers ($21,000)** – delivery of a comprehensive, certification-based occupational and essential skills training in stormwater management to one pilot cohort of 11 underserved Baltimore City residents facing significant barriers to employment over 12 months.

[1] DPW provided $200,000 for Chesapeake Bay Trust's Outreach & Restoration grant program. Two percent (2%) of the amount ($4,000) was an administration fee for CBT to manage the grant program.
[2] Dollars in ( ) is funding provided by DPW.

- **Civic Works Dayspring Garden and Green Parking Lot ($15,758)** – funding will be used to complete final plans, permitting, and site work for bioretention facilities adjacent to a parking lot for transitional housing.
- **Cylburn Arboretum ($50,000)** – installation of a bioretention facility that will treat runoff from the roof and adjacent drive at the Cylburn Mansion building.
- **Interfaith Partners for the Chesapeake ($19,116)** – IPC will train 20 volunteers at 10 faith institutions in Baltimore City about watershed stewardship so that they may teach the youth in their communities.
- **Southeast CDC ($15,133)** - This outreach and engagement program includes the development of a trained stewardship team to adopt and maintain bio-retention gardens in the Library Square area.

4.3 Capital Projects – Expenditures and Financing

The capital improvements for stormwater management include projects specifically listed in the Appendix R of this report, plus the capital projects to remediate or replace stormwater infrastructure. These projects are funded by a combination of the following:

- Stormwater utility (pay-go);
- County transportation bonds;
- General obligation bonds;
- State revolving loan funds;
- Stormwater revenue bonds; and
- Environmental impact bonds.

The capital costs listed in Appendix K 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 2018, the City Council approved the sale of stormwater utility bonds. The City is also in negotiation for funding from Environmental Impact Bonds (EIB), using a pay-for-success model to achieve specific environmental outcomes associated with green infrastructure. Projects funded by EIB are primarily ESD and impervious area removal projects scheduled to be completed by FY 2021.

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, 2017 to June 30, 2018) is as follows:

- Number of Concept Plans received: 275
- Number of Site Development Plans received: 146
- Number of Final Plans received: 146
- Number of Redevelopment projects received: 72
- Numbers of Stormwater exemptions issued: 228

DPW received and approved as-built drawings for 23 stormwater management BMPs between July 1, 2017 and June 30, 2018. 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	44	44
Qualitative Control Waiver	4	4
Quantitative and Qualitative Waiver	2	2
Redevelopment Waiver	72	72
Phased Development Waiver	0	0
Administrative Waiver	0	0
Variance	1	1
Total	**123**	**123**

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, 90 inspections of ESD treatment practices and structural stormwater management facilities were conducted as part of preventive maintenance inspections. Of those inspections, a total of 20 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 18, a total of 196 service requests were received. The service requests resulted in 2 stop work orders and $400 penalty fine.

During this reporting period, 1,173 inspections were conducted for compliance with approved erosion and sediment control plans. A total of 7 violation notices were issued by the City, resulting in a sum of $400 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. The monitoring results from the surveys for the AS and SIS programs for FY 2018 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 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 DPW, and request an investigation. During FY 2018, DPW initiated twelve (12) PSTs in response to BWB water quality complaints. These investigations led to finding the following illicit discharges:

- OCAL found one potable water discharge that was then abated;
- An investigation of sudsy water in Dead Run was referred to Baltimore County after OCAL found that the sudsy water came from Baltimore County;
- OCAL found one construction site where erosion and sediment controls needed to be corrected, which resulted in MDE issuing a violation for that contractor's illicit sediment discharge practices;
- One discharge of mineral oil by private business that was ultimately found by MDE; and
- One intermittent discharge with sediment that has been referred to MDE, which is working with MTA to determine the problem.

These illicit discharges are included in the discussions in Sections 5.3.3 and 5.3.4.

5.3.2.2 Ridge to Reefs Illicit Discharge Project

In FY 2017, DPW assisted Ridge to Reefs on an illicit discharge project, supported by a 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 5.3.2.1. 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, *Isolating High Concentration Illicit Discharges in the City of Baltimore for Remediation*, which was written by the staff of Ridge to Reefs, is included in Appendix M.

5.3.2.3 Microbial Source Tracking

DPW initiated Microbial Source Tracking (MST) DNA analysis in an effort to supplement the existing chemical indicators used to track wastewater contamination in the streams and storm drain systems. The analyses were performed by Dr. Wolf Pecher through a contract between DPW and the University of Baltimore. Beginning in 2017, four sampling events (31 total samples) were submitted for analysis. These sampling sites were based on 13 Pollution Source Tracking (PST) investigations. Many of the PST investigations had several sample locations. In addition, three reference sites were also included. The samples were analyzed for the number of human and canine DNA markers as well as a percent sewage equivalent. The percent sewage equivalent was a comparison of the number of human markers from a sample to the number of human markers found in wastewater samples taken from the influent at the Back River Wastewater Treatment Plant.

MST analysis was primarily used during PST investigations where high levels of the primary wastewater indicators (ammonia nitrogen and bacteria) were found, but various investigative techniques were exhausted (dye testing, CCTV of pipelines, visual inspection, and historical mapping review) and yielded no sanitary sewer sources If the samples contained a high number of human markers and a sewage equivalent greater than 1%, the investigation would remain open for further monitoring and investigation. If the number of human markers was low and the sewage equivalent was less than 1%, the investigation was discontinued.

Of the 13 PST investigations with MST DNA samples submitted, 11 were discontinued due to the sewage equivalent value being less than 1%. One PST investigation with a sampling site value of 12.21% sewage equivalent was continued and eventually solved and abated. A single illicit house connection to the storm drain was found up stream. Another PST investigation with multiple sampling site values ranging from 1.38 – 2.51% sewage equivalent remains open with an active investigation. To date, one source has been found within this drainage system and more are suspected.

In addition to investigation sites, three reference sites were included to evaluate the MST DNA analysis. An outfall sampling site with historically low ammonia nitrogen and enterococci bacteria values resulted in only 9 copies of a human marker in 1 ml and 0.00% sewage equivalent. An outfall sampling site with a known (and soon eliminated) small wastewater infiltration up stream was sampled, and resulted in a value of 2.61% sewage equivalent. This site prompted the use of 1% sewage equivalent as the threshold for continuing an investigation- since a known trace amount of sewage was detected at just over 2.5%. An additional reference site with a moderate known level of wastewater contamination was submitted, and the resulting value was 9.59% sewage equivalent.

As of November 2018, four more sampling events (32 samples) remaining on the contract with the University of Baltimore for MST DNA analysis. The results of the samples processed through FY 2018 are included in Appendix N of this 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 2018, a total of 173 service requests were received. Twenty-five (25) resulted in a pollution source tracking investigation. Eight (8) 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;
- Two (2) sewage inputs from private properties to the storm drain system; one (1) of these was designated as sanitary discharge of unknown origin (SDUOs) at some point during its investigation;
- One (1) private property discharging laundry wash water through its sump pump into the alley;
- One (1) related to a constructions site where erosion and sediment controls needed to be corrected; and
- One (1) discharge of mineral oil by private business that was ultimately found by MDE.

Two (2) more investigations led to the discovery of a potable water system leak, but the repairs were not completed by the end of FY 2018.

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 2018, a total of 197 PST investigations were conducted: 180 PST investigations were initiated during FY 2018 and the others were a continuation of PST investigations initiated prior to FY 2018. The PST investigations resulted in mobilizing to 1,500 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 O of this report:

- Forty-nine (49) dry weather sanitary sewer overflows (SSOs) from the public sewer; three (3) of these were designated as sanitary discharge of unknown origin (SDUOs) at some point during their investigations;
- Eighteen (18) sewage inputs from private properties to the storm drain system; fifteen (15) of these were designated as sanitary discharge of unknown origin (SDUOs) at some point during their investigations;
- Eight (8) drinking water transmission losses; and

- Ten (10) with other types of illicit discharge:
    - Five (5) related to constructions sites where erosion and sediment controls needed to be corrected;
    - Three (3) involving businesses discharging wastes; and
    - One (1) leaking dumpster that ran into a storm drain inlet; and
    - One (1) private home washing pet waste off property that ran into a storm drain inlet.

Additionally, twenty-nine (29) illicit discharge sources were located and await further repairs:

- One (1) discharge from private business that has been referred to MDE for further investigation;
- Two (2) sanitary sewage inputs from private properties; both of which were designated as SDUOs at some point during their investigations;
- Seven (7) SSOs, three (3) of which began as SDUOs; and
- Nineteen (19) drinking water transmission losses.

There are fourteen (14) on-going investigations for which a pollution source has not yet been identified:

- Twelve (12) discharges that suggest that the source is coming from the sanitary sewer network; one (1) of these investigations has been designated as an SDUO;
- One (1) with high chlorine levels suggesting the source is from drinking water transmission loss; and
- One (1) intermittent discharge with sediment that has been referred to MDE, which is working with MTA to determine the problem.

5.3.5 FOG Program

Since November 2013, DPW has conducted 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 are included with water bills. Outreach at festivals and community meetings have 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 3,710 inspections of FSEs during FY 2018: this is a decrease of 7% compared to the 3,999 inspections during FY 2017. During FY 2018, 1,304 FSEs (35%) were found not to be in compliance. There were 1,980 notices of violation (NOV) issued to the non-compliant FSEs. Sixty-four (64) FSEs were issued consent agreements. A breakdown by type of NOV is included in Appendix O of this Annual Report.

In the FY 2015 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. DPW does not have any new information to report on the progress of the remaining schools toward their installation of GCDs.

5.3.6 Exterior Lead Paint Removal Waste Control Program

This program is administered by the DPW - Pollution Control Section. During FY 2018, there were 216 permitted sites. Inspectors made 179 site visits and issued 57 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. 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.

5.4 Property Management and Maintenance

5.4.1 Street Sweeping and Trash Reduction

In FY 2018, the mechanical street sweepers operated by DPW- Bureau of Solid Waste removed 13,483 tons of debris while sweeping 110,665 miles of street surface. Street sweeping tonnage and mileage is listed by frequency and 8-digit watershed in the MS4 geodatabase (Appendix C) and on Table R-2 (Appendix R) of this report. 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 and plans to continue through FY 2019.

5.4.2 Inlet Cleaning

In May 2016, DPW completed the installation of screens and inserts for 414 inlets as a pilot program to improve the efficiency of inlet cleaning and street sweeping by preventing trash and debris from entering the storm pipe system. Modified inlets were installed in five neighborhoods: McElderry Park, Oliver, Baltimore-Linwood, Franklin Square, and Carrollton Ridge. 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. In FY 2018, a total of 31.16 tons of debris was collected from the inlets in the 5 targeted neighborhoods.

DPW- Utility Maintenance Division also initiated a targeted pro-active inlet cleaning program in 2017 for 206 inlets, selected based on sump condition and proximity to the Mayor's Violence Reduction Initiative. Each of the inlets are cleaned quarterly, yielding a total of 67 tons of debris collection in FY 2018. Additionally, DPW- Utility Maintenance Division continued its daily reactive cleaning of the City's storm

drain inlets, removing approximately 568 tons of debris from 5,940 inlets in the City's public storm drain system, which is equivalent to about 17% of the City's storm drain system. Since Quarantine Road landfill prohibits the unloading of saturated debris, the weight measurement is based on the weight of the debris after it was spread and dried within a bermed area at the maintenance yard. Although the number of inlets is close to the amount reports in FY 2015 (6,345), the FY 2018 tonnage is about 42% of the FY 2015 reported tonnage for reactive inlet cleaning. This reduction in weight may be attributed to source reduction practices such as municipal trash can deployment and litter education programs.

5.4.3 Middle Branch Shoreline Cleaning

In 2017, DPW contracted DemoUSA (with enhancement funds from the Casino) to conduct shoreline cleaning of the Middle Branch. Additionally, DemoUSA was contracted to repair and install booms across several outfalls in the upper Middle Branch, adjacent to the Horseshoe Casino, and across the lower Gwynns Falls. A total of 9.79 tons of trash and debris were removed during three clean-up events:

- Harbor Hospital (July 2017)
- Middle Branch (October 2017 and November 2017)

No additional cleaning was done in FY 2018 due to the completion of DemoUSA's contract. Cleaning resumed on July 23, 2018.

5.4.4 Integrated Pest Management

During FY 2018, the Department of Transportation (DOT) did not apply any herbicide because there was no one on staff with a license to apply herbicide.

During FY 2018, 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 the same amount as in FY 2017. 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 19.5 pounds of glyphosate acid applied during FY 2018 compared to 42 pounds applied during FY 2017.

The Baltimore City Public Schools System reports that no herbicides were applied on school properties during FY 2018.

5.4.5 Deicing Materials

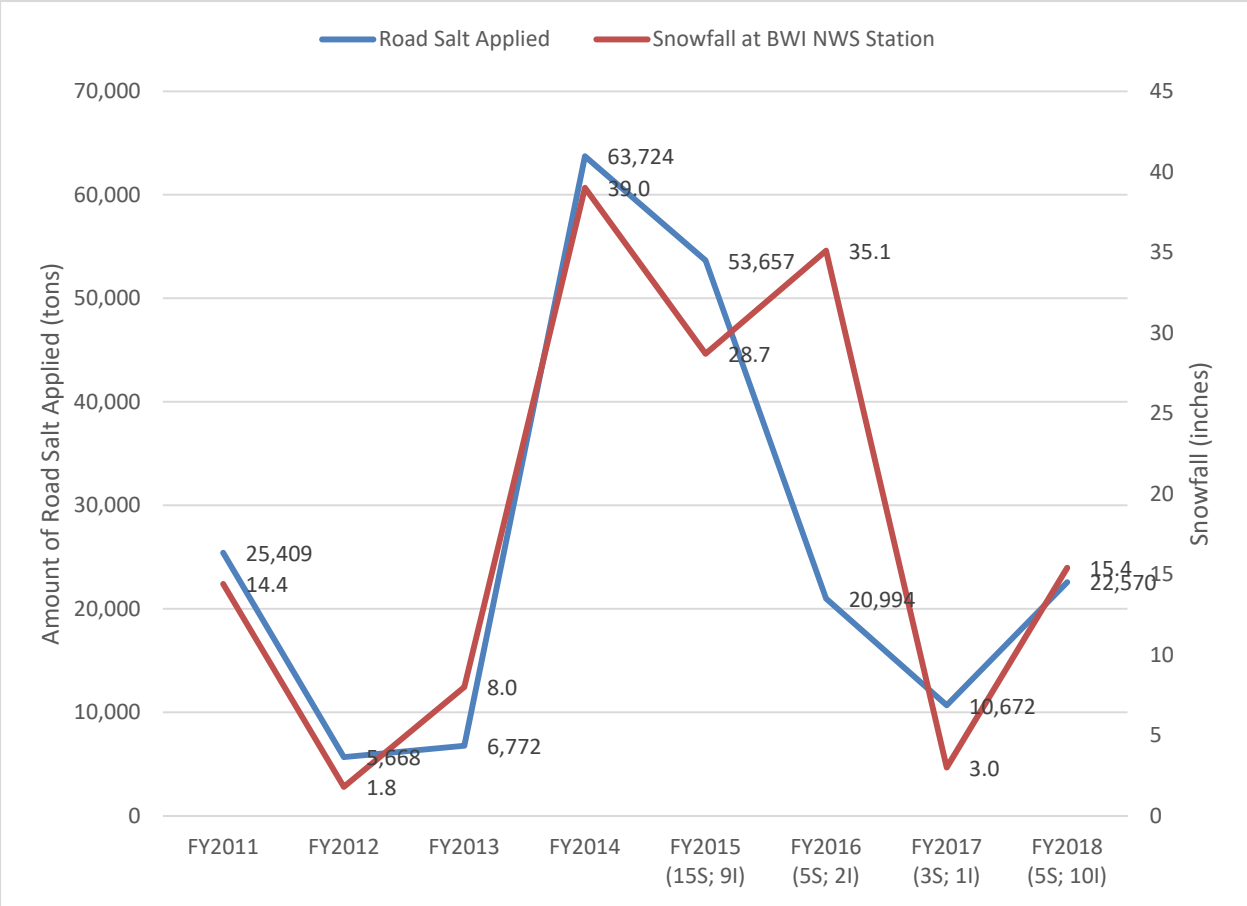
DOT applied 22,570 tons of road salt (sodium chloride) during FY 2018. This is a significant increase from the 10,672 tons that were applied during FY 2017. The snowfall total recorded at BWI for FY 2018 was 15.4 inches- compared to only 3 inches for FY 2017. In FY 2018, there were five (5) storms and ten (10) days of icy conditions for which DOT applied road salt. About 82% of the annual road salt application occurred during the following storm events:

1. December 15, 2017: 3,382 tons applied
2. January 4, 2018: 3,738 tons applied

3. January 8, 2018: 1938 tons applied
4. January 17, 2018: 2,793 tons applied
5. March 30, 2018: 6,677 tons applied

In addition to the rain events shown in Figure 3-1, there was a record number of water main breaks occurring in January 2018, which would have cause the road salt to wash off into the storm drain system.

Figure 5-1 depicts the amount of road salt applied (left-hand y-axis) and the amount of snowfall recorded at the National Weather Service station at BWI Airport (right-hand y-axis) for each fiscal year, from FY 2011 through FY 2018. Note that 30 inches out of the 35.1 inches of snow fell in one event in FY 2016, specifically on January 21-22, 2016. That is why that pair of numbers (20,994 tons of road salt applied and 35.1 inches of snowfall) are not well related with the other pairs of numbers.



Note: For FY 15 – 18, S = number of snow events; I = number of Ice events

Figure 5-1: Road Salt Applied by City of Baltimore and Snowfall at BWI by Fiscal Year

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 2018 (Mark)

Description	Details
Public Presentations on the MS4 WIP	• 28 presentations were given to communities where MS4 projects are to be located
School presentations providing information on trash reduction, recycling, rats, and storm drains, related to the health of the harbor	• 16 Presentations • 9 Schools • 300+ Students • Post-presentation testing
Community events where DPW provided educational materials on environmental topics	• Youth Works Resource Fair – July 17, 2017 • Artscape – July 21 – 23, 2017 • Mayor's Back to School Rally – August 5, 2017 • African American Festival – August 12, 2017 • Dam Jam – August 26, 2017 • WasteCon – September 26, 2017Book Festival – September 22 – 24, 2017 • Council President's Senior Symposium – 10/14/17 • Mayor's Harvest Festival – October 27, 2017 • 40th District Community Leadership Forum – January 6, 2018 • District 8 Community Fair – January 13, 2018 • Tax Payers Night – April 4, 2018 • Senior Law Day – April 14, 2018 • Mayor's Spring Cleanup – April 28, 2018 • Beechfield's Annual Peace Day – May 12, 2018 • Big Truck Day – May 12, 2018 • Councilman Burnett's Multi-agency Resource Fair – May 19, 2018 • Caregivers Conference – May 23, 2018 • Govans Manor Health Fair – June 15, 2018 • Mayor's Call to Action (various times throughout the year)Youth Summer Block

Description	Details
	Party Tour – (various times throughout the year) • Community meetings (various times throughout the year) • Senior centers (various times throughout the year) • Community Action Centers (various times throughout the year)
Incentives related to trash reduction	• Household Hazardous Waste collections (First Friday/Saturdays; July-October 2017, April-June 2018) • Discount Recycle Bin sales/Free Paper Shredding (various dates) • Recycle Bin Sale (Big Truck Day, May 2018) • 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 information on the DPW's web site, 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:

- 35 stormwater participation events completed
- 1,591 volunteers participated
- 26.88 tons of trash collected
- 150 trees planted and/or maintained[3]

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 2017 and Spring 2018 Clean-ups.

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

[3] Trees are reported as afforestation.

lots, creating community spaces, and reducing and treating stormwater. Signage for each of the sites was installed in the Fall of 2017.

5.5.3 Workforce Development Programs

5.5.3.1 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 fourth year with 8 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.

5.5.3.2 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. Baltimore hosted one training session and exam for the region in the Fall 2017.

5.5.4 GROW Center

In Fiscal Year 2018, DPW launched a feasibility study for a concept known as "GROW Centers". GROW stands for Green Resources and Outreach for Watersheds, and will be places that links existing community greening networks to much needed sources 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.

The feasibility study consists of two efforts – 1) the testing of the concept through a series of "pop-up" events, and 2) the development of an Alternatives Analysis and Business Plan. Both efforts will be funded in part by a grant from the USDA Forest Service received in FY2017.

In August 2017 DPW was awarded a Peaceworker Fellow from the Shriver Center at the University of Maryland, Baltimore County to serve as the Project Coordinator for the GROW Center pop-ups. Fall 2017 was spent researching best practices, building networks, and planning pop-ups. In the Spring of 2018 four pop-ups were held in various locations across Baltimore. Summary results are:

- 206 people attended from 86 different neighborhoods
- 12 partner organizations participated
- 8 workshops were held, including a rain barrel workshop where 15 people built rain barrels
- 110 trees were given away along with 10+ cubic yards of mulch

A report for the Spring 2018 GROW Center pop-ups can be found in Appendix P.

At the end of 2017 an RFP was advertised for the Alternatives Analysis and Business Plan. Unfortunately there were no bids. The RFP wad revised and re-advertised in Spring 2018 through targeted outreach. Bids closed in June 2018 with three consultant teams submitting proposals.

5.5.5 Baltimore Green Registry: Mapping of SWM BMPs Phase 2

In FY17, 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. During FY18 DPW worked with BNIA to create a beta mapping site that displayed the following data sets: project locations identified in previous Small Watershed Action Plans, facilities reported to MDE as part of the MS4 FY17 Annual Report, and proposed MS4 projects. Final development of the mapping tool, including data from non-profits and others, will be completed in FY19.

5.5.6 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.

5.5.6.1 B'More Beautiful

B'More Beautiful is a City-led peer to peer beautification program that launched April 2017. The goal of the program is to change behaviors and attitudes towards the beautification of the City as well as encourage residents, businesses and organizations to become directly involved in activities and projects that will keep their neighborhoods clean. To meet this goal, the City works closely with neighborhoods on beatification projects and cleanliness challenges, as well as provides educational literature, outreach materials and other resources that residents can use to Keep B'More Beautiful.

B'More Beautiful started with twenty-three (23) pilot neighborhoods. In May 2018 the pilot expanded into twenty-four (24) additional neighborhoods:

- 4x4
- Belair Edison
- Bocek
- Boyd Booth
- Broadway East
- Brooklyn
- Canton
- CARE
- Carrollton Ridge
- Cherry Hill
- CHM
- Curtis Bay
- Darley Park
- Druid Heights
- Evergreen Lawn
- Franklintown Road
- Franklin Square
- Greektown
- Greenmount West
- Hampden
- Harlem Park
- Highlandtown
- Hopkins Bayview
- Howard Park
- Johnston Square
- Langston Hughes
- Matthew Henson
- McElderry Park
- Milton-Montford
- Mondawmin
- Morrell Park
- Mosher
- Oliver
- Park Heights
- Parklane
- Patterson Park
- Penn-North
- Pigtown
- Remington
- Reservoir Hill
- Rosemont
- Sandtown Winchester
- South Baltimore
- Upton
- Waverly
- West Arlington
- Westport

In each piloted neighborhood a volunteer resident block captain was 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 their neighbors on how to comply with specific City Code requirements and how they can keep their neighborhood beautiful through simple, easy-to-follow behaviors.

In FY18, BMORE Beautiful achieved the following:

- 3 Neighborhood Block Captain Training
- 18 Baseline Community Surveys
- 56 Community Clean-ups
- 30 Beautification Projects

5.5.6.2 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 FY18:

- 477 communities participated
- 8,200 residents volunteered
- 94.84 tons (Fall) + 56.33 tons (Spring)[4]

[4] There was an issue with collections for the Spring 2018 event; only the roll-off dumpsters were weighed and none of the bagged trash collected by community groups.

DPW also coordinates the Community Pitch-in program, which provides up to 4 dumpsters/year to community groups. In FY18, 796 requests were made for dumpsters (a 29% increase over FY17), with 5,279.8 tons of debris collected (a 285% increase over FY17). 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. 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 and submitted to MDE on August 24, 2015.

DPW is in the process of updating the baseline to reflect changes in industrial permitting and as-built data for BMPs installed prior to 2010 (See Table 2-3 of this report), resulting in a lower baseline impervious area. To be conservative, the proposed restoration plans cited in Section 6 of this Annual Report refer only to the WIP (August 2015) and current 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, 2018, related to the Chesapeake Bay TMDL, are included in Appendix Q.

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 R of this Annual Report, specifically Table R-1. The original plan scope, cost and schedule are shown in addition to the current projections. Most of the projects completed the design phase during Fiscal Year 2018, with the bid phase initiating FY 2019 and construction completing by FY 2021. Two (2) stream restoration projects (Lower Lower Stony Run and Chinquapin Run) continued through the construction phase. The current projections are based on the project progress as of June 20, 2018. Each of the current proposed projects, with specific locations, is included in the restoration BMPs tables of the georeference database in Appendix C. The delays of the projects are discussed in the Executive Summary of the Financial Assurance Plan (Appendix K of this report).

6.3.2 Program Implementation and Tracking

The progress status of the programs listed in the WIP is provided in Appendix R of this Annual Report, specifically Table R-2. Current program implementation and corresponding georeference database records are reported, based on frequency and geographic distribution of the operation (tonnage by watershed) in the georeference database (Appendix C of this report).

During FY 2018, the City participated with MDE on a work group to revise the 2014 MS4 Accounting Stormwater Wasteload Allocations and Impervious Acres Treated (MS4 Accounting Guidelines). As part of the effort, the City plans to submit proposed impervious surface restoration and nutrient reduction credit for IDDE programs in FY 2019, following the final approved report entitled “Recommendations of the Expert Panel to Define Removal Rates for the Elimination of Discovered Nutrient Discharges from

Grey Infrastructure", dated November 20, 2014. The progress for pipe lining and dry-weather SSO reduction has been documented in the Consent Decree quarterly reports, starting with the quarter ending December 2017, which are posted on-line. The length of sanitary pipe lining and rehabilitation, listed in Table R-2, is only the portion documented from January 2018 to June 2018. DPW will account for this total effort, plus dry-weather SSO reduction, during the permit period as part of the FY 2019 Annual Report, pending MDE's approval of the proposed credits.

Starting in FY 2013, the City initiated a program to proactively replace the City's drinking water distribution system annually in order to reduce water loss from the system. The progress of this program, during this permit period, is shown in Table 6-1, with the cumulative total amount listed in Table R-2 of this report. Impervious area restoration and nutrient reduction will be estimated in the FY 2019 Annual Report, pending MDE approval as part of the MS4 Accounting Guidelines update.

Table 6-1: Summary of Water Main Replacement Program

Fiscal Year	Completed (miles /year)	Cumulative Replacement (miles)
2015	15.9	15.90
2016	19.55	35.45
2017	15.09	50.54
2018	15.31	65.85

6.3.3 Partnership Implementation and Tracking

The progress status of the partnerships listed in the WIP is provided in Appendix R of this Annual Report, specifically Table R-3. All restoration BMPs with approved plans and status of "completed" in the georeference database (Appendix C), implemented to meet development requirements, were simply listed in the Table R-3 under development, using conservative pollutant removal efficiencies for pond and bioretention retrofits in type D soils. During FY 2018, the completion year was refined as shown in Table 2-3 of this report, thus reducing the restored acreage attributed to the 20% impervious surface goal. Pollutant efficiencies and geographic reference (watershed) will be included in this table in the FY 2019 Annual Report.

6.4 Impervious Area Restoration

The progress status of implementation of proposed projects, programs, and partnerships of the WIP is provided in Appendix R. 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. A summary of the impervious area restoration efforts (Appendix R) is provided in Table 6-3 and shows that the City has exceeded the impervious area restoration goal (4,291 acres) as of June 30, 2018.

Table 6-2: Summary of Impervious Surface Restoration (ISR) Efforts

Description	ISR Completed by June 30, 2018 (ac)
Projects	53
Programs	4,006
Partnerships	471
Total	**4,530**

6.5 Bay TMDL Compliance

In FY 2018, MDE transitioned from the Maryland Assessment Scenario Tool (MAST) to the Chesapeake Bay Assessment Scenario Tool (CAST). The evaluation of Bay TMDL compliance using CAST will be included in the FY 2019 Annual Report. As an alternative to CAST, an estimation of the pollutant removals (% reduction) using the MS4 Accounting Guidelines is provided in Appendix S, specifically Table S-2. Only increased tonnage was used for street sweeping after baseline TMDL conditions were established (December 2009) in estimating pollutant reductions. Previous Annual Reports had used the total street sweeping for pollutant reductions. Inlet cleaning was not included since the tonnage had reduced, most likely due to source reduction. The IDDE program was also not included, since any associated credits are pending approval by MDE as part of the MS4 Accounting Guidelines update.

The evaluation (Table S-2) showed that the City has met the Bay TMDL goal for sediment. Phosphorus goals should be met with the completion of the remaining projects by FY 2021. The efforts for nitrogen reduction are still insufficient; only one quarter of the reductions would be achieved with the current proposed projects. The City anticipates that the proposed credit for IDDE should increase the estimated pollutant removal for nitrogen.

6.6 Local TMDL Compliance

6.6.1 Nutrients and Sediment

An analysis of the nutrient and sediment removals, based on the current implementation status, using the current MS4 Accounting Guidelines is provided in Appendix T. Just like the Bay TMDL compliance assessment, load reductions attributed to street sweeping only included the increase in annual tonnage collected since TMDL baseline conditions (December 2009). The analysis used a percent reduction methodology with both loads and load reductions calculated based on the MS4 Accounting Guidelines.

The estimated baseline load for nitrogen and phosphorus were significantly higher using the loading factors from the MS4 Accounting Guidelines (Table S-1 of this report), as compared to the baseline load listed in the approved TMDL documents, which were derived from direct measurements of surface water conditions. The progress analysis shows the current planned efforts will be insufficient for meeting the nitrogen goals; however, the City anticipates that the proposed credit for IDDE should increase the estimated removal for nitrogen significantly. The phosphorus goal should be met with the completion of the capital projects by Fiscal Year 2021 for Back River and has already been met for the

Baltimore Harbor TMDL. Furthermore, the City's SIS monitoring results show a continued decrease in nutrient and phosphorus concentrations, as described in Section 3.1.1 of this report.

Contrary to the local nutrient TMDLs, the estimated baseline load for sediment was significantly lower using the loading factors for from MS4 Accounting Guidelines (Table S-1) as compared to the baseline load listed in the approved TMDL documents, which were derived biological assessments, not direct measurements of sediment. The analysis showed that the current proposed efforts would be insufficient using the current MS4 Accounting Guidelines for Gwynns Falls (Table T-3) and Jones Falls (Table T-4) watersheds; however, the proposed sediment removal rate for stream restoration (248 lbs / year/ LF) would provide an additional load sediment load reduction of 2,790,400 and 1,744,000 lb / year for Gwynns Falls and Jones Falls watersheds, respectively, upon the completion of the capital projects in FY 2021. The sediment load reduction goals for the Lower North Branch Patapsco watershed should also be met by FY 2021 with the completion of the current proposed efforts.

6.6.2 Bacteria

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 approved on October 6, 2017 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 City submitted a modified implementation plan to reflect the schedule approved as part of the modified Consent Decree. Progress for the milestone implementation schedule (education and IDDE credit study) is included in Table Q-1 of Appendix Q of this report. The City's progress on a microbial source tracking study is discussed in Section 5.3.2.3 of this report.

The City has continued to make significant capital investments in rehabilitating the sanitary sewer system. Phase I of these capital investments will be completed in FY 2021 and includes the Headworks project, which is expected to reduce the number of wet weather SSOs by 80%. Two sanitary sewer re-alignment and rehabilitation projects were designed in concert with two of the City's stream restoration projects (Chinquapin Run and Powder Mill Run) to reduce land and community disturbance. Further information on these efforts is provided in quarterly Consent Decree reports, posted on the City's website.

The results of the City's routine stream sampling for bacteria are provided in Section 3.1.2 of this Annual Report. While two SIS stations are very close to meeting the prescribed water quality standards for recreation and other sample stations are trending towards compliance, the following SIS stations remain a concern:

- All stations in the Back River, Moore Run Subwatershed. Phase I Consent Decree projects should significantly reduce SSOs and thus bacteria loading for this subwatershed.
- JF 11.5 is a structured overflow. Pending the completion of the Headworks project, the structured overflow will be removed.

- Gwynns Falls: all but stations at Dead Run and GF Hilton Street. Phase I Consent Decree projects should significantly reduce SSOs and thus bacteria loading for this subwatershed.
- Lakewood and Linwood stations in Baltimore Harbor. The drainage are for these two stations account for about 15% of the City land area. The storm drain systems inter-connect in and around Patterson Park. The Lakewood station is associated with the sub-watershed known as Harris Creek; this system has endured 4 emergency repairs for sinkholes in and around Monument Street for the last 10 years due to failure of a 10-foot storm drain tunnel. A $22 million capital rehabilitation project for this system is scheduled to begin in FY 2020. This rehabilitation, in addition to the Phase I Consent Decree projects should significantly reduce bacteria loading.

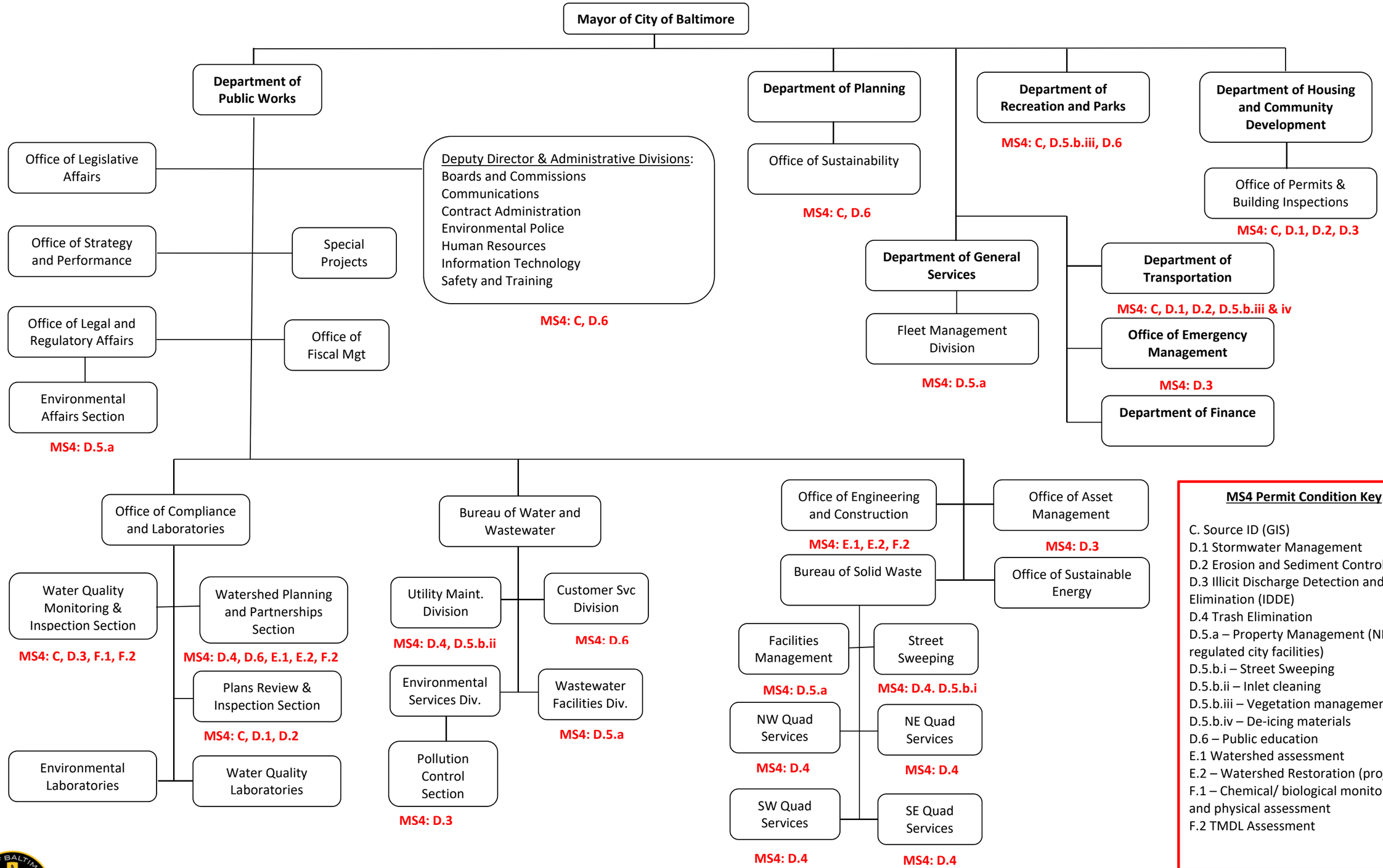
6.6.3 Trash

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 Q of this report.

6.6.4 PCB

The City submitted a revised PCB TMDL implementation plan to MDE in September 2018. The plan included details of a collaborative study with USGS and UMBC in the Back River watershed, to be completed by FY 2020. The City is on schedule for this task.

Appendix A: Organization Chart



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

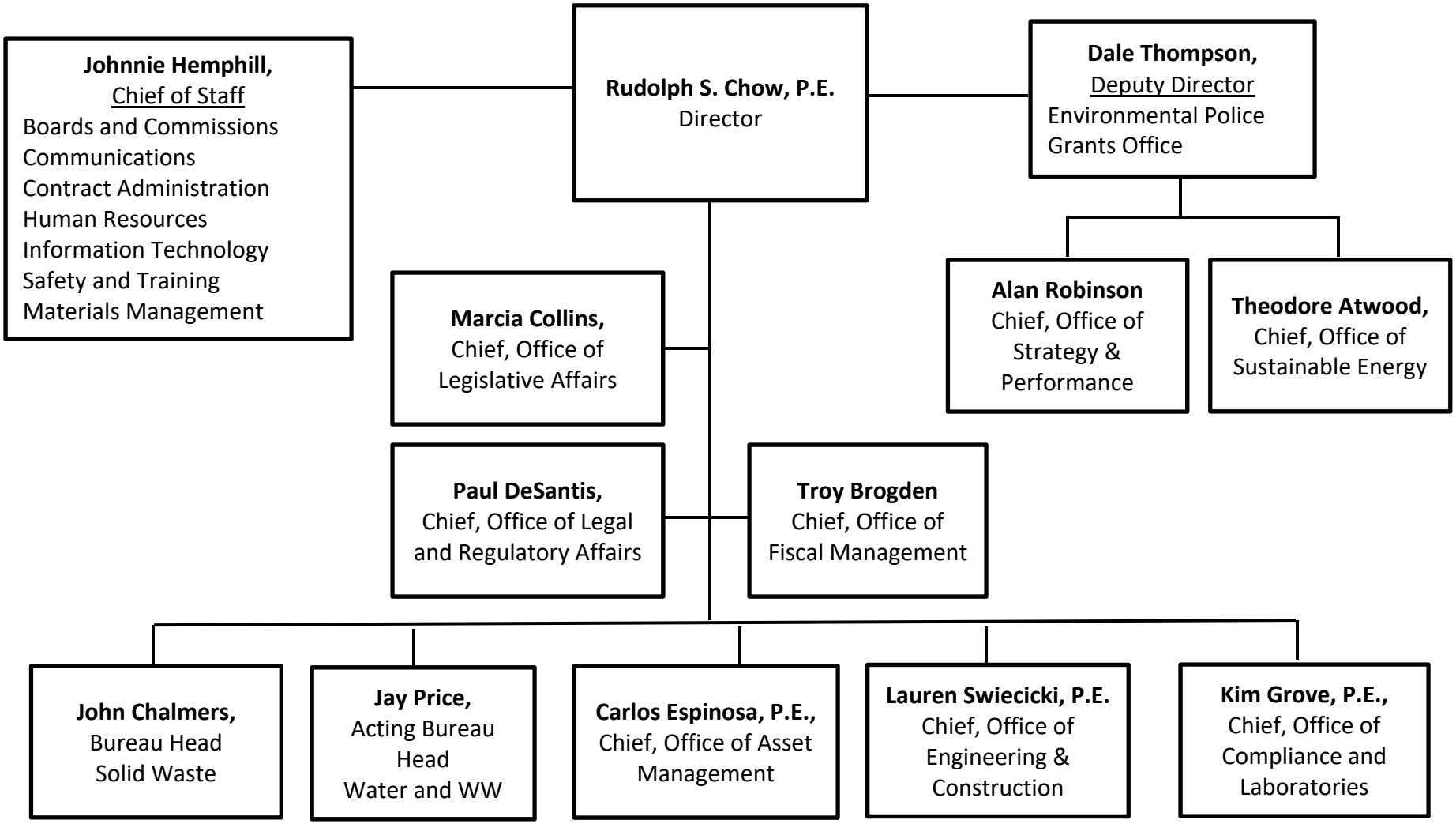
Catherine E. Pugh
Mayor

City of Baltimore Organization Chart in Reference to MS4 Permit Conditions as of June 30, 2018

Catherine E. Pugh
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, 2018.

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

Summary of Null Values Used on MDE Geodatabase

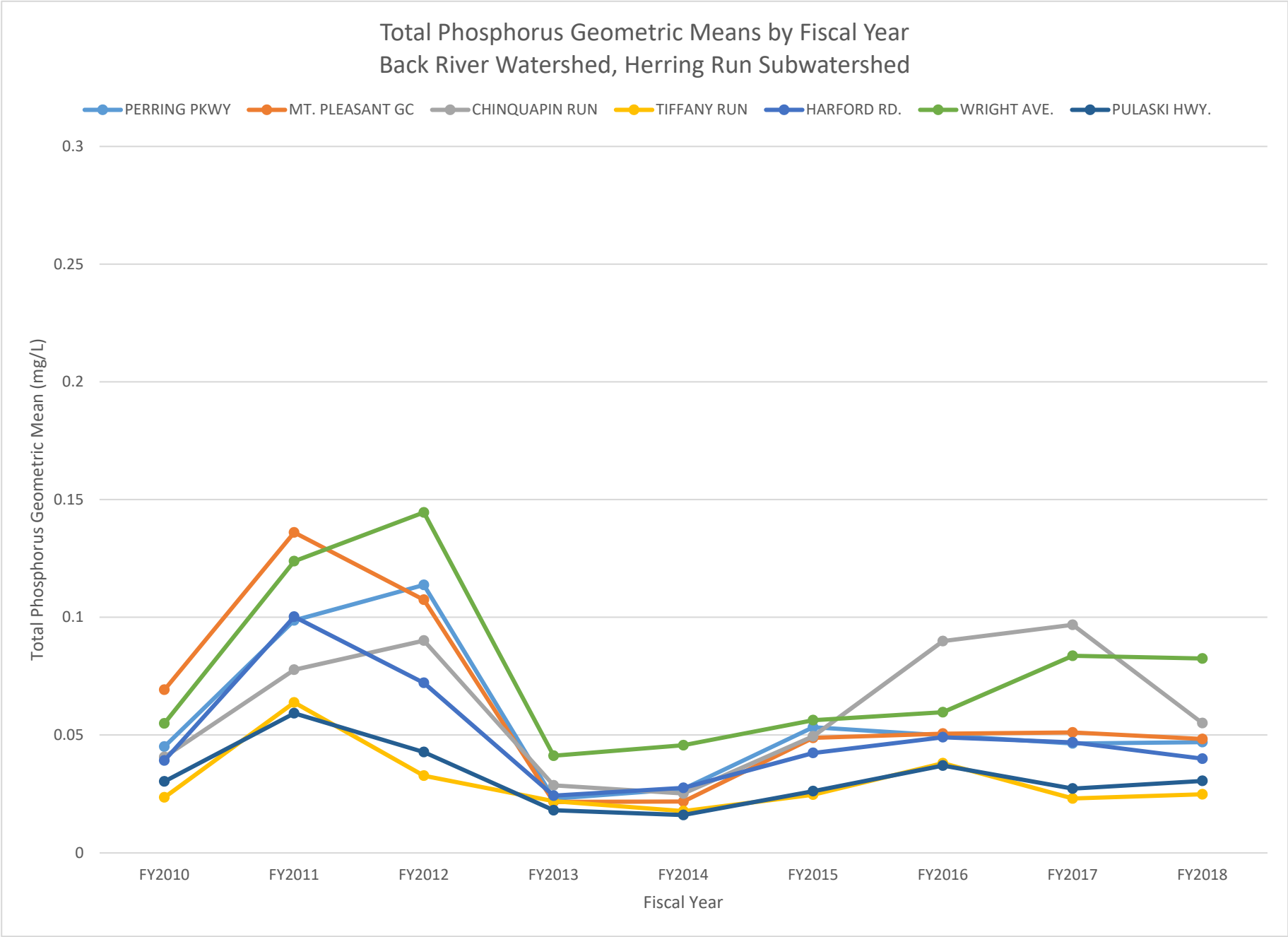
Table	Field	Value	Comments	Schema
Biological Monitoring	EVENT_TIME	12:00	Not recorded in field report.	
	FIBI	-999	FIBI is not done; it is not required for this permit.	X
	EMBEDDEDNESS	-999	Not recorded in field report.	
Chemical Monitoring	WATER_TEMP	-999	Not recorded in field report.	
	pH	-999	Not 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.	
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	Total program costs are shown Section 4, but not broken down by frequency / watersheds.	
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

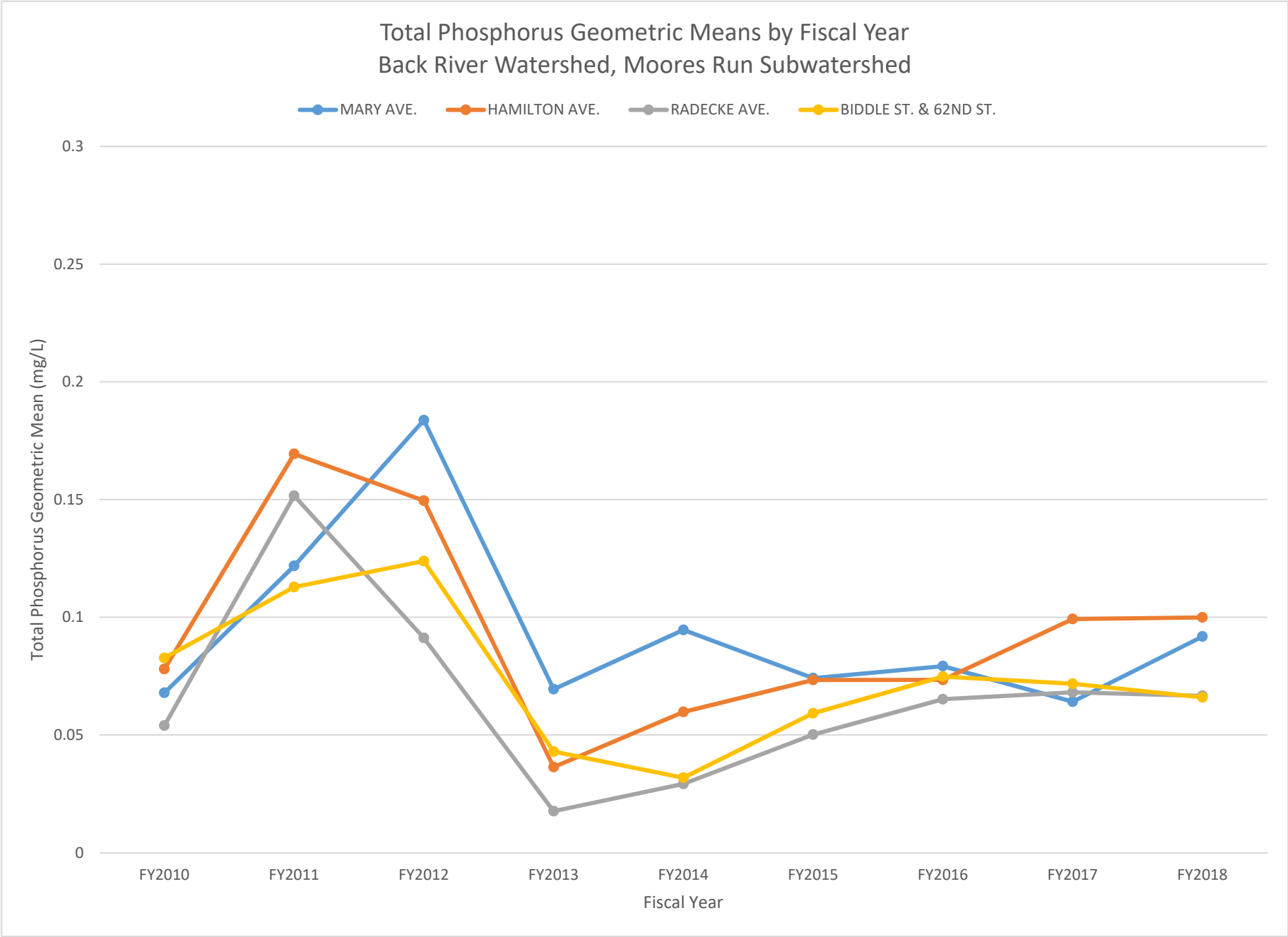
Note: Schema indicates MDE plans to change the field to optional in next generation of database.

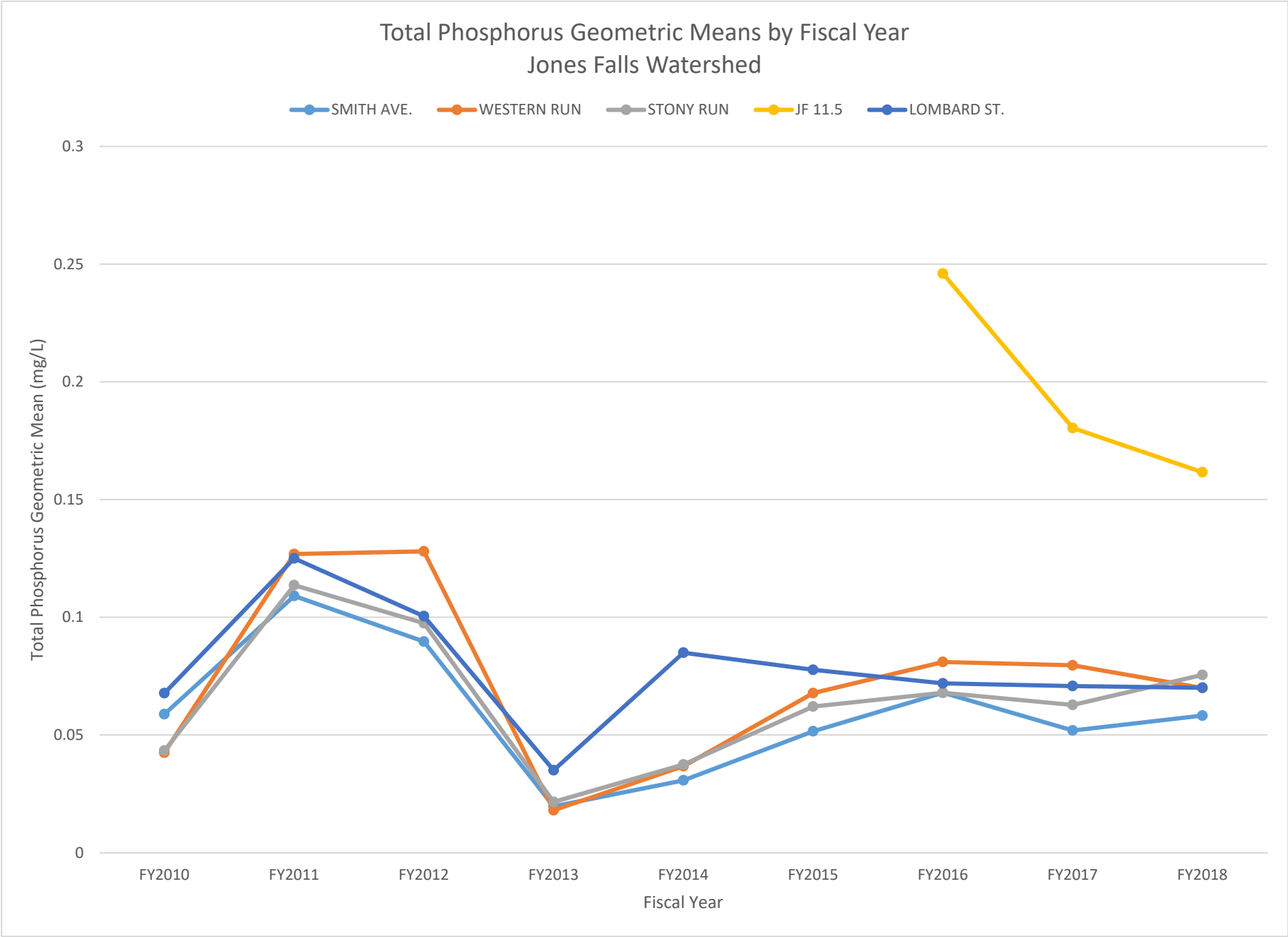
Appendix C: Source Information using MS4 Geodatabase (*electronic files only*)

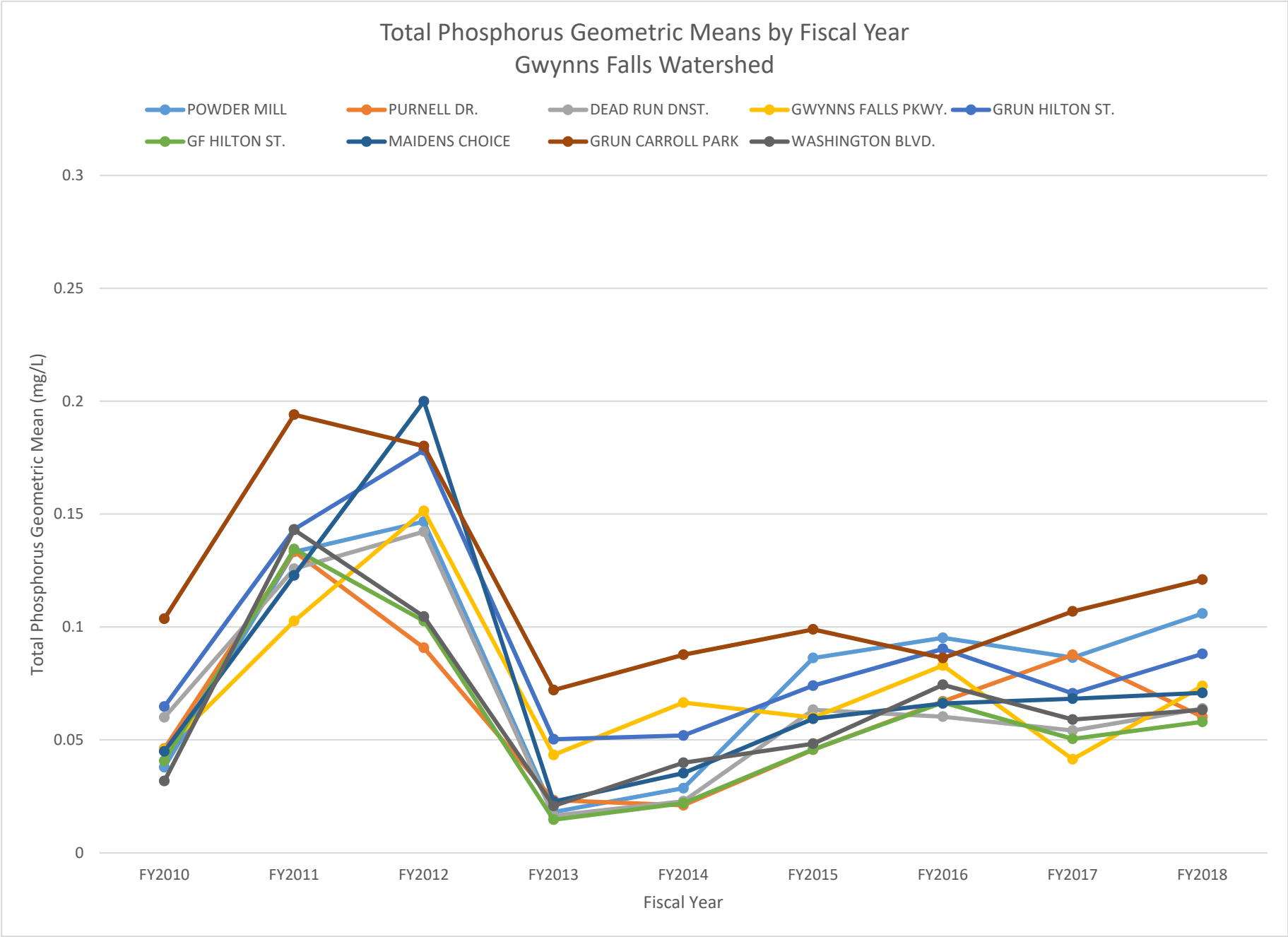
Appending D: Ammonia Screening and Stream Impact Sampling Results (*electronic files only*)

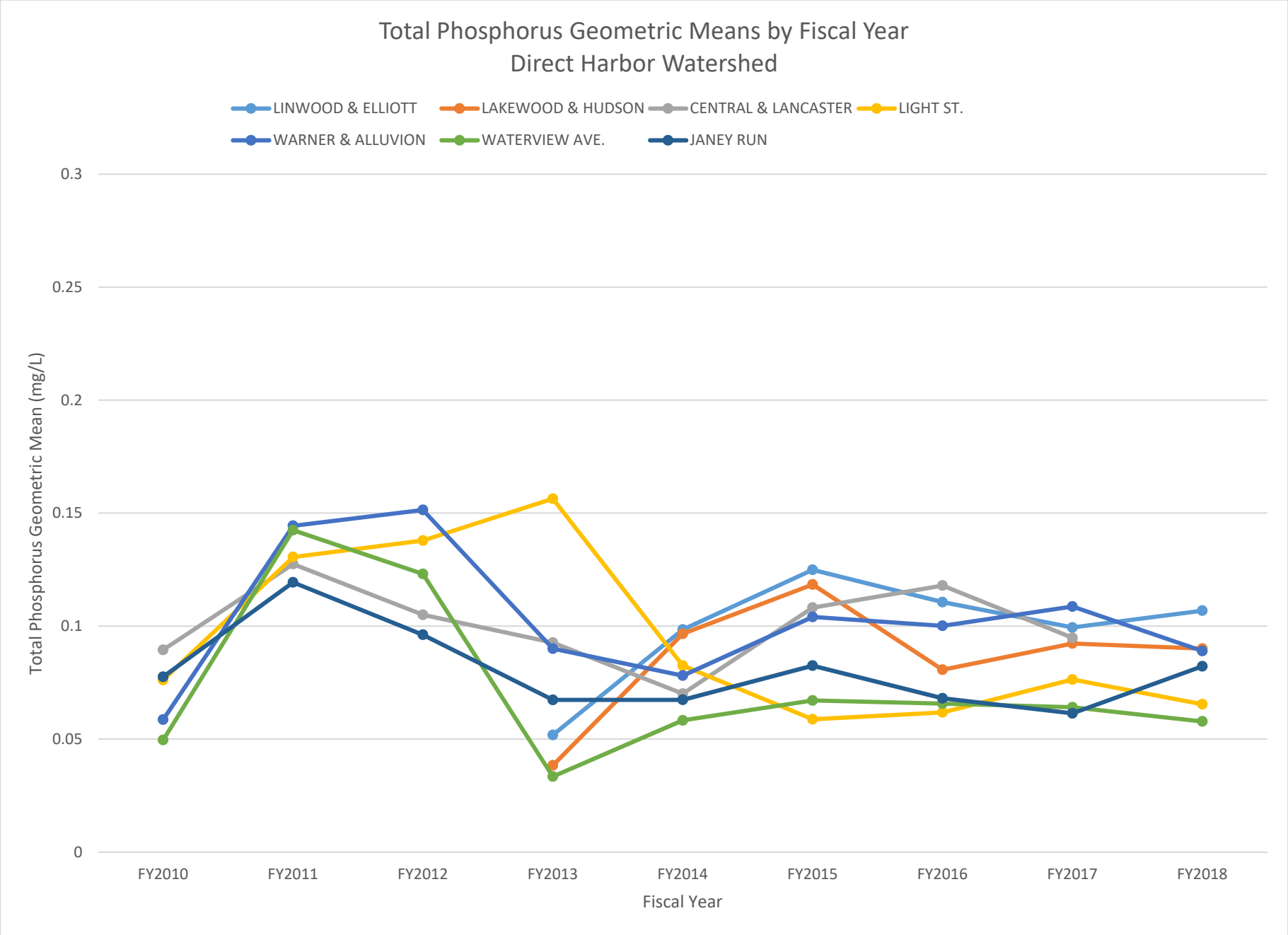
Appendix E: Total Phosphorus Monitoring Histographs

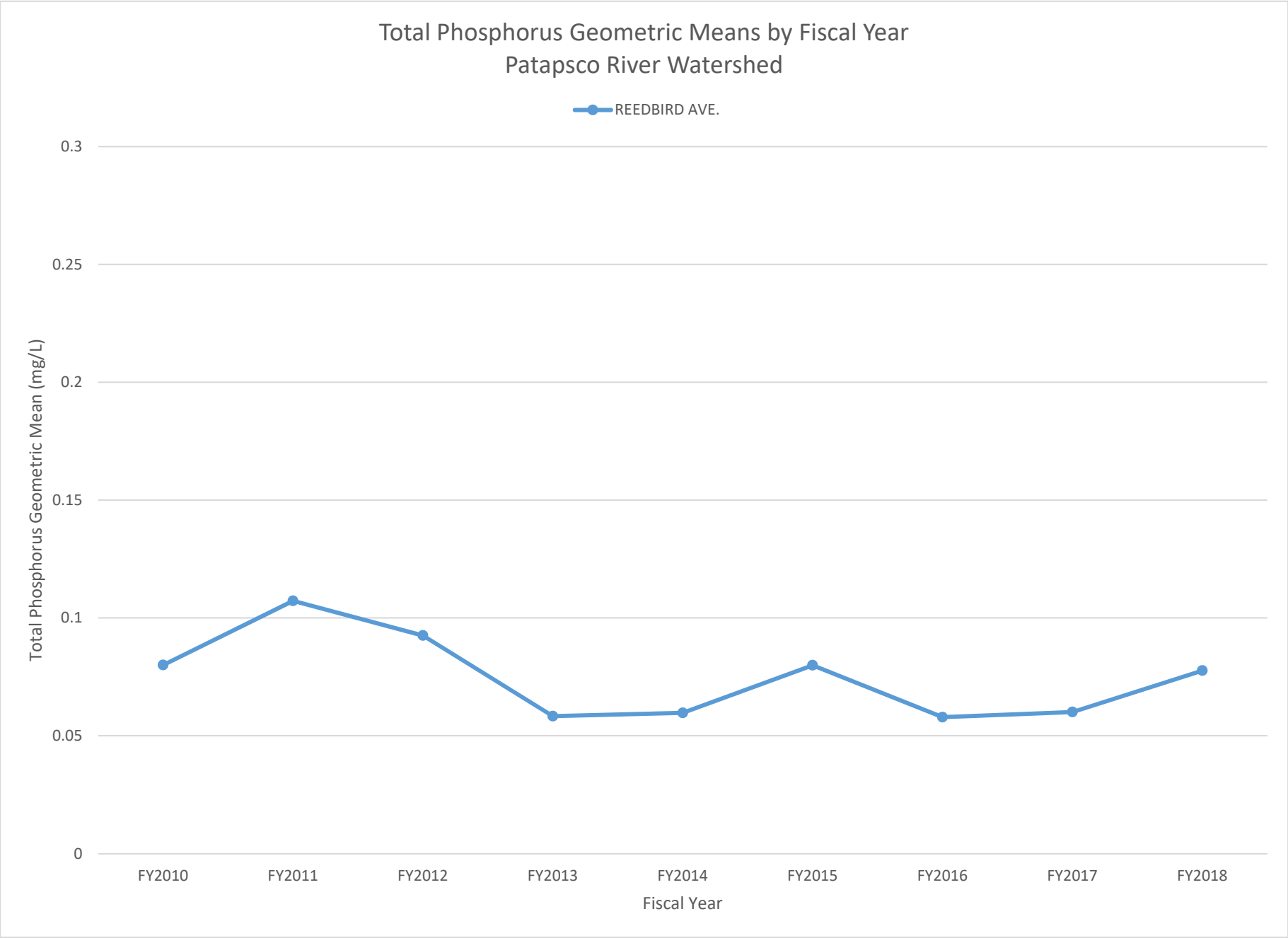

Total Phosphorus Geometric Means by Fiscal Year
Back River Watershed, Herring Run Subwatershed
PERRING PKWY
MT. PLEASANT GC
CHINQUAPIN RUN
TIFFANY RUN
HARFORD RD.
WRIGHT AVE.
PULASKI HWY.
Total Phosphorus Geometric Mean (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
FY2010
FY2011
FY2012
FY2013
FY2014
FY2015
FY2016
FY2017
FY2018
Fiscal Year

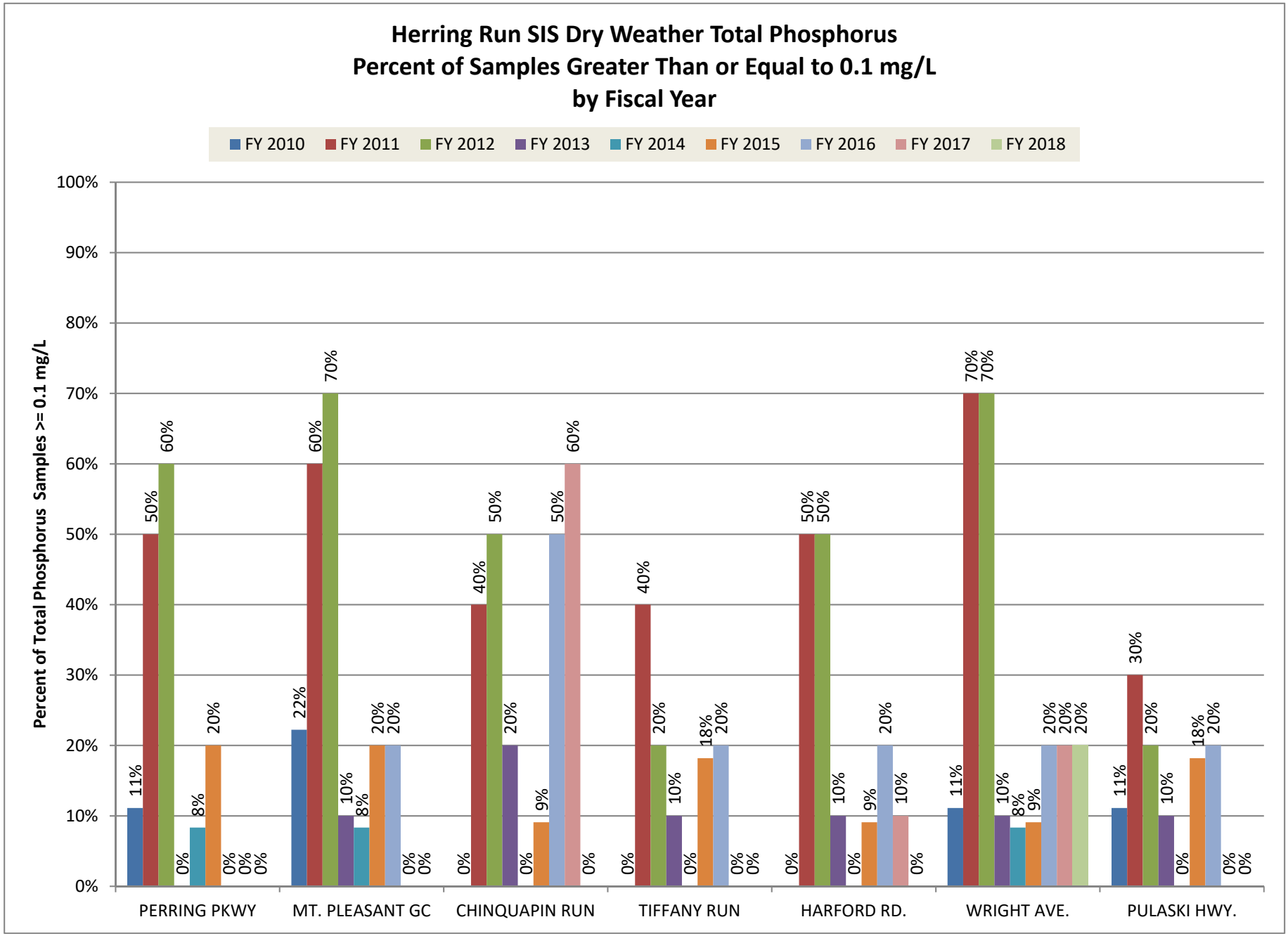

Total Phosphorus Geometric Means by Fiscal Year
Back River Watershed, Moores Run Subwatershed
MARY AVE.
HAMILTON AVE.
RADECKE AVE.
BIDDLE ST. & 62ND ST.
Total Phosphorus Geometric Mean (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
FY2010
FY2011
FY2012
FY2013
FY2014
FY2015
FY2016
FY2017
FY2018
Fiscal Year

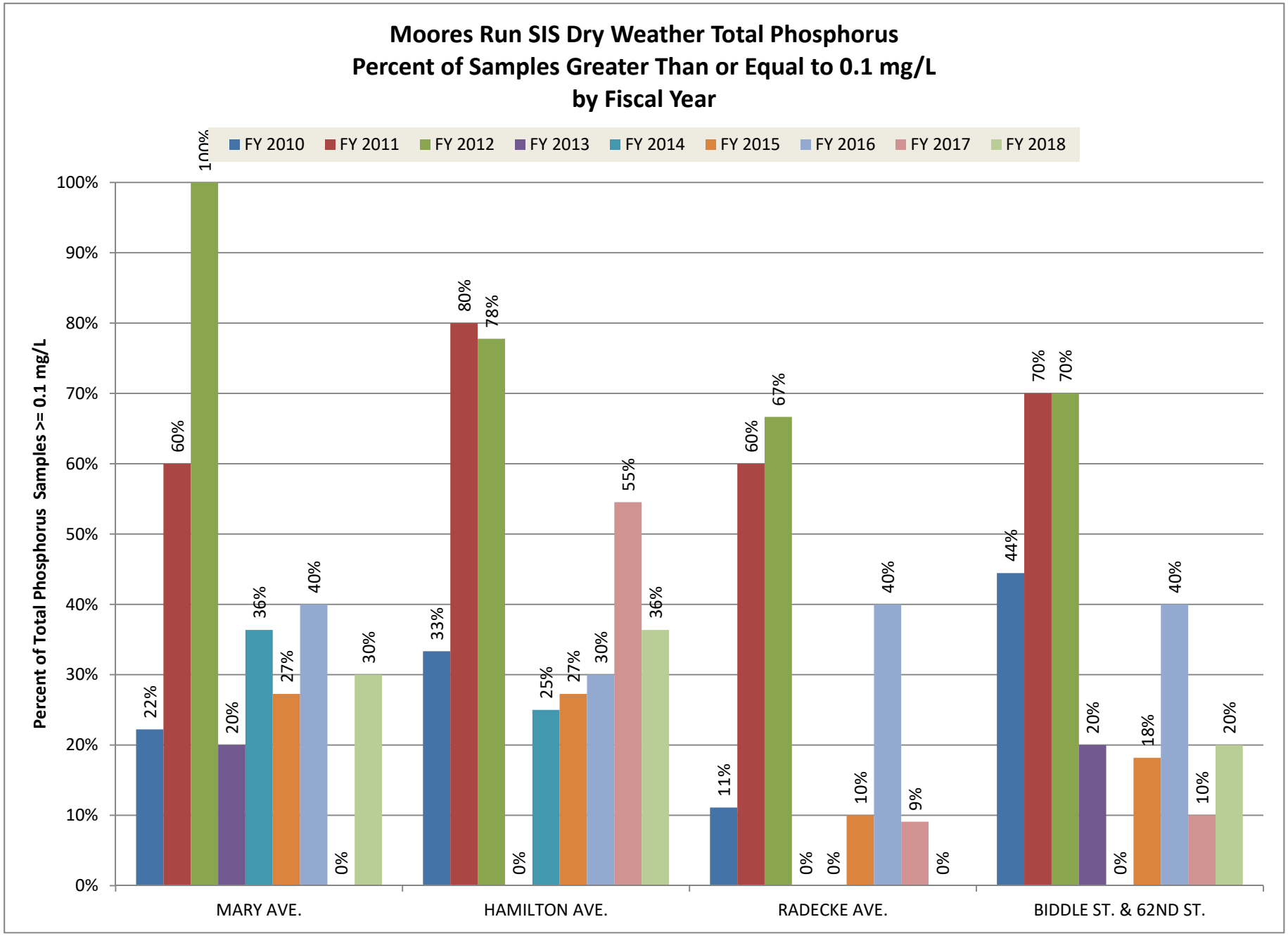

Total Phosphorus Geometric Means by Fiscal Year
Jones Falls Watershed
SMITH AVE.
WESTERN RUN
STONY RUN
JF 11.5
LOMBARD ST.
Total Phosphorus Geometric Mean (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
FY2010
FY2011
FY2012
FY2013
FY2014
FY2015
FY2016
FY2017
FY2018
Fiscal Year

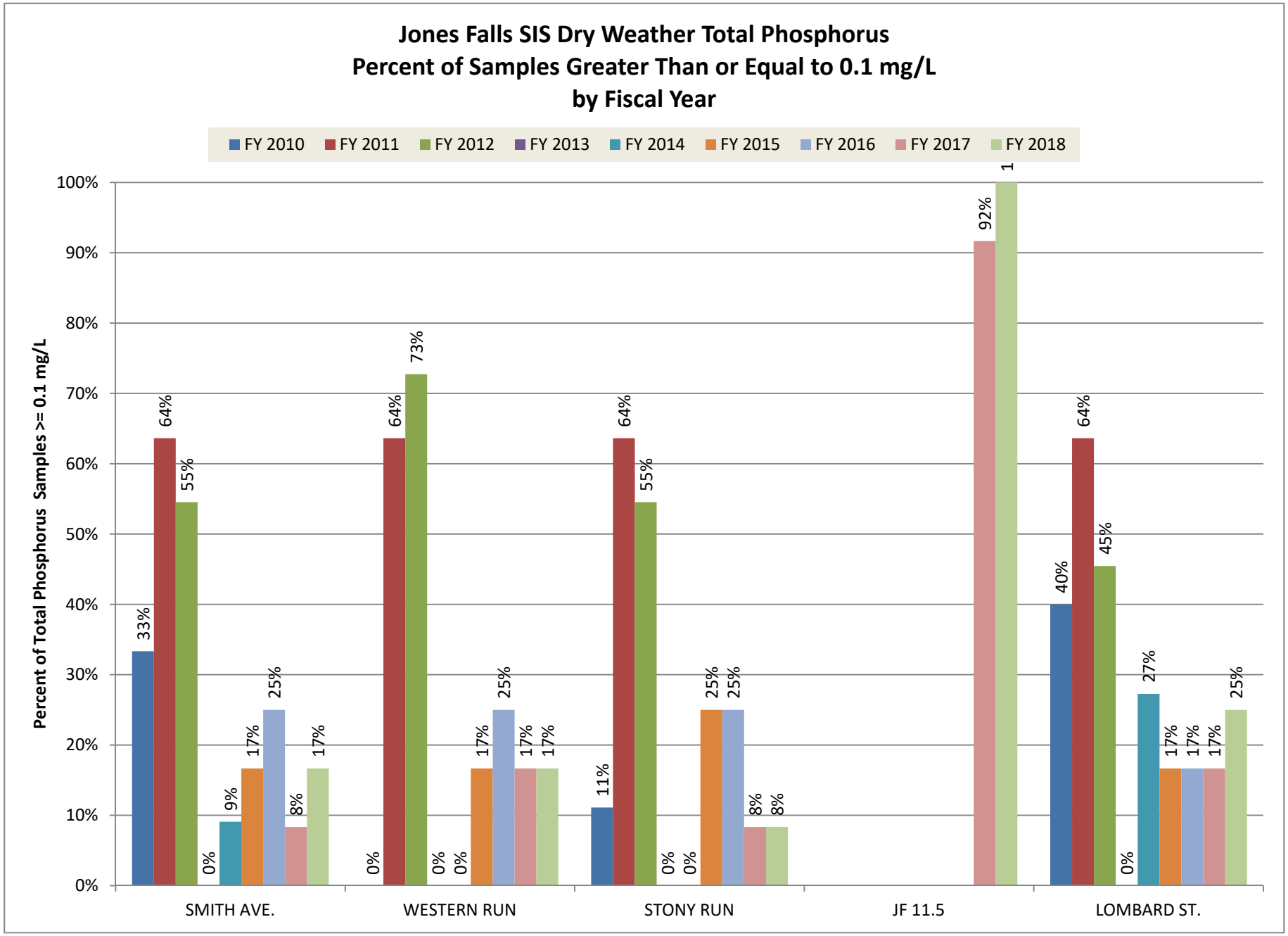

Total Phosphorus Geometric Means by Fiscal Year
Gwynns Falls Watershed
POWDER MILL
PURNELL DR.
DEAD RUN DNST.
GWYNNS FALLS PKWY.
GRUN HILTON ST.
GF HILTON ST.
MAIDENS CHOICE
GRUN CARROLL PARK
WASHINGTON BLVD.
Total Phosphorus Geometric Mean (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
FY2010
FY2011
FY2012
FY2013
FY2014
FY2015
FY2016
FY2017
FY2018
Fiscal Year

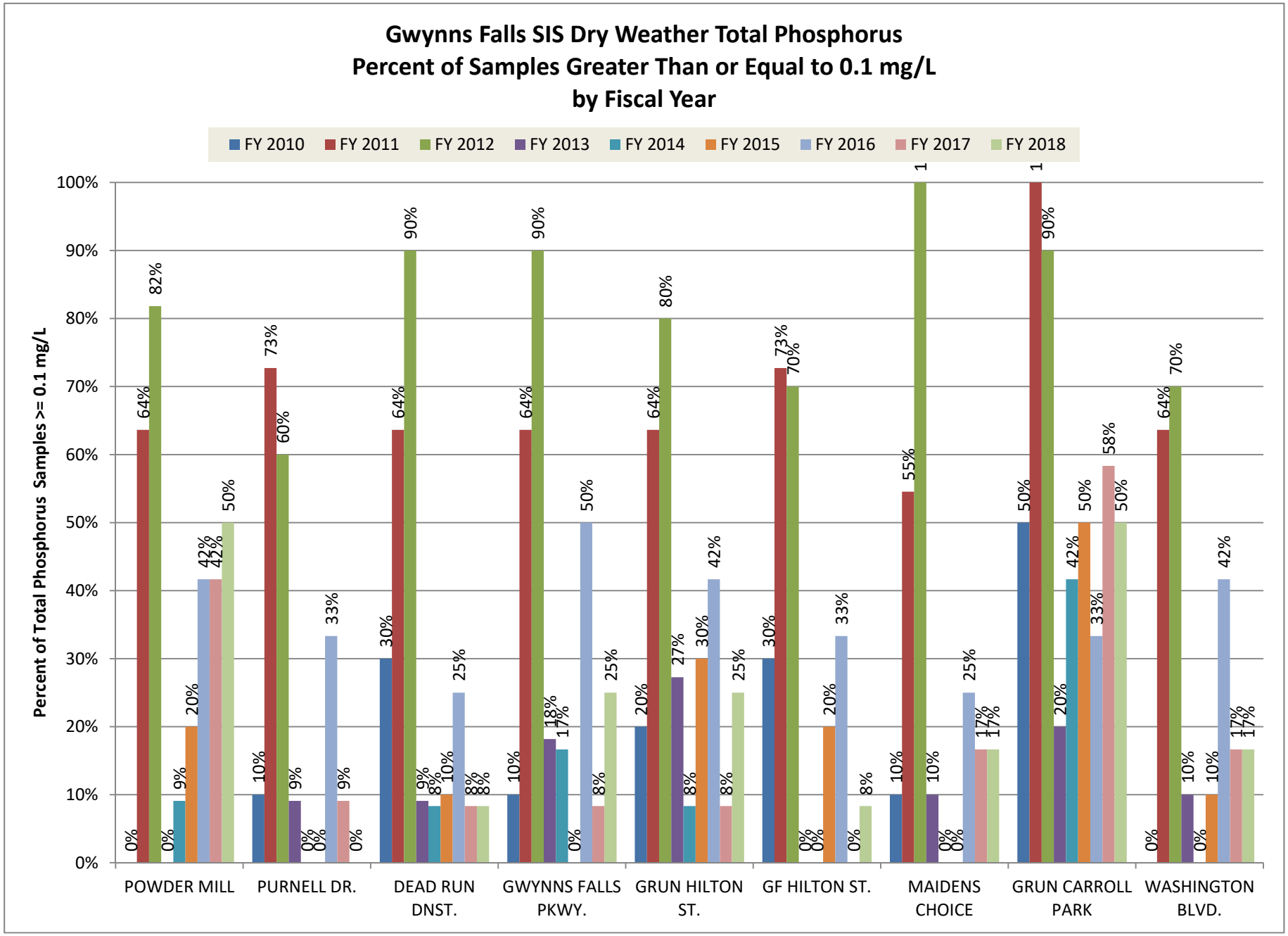

Total Phosphorus Geometric Means by Fiscal Year
Direct Harbor Watershed
LINWOOD & ELLIOTT
LAKEWOOD & HUDSON
CENTRAL & LANCASTER
LIGHT ST.
WARNER & ALLUVION
WATERVIEW AVE.
JANEY RUN
Total Phosphorus Geometric Mean (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
FY2010
FY2011
FY2012
FY2013
FY2014
FY2015
FY2016
FY2017
FY2018
Fiscal Year

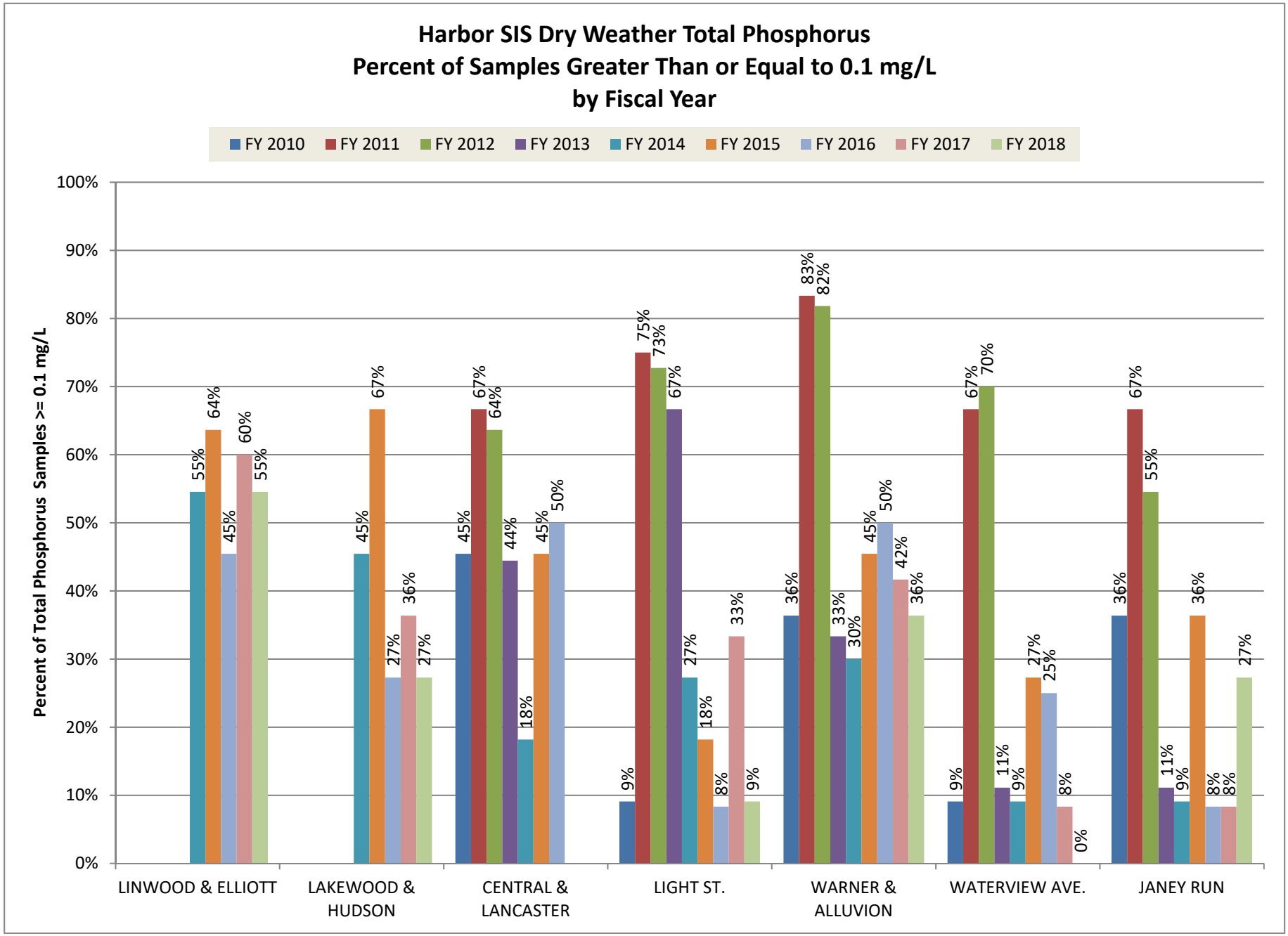

Total Phosphorus Geometric Means by Fiscal Year
Patapsco River Watershed
REEDBIRD AVE.
Total Phosphorus Geometric Mean (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
FY2010
FY2011
FY2012
FY2013
FY2014
FY2015
FY2016
FY2017
FY2018
Fiscal Year

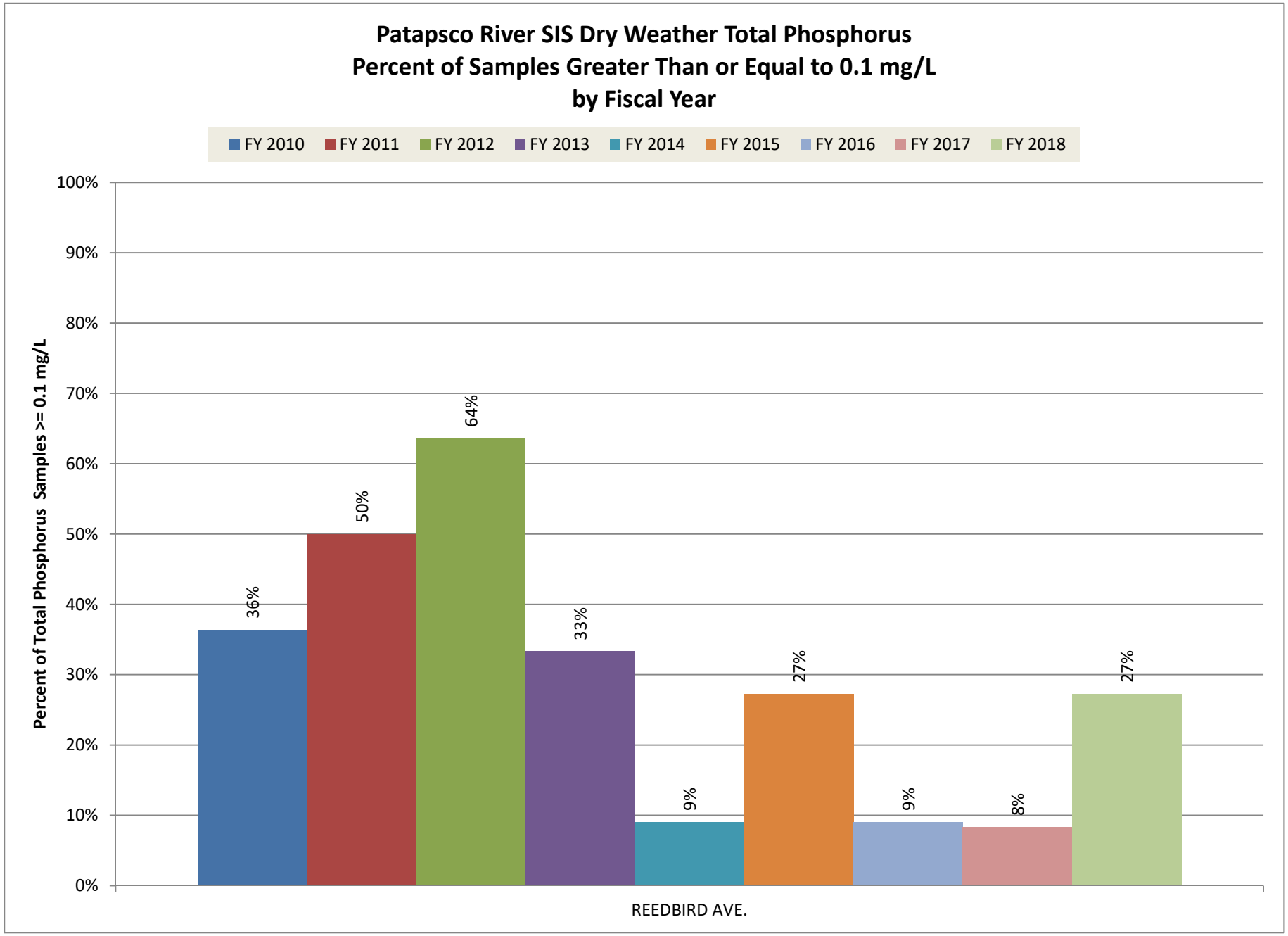

Herring Run SIS Dry Weather Total Phosphorus
Percent of Samples Greater Than or Equal to 0.1 mg/L
by Fiscal Year
FY 2010
FY 2011
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
Percent of Total Phosphorus Samples >= 0.1 mg/L
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
PERRING PKWY
MT. PLEASANT GC
CHINQUAPIN RUN
TIFFANY RUN
HARFORD RD.
WRIGHT AVE.
PULASKI HWY.


Moores Run SIS Dry Weather Total Phosphorus
Percent of Samples Greater Than or Equal to 0.1 mg/L
by Fiscal Year
FY 2010
FY 2011
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
Percent of Total Phosphorus Samples >= 0.1 mg/L
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
22%
60%
100%
20%
36%
27%
40%
0%
30%
33%
80%
78%
0%
25%
27%
30%
55%
36%
11%
60%
67%
0%
0%
10%
40%
9%
0%
44%
70%
70%
20%
0%
18%
40%
10%
20%
MARY AVE.
HAMILTON AVE.
RADECKE AVE.
BIDDLE ST. & 62ND ST.

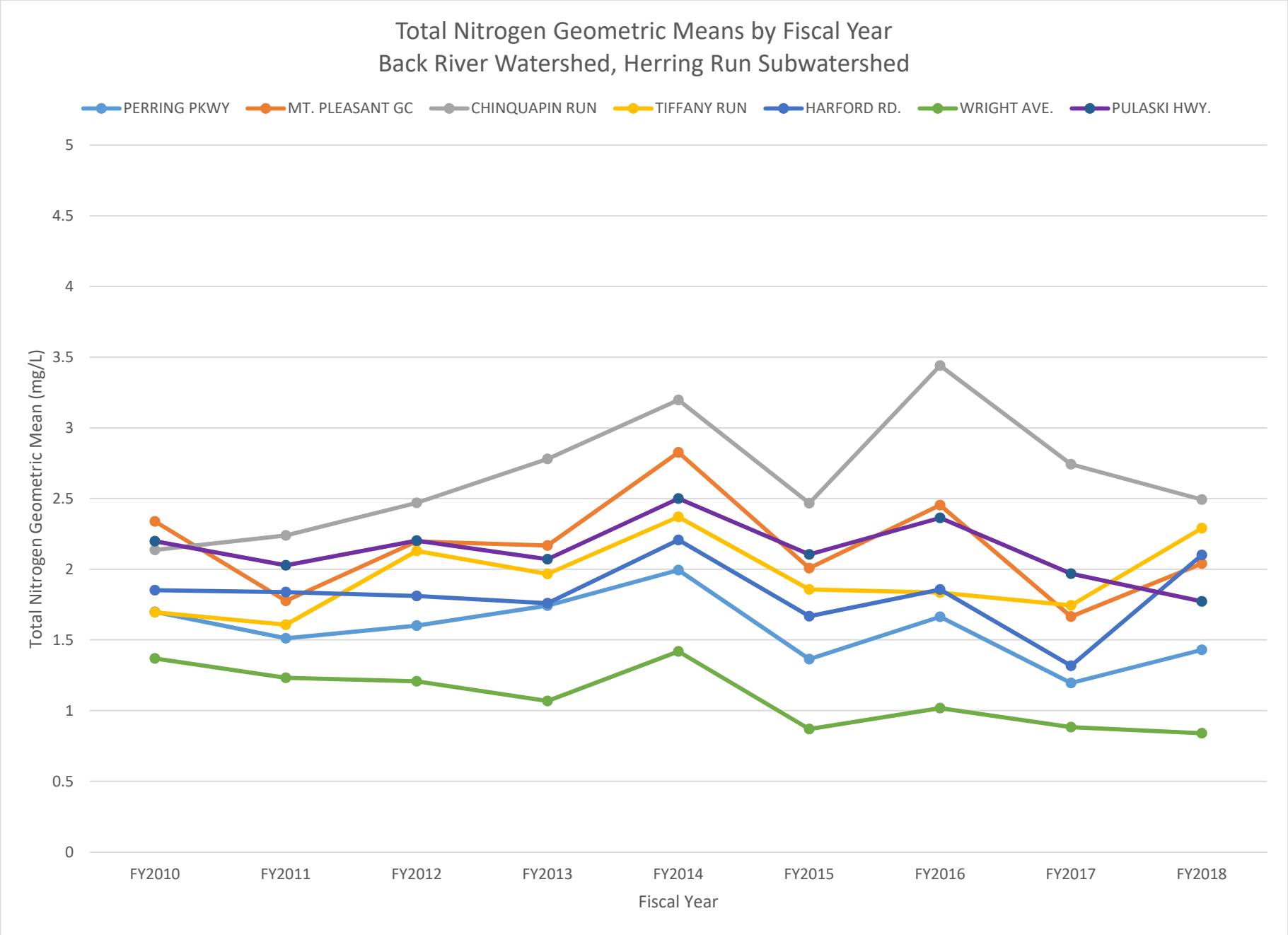

Jones Falls SIS Dry Weather Total Phosphorus
Percent of Samples Greater Than or Equal to 0.1 mg/L
by Fiscal Year
FY 2010
FY 2011
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
Percent of Total Phosphorus Samples >= 0.1 mg/L
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
33%
64%
55%
0%
9%
17%
25%
8%
17%
0%
64%
73%
0%
0%
17%
25%
17%
17%
11%
64%
55%
0%
0%
25%
25%
8%
8%
92%
1
40%
64%
45%
0%
27%
17%
17%
17%
25%
SMITH AVE.
WESTERN RUN
STONY RUN
JF 11.5
LOMBARD ST.

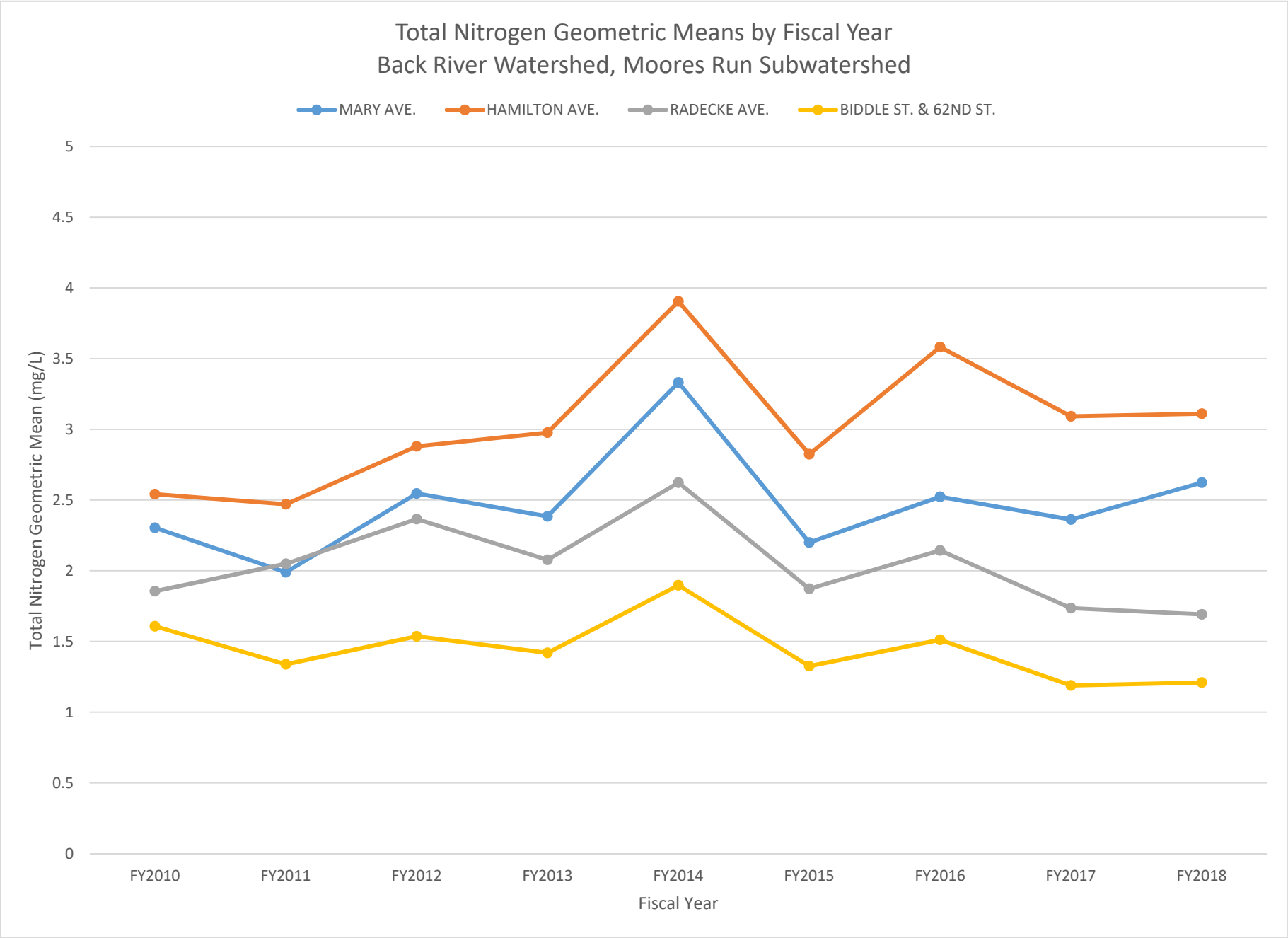

Gwynns Falls SIS Dry Weather Total Phosphorus
Percent of Samples Greater Than or Equal to 0.1 mg/L
by Fiscal Year
FY 2010
FY 2011
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
Percent of Total Phosphorus Samples >= 0.1 mg/L
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
POWDER MILL
PURNELL DR.
DEAD RUN DNST.
GWYNNS FALLS PKWY.
GRUN HILTON ST.
GF HILTON ST.
MAIDENS CHOICE
GRUN CARROLL PARK
WASHINGTON BLVD.

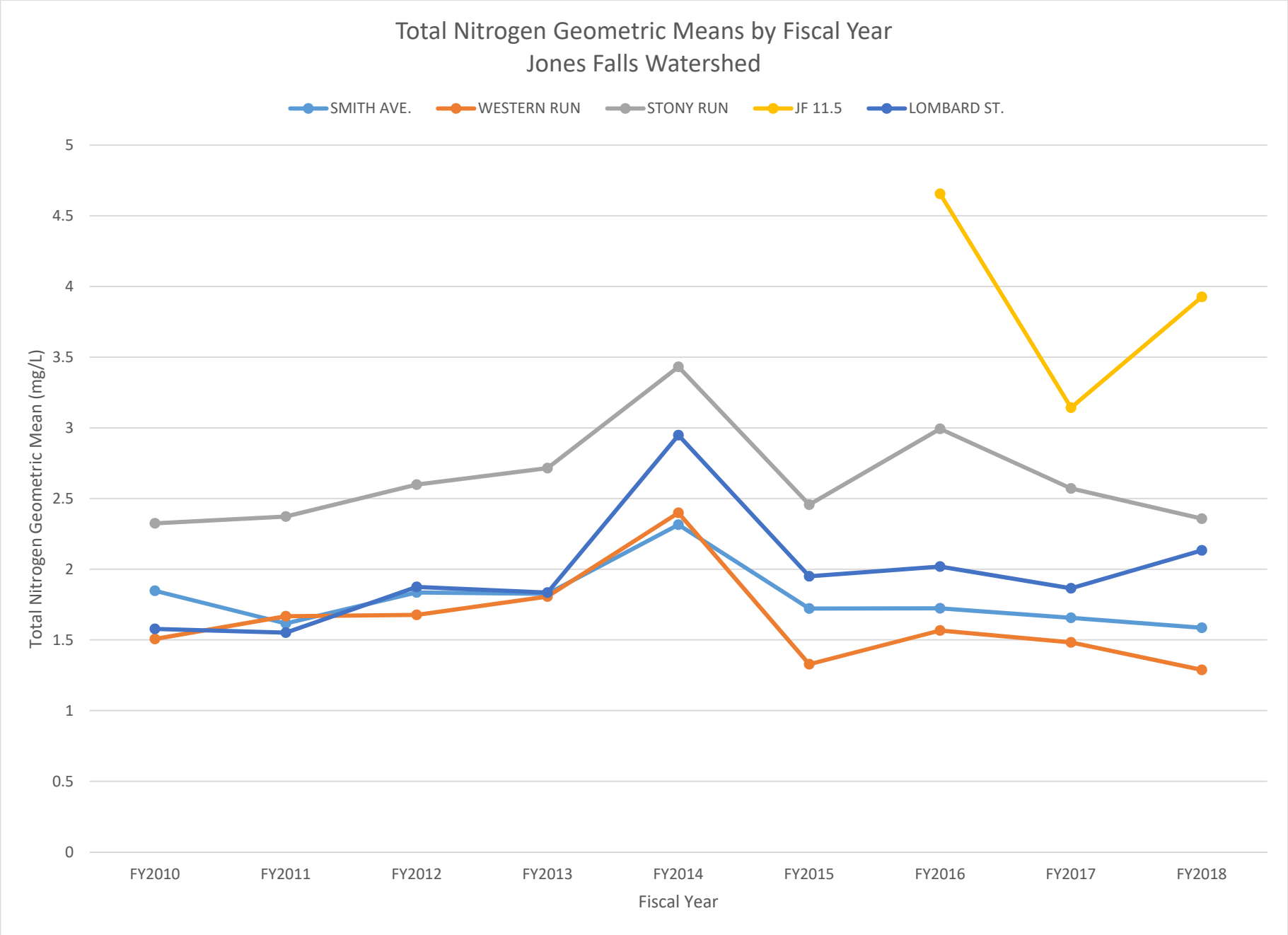

Harbor SIS Dry Weather Total Phosphorus
Percent of Samples Greater Than or Equal to 0.1 mg/L
by Fiscal Year
FY 2010
FY 2011
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
Percent of Total Phosphorus Samples >= 0.1 mg/L
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
LINWOOD & ELLIOTT
LAKEWOOD & HUDSON
CENTRAL & LANCASTER
LIGHT ST.
WARNER & ALLUVION
WATERVIEW AVE.
JANEY RUN
55% 64% 45% 60% 55%
45% 67% 27% 36% 27%
45% 67% 64% 44% 18% 45% 50%
9% 75% 73% 67% 27% 18% 8% 33% 9%
36% 83% 82% 33% 30% 45% 50% 42% 36%
9% 67% 70% 11% 9% 27% 25% 8% 0%
36% 67% 55% 11% 9% 36% 8% 8% 27%

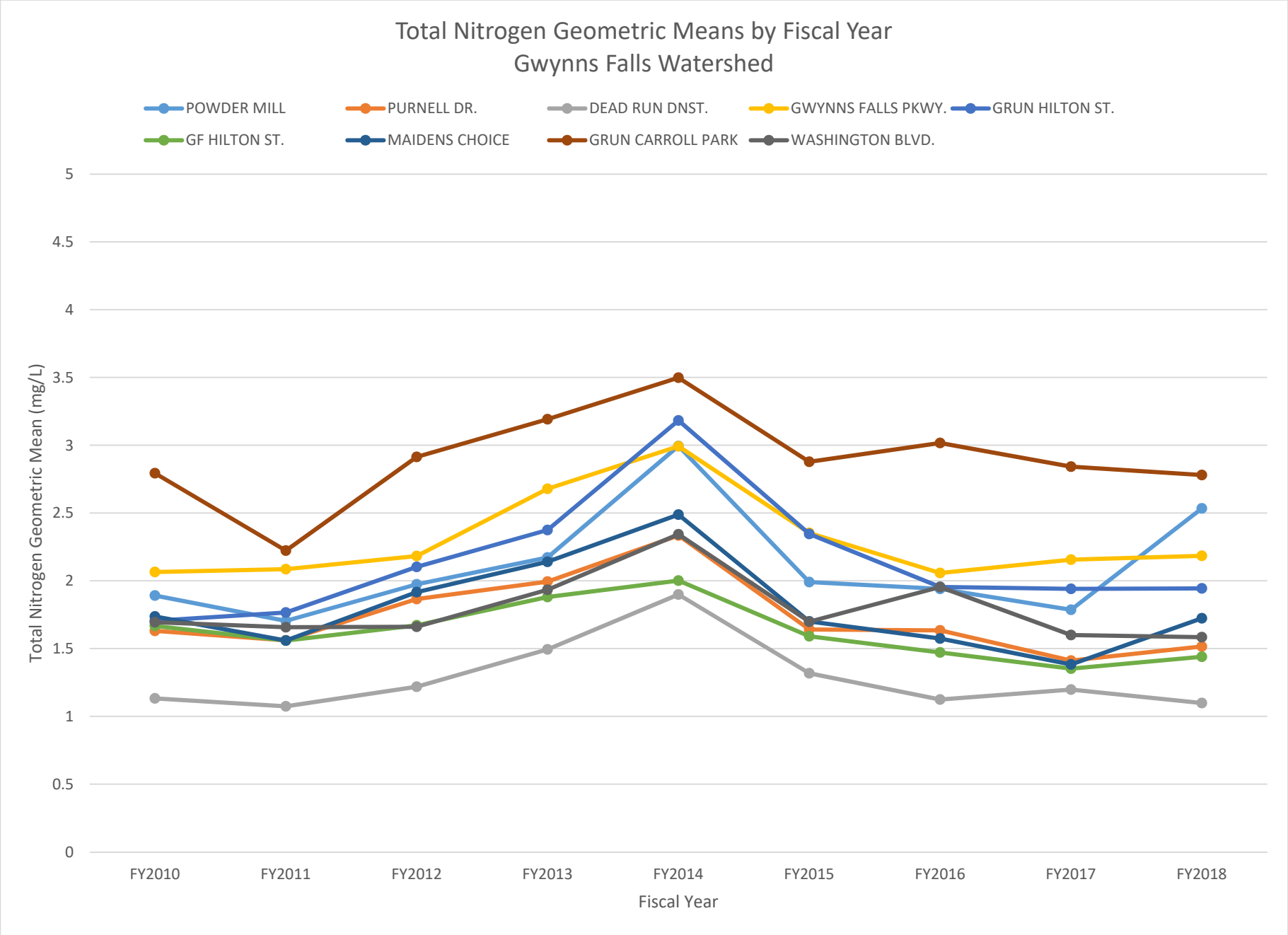

Patapsco River SIS Dry Weather Total Phosphorus
Percent of Samples Greater Than or Equal to 0.1 mg/L
by Fiscal Year
FY 2010
FY 2011
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
Percent of Total Phosphorus Samples >= 0.1 mg/L
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
36%
50%
64%
33%
9%
27%
9%
8%
27%
REEDBIRD AVE.

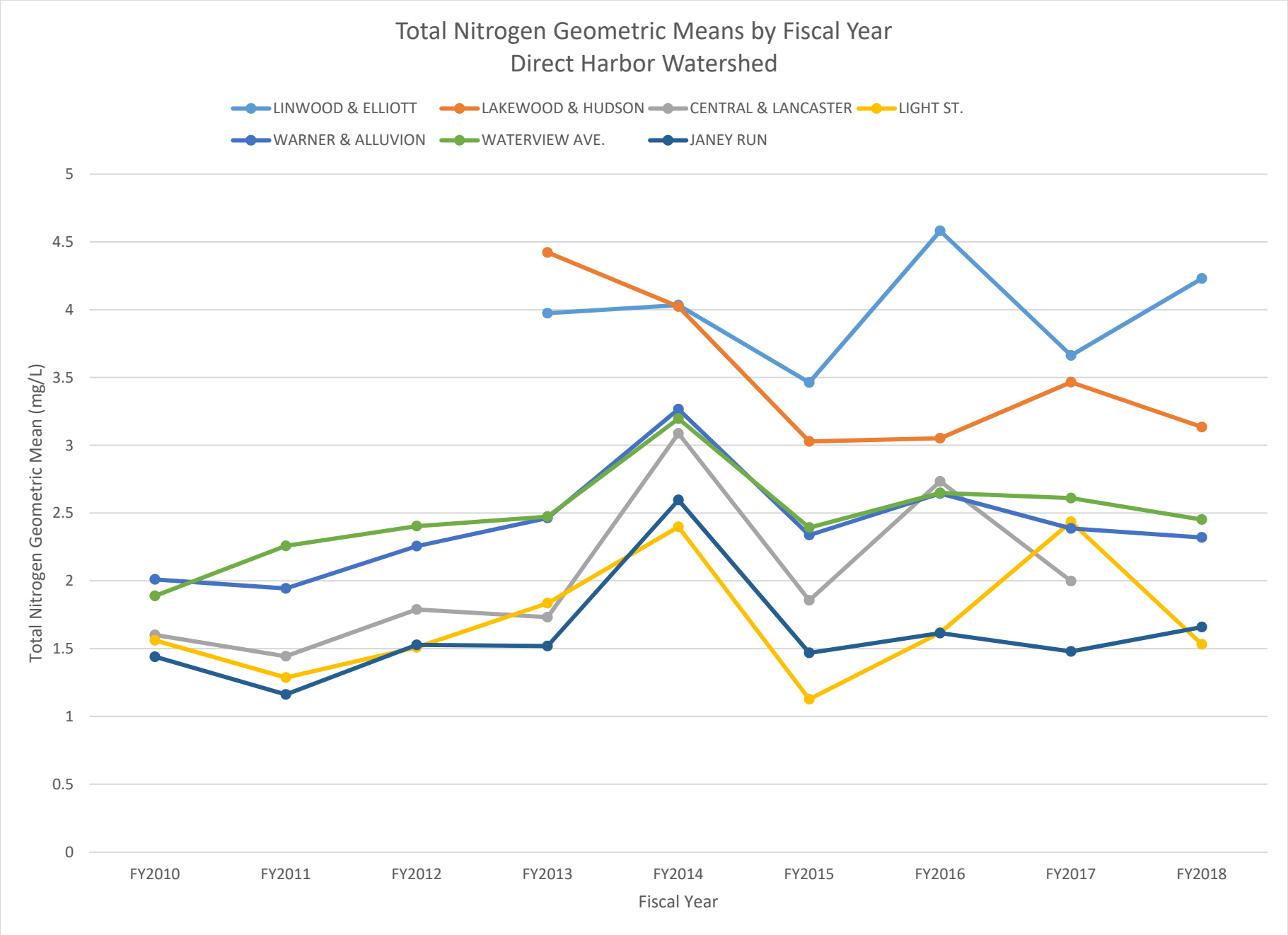
Appendix F: Total Nitrogen Monitoring Histographs

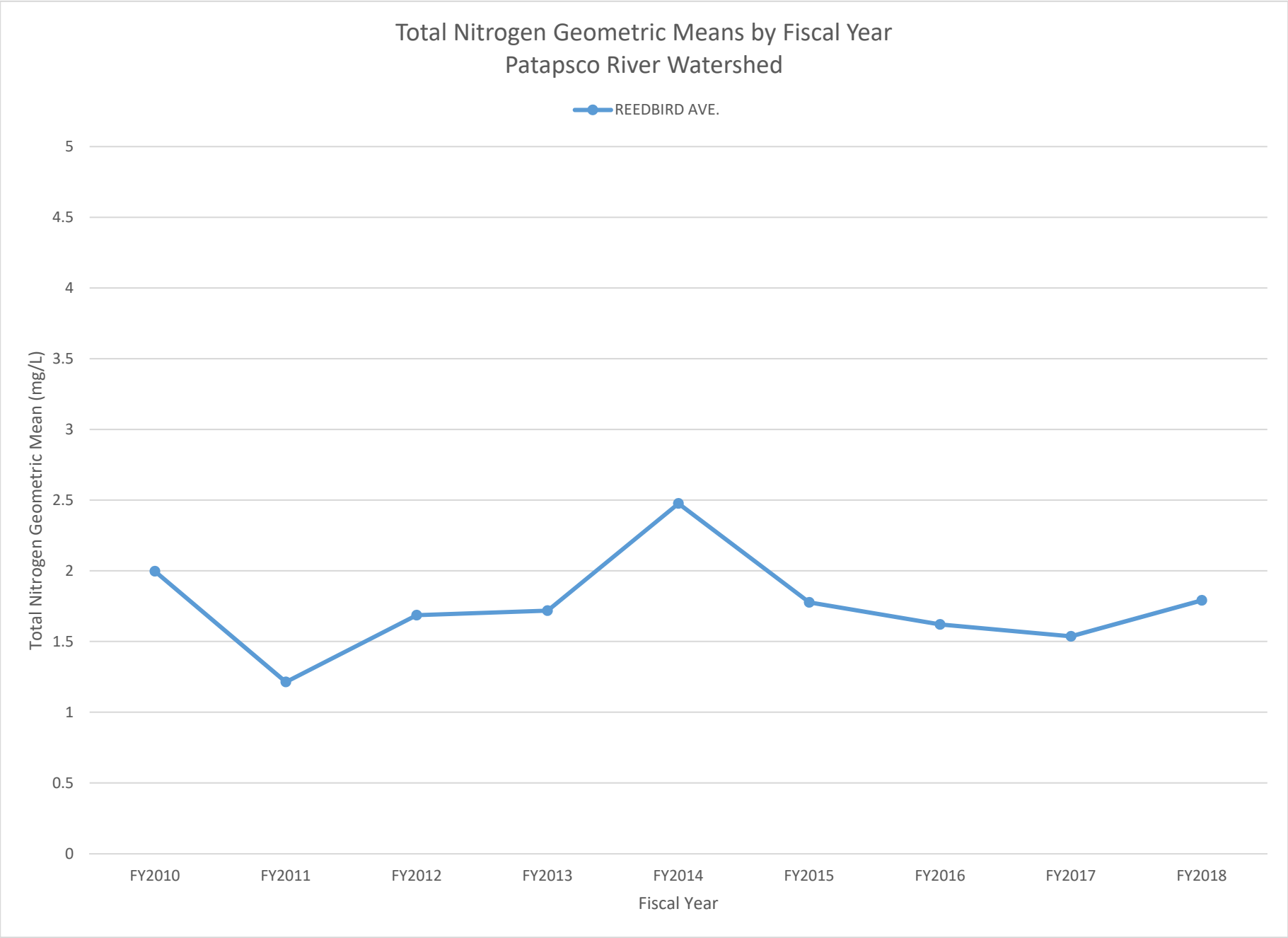

Total Nitrogen Geometric Means by Fiscal Year
Back River Watershed, Herring Run Subwatershed
PERRING PKWY
MT. PLEASANT GC
CHINQUAPIN RUN
TIFFANY RUN
HARFORD RD.
WRIGHT AVE.
PULASKI HWY.
Total Nitrogen Geometric Mean (mg/L)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
FY2010
FY2011
FY2012
FY2013
FY2014
FY2015
FY2016
FY2017
FY2018
Fiscal Year

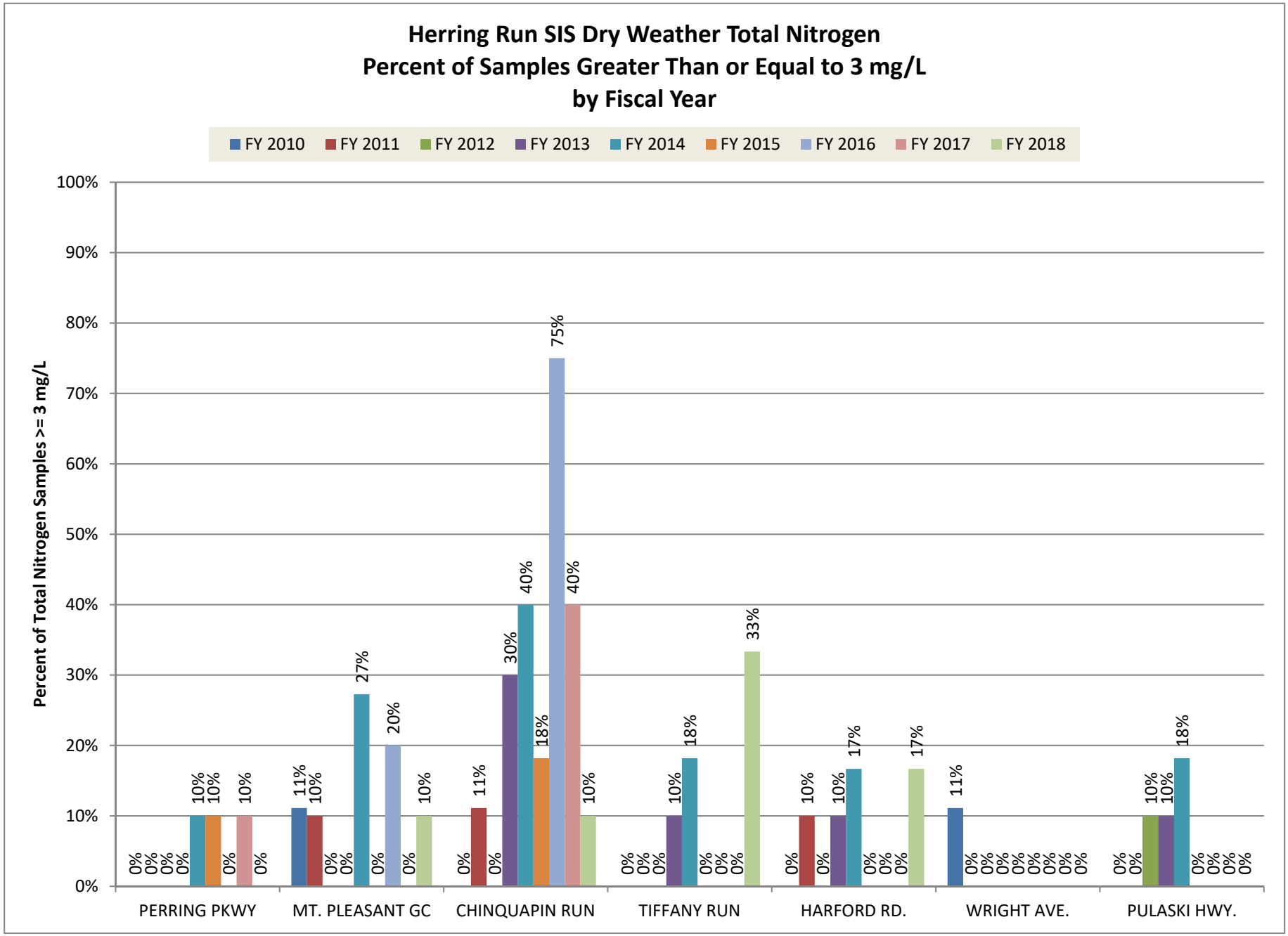

Total Nitrogen Geometric Means by Fiscal Year
Back River Watershed, Moores Run Subwatershed
MARY AVE.
HAMILTON AVE.
RADECKE AVE.
BIDDLE ST. & 62ND ST.
Total Nitrogen Geometric Mean (mg/L)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
FY2010
FY2011
FY2012
FY2013
FY2014
FY2015
FY2016
FY2017
FY2018
Fiscal Year

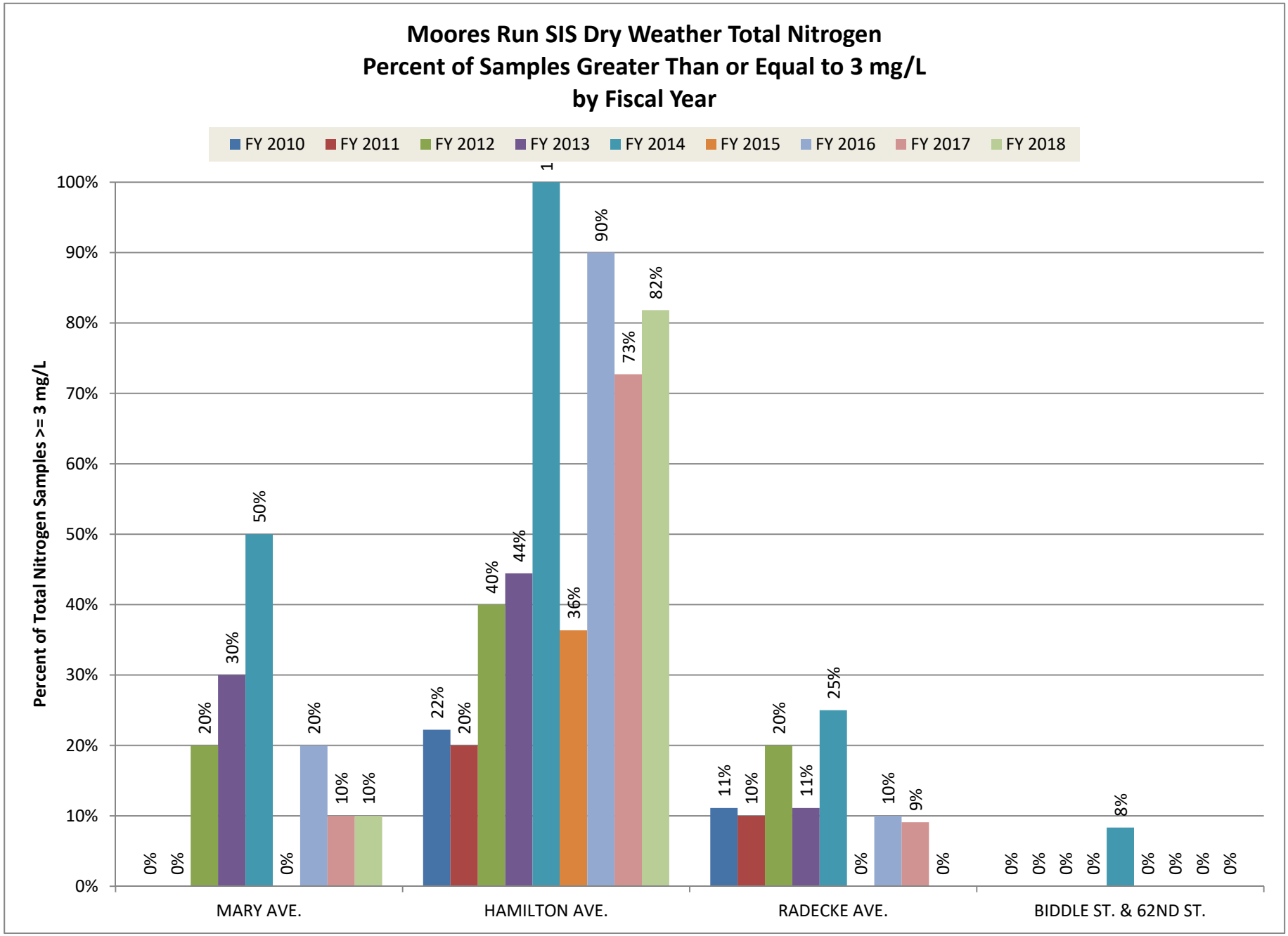

Total Nitrogen Geometric Means by Fiscal Year
Jones Falls Watershed
SMITH AVE.
WESTERN RUN
STONY RUN
JF 11.5
LOMBARD ST.
Total Nitrogen Geometric Mean (mg/L)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
FY2010
FY2011
FY2012
FY2013
FY2014
FY2015
FY2016
FY2017
FY2018
Fiscal Year

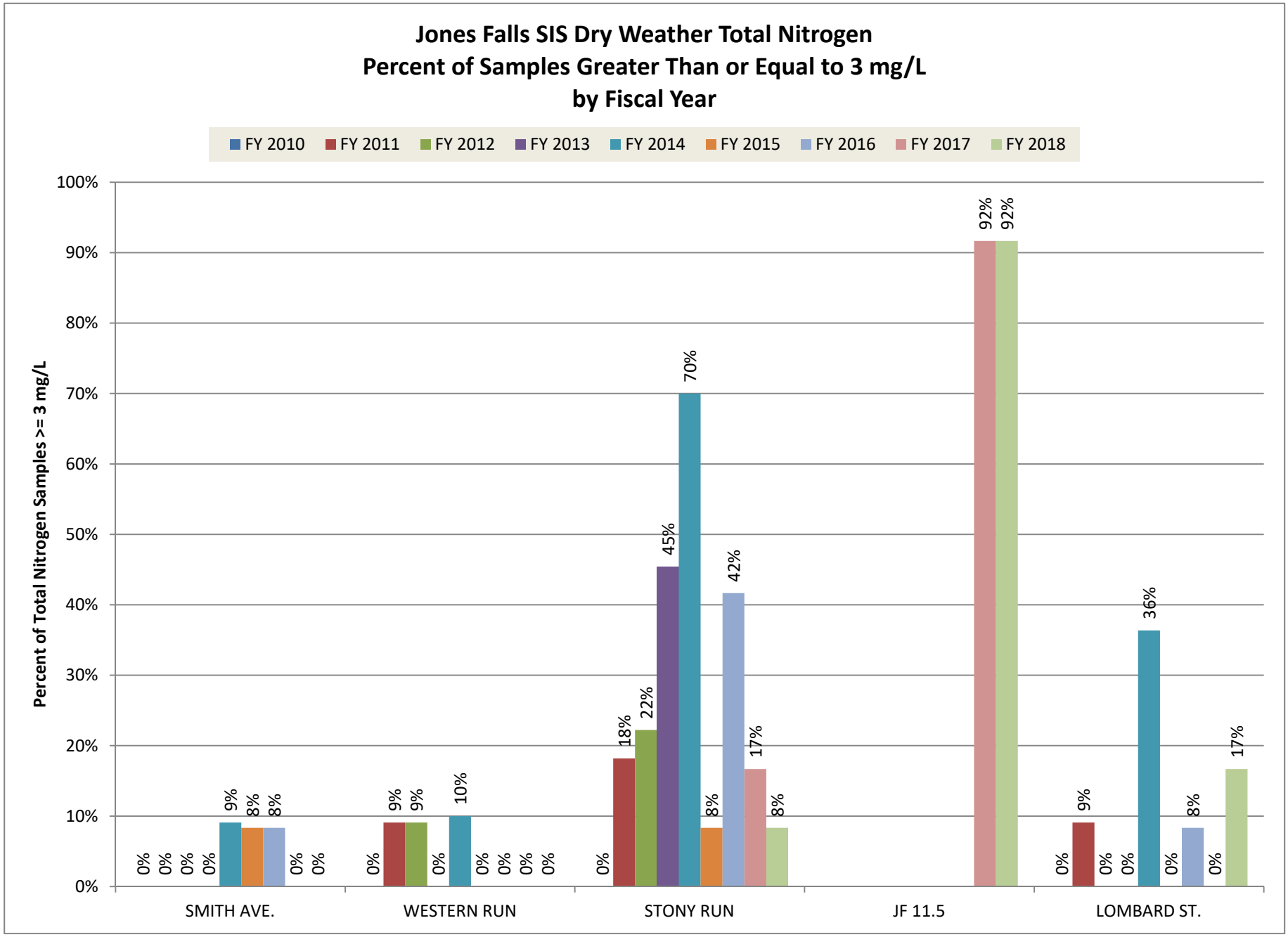

Total Nitrogen Geometric Means by Fiscal Year
Gwynns Falls Watershed
POWDER MILL
PURNELL DR.
DEAD RUN DNST.
GWYNNS FALLS PKWY.
GRUN HILTON ST.
GF HILTON ST.
MAIDENS CHOICE
GRUN CARROLL PARK
WASHINGTON BLVD.
Total Nitrogen Geometric Mean (mg/L)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
FY2010
FY2011
FY2012
FY2013
FY2014
FY2015
FY2016
FY2017
FY2018
Fiscal Year

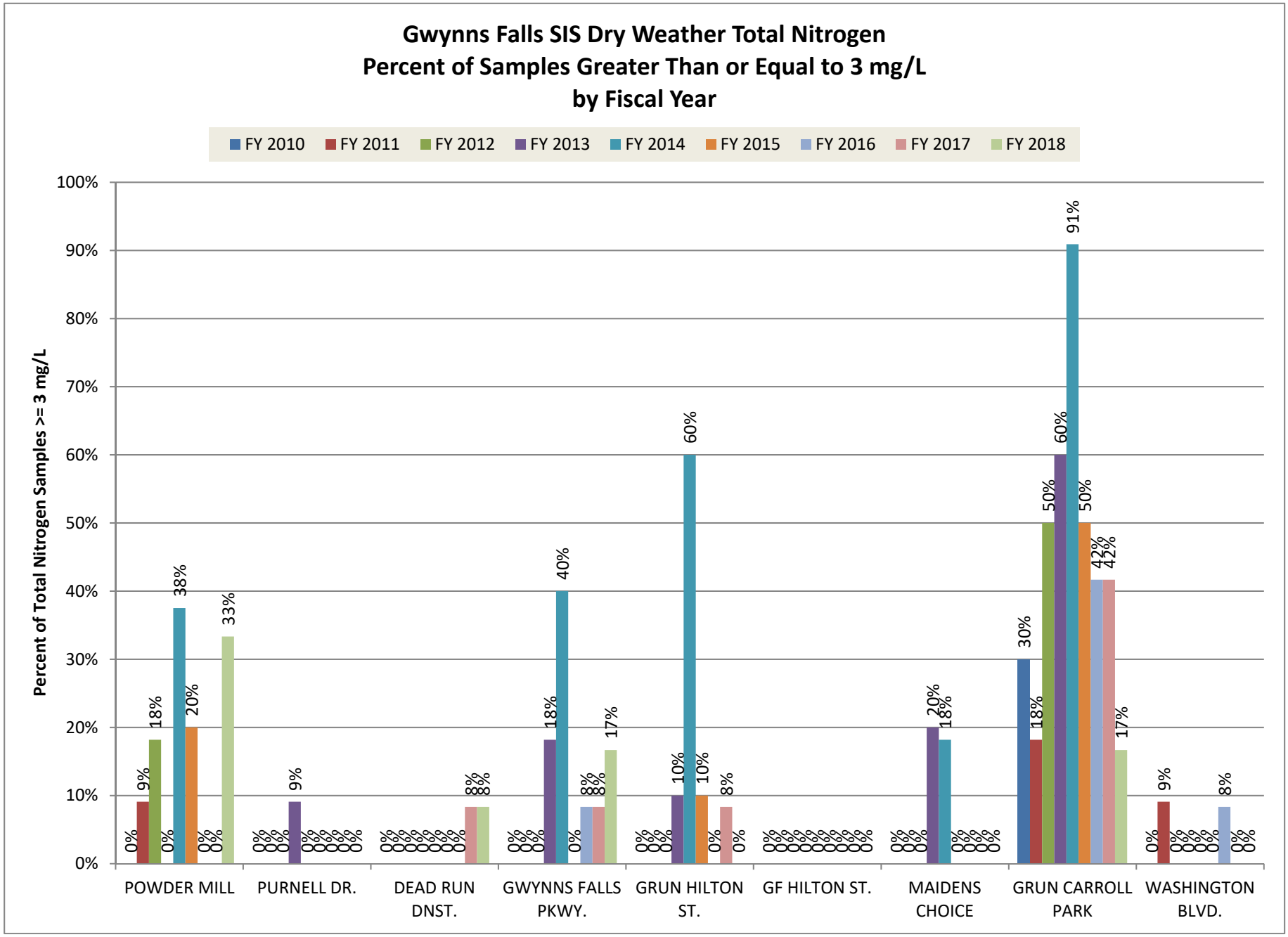

Total Nitrogen Geometric Means by Fiscal Year
Direct Harbor Watershed
LINWOOD & ELLIOTT
LAKEWOOD & HUDSON
CENTRAL & LANCASTER
LIGHT ST.
WARNER & ALLUVION
WATERVIEW AVE.
JANEY RUN
Total Nitrogen Geometric Mean (mg/L)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
FY2010
FY2011
FY2012
FY2013
FY2014
FY2015
FY2016
FY2017
FY2018
Fiscal Year

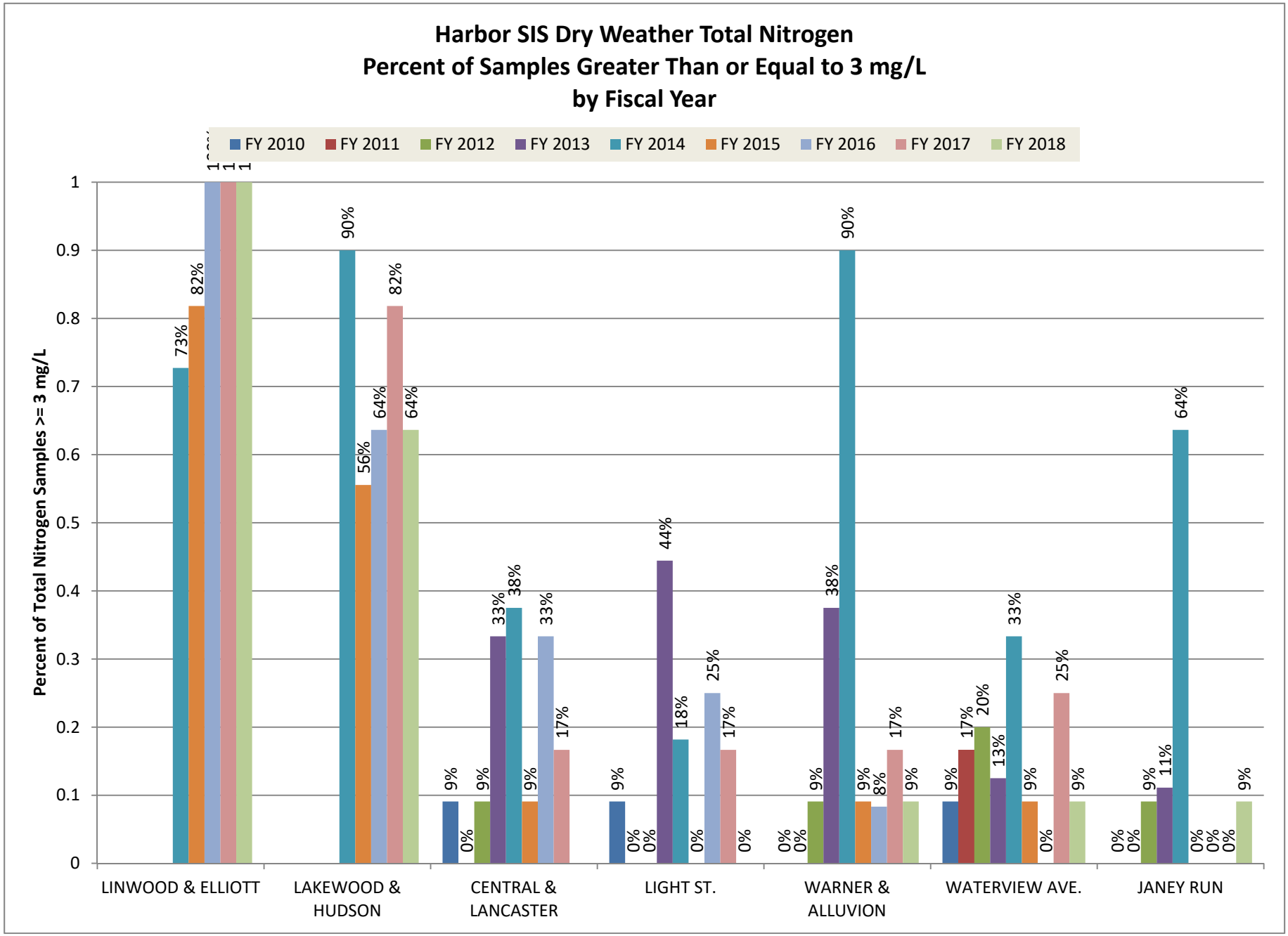

Total Nitrogen Geometric Means by Fiscal Year
Patapsco River Watershed
REEDBIRD AVE.
Total Nitrogen Geometric Mean (mg/L)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
FY2010
FY2011
FY2012
FY2013
FY2014
FY2015
FY2016
FY2017
FY2018
Fiscal Year

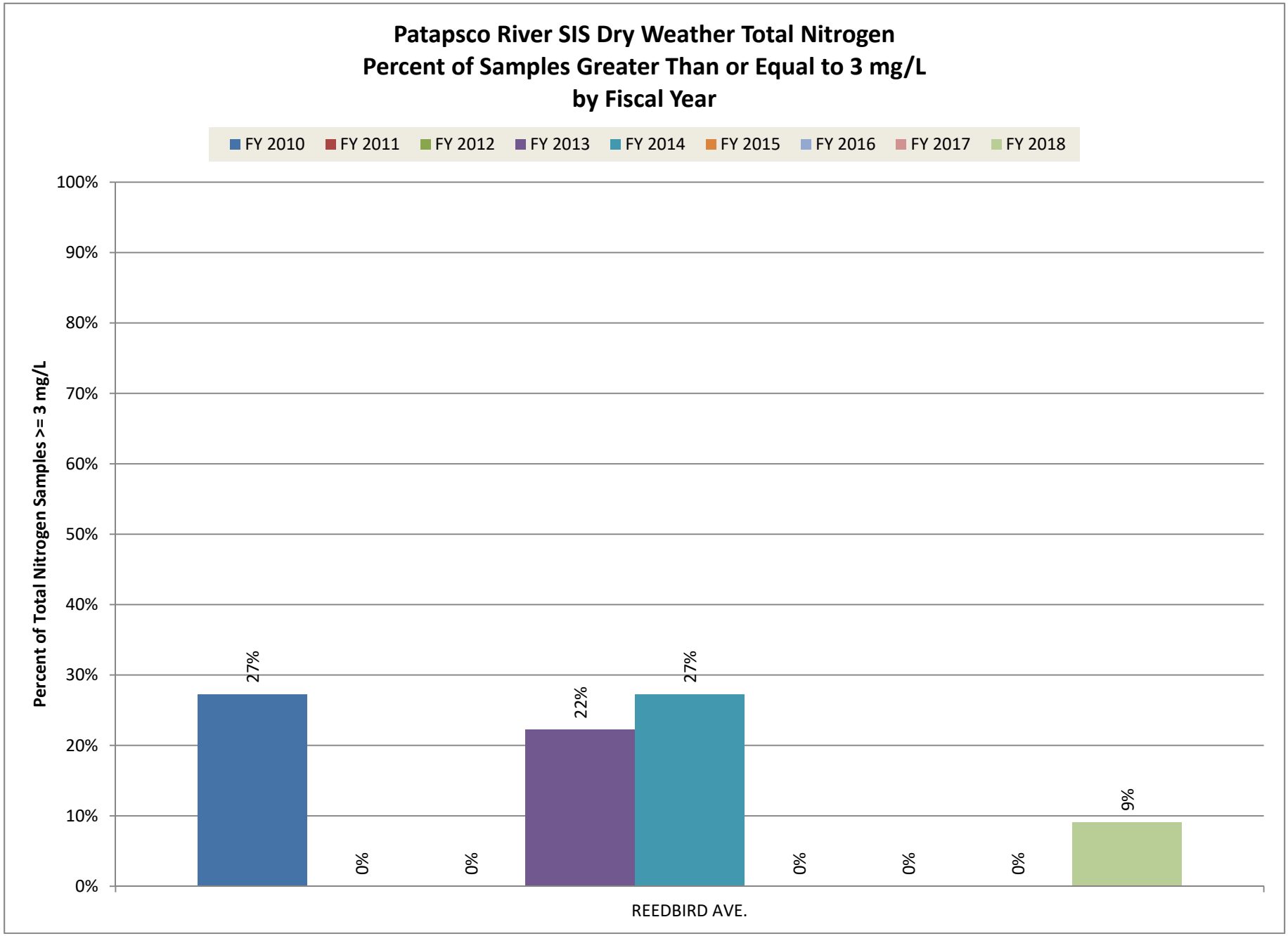

Herring Run SIS Dry Weather Total Nitrogen
Percent of Samples Greater Than or Equal to 3 mg/L
by Fiscal Year
FY 2010
FY 2011
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
Percent of Total Nitrogen Samples >= 3 mg/L
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
PERRING PKWY
MT. PLEASANT GC
CHINQUAPIN RUN
TIFFANY RUN
HARFORD RD.
WRIGHT AVE.
PULASKI HWY.


Moores Run SIS Dry Weather Total Nitrogen
Percent of Samples Greater Than or Equal to 3 mg/L
by Fiscal Year
FY 2010
FY 2011
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
Percent of Total Nitrogen Samples >= 3 mg/L
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0%
0%
20%
30%
50%
0%
20%
10%
10%
22%
20%
40%
44%
1
36%
90%
73%
82%
11%
10%
20%
11%
25%
0%
10%
9%
0%
0%
0%
0%
0%
8%
0%
0%
0%
0%
MARY AVE.
HAMILTON AVE.
RADECKE AVE.
BIDDLE ST. & 62ND ST.


Jones Falls SIS Dry Weather Total Nitrogen
Percent of Samples Greater Than or Equal to 3 mg/L
by Fiscal Year
FY 2010
FY 2011
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
Percent of Total Nitrogen Samples >= 3 mg/L
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
SMITH AVE.
WESTERN RUN
STONY RUN
JF 11.5
LOMBARD ST.
0%
0%
0%
0%
9%
8%
8%
0%
0%
0%
9%
9%
0%
10%
0%
0%
0%
0%
0%
18%
22%
45%
70%
8%
42%
17%
8%
92%
92%
0%
9%
0%
0%
36%
0%
8%
0%
17%


Gwynns Falls SIS Dry Weather Total Nitrogen
Percent of Samples Greater Than or Equal to 3 mg/L
by Fiscal Year
FY 2010
FY 2011
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
Percent of Total Nitrogen Samples >= 3 mg/L
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
POWDER MILL
PURNELL DR.
DEAD RUN DNST.
GWYNNS FALLS PKWY.
GRUN HILTON ST.
GF HILTON ST.
MAIDENS CHOICE
GRUN CARROLL PARK
WASHINGTON BLVD.

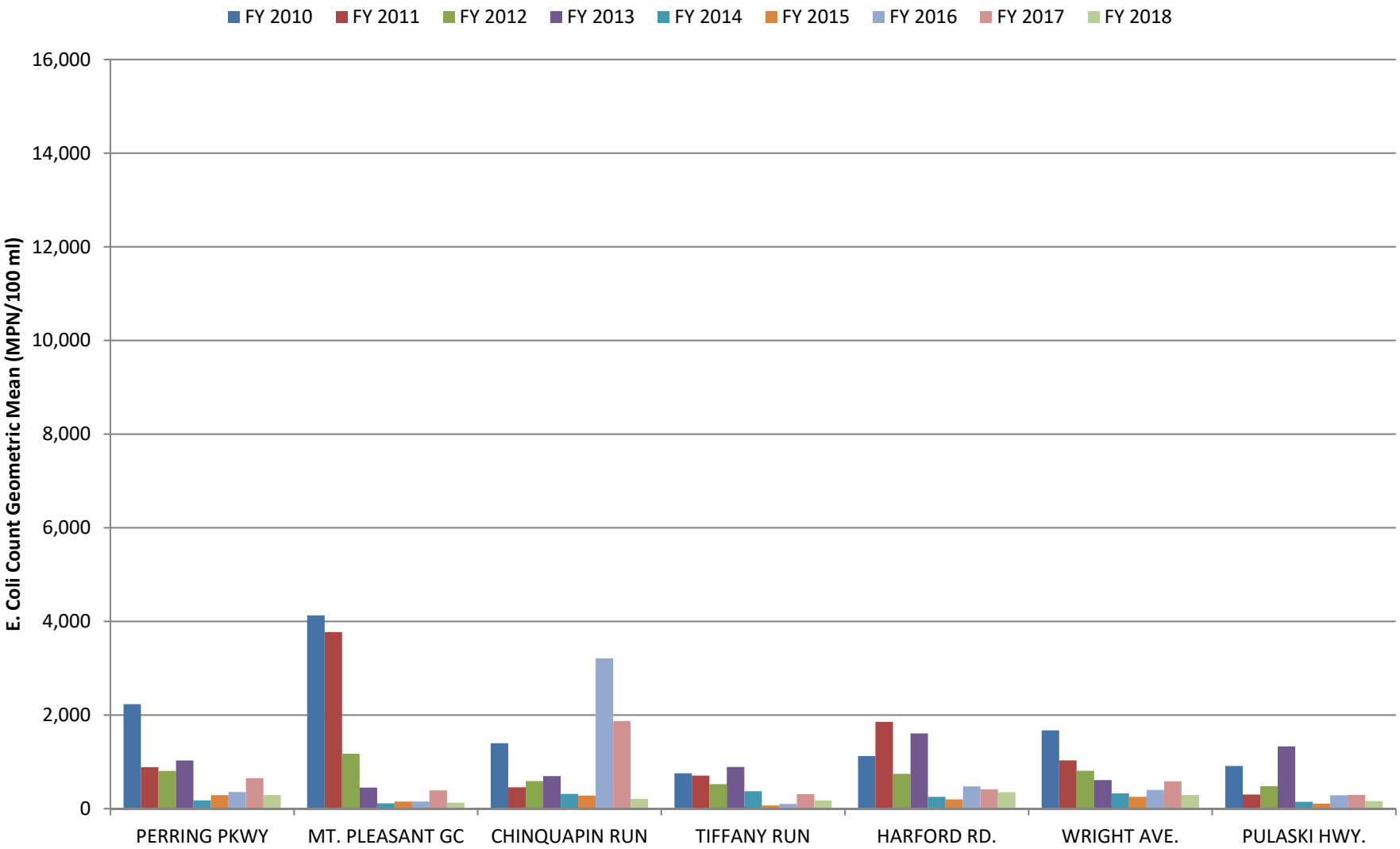

Harbor SIS Dry Weather Total Nitrogen
Percent of Samples Greater Than or Equal to 3 mg/L
by Fiscal Year
FY 2010
FY 2011
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
Percent of Total Nitrogen Samples >= 3 mg/L
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
LINWOOD & ELLIOTT
LAKEWOOD & HUDSON
CENTRAL & LANCASTER
LIGHT ST.
WARNER & ALLUVION
WATERVIEW AVE.
JANEY RUN


Patapsco River SIS Dry Weather Total Nitrogen
Percent of Samples Greater Than or Equal to 3 mg/L
by Fiscal Year
FY 2010
FY 2011
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
Percent of Total Nitrogen Samples >= 3 mg/L
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
27%
0%
0%
22%
27%
0%
0%
0%
9%
REEDBIRD AVE.

Appendix G: Bacteria Monitoring Histographs

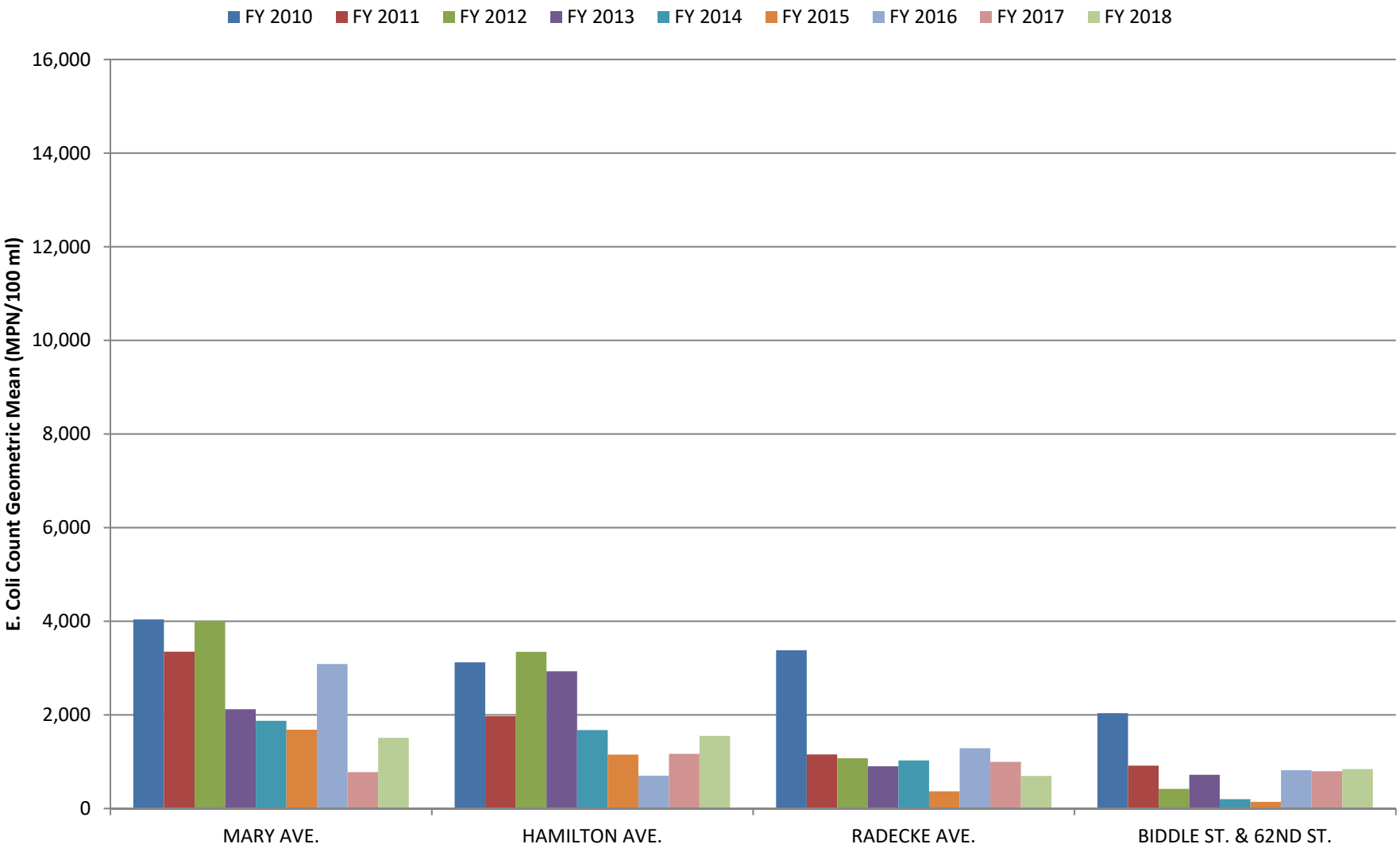
Herring Run SIS Dry Weather E. Coli MPN Count Geometric Means by Fiscal Year

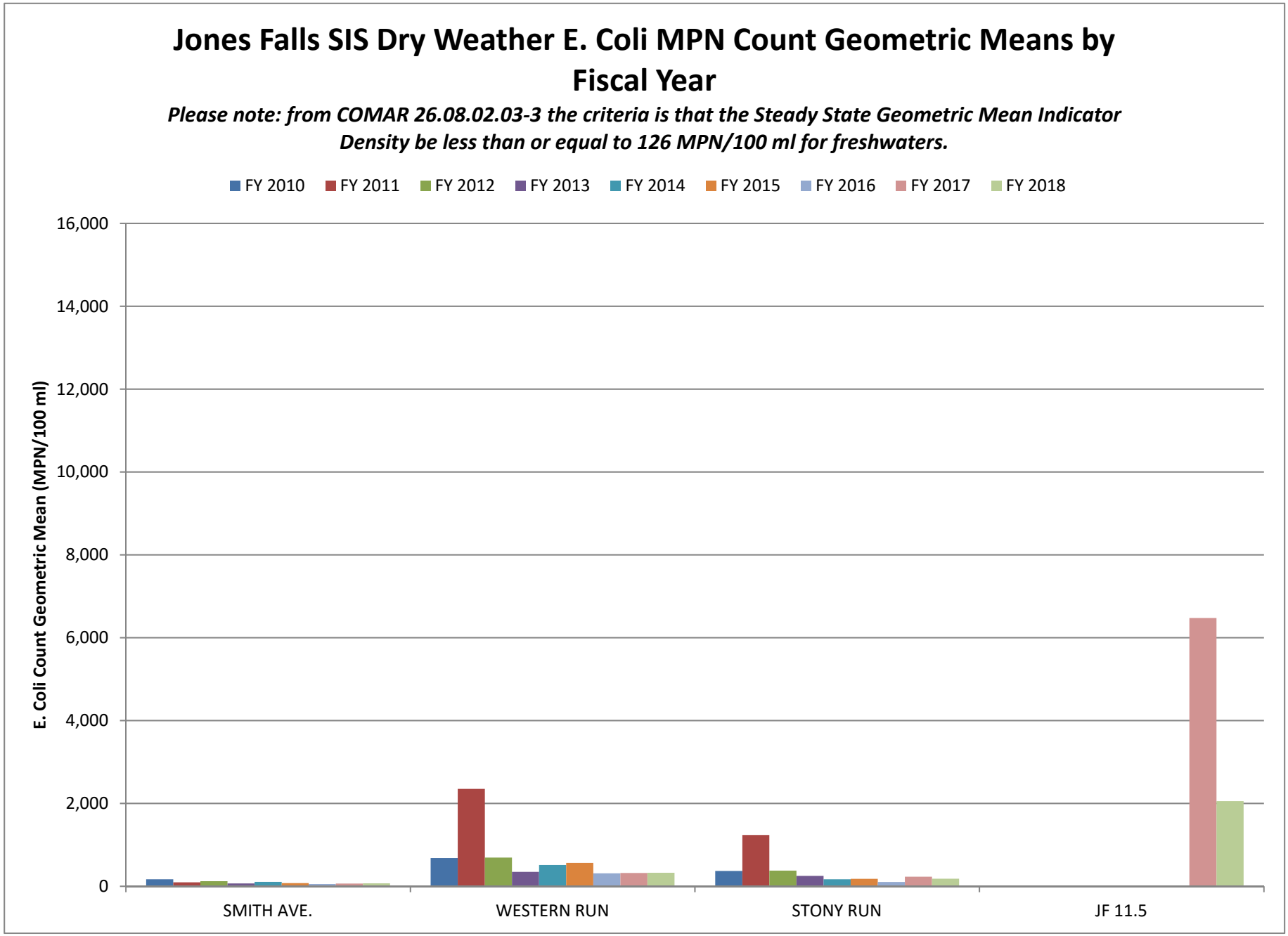
Please note: from COMAR 26.08.02.03-3 the criteria is that the Steady State Geometric Mean Indicator Density be less than or equal to 126 MPN/100 ml for freshwaters.



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

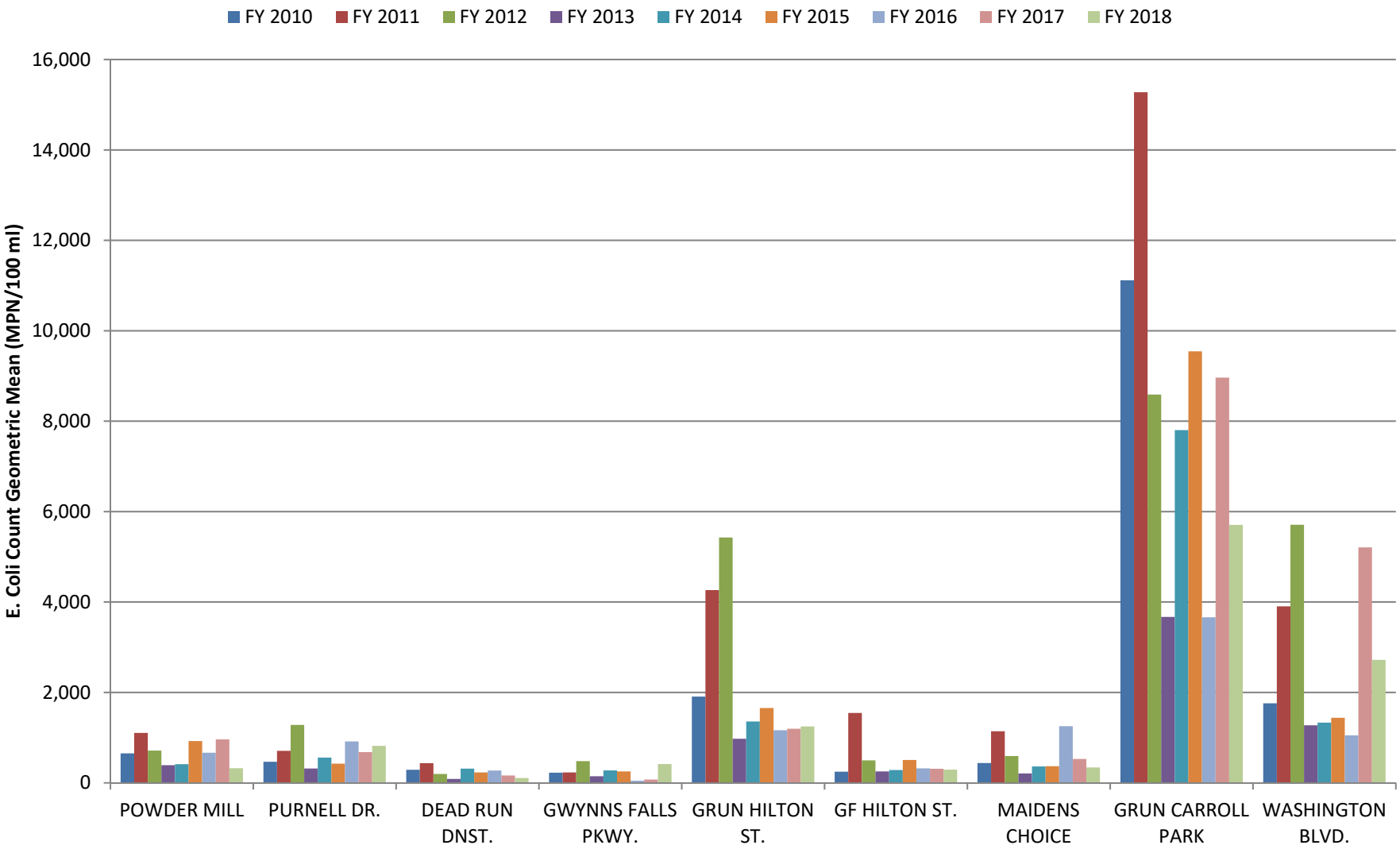
Please note: from COMAR 26.08.02.03-3 the criteria is that the Steady State Geometric Mean Indicator Density be less than or equal to 126 MPN/100 ml for freshwaters.




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.
FY 2010
FY 2011
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
E. Coli Count Geometric Mean (MPN/100 ml)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
SMITH AVE.
WESTERN RUN
STONY RUN
JF 11.5

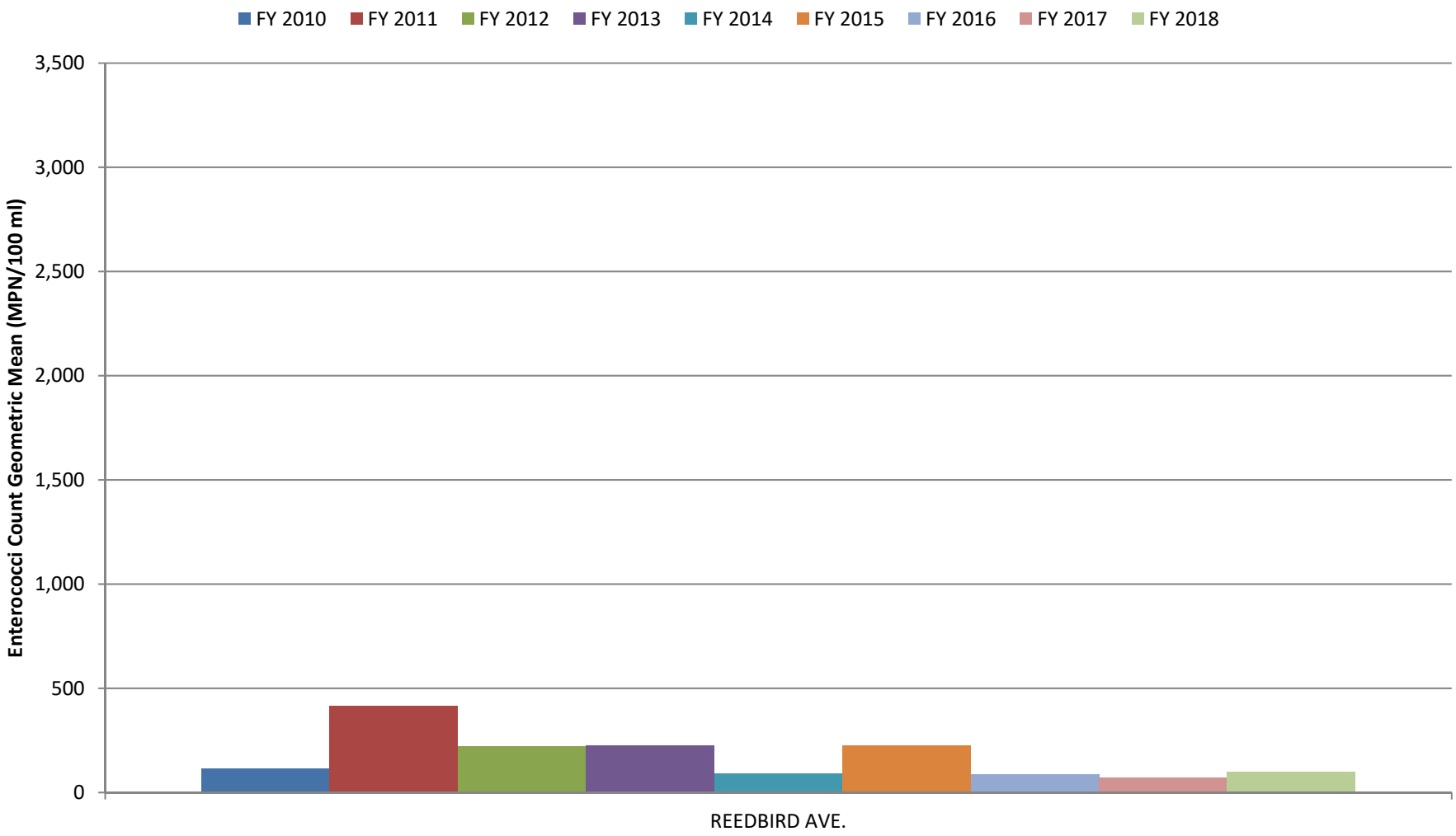
Gwynns Falls SIS Dry Weather E. Coli MPN Count Geometric Means by Fiscal Year

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.



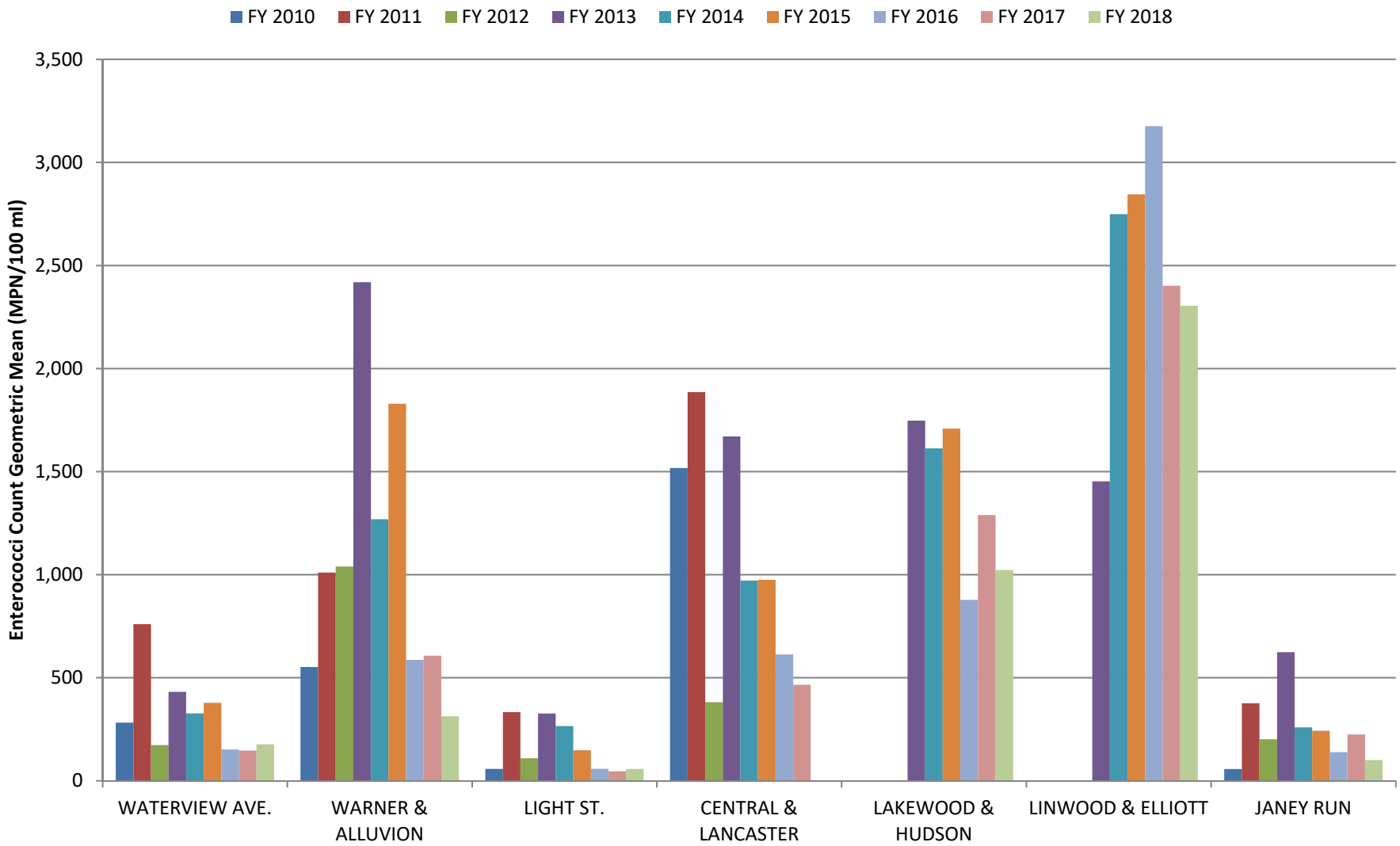
Patapsco River SIS Dry Weather Enterococci MPN Count Geometric Means by Fiscal Year

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.



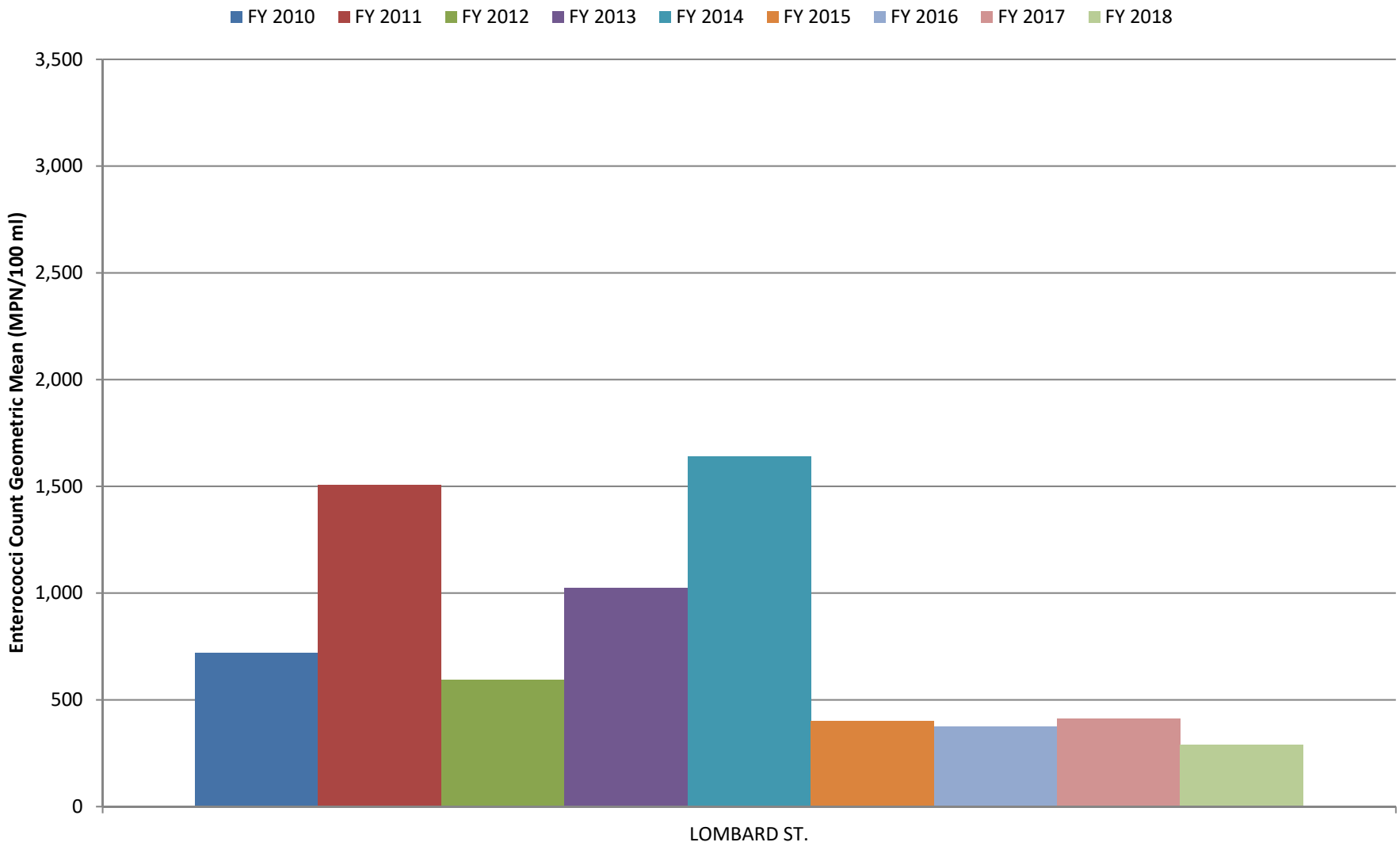
Harbor SIS Dry Weather Enterococci MPN Count Geometric Means by Fiscal Year

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 H: 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
2018-06-07	16	16	18	3	14	12	12	16	5	12	1	13
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
2018-06-07	14	16	16	3	14	12	12	16	5	12	6	9
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
2018-06-07	10	13	15	6	10	10	10	14	6	10	10	10
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

	Moores Run above Radecke Ave. Segments											
	1	2	3	4	5	6	7	8	9	10	11	Tributary
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
2018-06-07	10	14	6	16	13	8	6	12	8	10	10	7
Riffle/Run Quality												
2005-05-18	11	13	11	3	12	12	13	14	10	14	2	7
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
2018-06-07	14	14	11	10	12	10	14	13	1	13	0	7
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
2018-06-07	40	40	50	NA	30	50	40	40	NA	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
2018-06-07	12	12	11	NA	14	11	14	12	12	14	0	11

	Moores Run above Radecke Ave. Segments											
	1	2	3	4	5	6	7	8	9	10	11	Tributary
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
2018-06-07	5	5	5	8	8	8	4	2	2	8	16	5
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
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
2018-06-07	17	17	17	15	14	18	16	16	17	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
2018-06-07	18	17	12	10	16	15	12	13	16	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

	Moores Run above Radecke Ave. Segments											
	1	2	3	4	5	6	7	8	9	10	11	Tributary
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**
2018-06-07	**17**	**18**	**16**	**12**	**18**	**15**	**16**	**16**	**17**	**18**	**18**	**17**
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**
2018-06-07	**9**	**7**	**13**	**18**	**16**	**15**	**15**	**15**	**18**	**15**	**2**	**10**

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

Appendix I: Hydraulic Model for Moores Run
(*electronic files only*)

Appendix J: Hydraulic Model for Stony Run
(*electronic files only*)

Appendix K: Financial Assurance Plan

CERTIFICATION

WHEREAS, the provisions of § 4-202.1 of the Environment Article of the Annotated Code of Maryland require _Baltimore City__ (County/City) to file a financial assurance plan to the Maryland Department of the Environment that demonstrates that it has sufficient funding to meet the impervious surface restoration plan requirements of the (County's/City's) National Pollutant Discharge Elimination System Phase I Municipal Separate Storm Sewer System Permit; and

WHEREAS, the provisions of this law require that "a county or municipality may not file a financial assurance plan under this subsection until the local governing body of the county or municipality: (i) Holds a public hearing on the financial assurance plan; and (ii) Approves the financial assurance plan."

NOW, THEREFORE, I certify that:

1. A public hearing was held on the financial assurance plan on November 29, 2018 (Date);
2. The local governing body approves the aforementioned financial assurance plan; and
3. Under penalty of law, the information in this financial assurance plan is, to the best of my knowledge and belief, true, accurate, and complete.

_____ 12/18/18

Signature of County Executive/Municipal Mayor or Chief Financial Officer Date

_Catherine E. Pugh_____

Printed Name of County Executive/Municipal Mayor or Chief Financial Officer

_Mayor_____

Title

Baltimore City– Fiscal Year 2018
Financial Assurance Plan
as required under the
Watershed Protection and Restoration Program
November, 2018

Executive Summary

The submission of Baltimore City's Financial Assurance Plan (FAP) to the Maryland Department of the Environment (MDE) fulfills requirements specified in the Maryland Article – Environment, Section 4-202.1. This plan is being filed with MDE in order to document all actions implemented by Baltimore City to comply with its National Pollutant Discharge Elimination System (NPDES) municipal separate storm sewer system (MS4) permit and demonstrate the City's ability to pay for these activities through the Watershed Protection and Restoration Fund.

An MS4 permit was issued to Baltimore City on December 27, 2013. Annual reports for Fiscal Years (FY) 2014 through 2017 have been submitted to MDE by the City and are available on the City's website. The FY 2018 Annual Report will be submitted to MDE by December 27, 2018, and will include the Watershed Protection and Restoration Program (WPRP) report for FY 2018. These annual reports are based on the City's fiscal year (FY) and include updates on the City's MS4 programs and impervious surface area restoration. Baltimore City has continued implementing its MS4 program. This Executive Summary documents achievements met since the FY 2016 FAP, submitted to MDE on July 1, 2016.

In compliance with the Maryland Article Section 4-202.1, the following FAP includes all activities that have been completed in compliance with Baltimore City's MS4 permit, and five-year projections for the implementation of its stormwater program and best management practices (BMPs) necessary for meeting specific permit requirements. The following FAP documents implementation and financial data since the beginning of the current permit, in FY 2014.

A major tenet of the FAP is to demonstrate the financial wherewithal for meeting the current MS4 permit impervious surface area restoration requirements. In order to document this ability, Baltimore City is providing MS4 program implementation projections for FY 2019 through 2023, although the current permit technically expires on December 27, 2018. The sections in this Executive Summary follow the order of Baltimore City's MS4 permit found in Part IV, Standard Permit Conditions, and highlight the major achievements for each program element.

- **Part IV.C. Source Identification** – Existing BMP data has being converted to the MDE- specified georeference database. Additional data for development and updates from field verification have also been incorporated. The new database was included in the FY 2016 MS4 Annual Report. The FY 2018 MS4 Annual Report included all approved and constructed BMPs, in addition to the proposed adjustments to the baseline impervious area which would reduce the 20% restoration requirement by 73 acres. Since the proposed adjusted baseline impervious area has not been approved by MDE, the 2015 baseline was used for the "All Actions" table of the FAP. The only remaining data to be completed for the georeference database is the impervious area removal (scheduled for FY 2019). This effort was primarily completed by in-house resources.

- **Part IV.D.1 and 2. Stormwater Management and Erosion and Sediment Control**– By FY 2018, the workforce totaled 21 full-time employees (FTE) to fulfill both the plan review and inspection obligations of these permit conditions. This workforce included 2 FTE hired from the City's YH2O program (workforce development). Since FY 2014, the average response time for plans review has reduced from 90+ days to 18 days. Starting in FY 2017, the City has hosted training and testing for the National Green Infrastructure Certification Program (NGICP). In FY 2019, the City plans to initiate an on-line submittal and tracking system for plans review, compatible with the City's e-plans system.

- **Part IV.D.3. Illicit Discharge Detection and Elimination (IDDE)**– By FY 2018, the workforce for this permit condition (and assessment of controls) totaled 12 FTEs. Currently, the City tests surface waters for nitrogen-ammonia, chloride, and other field parameters at 88 locations on a weekly basis as part of the Ammonia Screening program. The number of locations was expanded from 44 in FY 2016. Additionally, the City tests surface waters for bacteria, metals, and nutrients at 33 locations on a monthly basis. All test data is posted quarterly on-line. From January 2014 to June 2017, the City has found over 450 illicit discharges to the storm sewer system, due to investments in technology (camera, IPad applications, new probes, etc.) for field operations and reporting. The City initiated an outfall inventory in FY 2016 and a microbial source tracking (MST) study in FY 2017. The MST study was contracted to local universities: UMBC and University of Baltimore. Although the City has included the IDDE abatement activities in the nutrient reduction listed in the MS4 Annual Reports, IDDE is not included in the "All Actions" table of the FAP because the equivalent impervious area methodology has not been approved by the MDE. Funding to comply with the permit condition (detection and abatement of bacteria sources) is included in the "Fund Sources" table of the FAP.

- **Part IV.D.4. Trash and Litter** – Following on the success of the municipal trash can distribution to all City residents in FY 2016, the City initiated the installation solar-powered corner cans in the downtown area in FY 2018 to improve operation efficiency. In April 2017, the City created the B'More Beautiful pilot program: a City-led, peer to peer beautification program, which has expanded into 47 neighborhoods. The City continued the Small Haulers program, initiated in April 2017. These new efforts are not included in the FAP or WPRP, since the programs extend beyond NPDES compliance. These efforts are funded by the General Fund and public-private partnerships.

- **Part IV.D.5. Property Management and Maintenance** – Street sweeping operations expanded city-wide in FY 2014. Parking signage was installed in the Central District in FY 2018 to improve operation efficiency. In FY 2017, the City modified the reporting of this operation to designate frequency and watershed. Inlet screens and catch basin inserts were installed in five neighborhoods in FY 2016 as a pilot program to improve the efficiency of street sweeping and inlet cleaning, preventing trash and debris from migrating to the storm pipe. Street sweeping and inlet cleaning operational programs are part of the impervious surface restoration plan (ISRP); the impervious acreage and associated costs for these operations are listed in the "All Actions" table of the FAP. In addition to nutrient and sediment reduction; these two routine operations are significant in the addressing the City's trash TMDL, in addition to reducing potential roadway flooding. Although operational efficiencies are anticipated with the installation of street signs and subsequent parking enforcement, plus the installation of inlet screens, the equivalent impervious area projections were kept at the same level as FY 2018 to be conservative.

- **Part IV.D.6. Public Education** - In addition to website modifications and participations in public outreach events, like Dam Jam, the City initiated GROW Center pop-up events in April 2018. GROW Centers are an incentive program to connect property owners with resources (technical expertise, materials, and equipment) to promote the installation of green practices on their private property or vacant lots, while diverting re-usable materials from the solid waste disposal stream. In addition to the pop-up events, an alternatives analysis and business plan for the GROW centers was initiated in FY 2019. This effort was partially funded by a grant from the USDA. DPW also worked with the University of Baltimore / Baltimore Neighborhood Indicator Alliance to develop an interactive planning tool for stormwater BMP installation, locating projects that are identified, planned, active, or found not feasible.

- **Part IV.E.1. Watershed Assessment** – Watershed Assessments for the Lower North Branch Patapsco watershed and the Baltimore Harbor watershed were completed and posted for public comment in November 2018. Final versions of the assessments will be submitted to MDE in December 2018. The assessments were completed using in-house resources and include prioritization maps (by community statistical area); a summary of BMP locations found infeasible; and an evaluation of social-economic

factors (including equity) within the watersheds. Watershed assessment for the Back River, Jones Falls, and Gwynns Falls were already approved by MDE, but updates to these watershed assessments are anticipated to begin in FY 2020.

- **Part IV. E. 2. Restoration Plans**— In August 2015, the City submitted a revised MS4 and TMDL Watershed Implementation Plan (WIP). The WIP included a list of programs, projects and partnerships that would be part of the ISRP. Programs included street sweeping and inlet cleaning, previously addressed in Part IV.D.5 of this executive summary. Partnerships include BMPs installed as either voluntary restoration projects by non-profits / community organizations or as redevelopment projects. The impervious acreage for partnerships are listed in the "All Actions" table of the FAP, under the category of "Other". Design and construction costs were not the responsibility of the City; therefore the costs were listed as zero. The impervious acreage for the development projects varies from those values listed in Table K-3 of Appendix K of the FY 2017 MS4 Annual Report; some of those BMPs were built prior to 2010 and the associated impervious acreage has since been attributed to the baseline impervious area (see Part IV.C of this Executive Summary). Although the permit term extends into FY 2019, the projection for impervious acreage implemented through partnerships was not included for FY 2019 to be conservative.

  The projects portion of the WIP included capital projects to be installed by DPW. The original WIP projects were estimated to restore 1,205 acres of impervious surface area at a total cost of $77.5 million by FY 2019. The current plan for projects listed in the "All Actions" table of the FAP, show only 152 impervious acres restored by FY 19 at a cost of $7.5 million. The remaining projects from the WIP which were still designated as practicable are scheduled to be completed by FY 2021, for a total restoration of 911 acres at a cost of $92.3 million. The City anticipates that the impervious acreage restored by BMPs after FY 2019 will be used towards compliance of future MS4 permits. These estimated costs only include direct costs for design and construction services, plus land acquisition, permit fees, and mitigation efforts. The costs listed in the FAP for ISR actions do not include maintenance. The reasons for the delay in progress on the projects include the following:

  - Contracted services procurement and negotiations were hindered by a competitive market (i.e. other MS4 jurisdictions). This also increased implementation costs.
  - Two of the stream restoration projects were delayed to align with sanitary capital projects, in order to reduce land disturbance, community disruption and construction costs, like mobilization.
  - One pond retrofit project was delayed due to a capital project by a private utility.
  - Site selection for ESD projects, especially in the right-of-way, was limited by compacted soils, accessibility, traffic patterns, and existing utilities. Typically, only one in 10 locations were identified as feasible (treating more than 0.2 acre / facility and costing less than $300,000 / acre). The results of

the site selection were included in the FY 2018 Annual Report and DPW's interactive BMP planning tool.
  - Stream restoration and regenerative stormwater conveyance projects required access agreements with private property owners.
  - Although MDE improved their process for the Joint Permit Application process for work in the floodplain and wetlands, the overall permitting process (local, state, and federal) increased the project life cycle, based on the total increase in the number of restoration projects. The City also received State Revolving Loans from the state, which added another layer of plan review to the project schedule.
  - Many of the ESD projects will be funded in part by an Environmental Impact Bond, a pay-for performance debt service mechanism, which is still in negotiations.

- Part IV.E.5. TMDL Compliance – Nutrient and sediment TMDL compliance is aligned with the restoration plan progress (ISRP). The Trash TMDL implementation plan was submitted in FY 2016, efforts for compliance were already described in Part IV.D.4 of this executive summary. The bacteria TMDL implementation plan and PCB implementation plan were submitted as part of the WIP; modifications to the bacteria implementation plan schedule and the PCB study details were submitted to MDE in September 2018.

- Part IV.F. Assessment of Controls – DPW approved agreements with USGS to add monitoring parameters to existing stations in the County (reservoir) and City. Biological assessment of controls continues. Physical assessment of controls for Stony Run were completed in FY 2018 and included the FY 2018 Annual Report.

- Other FAP discussions:

  - The 2016 FAP and 2014-2016 WPRP reports were submitted based on limited financial information related to stormwater fee revenue. Since those submittals, certified annual financial reports for the stormwater utility have resulted in revisions of revenues listed in "Fund Sources' table of the FAP for the stormwater remediation fees. Furthermore, the 2018 FAP only lists 70 percent of stormwater remediation fee revenue, since the fee is also used for non-NPDES activities such as flood control and stormwater sewer system repairs.
  - The stormwater fee rate has remained the same since FY 2014. The FY 2016 FAP had indicated an increase in the rates, but the delay in the capital project implementation did not require the increase.
  - The 2016 FAP listed higher fund sources attributed from County Transportation Bonds than the 2018 report. Those bond appropriations were re-distributed due to the progress of the capital project implantation.

MS4 Information	
Jurisdiction	Baltimore City
Contact Name	Kimberly Grove
Phone	410-396-0732
Address	3001 Druid Park Drive
City	Baltimore
State	MD
Zip	21215
Email	kimberly.grove@baltimorecity.gov
Baseline Treatment Requirement (Acres)	4291.00
Permit Num	11-DP-3315
Reporting Year	2018

Check with MDE Geodatabase:

Should match Permit info table of Geodatabase, except for Impervious Acre Baseline-- that should match Impervious Surface Table.

VERSION 2-28-18

Article 4-202.1(j)(1)(i)1: Actions that will be required of the county or municipality to meet the requirements of its National Pollutant Discharge Elimination System Phase I Municipal Separate Storm Sewer System Permit.

Note: To identify all "actions" required under the MS4 permit, provide an executive summary of the jurisdiction's MS4 programs. See MDE's FAP Guidance. For proposed actions to meet the impervious surface restoration plan, fill in the table below.

Baseline: 4,291 **Requirement:** 20%

REST BMP TYPE*	BMP CLASS	IMP ACRES	IMPL COST	% ISRP COMPLETE	IMPL STATUS**	PROJECTED IMPL YR
Operational Programs						
VSS	A	3175	$5,048,864	74.0%	Complete	2015
VSS	A	3400	$4,942,590	79.2%	Complete	2016
VSS	A	3333	$4,894,960	77.7%	Complete	2017
SDV	A	222	$4,183,524	5.2%	Complete	2017
VSS	A	3732	$4,826,942	87.0%	Complete	2018
SDV	A	225	$4,148,389	5.2%	Complete	2018
VSS	A	3730	$5,184,904	86.9%	Under Construct	2019
SDV	A	225	$5,138,181	5.2%	Under Construct	2019
VSS	A	3730	$5,288,602	86.9%	Proposed	2020
SDV	A	225	$5,240,945	5.2%	Proposed	2020
VSS	A	3730	$5,394,374	86.9%	Proposed	2021
SDV	A	225	$5,345,764	5.2%	Proposed	2021
VSS	A	3730	$5,502,262	86.9%	Proposed	2022
SDV	A	225	$5,452,679	5.2%	Proposed	2022
VSS	A	3730	$5,612,307	86.9%	Proposed	2023
SDV	A	225	$5,561,732	5.2%	Proposed	2023
Average Operations Next Two Years (FY2019-FY2020)***		3955.0	$20,852,632	92.2%		
Average Operations Permit Term (FY2014-FY2019)***		3,697.5	$38,368,354	86.2%		
Average Operations Permit Term and Projected Years (FY2014-FY2023)***		3,812.3	$81,767,018	88.8%		

REST BMP TYPE*	BMP CLASS	IMP ACRES	IMPL COST	% ISRP COMPLETE	IMPL STATUS**	PROJECTED IMPL YR
Capital Projects						
STRE	A	31.2	$700,000	0.7%	Complete	2014
MMBR	E	0.88	$411,800	0.0%	Complete	2017
FPU	A	5.84	$340,150	0.1%	Complete	2017
FPU	A	8.3	$340,150	0.2%	Complete	2018
STRE	A	12	$1,135,000	0.3%	Complete	2018
SPSC	A	5	$244,020	0.1%	Under Construct	2019
STRE	A	69	$3,367,474	1.6%	Under Construct	2019
WPWS	S	20.2	$976,079	0.5%	Under Construct	2019
SPSC	A	6.1	$1,403,750	0.1%	Planning	2020
STRE	A	345	$33,785,322	8.0%	Planning	2020
FBIO	E	3.3	$955,080	0.1%	Planning	2021
MMBR	E	29.8	$11,189,183	0.7%	Planning	2021
OTH	A	17.2	$6,935,392	0.4%	Planning	2021
STRE	A	333.2	$26,830,198	7.8%	Planning	2021
PWET	S	15	$1,116,000	0.3%	Planning	2022
STRE	A	9	$2,589,956	0.2%	Planning	2022
Subtotal Capital Next Two Years (FY2019-FY2020)		445.3	$39,776,645	10.4%		
Subtotal Capital Permit Term (FY2014-FY2019)		152.42	$7,514,673	3.55%		
Subtotal Capital Permit Term and Projected Years (FY2014-FY2023)		911.02	$92,319,554	21.2%		

REST BMP TYPE*	BMP CLASS	IMP ACRES	IMPL COST	% ISRP COMPLETE	IMPL STATUS**	PROJECTED IMPL YR
Other						
Redevelopment	E	277.35	$0	6.5%	Complete	2018
Redevelopment	S	187.5	$0	4.4%	Complete	2018
Subtotal Other Next Two Years (FY2019-FY2020)		465	$0	10.8%		
Subtotal Other Permit Term (FY2014-FY2019)		465	$0	10.8%		
Subtotal Other Permit Term and Projected Years (FY2014-FY2023)		465	$0	10.8%		
Total Next Two Years (FY2019-FY2020)		**4865.2**	**$60,629,277**	**113.4%**		
Total Permit Term (FY2014-FY2019)		**4314.8**	**$45,883,027**	**100.6%**		
Total Permit Term and Projected Years (FY2014-FY2023)		**5188.2**	**$174,086,572**	**120.9%**		

Check with MDE Geodatabase:

Type, class, impervious acres, implementation cost and implementation status should match the various geodatabase tables for BMPs (AltBMPLine, AltBMPPoint, AltBMPPoly, and RestBMP)-- aggregated by type and status.

*Use BMP domains from MDE Geodatabase.

**Complete, Under Construction, Planning, or Proposed

***IMPL COST is a summation and not an average.

VERSION 2-28-18

Article 4-202.1(j)(1)(i)2: Projected annual and 5-year costs for the county or municipality to meet the impervious surface restoration plan requirements of its National Pollutant Discharge Elimination System Phase I Municipal Separate Storm Sewer System Permit.

DESCRIPTION	PAST UP THRU FY 2017	CURRENT YEAR FY 2018	PROJECTED YEAR 1 FY 2019	PROJECTED YEAR 2 FY 2020	PROJECTED YEAR 3 FY 2021	PROJECTED YEAR 4 FY 2022	PROJECTED YEAR 5 FY 2023	TOTAL COSTS
Operating Expenditures (costs)								
Street Sweeping Program	$14,866,414	$4,826,942	$5,184,904	$5,288,602	$5,394,374	$5,502,262	$5,612,307	$46,675,805
Inlet Cleaning	$4,183,524	$4,148,389	$5,138,181	$5,240,945	$5,345,764	$5,452,679	$5,651,732	$35,161,214
Support of Capital Projects	$3,093,115	$714,597	$592,409	$146,886	$27,852			$4,574,858
Debt Service Payment	$3,658,667	$714,941	$3,308,749	$7,000,000	$7,200,000	$7,200,000	$7,200,000	$36,282,356
Other (please stipulate program expenditure)*	-	-	-	-	-	-	-	$0
Capital Expenditures (costs)								
General Fund (Paygo)	$586,515		$880,419					$1,466,934
WPR Fund (Paygo)	$4,202,666	$8,676,810	$11,725,681	$6,152,306	$439,862			$31,197,325
Debt Service	$1,311,433		$53,043,764	$3,335,478	$378,051			$58,068,727
Grants & Partnerships				$200,000				$200,000
Other (please stipulate capital expenditure)*	-	-	-	-	-	-	-	$0
Subtotal operation and paygo:	$30,590,901	$19,081,678	$26,830,343	$23,828,739	$18,407,852	$18,154,941	$18,464,039	$155,358,493
Total expenditures:	**$31,902,334**	**$19,081,678**	**$79,874,107**	**$27,364,218**	**$18,785,903**	**$18,154,941**	**$18,464,039**	**$213,627,220**
							Total ISRP costs except debt service:	**$177,344,864**
							Compare ISRP costs (except debt service) / total ISRP proposed actions:	**102%**

Check with MDE Geodatabase:

The total current FY 2018 expenditure should be less than the combined total of the "OP_cost" and "CAP_Cost" fields in the fiscal analyses table of the geodatabase.

The total projected FY 2019 expenditure should be less than the combined total of the "OP_budget" and "CAP_budget" fields in the fiscal analyses table of the geodatabase.

*Insert additional rows as necessary.

VERSION 2-28-18

Article 4-202.1(j)(1)(i)3: Projected annual and 5-year revenues or other funds that will be used to meet the cost for the county or municipality to meet the impervious surface restoration plan requirements under the National Pollutant Discharge Elimination System Phase I Municipal Separate Storm Sewer System Permit.

DESCRIPTION	PAST UP THRU 2017	CURRENT YEAR FY 2018	PROJECTED YEAR 1 FY 2019	PROJECTED YEAR 2 FY 2020	PROJECTED YEAR 3 FY 2021	PROJECTED YEAR 4 FY 2022	PROJECTED YEAR 5 FY 2023	TOTAL NEXT 2-YEARS FY 19-20*	TOTAL
Annual Revenue** Appropriated for ISRP	$50,630,900	$55,134,868	$47,885,242	$29,135,433	$17,967,990	$18,154,941	$19,464,039	$77,020,675	$238,373,413
Annual Costs towards ISRP***	$31,902,334	$19,081,678	$79,874,107	$27,364,218	$18,785,903	$18,154,941	$18,464,039	$107,238,324	$213,627,220

Compare revenue appropriated / annual costs: 72%

WPRP 2018 Reporting Criteria: 100%

ISRP = Impervious Surface Restoration Program, or 20% Restoration Requirement

* Article 4-202.1(j)(2): Demonstration that county or municipality has sufficient funding in the current fiscal year and subsequent fiscal year budgets to meet its estimated cost for the 2-year period immediately following the filing date of the FAP. Note that the appropriations and expenditures include time period up to FY 2020.
** Revenue means "dedicated revenues, funds, or sources of funds (per Article 4-202.1(j)(4)(ii). Note that budget appropriations have only been approved by governing bodies through FY 2018 at the time of FAP reporting.
*** See table of ISRP Cost.

VERSION 2-28-18

Article 4-202.1(j)(1)(i)4: Any sources of funds that will be utilized by the county or municipality to meet the requirements of its National Pollutant Discharge Elimination System Phase I Municipal Separate Storm Sewer System Permit.

SOURCE	PAST UP THRU 2017	CURRENT YEAR FY 2018	PROJECTED YEAR 1 FY 2019	PROJECTED YEAR 2 FY 2020	PROJECTED YEAR 3 FY 2021	PROJECTED YEAR 4 FY 2022	PROJECTED YEAR 5 FY 2023	TOTAL PERMIT CYCLE
Paygo Sources								
Stormwater Remediation Fees (WPR Fund)	$ 77,887,615	$19,091,913	$20,160,000	$20,160,000	$20,160,000	$20,160,000	$20,160,000	$ 117,139,528
Miscellaneous Fees (WPR Fund)	$ 292,140	$199,604	$100,000	$100,000	$100,000	$100,000	$100,000	$ 591,744
General Fund	$ 8,514,655	$0	$0	$0	$0	$0	$0	$ 8,514,655
Other Funds 1 (Water / WW Utility)	$ 6,638,997	$2,049,091	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$ 10,688,088
Other Funds 2 (please stipulate funding source)								$ -
Other Funds 3 (please stipulate funding source)								$ -
Subtotal Paygo Sources	$ 93,333,407	$ 21,340,608	$ 22,260,000	$ 22,260,000	$ 22,260,000	$ 22,260,000	$ 22,260,000	$ 136,934,015
Debt Service (paygo sources will be used to pay off debt service. Note that previous appropriations for debt service used for ISRP is listed in FY 2017).								
County Transportation Bonds	$ 5,432,180							$ 5,432,180
General Obligation Bonds	$ 1,400,000							$ 1,400,000
Revenue (Utility) Bonds			$5,637,000					$ 5,637,000
State Revolving Loan Fund	$ 583,000	$ 20,700,000	$ 30,624,689					$ 51,907,689
Environmental Impact Bond (debt service)			$ 3,165,000					$ 3,165,000
Subtotal Debt Service	$ 7,415,180	$ 20,700,000	$ 39,426,689	$ -	$ -	$ -	$ -	$ 67,541,869
Grants and Partnerships (no payment is expected)								
State funded grants	$ 30,602		$0	$0	$0			$ 30,602
Federal funded grants	$ 200,000	$ 100,000	$0	$0	$0			$ 300,000
Public-private partnership (matched grant)	$ 250,465		$0	$0	$0			$ 250,465
Subtotal Grants and Partnerships	$ 481,067	$ 100,000	$ -	$ -	$ -	$ -	$ -	$ 581,067
Total Annual Sources of Funds	**$ 101,229,654**	**$ 42,140,608**	**$ 61,686,689**	**$ 22,260,000**	**$ 22,260,000**	**$ 22,260,000**	**$ 22,260,000**	**$ 205,056,951**
Percent of Funds Directed Toward ISRP								

Compare total permit term paygo ISRP costs / subtotal permit term paygo sources: 56%

Compare total permit term ISRP costs / total permit term annual sources of funds: 64%

* WPR Fund: Watershed Protection and Restoration Fund.

Check with MDE Geodatabase:

The total sources related to WPR Funds in Current FY 2018 should match the "WPR_Fund" field of the geodatabase.

VERSION 2-28-18

Article 4-202.1(j)(1)(i)5: Specific actions and expenditures that the county or municipality implemented in the previous fiscal years to meet its impervious surface restoration plan requirements under its National Pollutant Discharge Elimination System Phase I Municipal Separate Storm Sewer System Permit.

Baseline: 4,291 **Requirement:** 20%

REST BMP ID	REST BMP TYPE	BMP CLASS	NUM BMP	IMP ACRES	BUILT DATE	IMPL COST	% ISRP Complete	IMPL STATUS	GEN COMMENTS
Operational Programs									
BC18APV000001 (-20)	VSS	A	208	3333	6/30/2018	$4,894,960	77.7%	Complete	Most recent year
BC18APV000030	SDV	A	6,549	222	6/30/2018	$4,183,524	5.2%	Complete	Most recent year
							0.0%		
							0.0%		
Average Operations Complete To Date*			6,757	3,555		$9,078,484	44.0%		
Capital Projects									
BC17ALNSD7760	STRE	A	1	31	2014	$700,000	0.7%	Complete	Leakin Park
BC16RST000297	MMBR	E	1	0.2	2017	$102,900	0.0%	As-built pending	WS 263 - Bush
BC16RST000296	MMBR	E	1	0.7	2017	$308,900	0.0%	As-built pending	WS 263 - Lafayette
BC17APV000021 (-29)	FPU	A	1948	5.84	6/30/2017	$340,150	0.1%	Complete	Tree Baltimore
	STRE	A	1	12	2018	$1,135,000	0.3%	As-built pending	East SR
BC18APV000021 (-29)	FPU	A	2763	8.3	6/30/2018	$340,150	0.2%	Complete	Tree Baltimore
							0.0%		
Subtotal Capital Complete To Date			4715	58.04		$2,927,100	1.35%		
Other									
Various	Redevelopment	E	256	277.35	Various	$0	6.5%	Complete	
Various	Redevelopment	S	94	187.5	Various	$0	4.4%	Complete	
Subtotal Other Complete To Date			350	465		$0	10.8%		
Total Complete to Date			**11,822**	**4,077.9**		**$12,005,584**	**56.2%**		

Check with MDE Geodatabase:

Rest BMP ID, type, class, number of BMPs, impervious acres, built date, implementation cost and implementation status should match the various geodatabase tables for BMPs (AltBMPLine, AltBMPPoint, AltBMPPoly, and RestBMP)-- aggregated by type and status.

Notes:

For street sweeping indicate the annual frequency that the streets are swept and for inlet cleaning indicate the number of inlets cleaned-out.

*IMPL COST is a summation and not an average.

VERSION 2-28-18

Appendix L: Watershed Protection and Restoration Program Annual Report

Watershed Protection and Restoration Program Annual Report Table

Article 4-202.1(i)(4): "The percentage and amount of funds in the local watershed protection and restoration fund spent on each of the purposes provided in subsection (h)(4) of this section;"

Program Element		Cost	Percent of WPRF
Capital Improvements for Stormwater Management	$	13,888,095	43.74%
O & M of SWM Systems and Facilities	$	12,177,218	38.35%
Public Education and Outreach	$	278,412	0.88%
Stormwater Management Planning (see Md. Environment Code Ann. § 4-202.1(h)(4)(iv))	$	1,259,971	3.97%
Review of Stormwater Management Plans and Permit Applications for New Development	$	1,549,599	4.88%
Grants to Nonprofit Organizations	$	200,000	0.63%
Adminstration of WPRF	$	2,396,085	7.55%
TOTAL		$31,749,378.26	100.00%
Number of Properties Subject to Fee		224,304	
Reporting Year		2018	
Permit Number		11-DP-3315	
Comments:		Capital improvements of stormwater managemnt includes payment of debt	

VERSION 2-28-18

Jurisdiction	Agency	Local Ordinance Submitted to MDE	MDE Approval of Fee Reduction Policy	Fee Reduction Amount	Rate Structures								Additional Sources of Funds			Estimated Annual Revenue	Notes
					Annual Single Family Residential Rate	Annual Commercial Rate	Equivalent Residential Unit (ERU) Impervious	Commercial Capped Rates	Non-profits, Religious Organizations	Exemptions	Federal Facilities Status	Federal Facility Fee(s)/Rate(s)	Additional Source 1	Additional Source 2	Additional Source 3		
Baltimore City	Department of Public Works	Yes	NA	NA	$30 - 120[2]	$60 / ERU	1,050 sf	Capped at 20% of all State and local property taxes	$12 / ERU on religious and K-12 education structures	IA permitted to public ww system; streets privately maintained and open to public in SFR communities; IA requires as a superfund cap; solar panel bases; driveways for cemetaries	Charged	$60 / yr / ERU	SWM/ESC Misc. Fees for permitting and penalties as part of development			$27,473,766.00	
Directions:		Use: Yes or No	Use the approval date or N/A	Reduction amount(s), if any, with reason for reduction(s)		Use: N/A, amount of flate rate, rate amount per ERU, etc.				General description of exemption(s), if any	Use: No Facilities, Exempt, or Charged	Use: N/A or the fee and rate structures for federal facilities					

Notes:
ERU = Equivalent residential unit

VERSION 2-28-18

Article 4-202.1(i)(3): "The amount of money deposited into the watershed protection and restoration fund in the previous fiscal year by source;"

Source		Amount
Annual Single Family Residential Fees Collected	$	10,270,488.00
Annual Commercial Fees Collected	$	14,116,405.00
Non-profits, Religious Orgs Fees Collected	$	2,887,269.00
Miscellaneous fees related to development	$	199,604.00
	$	27,473,766.00
	$	27,473,766.00
	VERSION 2-28-18	

Note: Revenue by source is estimated based on the total revenue for the stormwater fee, proportional to the customer base (billing) and may not reflect actual proportion of revenue received for the fiscal year.

All SWM Projects Implemented in Previous FY for the 20% Restoration Requirement

REST BMP ID	REST BMP TYPE	BMP CLASS	NUM BMP	IMP ACRES	BUILT DATE	IMPL COST	IMPL STATUS	IMPL COMP YR
BC18APV000001 (-20)	VSS	A	208	3775	6/30/2018	$4,894,960	Complete	2018
BC18APV000030	SDV	A	7,238	226.4	6/30/2018	$4,183,524	Complete	2018
BC18APV000021 (-29)	FPU	A	2,763	8.3	6/30/2018	$340,150	Complete	2018
				4009.7		$9,418,634		

VERSION 2-28-28

Appendix M: “Isolating High Concentration Illicit Discharges in the City of Baltimore for Remediation” report by Ridges to Reefs

Final Report:
Isolating High Concentration Illicit Discharges in the City of Baltimore for Remediation
Grant Number 13397
Ridge to Reefs, Blue Water Baltimore
& The City of Baltimore

1. **Project Summary:**
    a. Summarize the implementation of the project and describe how you achieved the grant deliverables. This section should include information such as the actual acreage or linear feet that were restored/enhanced/protected or created, and how this measurement was determined

The project team completed 20 Illicit Discharge Detection and Elimination screening events, covering over 15 Stream miles. Volunteers have been heavily involved in the screening events. A total of 72 volunteers were trained through 6 "Pollution Reporting 101 & Outfall Screening Blitz" training events. Last year (2016), 78 outfalls were screened over 12 miles of stream, from these 24 samples were washwater, 8 were drinking water and 13 sewage. In April (2017) of this year we surveyed the remaining 3 miles of stream and 4 samples were taken. The findings from our desk top analysis were that 3 outfalls were exceeding ammonia levels, one was a broken lateral sewer line which tested high for fluoride and ammonia-- all posing threats to children, pets and the living resources in the streams (fish, birds, insects). Over 6.8 million gallons of illicit discharges with high levels of nutrients and bacteria due to sewage being a source of contamination have been abated through this project and additional nutrients will be reduced due to some of the expansions in technical and personnel capacity that the CIty of Baltimore has made at least in part due to some of our recommendations. In addition to the volume reduction, -- it is estimated that the project team together have reduced nitrogen loads by over 360 lbs and over 45lbs of phosphorus -- this represents very conservatively the equivalent cost based on typical reduction of urban pollution loads of $350,000 to $500,000 if other more traditional urban BMPs were used based on estimates by the Environmental Finance Center and Center for Watershed Protection. In addition, a clickable map was created to help track and display outfall screenings and results for the project team and the public.

Figure 1. Volunteers, Blue Water Baltimore and Ridge to Reefs Staff during screening events.

Work on the Jones Falls Watershed including Western Run, Stony Run and Little Stony Run watersheds is complete. Over 15 potential illicit discharges have been reported to the Baltimore City Department of Public Works (DPW) including one illegal sewer connection/sewer line break which was promptly fixed by the DPW and other investigations are still on-going for recent outfalls identified - particularly for those that were intermittent discharges.
Additionally, Ridge to Reefs (RTR) purchased a Field Fluorometer for Baltimore City to aid in the and enhance their technical capacity and speed in tracking of illicit discharges that can measure optical brighteners and fluorescence (fluorosin) instantaneously which will allow more rapid tracking of pollution than ammonia which currently takes 10 -15 minutes. The fluorosin measurement will also allow them to track small leaks or leaks that are small compared to the total flow in a pipe where a black light or other visual means of detection do not work.

b. Describe any public involvement in the project that has occurred, including the specific roles of volunteers in project activities. Describe in detail any outreach or educational activities (e.g. workshops, trainings, public events, community planting events, etc.).

We conducted 6 "Pollution Reporting 101 & Outfall Screening Blitz" training events across the duration of the project. Trainings have all been held on weekend days in order to engage as many volunteers in this project as possible. 72 people have been trained on how to identify the different types of pollution and illicit discharges that enter their neighborhood streams and Harbor, as well as who to report pollution to and how to engage their community in restoration events. Once these volunteers went through the training, they became eligible to join trained staff members during an Outfall Screening Blitz events. In the course of these events, volunteers collected water quality samples while following strict Standard Operating Procedures and analyzed them for the presence of six different pollution indicators. During one of the screening events in the Stony Run a major sanitary sewer overflow was discovered in the Stony Run in late April 2016, our partners at Blue Water Baltimore published an online blog about the finding in order to foster more public interest in the program and recruit more volunteers http://www.bluewaterbaltimore.org/blog/sewage-leak/ . As a result, there was a 33% increase in attendance at the following Pollution Reporting 101 & OSB training event.
We are also sharing a copy/summary of the report with City Council Members and the Waterfront Partnership to help them be aware of the project and the next steps.

c. In light of the Trust's commitment to the advancement of diversity in its grant-making, please provide demographic information regarding the community or population that benefited from or were served by the project. Describe how the population and/or community were involved in the planning, development, and implementation of the project, and if applicable in the development of this report.

The demographics from Baltimore City Planning Department from 2014 are as follows for the City (Figure 2.) -- where the vast majority of the work took place are as follows : 62.6% black, 30.3 white, 4.7% Hispanic and 4.1% Asian. 72 residents have participated in the program but we have not tracked ethnicity but for sure it is a diverse community that will benefit from improved water quality in the Jones Falls and Herring Run.

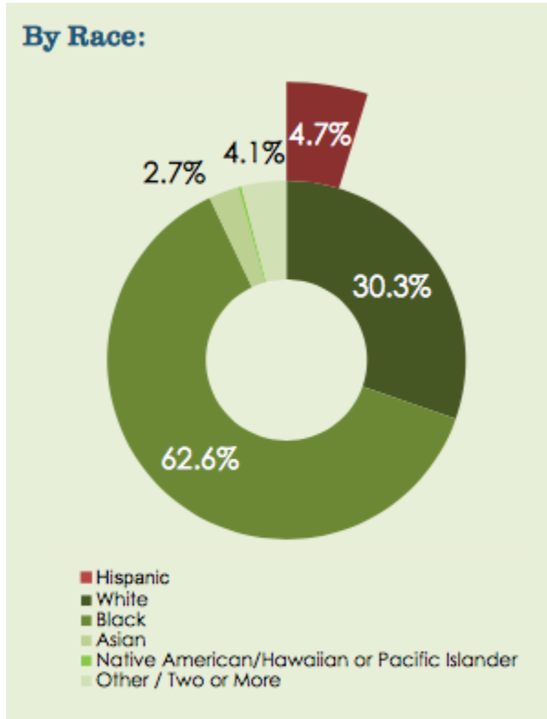


Figure 2. Demographics from Baltimore City Planning Department from 2014.

2. **Monitoring and Maintenance:** Describe any monitoring and maintenance that has taken place. When will monitoring results become available?

Monitoring results have been made available through diverse platforms. In April, 2016, Blue Water Baltimore published an online blog about findings in order to foster more public interest in the program and recruit more volunteers [http://www.bluewaterbaltimore.org/blog/sewage-leak/].

Additionally, Blue Water Baltimore in partnership with the Waterfront Partnership have created the Healthy Harbor Report Card. The report card helps communicate the conditions of streams and tracks progress. Results from the Outfall Screen Blitz events were reported in the 2016 Healthy Harbor Report Card and experts at Blue Water Baltimore analyzed this data to produce the report card scores(Figure 3.). Below the link for the 2016 Healthy Harbor Report Card.
http://baltimorewaterfront.com/wp-content/uploads/2017/05/1704_HH_ReportCard_FINAL-web-nospreads.pdf

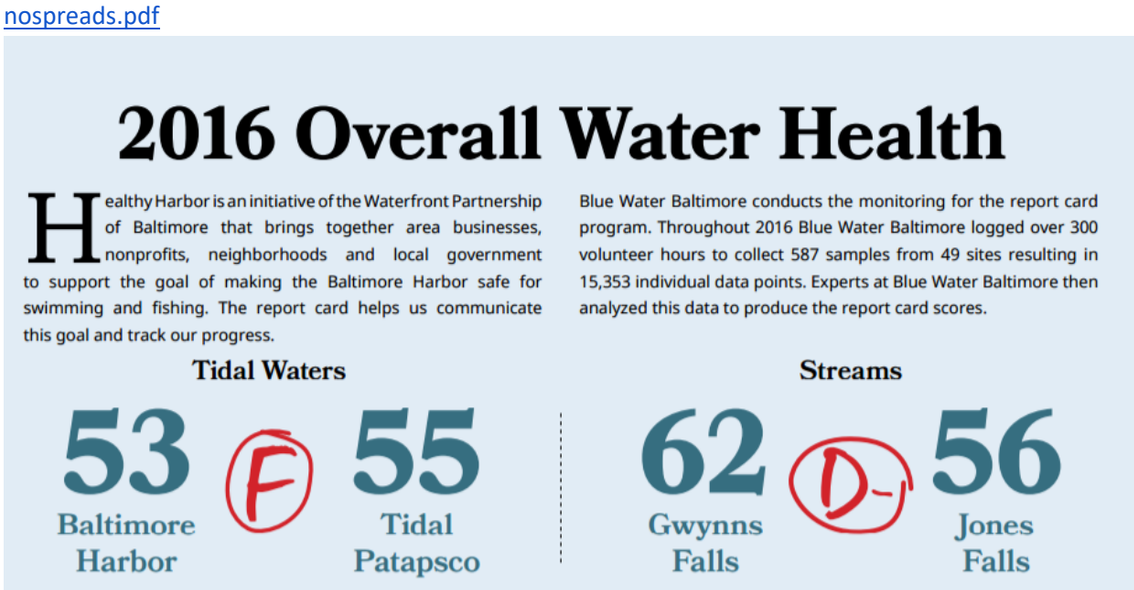
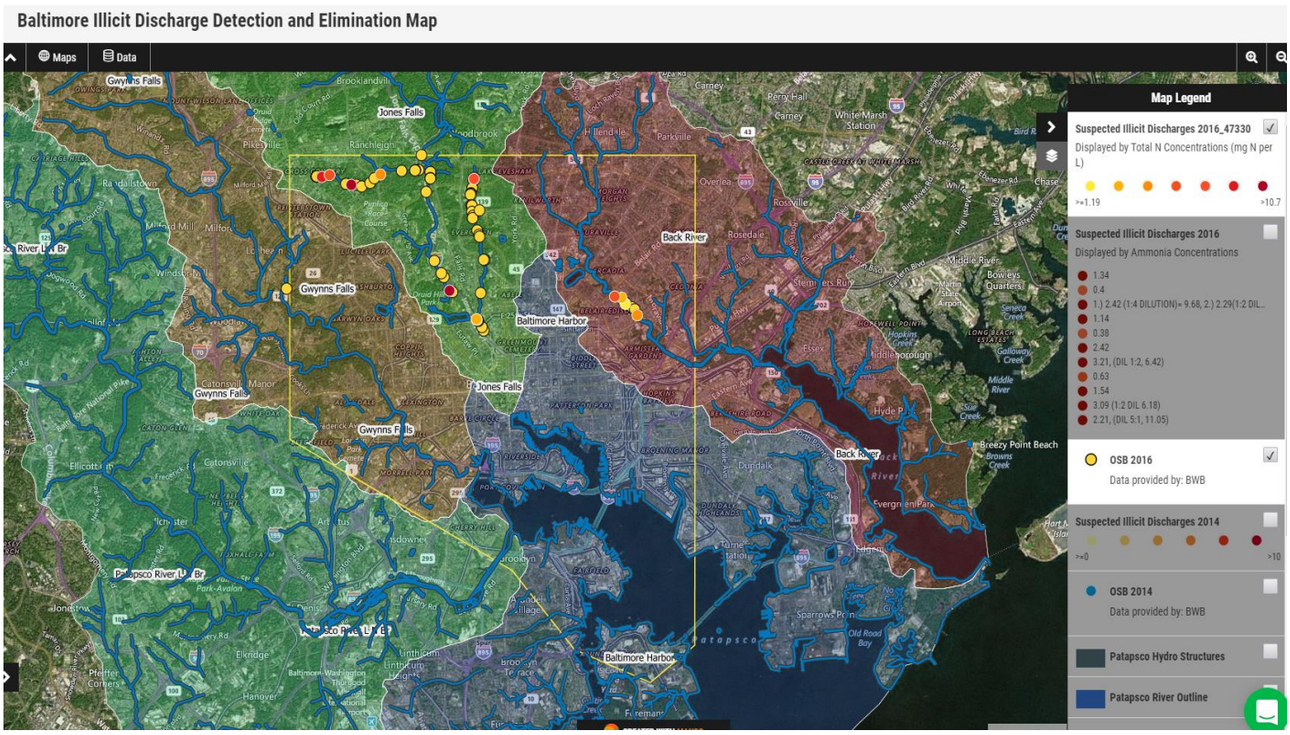


Figure 3. 2016 Healthy Harbor Report Score

Also, Ridge to Reefs has created an interactive map (Figure 4.) with all sampled sites and results for each outfall, we have shared this with Baltimore City DPW and Blue Water Baltimore and is accessible to the public on Ridge to Reefs website and to participants in the program through Blue Water Baltimore. One can also access the interactive map using the following link: http://mgo.ms/s/k703w. The information will be updated with additional results from the lab and a spreadsheet of raw data is



available as well and will be placed online on www.ridgetoreefs.org .

Figure 4. Screencapture of Baltimore's IDDE Map created, available on Ridge to Reefs website.

3. **Project Evaluation:** Provide a written evaluation of the project. Describe:
    a. Methods/procedures that are being used to evaluate the relative success of the project in achieving its goals and objectives.
    b. Your greatest success and the biggest challenge. What advice would you give someone considering a similar project?

The Project progressed as expected except for the exceptionally frequent rainfall that occurred during the spring of 2016. This made sampling with a 48-hour dry period needed for illicit discharge monitoring very challenging and led to us having to cancel many monitoring events. Roughly 65% of our scheduled monitoring dates were rained out. Still we were able to complete more monitoring events during dry weather periods. In some cases, we had targeted screening events based on weather forecasts.

Some of the successes accomplished by this project have been:

- Over 15 miles of streams and associated outfalls were surveyed with an engaged public.
- Identifying over 11 million gallons per year of contaminated outfall effluent which represents loads of over 650 lbs per year of nitrogen and over 50 lbs of phosphorus.
- Of the 11 million gallons identified at least 6.5 million gallons reduced (most of the discharges not fixed are due to them being intermittent and not occurring all the time) - which accounts for over 350 lbs of nitrogen and over 45 lbs of phosphorus.

- Baltimore City Department of Public Works (DPW) fixing an illegal sewer connection/sewer line break and is still currently investigating other outfalls recently identified with potential issues.
- We believe this project helped encourage the City of Baltimore Water Quality Section to purchasing their own tracking resources – CCTV (robot type tracker that can be deployed in underground pipes to ID and detect leaks) and vehicle to transport it -- this has resulted in City WQ staff being much more successful in tracking leaks throughout the CIty and for this project. Moreover, the City has hired one person that is now dedicated to resolving suspected discharges of an unknown origin(SDUO). These are long-term benefits to the program which will continue to pay environmental dividends over time as well as the new fluorometer.

4. **Transferability and Sustainability:** How will the results of your work be used by others? Was the project or will the project be transferred to other jurisdictions/locations? How will these efforts be sustained in the future?

Next Steps

- Potentially focus in on a specific watershed (such as Herring Run) or the direct drainage to the Harbor (using coastal IDDE methods) and continue working with BWB and City of Baltimore to clean it up significantly.
- Share this case study with others in older Cities through the Ridge to Reefs website and list serves.
- Sample for bacteria in the streams/ creeks and outfalls as well to help to highlight the public health risk that polluted and contaminated outfalls create
- Work from the top of one of the watersheds to the bottom to identify and track illicit discharges in cooperation with the City of Baltimore and Baltimore County ie. Gwynns Falls or Herring Run starting at the headwaters in Baltimore County (some of which are trout streams) but quickly degrade as streams flow through Owings Mills and Reisterstown etc or Herring Run which historically had Herring runs.
- City of Baltimore to consider providing funds to Blue Water Baltimore to identify polluted outfalls – as currently the City screens only limited outfalls as part of its SIS (stream impact sampling).
- City of Baltimore to consider a more permanent fix to one of the sanitary lines that crosses a stream and has broken twice in the last 8 years or so.

Appendix N: Microbial Source Tracking Study

Microbial Source Tracking Analysis Report

Wolf T. Pecher, College of Arts and Sciences, University of Baltimore
Eric J. Schott, Institute of Marine & Environmental Technology, University of Maryland
Center for Environmental Science

Date: April 12, 2017

1 Results

Eight water samples collected by the Department of Public Works (DPW) on March 23, 2017 were tested for the presence and levels of human and canine fecal waste. Results are summarized in Table 1.

In addition to the quantitative standards for human and canine fecal contamination, a standard consisting of diluted Back River sewage was analyzed. This provides an internal reference for performance of the method and permits the levels of human fecal waste to be expressed in %sewage equivalent. This will give an empirical estimate of the proportion of raw sewage in the sample, if all human stool stems from sewage.

1.1 Human Fecal Matter Contribution

Out of the eight environmental samples, two samples had comparatively high levels of human fecal contamination: Fountain & Castle, and Homeland & Springlake. Based on the levels of the human marker in raw sewage, and assuming that the source of the human marker in environmental samples is sewage, about 2.6% of the sample collected at Homeland & Springlake were raw sewage, and about 12.2% of the water sample at Fountain & Castle (Table 1).

1.2 Canine Fecal Matter Contribution

Three samples had some level of canine fecal contamination, Homeland & Springlake, JF 11.5 OF, and 26th Huntingdon. However, since raw sewage shows some level of canine signal, it is likely that the contamination observed in the field sample from Homeland & Springlake stems from sewage. The other two water samples showed canine fecal waste levels that were higher than the background signal in sewage. Amounts were small: JF 11.5 OF had 0.02 μg canine feces in 100 ml sample, and 26th Huntigdon 0.34 μg canine feces in 100 ml sample (Table 1).

2 Method Summary

2.1 Sample Processing & DNA extraction

On March 23, 2017 eight water samples were collected by the Department of Public Works (DPW). The samples and a field blank consisting of 500 ml phosphate buffered water were delivered to the University of Baltimore (UB).

Table 1: Summary of MST Results. %Sewage equivalent was calculated using the amount of human marker in raw sewage (9.92×10^5 copies in 1 ml) as a reference. Amount of canine feces (µg) in 100 ml was calculated using the amount of canine marker in canine feces (2.77×10^9 copies in 1 g feces) as a reference. **Total**: amount of canine feces (in µg) observed in 100 ml sample; **Canine Only**: amount of canine feces in 100 ml sample corrected for the amount of canine marker in raw sewage (9,800 copies in 1 ml sewage).

				Canine Marker		
		Human Marker			Fecal Waste (µg)	
Sample ID	Sample Description	Copy Nr. in 1 ml	%Sewage Equivalent	Copy Nr. in 1 ml	Total in 100 ml	Canine Only in 100 ml
D001	5012 Wetheredsville RD	9.05	0.00	0.00	0.00	0.00
D002	Clifon/Fairfax	1291.70	0.13	2.12	0.08	0.00
D003	Homeland & Springlake	25890.22	2.61	161.10	5.82	0.00
D004	Fountain & Castle	121074.58	12.21	0.00	0.00	0.00
D005	JF 11.5 OF	1723.85	0.17	17.73	0.64	0.02
D006	26th Huntingdon	502.30	0.05	14.45	0.52	0.34
D007	28th & Howard	24.54	0.00	0.00	0.00	0.00
D008	31th & Charles	461.05	0.05	2.00	0.07	0.00
D009	Field Blank	0.00	0.00	0.00	0.00	0.00
D010	Method Blank	0.00	0.00	0.00	0.00	0.00
D011	Extraction Blank	0.00	0.00	0.00	0.00	0.00

Samples were recoded to D001 - D009. It should be noted that 2 sample bottles were labeled as “31th & Charles” whereas “26th & Huntigdon” was missing. Based on the collection time (as noted on the chain of custody form, and on the bottles) the sample collected at 10:08 AM was assigned to “26th & Huntigdon” (D006), and the sample collected at 10:48 AM to “31th & Charles” (D008).

Processing of Environmental Samples. Generally, 500 ml of the water samples and the field blank were filtered through mixed cellulose ester (MCE) membranes with a pore size of 0.45 µm. Due to turbidity of the samples from Fountain & Castle (D004), 28th & Howard (D007), and 31th & Charles (D008), only 150 ml, 350 ml, and 250 ml were filtered, respectively. A method blank (500 ml phosphate buffered water) was included. Membranes were stored at -80°C prior to DNA extraction.

DNA was extracted from the membranes the next day (March 24, 2017) using the DNeasy® PowerLyzer® PowerSoil® DNA extraction kit (QIAGEN Inc., Germantown, MD) following the manufacturer’s recommendation with slight modification to maximize DNA recovery. DNA extracts were eluted in 100 µl elution buffer, divided between analytical and archived samples, and stored at -80°C. Analytical samples were delivered to UMCES/IMET for quantitative molecular microbial source tracking (mMST) analysis.

Sewage Reference. A sewage reference sample was used consisting of DNA extracts from 5 raw sewage samples that were collected from the Back River Watertreatment plant. Briefly, from each sewage sample, 5 ml was filtered through MCE membranes. DNA was extracted from the membranes, eluted in 100 µl elution buffer, and stored as described above for Environmental samples. DNA extracts were pooled prior to analysis.

Canine Reference Sample. A canine reference sample was used consisting of DNA extracts from feces collected from 5 dogs. Briefly, 250 mg of feces was collected from each dog, DNA extracted, eluted in 100 µl elution buffer, and stored as described above. DNA extracts were pooled prior to analysis.

2.2 mMST analysis using qPCR

DNA extracts were tested by quantitative Polymerase Chain Recation (qPCR) for the levels of human, and canine fecal contamination with published molecular probes. Briefly, DNA preparations from environmental samples were diluted 5-fold, and 4 µl of the dilutions used for each qPCR reaction. Using qPCR results on DNA extracts from pooled sewage and dog fecal samples as a reference (4 µl of a 100-fold dilution each), the amount of sewage and canine fecal matter was calculated. The level of contamination was expressed as copy number of human marker per ml sample and %sewage equivalent, and as copy number of canine marker in 1 ml sample and mg or µg of feces in 100 ml sample (Table 1).[1] It should be noted that in the reference sewage sample, canine fecal matter was detected (9,800 copies of canine marker in 1 ml sewage). Levels of canine fecal matter reported in field samples were adjusted accordingly to reflect the amount from non-sewage canine sources only (Table 1, column "Canine Only").

[1]The concentration of sewage varies, and there is variability of the amount of dog associated gut bacteria in different dogs. Therefore the volume of fecal contamination is an estimate.

Microbial Source Tracking Analysis Report

Sample Event: May 18, 2017

Wolf T. Pecher, College of Arts and Sciences, University of Baltimore
Eric J. Schott, Institute of Marine & Environmental Technology, University of Maryland
Center for Environmental Science

Date: June 6, 2017

1 Results

Eight water samples collected by the Department of Public Works (DPW) on May 18, 2017 were tested for the presence and levels of human and canine fecal waste. Results are summarized in Table 1.

In addition to the quantitative standards for human and canine fecal contamination, a standard consisting of diluted Back River sewage was analyzed. This provides an internal reference for performance of the method and permits the levels of human fecal waste to be expressed in %sewage equivalent. This will give an empirical estimate of the proportion of raw sewage in the sample, if all human stool stems from sewage.

1.1 Human Fecal Matter Contribution

Out of the eight environmental samples, the sample from Lakewood & Hudson carried the most amount of sewage (0.64% raw sewage), followed by 940 Chester (0.44% raw sewage), and Lakewood & Eastern (0.41% raw sewage) (Table 1).

1.2 Canine Fecal Matter Contribution

Seven of the eight samples were positive for the canine marker. However, since raw sewage shows some level of canine signal, it is likely that the contamination observed in six of the seven field sample stems from sewage. The sample from Lakewood & Beryl, however, showed canine fecal waste levels that were higher than the background signal in sewage. About 0.51 µg canine feces in 100 ml sample was detected (Table 1).

2 Method Summary

2.1 Sample Processing & DNA extraction

On May 18, 2017 eight water samples were collected by the Department of Public Works (DPW). The samples and a field blank consisting of 500 ml phosphate buffered water were delivered to the University of Baltimore (UB). Samples were recoded to D012 - D019.

Table 1: Summary of MST Results. %Sewage equivalent was calculated using the amount of human marker in raw sewage (9.54×10^5 copies in 1 ml) as a reference. Amount of canine feces (µg) in 100 ml was calculated using the amount of canine marker in canine feces (2.77×10^9 copies in 1 g feces) as a reference. **Total**: amount of canine feces (in µg) calculated for the 100 ml sample; **Canine Only**: amount of canine feces calculated for the 100 ml sample corrected for the amount of canine marker in raw sewage (19,500 copies in 1 ml sewage).

				Canine Marker		
		Human Marker			Fecal Waste (µg)	
Sample ID	Sample Description	Copy Nr. in 1 ml	%Sewage Equivalent	Copy Nr. in 1 ml	Total in 100 ml	Canine Only in 100 ml
D012	Purlington & Taplow	2453.50	0.26	7.25	0.26	0.00
D013	Lakewood & Hudson	6137.50	0.64	55.25	1.99	0.00
D014	1515 N. Wolfe	3170.00	0.33	14.75	0.53	0.00
D015	3637 Roberts Place	2168.75	0.23	34.25	1.24	0.00
D016	Lakewood & Beryl	88.00	0.01	16.00	0.58	0.51
D017	940 Chester	4240.75	0.45	33.75	1.22	0.00
D018	Ester Place North Branch	1224.75	0.13	2.50	0.09	0.00
D019	Lakewood & Eastern	3900.00	0.41	61.75	2.23	0.00
D020	Field Blank	0.00	0.00	0.00	0.00	0.00
D021	Method Blank	0.00	0.00	0.00	0.00	0.00
D022	Extraction Blank	0.00	0.00	0.00	0.00	0.00

Processing of Environmental Samples. 500 ml of the water samples and the field blank were filtered through mixed cellulose ester (MCE) membranes with a pore size of 0.45 µm. A method blank (500 ml phosphate buffered water) was included. Membranes were stored at -80°C prior to DNA extraction.

DNA was extracted from the membranes the next day (May 19, 2017) using the DNeasy® PowerLyzer® PowerSoil® DNA extraction kit (QIAGEN Inc., Germantown, MD) following the manufacturer's recommendation with slight modification to maximize DNA recovery. DNA extracts were eluted in 100 µl elution buffer, divided between analytical and archived samples, and stored at -80°C. Analytical samples were delivered to UMCES/IMET for quantitative molecular microbial source tracking (mMST) analysis.

Sewage Reference. A sewage reference sample was used consisting of DNA extracts from 5 raw sewage samples that were collected from the Back River Watertreatment plant. Briefly, from each sewage sample, 5 ml was filtered through MCE membranes. DNA was extracted from the membranes, eluted in 100 µl elution buffer, and stored as described above for Environmental samples. DNA extracts were pooled prior to analysis.

Canine Reference Sample. A canine reference sample was used consisting of DNA extracts from feces collected from 5 dogs. Briefly, 250 mg of feces was collected from each dog, DNA extracted, eluted in 100 µl elution buffer, and stored as described above. DNA extracts were pooled prior to analysis.

2.2 mMST analysis using qPCR

DNA extracts were tested by quantitative Polymerase Chain Recation (qPCR) for the levels of human, and canine fecal contamination with published molecular probes. Briefly, DNA preparations from environmental samples were diluted 5-fold, and 4 µl of the dilutions used for each qPCR reaction. Using qPCR results on DNA extracts from pooled sewage and dog fecal samples as a reference (4 µl of a 100-fold dilution each), the amount of sewage and canine fecal matter was calculated. The level of contamination was expressed as copy number of human marker per 1 ml sample and %sewage equivalent, and as copy number of canine marker in 1 ml sample and the equivalent quantity (in µg) of canine feces in a 100 ml sample (Table 1).[1] It should be noted that in the reference sewage sample, the canine fecal marker was detected (19,500 copies of canine marker in 1 ml sewage). Levels of canine fecal matter reported in field samples were adjusted accordingly to reflect the amount from non-sewage canine sources only (Table 1, column "Canine Only").

[1]The concentration of sewage varies, and there is variability of the amount of dog associated gut bacteria in different dogs. Therefore the volume of fecal contamination is an estimate.

Microbial Source Tracking Analysis Report

Wolf T. Pecher, College of Arts and Sciences, University of Baltimore

Sample Date: October 5, 2017

Report: November 14, 2017

1 Results

Seven water samples collected by the Department of Public Works (DPW) on October 5, 2017 were tested for the presence and levels of human and canine fecal waste, and mammalian fecal waste in general. Results are summarized in Tables 1 and 2.

In addition to the quantitative standards for human and canine fecal contamination, a standard consisting of diluted Back River sewage was analyzed. This provides an internal reference for performance of the method and permits the levels of human fecal waste to be expressed in %sewage equivalent. This will give an empirical estimate of the proportion of raw sewage in the sample, if all human stool stems from sewage.

1.1 Human Fecal Matter Contribution

Out of the seven environmental samples, the water sample collected at 2063 Clipper Park Rd @ Foot Bridge had the highest amount of sewage. Based on the levels of the human marker in raw sewage, and assuming that the source of the human marker in environmental samples is sewage, about 9.6% of the sample was raw sewage. The water samples collected at Poplar Grove St & Old Franklin and Monument St. & Buren St (East) did not show evidence of sewage contamination (Table 1).

The water sample collected at Poplar Grove St & W. Mulberry St. showed the highest proportion of sewage contamination with 40% of the total (mammalian) fecal contamination detected being sewage. The proportion of sewage contamination at Nieman & Harriet, Dean & McElderry, and 2063 Clipper Park Rd @ Foot Bridge was 20% (Table 2).

1.2 Canine Fecal Matter Contribution

Two samples had some level of canine fecal contamination, Poplar Grove St & W. Mulberry St. and 2560 Lauretta, with corrected amounts of 6.78 µg and 4.15 µg canine feces in 100 ml sample (Table 1).

1.3 General Mammalian Fecal Matter

Overall, highest (mammalian) fecal contamination was detected at 2063 Clipper Park Rd @ Foot Bridge with 5.61×10^6 copies of the generic marker in 1 ml sample, followed by 2560 Lauretta with 2.63×10^6 copies. The other samples showed considerable less mammalian fecal contamination. Approximately 20% of the mammalian fecal contamination at 2063 Clipper Park Rd @ Foot Bridge was caused by human fecal waste. In contrast, the source of the fecal contamination at 2560 Lauretta remains unkown as less than 1% of the fecal contamination stems from sewage, and the amount of canine marker low.

Table 1: **Summary of MST Results.** %Sewage equivalent was calculated using the amount of human marker in raw sewage (9.92×10^5 copies in 1 ml) as a reference. Amount of canine feces (µg) in 100 ml was calculated using the amount of canine marker in canine feces (2.77×10^9 copies in 1 g feces) as a reference. **Total**: amount of canine feces (in µg) observed in 100 ml sample; **Canine Only**: amount of canine feces in 100 ml sample corrected for the amount of canine marker in raw sewage (31,000 copies in 1 ml sewage).

				Canine Marker		
		Human Marker			Fecal Waste (µg) in 100 ml	
Sample ID	Sample Description	Copy Nr. in 1 ml	%Sewage Equivalent	Copy Nr. in 1 ml	Total	Canine Only
D023	Poplar Grove St & W. Mulberry St.	892	0.09	216	7.81	6.78
D024	Poplar Grove St & Old Franklin	0	0.00	0	0.00	0.00
D025	2560 Lauretta	1208	0.12	154	5.54	4.15
D026	Nieman & Harriet	30	0.00	0	0.00	0.00
D027	Dean & McElderry	25	0.00	2	0.09	0.06
D028	Monument St. & Buren St (East)	0	0.00	0	0.00	0.00
D029	2063 Clipper Park Rd @ Foot Bridge	93116	9.59	2102	75.87	0.00
BRPool	Raw Sewage	971000	100.00	31000	1119.13	0.00

2 Method Summary

2.1 Sample Processing & DNA extraction

On October 5, 2017 seven water samples were collected by the Department of Public Works (DPW). The samples and a field blank consisting of 500 ml phosphate buffered water were delivered to the University of Baltimore (UB). Samples were recoded to D023 to D029.

Processing of Environmental Samples. 100 – 250 ml of environmental samples and 500 ml of the field blank were filtered through mixed cellulose ester (MCE) membranes with a pore size of 0.45 µm. A method blank (500 ml phosphate buffered water) was included. Membranes were stored at -80°C prior to DNA extraction.

DNA was extracted from the membranes the next day (Oct. 6, 2017) using the DNeasy® PowerLyzer® PowerSoil® DNA extraction kit (QIAGEN Inc., Germantown, MD) following the manufacturer's recommendation with slight modification to maximize DNA recovery. DNA extracts were eluted in 100 µl elution buffer, divided between analytical and archived samples, and stored at -80°C. Analytical samples were delivered to UMCES/IMET for quantitative molecular microbial source tracking (mMST) analysis.

Sewage Reference. A sewage reference sample was used consisting of DNA extracts from 5 raw sewage samples that were collected from the Back River Watertreatment plant. Briefly, from each sewage sample, 5 ml was filtered through MCE membranes. DNA was extracted from the membranes, eluted in 100 µl elution buffer, and stored as described above for Environmental samples. DNA extracts were pooled prior to analysis.

Table 2: **Percent contribution of human fecal waste to total mammalian fecal contamination.** The contribution of sewage and canine waste to total mammalian fecal contamintation was estimated by calculating the ratio of the expected copy number of the mammalian marker in sewage or canine waste and the observed copy number of the mammalian maker in the water sample. The expected copy number of the mammalian marker contribued by sewage was calculated using the ratio of human marker:mammalian marker in the reference sewage sample (8%). Due to variability, contributions are presented in 10% increments, and calculated contributions rounded to the nearest 10%. **Total:** copy number of mammalian marker. **Expected Copy Nr.:** Calculated copy number of the mammalian marker from human in the water sample based on the ratio of human:mammalian marker determined in the sewage reference sample. **%Human:** relative contribution of human fecal contamination to total mammalian fecal contamination.

		Total	Human	
Sample ID	Sample Description	Observed Copy Nr.	Expected Copy Nr.	%Human
D023	Poplar Grove St & W. Mulberry St.	28826	12110	40
D024	Poplar Grove St & Old Franklin	131	0	0
D025	2560 Lauretta	2631203	16398	1
D026	Nieman & Harriet	1786	407	20
D027	Dean & McElderry	4097	339	10
D028	Monument St. & Buren St (East)	11599	0	0
D029	2063 Clipper Park Rd @ Foot Bridge	5607953	1263498	20

Canine Reference Sample. A canine reference sample was used consisting of DNA extracts from feces collected from 5 dogs. Briefly, 250 mg of feces was collected from each dog, DNA extracted, eluted in 100 µl elution buffer, and stored as described above. DNA extracts were pooled prior to analysis.

2.2 mMST analysis using qPCR

mMST analysis was performed by Dr. Eric Schott (UMCES/IMET). Briefly, DNA extracts were tested by quantitative Polymerase Chain Recation (qPCR) for the levels of human, and canine fecal contamination with published molecular probes. DNA preparations from environmental samples were diluted 5-fold, and 4 µl of the dilutions used for each qPCR reaction. Using qPCR results on DNA extracts from pooled sewage and dog fecal samples as a reference (4 µl of a 100-fold dilution each), the amount of sewage and canine fecal matter was calculated. The level of contamination was expressed as copy number of human marker per ml sample and %sewage equivalent, and as copy number of canine marker in 1 ml sample and mg or µg of feces in 100 ml sample (Table 1).[1] It should be noted that in the reference sewage sample, canine fecal matter was detected (3.1×10^4 copies of canine marker in 1 ml sewage). Levels of canine fecal matter reported in field samples were adjusted accordingly to reflect the amount from non-sewage canine sources only (Table 1, column

[1]The concentration of sewage varies, and there is variability of the amount of dog associated gut bacteria in different dogs. Therefore the volume of fecal contamination is an estimate.

"Canine Only").

To estimate the contribution of human fecal waste to the total (mammalian) fecal contamination observed at a site, levels of mammalian fecal contamination was assessed with published molecular probes.[2] The relative contribution of human fecal contamination to the total mammalian contamination was calculated by multiplying the amount of human marker observed in the water sample with the ratio of human:mammalian marker determined in the sewage reference sample (7.8%).

[2]The mammalian probe targets a group of bacteria present in most mammals, known as *Bacteroidales*. The human marker targets a subgroup of the *Bacteroidales*. Unfortunately, birds do not necessarily carry *Bacteroidales* bacteria, and therefore are excluded from the analysis.

Microbial Source Tracking Analysis Report

Wolf T. Pecher, College of Arts and Sciences, University of Baltimore

Sample Date: March 15, 2018

Report: April 10, 2018

1 Results

Eight water samples collected by the Department of Public Works (DPW) on March 15, 2018 were tested for the presence and levels of human and canine fecal waste, and mammalian fecal waste in general. Results are summarized in Tables 1 and 2.

In addition to the quantitative standards for human and canine fecal contamination, a standard consisting of diluted Back River sewage was analyzed. This provides an internal reference for performance of the method and permits the levels of human fecal waste to be expressed in %sewage equivalent. This will give an empirical estimate of the proportion of raw sewage in the sample, if all human stool stems from sewage. It also allows to estimate the percent contribution of human fecal waste to total mammalian fecal contamination.

1.1 Human Fecal Matter Contribution

Out of the eight environmental samples, the water sample collected at Kirk & Curtain (NE) had the highest amount of sewage. Based on the levels of the human marker in raw sewage, and assuming that the source of the human marker in environmental samples is sewage, about 2.5% of the sample was raw sewage. The water sample collected at Mt. Royal & St. Paul East did not show evidence of sewage contamination (Table 1).

The water samples collected at Greenmount & Federal and Federal & Brentwood showed the highest proportion of sewage contamination with 50% and 40% of the total (mammalian) fecal contamination detected being sewage. The proportion of sewage contamination at Kirk & Curtain (NE) was 30% (Table 2).

1.2 Canine Fecal Matter Contribution

Two samples had some level of canine fecal contamination, Federal & Brentwood, and 2260 Cecil Rear, with corrected amounts of 3.72 µg and 2.34 µg canine feces in 100 ml sample (Table 1).

1.3 General Mammalian Fecal Matter

Highest (mammalian) fecal contamination was detected at Mt. Royal & St. Paul East with 1.38×10^7 copies of the generic marker in 1 ml sample. This level of contamination is high[1], however, the

[1] For comparision, 1 ml sewage has 5.44×10^6 copies of the generic marker. Initial Quality Assurance Analysis confirmed the high copy number in the Mt. Royal & St. Paul East sample. Additional confirmatory tests are being performed.

Table 1: **Summary of MST Results.** %Sewage equivalent was calculated using the amount of human marker in raw sewage (6.96×10^5 copies in 1 ml) as a reference. Amount of canine feces (µg) in 100 ml was calculated using the amount of canine marker in canine feces (2.77×10^9 copies in 1 g feces) as a reference. **Total**: amount of canine feces (in µg) observed in 100 ml sample; **Canine Only**: amount of canine feces in 100 ml sample corrected for the amount of canine marker in raw sewage (8,5000 copies in 1 ml sewage).

				Canine Marker		
		Human Marker			Fecal Waste (µg) in 100 ml	
Sample ID	Sample Description	Copy Nr. in 1 ml	%Sewage Equivalent	Copy Nr. in 1 ml	Total	Canine Only
D033	Mt. Royal & St. Paul East	0	0.00	0	0.00	0.00
D034	Greenmount & Federal	9582	1.38	122	4.40	0.18
D035	Federal & Brentwood	3762	0.54	149	5.38	3.72
D036	20th & Homewood	5160	0.74	80	2.89	0.61
D037	2260 Cecil Rear	1612	0.23	84	3.05	2.34
D038	Kirk & Curtain (NE)	17450	2.51	166	5.97	0.00
D039	5306 Nuth	3462	0.50	0	0.00	0.00
D040	Frankfort & Nuth	634	0.09	8	0.31	0.03
BRPool	Raw Sewage	696000	100.00	8500	306.86	0.00

source is unkown as we did not detect human nor canine fecal contamination. The second highest level of mammalian fecal contamination was detected at Kirk & Curtain (NE) with 5.41×10^5 copies. At this site, approximately 30% of the mammalian fecal contamination was caused by human fecal waste (Table 2).

2 Method Summary

2.1 Sample Processing & DNA extraction

On March 15, 2018 eight water samples were collected by the Department of Public Works (DPW). The samples and a field blank consisting of 500 ml phosphate buffered water were delivered to the University of Baltimore (UB). Samples were recoded to D033 to D040.

Processing of Environmental Samples. 50 – 500 ml of environmental samples and 500 ml of the field blank were filtered through mixed cellulose ester (MCE) membranes with a pore size of 0.45 µm. Membranes were stored at -80°C prior to DNA extraction.

DNA was extracted from the membranes March 19, 2018 using the DNeasy® PowerLyzer® PowerSoil® DNA extraction kit (QIAGEN Inc., Germantown, MD) following the manufacturer's recommendation with slight modification to maximize DNA recovery. DNA extracts were eluted in 100 µl elution buffer, divided between analytical and archived samples, and stored at -80°C. An extraction blank was included. Analytical samples were delivered to UMCES/IMET for quantitative molecular microbial source tracking (mMST) analysis.

Table 2: **Percent contribution of human fecal waste to total mammalian fecal contamination.** The contribution of sewage to total mammalian fecal contamintation was estimated by calculating the ratio of the expected copy number of the mammalian marker in sewage and the observed copy number of the mammalian maker in the water sample. The calculated copy number of the mammalian marker contribued by sewage was calculated using the ratio of human marker:mammalian marker in the reference sewage sample (13%). Due to variability, contributions are presented in 10% increments, and calculated contributions rounded to the nearest 10%. **Total:** copy number of mammalian marker. **Calculated Copy Nr.:** calculated copy number of the mammalian marker contributed by human fecal waste in the water sample based on the ratio of human:mammalian marker. **%Human:** relative contribution of human fecal contamination to total mammalian fecal contamination.

		Total	Human	
Sample ID	Sample Description	Observed Copy Nr.	Calculated Copy Nr.	%Human
D033	Mt. Royal & St. Paul East	13827425	0	0
D034	Greenmount & Federal	142323	74956	50
D035	Federal & Brentwood	66741	29432	40
D036	20th & Homewood	208432	40360	20
D037	2260 Cecil Rear	46815	12606	30
D038	Kirk & Curtain (NE)	540672	136500	30
D039	5306 Nuth	379028	27086	10
D040	Frankfort & Nuth	74528	4963	10

Sewage Reference. A sewage reference sample was used consisting of DNA extracts from 5 raw sewage samples that were collected from the Back River Watertreatment plant. Briefly, from each sewage sample, 5 ml was filtered through MCE membranes. DNA was extracted from the membranes, eluted in 100 µl elution buffer, and stored as described above for Environmental samples. DNA extracts were pooled prior to analysis.

Canine Reference Sample. A canine reference sample was used consisting of DNA extracts from feces collected from 5 dogs. Briefly, 250 mg of feces was collected from each dog, DNA extracted, eluted in 100 µl elution buffer, and stored as described above. DNA extracts were pooled prior to analysis.

2.2 mMST analysis using qPCR

mMST analysis was performed by Dr. Eric Schott (UMCES/IMET). Briefly, DNA extracts were tested by quantitative Polymerase Chain Recation (qPCR) for the levels of human, and canine fecal contamination with published molecular probes. DNA preparations from environmental samples were diluted 5-fold, and 4 µl of the dilutions used for each qPCR reaction. Using qPCR results on DNA extracts from pooled sewage and dog fecal samples as a reference (4 µl of a 100-fold dilution each), the amount of sewage and canine fecal matter was calculated. The level of contamination was expressed as copy number of human marker per ml sample and %sewage equivalent, and as

copy number of canine marker in 1 ml sample and mg or μg of feces in 100 ml sample (Table 1).[2] It should be noted that in the reference sewage sample, canine fecal matter was detected (8500 copies of canine marker in 1 ml sewage). Levels of canine fecal matter reported in field samples were adjusted accordingly to reflect the amount from non-sewage canine sources only (Table 1, column "Canine Only").

To estimate the contribution of human fecal waste to the total (mammalian) fecal contamination observed at a site, levels of mammalian fecal contamination was assessed with published molecular probes.[3] The relative contribution of human fecal contamination to the total mammalian contamination was calculated by multiplying the amount of human marker observed in the water sample with the ratio of human:mammalian marker determined in the sewage reference sample (13%).

[2] The concentration of sewage varies, and there is variability of the amount of dog associated gut bacteria in different dogs. Therefore the volume of fecal contamination is an estimate.

[3] The mammalian probe targets a group of bacteria present in most mammals, known as *Bacteroidales*. The human marker targets a subgroup of the *Bacteroidales*. Unfortunately, birds do not necessarily carry *Bacteroidales* bacteria, and therefore are excluded from the analysis.

Appendix O: Summary of PST Investigations

PST ID	PST Name	Location Description	Watershed	PST Comments	Complainant	Investigation Date	PST Discharge Classification
1017	Hanlon Park Uncharted Outfall Water Leak	Peak's Branch approximately 100 ft upstream Gwynn's Falls Pkwy	Gwynns Falls	High chlorine reported on 9/24/14 during ammonia screening. OCAL staff investigation found high volume (~80-100 GPM) of chlorinated water discharging from uncharted outfall (18"x10"). The outfall leads to a relief valve on the main. The valve was found to be leaking so Spinello added a secondary valve to stop the leak.	OCAL	9/24/2014	Potable Water
2230	Perkins Homes Between Mason Ct & Dallas Ct Lateral Connections	Perkins Homes court yard between northside of 1500 block of Gough St. (39.287508, -76.596197)	Baltimore Harbor	Continued to record high ammonia at Gough St. & Mason Ct, after Perkins Homes 251-269 Dallas Ct SDUO was confirmed abated. Due to the high ammonia, a new investigation was initiated. An attempt on 03/23/16 to CCTV inspection of storm drain, but was blocked by root wads at one end (Gough St) and concrete debris 92 feet into the inspection at the other end (263 Dallas Ct). Dye testing along with CCTV on 4/12/16 found that both buildings east and west of the courtyard have leaking sanitary laterals. The sewage is then entering into the storm drain at multiple locations. Information about leaking laterals has been provided to Housing Authority Director of Special Maintenance Operations (James Anderson) 4/12/16. On 4/15/16 we dye tested the cleanout for 271-299 Dallas Ct and the one for 271-299 Mason Ct to confirm the leak was below, the dye showed in the storm drain in both. On 4/19/16 we sent Mr Stephenson & Mr Anderson all of our findings & CCTV video footage of our inspection. Desmond Stephenson- Maintenance Supervisor for Perkins Homes - Desmond.Stephenson@habc.org - (410) 302-8315. On 10/12/17 Staff visited the Perkins Home for a follow up and found that the requested sanitary lateral replacement work had been completed in August. Ammonia was low in the down stream storm drain. Also, dye deployed in each of the buildings remained absent in the storm drain. SDUO abated.	OCAL	12/15/2015	SDUO, Private
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 had 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. On 8/10/2017 a cleanout was unearthed in the front yard of 2918 Woodland. The cap is rusted on and must be broken to remove. A dye test from the cleanout is needed. SDUO was abated on 09/07/2017	OCAL	5/5/2016	SDUO, SSO-Subsurface
2262	2924 Woodland Ave (SSO #4747)	2924 Woodland Ave	Jones Falls	CCTV inspection of 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. On 3/10/17 This was reported as an SSO because the property is now occupied. OAM hired contractors to line the house connection in May. On 8/09/2017 OCAL follow up found problem abated.	OCAL	5/10/2016	SSO-Subsurface
2303	2024 Fleet St	Fleet St & Castle St	Baltimore 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

PST ID	PST Name	Location Description	Watershed	PST Comments	Complainant	Investigation Date	PST Discharge Classification
2309	Perkins Homes 231-269 Ballou Ct	Courtyard of Perkins Homes at 231 Ballou Ct	Baltimore Harbor	High ammonia (0.58mg/L) reported during Harbor Bacteria survey on 8/3/16. Investigation led us to an area that we were previously investigating as a result of high ammonia during the East Harbor Ammonia Survey. High ammonia was tracked to an overflowing cleanout under the 231-269 Ballou bldg within the Perkins Homes Community. After the cleanout was capped the waste water then backed into sanitary manhole at 231 Ballou Ct. On 8/12/16 the sanitary choke resolved itself so we then found that there was a broken section of pipe 1 foot downstream of the manhole at 231 Ballou allowing sewage to escape during backups making this an intermittent SDUO. An additional defect to the sanitary pipe was found by UMD at the drop connection to the Pratt St sanitary manhole. UMD fixed the drop connection and OCAL was able to inspection most of the 8" sanitary mainline within Perkins Homes. A pipe break was found at 162' and the camera could not continue. Approximately 50' of pipe remains unseen. IDDE engineer has met with HCCD and contractors for abatement solution. On 10/12/17 Staff visited the Perkins Home for a follow up and found that the requested sanitary replacement work had been completed in August. Ammonia was low in the down stream storm drain. SDUO abated.	OCAL	8/3/2016	SDUO, Private
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
2398	4728 Parkside Dr Water Leak (BWB-20161119-HR-02)	Storm drain on the North side of intersection of Parkside Dr & Elison Ave	Herring Run	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
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
2454	Friends School Lower School	5114 N Charles St: Uncharted storm drain inlet located at the southeast corner of Friends' School ball field (beyond the end of the Boxhill Rd.)	Jones Falls	High ammonia recorded (0.35 mg/l) was recorded at the Wyndhurst ammonia survey site. The problem was narrowed to an uncharted storm drain inlet on the campus of Friends School. This investigation will require CCTV of the 10-12" pipe in the uncharted storm drain. Choked sanitary located on Friends School property. Friends is aware of the issue and taking corrective actions. Estimated discharge 10 GPM. Friends maintenance had the properties sewer system cctv'd and found a collapsed sanitary line and adjacent storm line. This we believe to be the main problem. The manhole was repaired but ammonia is still very high in the inlet. Monitoring ammonia levels at outfall and inlet. 7/12/17 Spoke with Bill and a contractor (Savin) is beginning work to cctv the whole property. 7/26 Construction and cctv is in progress.	OCAL	3/29/2017	SDUO, Private
2470	101 W Read St (Professional Arts Bldg)	Southwest corner of W Read & Cathedral St	Jones Falls	High ammonia (2.70mg/L) reported during Jones Falls Lateral Survey on 5/26/2017. The high ammonia was tracked to a manhole at Read & Cathedral with an uncharted connection from the direction of 101 W Read St. The connection had an obvious flow of sewage. Also, 101 W Read St has a sanitary lateral connection that crosses nearby and no flow was observed entering the correct sanitary manhole from this connection. On 5/31/17 a dye test of 101 W Read St from a basement bathroom was positive in the storm drain. No dye was present in the sanitary. An additional dye test of an office sink was negative in the storm drain. On 6/1/2017 two interior sanitary cleanouts and one unused cleanout were dye tested. The interior sanitary c/o in the southeast portion of the building was positive in the storm drain. The waste line was CCTVed from the cleanout for approximately 85' before it could not be pushed any further. Several connections were observed but the connection to the storm drain manhole at Read & Cathedral had not been reached. CCTV from the storm drain manhole at Read & Cathedral found a vault-like structure next to the manhole and an 8" pipe discharging the waste water from 101 W Read St. On 8/11/17 the correct sanitary house connection was cleaned, CCTVed, and marked. On 8/16/17 plumbers assisting OCAL to rule out any clear water connections to the existing sanitary connection to the storm drain. Owner working with contractor to make repairs. Repair work started on 12/27/17. As on 1/11/18 both the intended house connection and the existing house connection leaving the building have been located and excavated. On 1/19/18 Contractors made the connection between the intended house connection and the existing house connection leaving the building. Waste water is now entering the correct sanitary system and not entering the storm drain. SDUO abated.	OCAL	5/26/2017	SDUO, Private

PST ID	PST Name	Location Description	Watershed	PST Comments	Complainant	Investigation Date	PST Discharge Classification
2471	217-221 Read St (Robert's Key Service/Mt Vernon Tobacco Co)	217-221 Read St plumbing on Northwest side of building.	Jones Falls	High ammonia (2.70 mg/L) was reported on 5/26/2017 during the Lower Jones Falls Lateral Survey 2017. The high ammonia was first tracked to an SDUO at 101 W Read St. In addition, the ammonia was also high in the storm drain upstream from that SDUO. The ammonia was tracked to A/C condensation from a University of Maryland Medical Center building at Howard St & Read St. While investigating the high ammonia an intermittent surge with possible toilet paper was observed at Read St & Park Ave, therefore, the storm drains of the 200 & 300 blocks of Read St were CCTVed. During the pipe inspection a 6" connection was noticed with fecal material nearby. A dye test of a toilet in 217-221 W Read St was positive at the 6" connection into the storm drain. It was found that the jointed properties of 217 & 221 W Read St have two sanitary waste lines leaving the basement of the building. The plumbing on the Northwest side is entering the storm drain and the plumbing on the Southeast side is entering the sanitary system. On 7/6/2017 IDDE Engineer spoke with owners about contracting a plumber for abatement repairs. Follow up on 9/27/17 found that sanitary repairs have be finished in basement and connection to the storm drain has been permanently capped.	OCAL	5/26/2017	SDUO, Private
2480	1001 Wilmot Ct	Crawl space under 1001 Wilmot Ct. at Latrobe Homes	Jones Falls	Found during 2017 JF Lateral Survey. Sewage is flowing from a sanitary service pipe that has two missing cleanout cap in the crawl space under 1001 Wilmot Ct at Latrobe Homes. Sewage is flowing out of the two horizontal cleanouts, on to the ground, and we believe infiltrating the storm drain line on the east side of Ensor St either from a sump pump or through the ground. On 7/7/17 we met with the Latrobe Homes maintenance supervisor and told them about the problem and asked them to put end caps on the cleanouts. On 7/11/17 we followed up to see if the problem was abated only to find that sewage had backed up into the apartments. It appears the cleanout cap were removed because the line does not flow properly and they leave the caps off to overflow instead of backing up. After talking again with the Maintenance supervisor he informed us that this had been going on for three years and instead of fixing the issue this was their solution. On 7/12/17 we attempted to push camera the line(since they said their's was broken) the camera went under water after 4' and it could only be pushed 44' staying underwater the entire time. After that the someone from HABC attempted to snake the line and it also only traveled 44'. On 7/14/17 dye testing of the crawlspace under 1001 Wilmot found: 1) sewage is leaking from an unknown area of the lateral connection into the storm drain observed at E. Madison & Ensor St NE Corner (East Branch). 2) Any sewage overflowing from the open cleanout is eventually pumped into the storm drain in Wilmot Ct leading to the manhole at Ensor St & Wilmot Ct. At this time the constant flow of sewage observed at E. Madison & Ensor St NE Corner (North Branch) is unknown. On 7/18/17 we met Brian Dadey (HABC plumbing supervisor) and Sydney (HABC plumbing maintenance) at 1001 Wilmot Ct to discuss how to proceed in regards to resolving this problem. On 7/31/17 City hired contractors begun point repair to collapsed section of house connection on Madison St. On 8/10/2017 CCTV follow up of the storm drain on Ensor St found a large fracture and small hole which is believed to be how the sewage from 1001 Wilmot was entering prior to the house connection repair. Follow up samples show that the ammonia levels are quickly decreasing in storm drain, yet further testing is still needed. Follow up on 9/15/17 found that sewage in again flowing in the manhole at Madison & Ensor as a result of the overflowing cleanout in the 1001 Wilmot crawl space. Contact with HABC was made and they claim that their snake can not pass through to clear the line. UMD was contacted for lateral launching to inspect the recent house connection repair and look for further possible damage/blockage. CCTV found that the CIPP lining contractor lined over the lateral connection in the main. The city is working with the lining contractor to have the lateral reinstated. On 10/19/17 OCAL confirmed that the CIPP liner was open and the lateral from 1001 Wilmot Ct was active. However, ammonia remains high the storm drain at Madison & Ensor. The plumbing in the crawl space below 1001 Wilmot was not overflowing as it had in the past and the cleanout cover was in place. However, waste water was observed flowing on the ground from the other end of the building. This initiated the 1035 Wilmot Ct PST/SDUO.	OCAL	7/7/2017	SDUO, Private
2482	3600 Keystone Ave SSO# 4976	3600 Keystone Ave	Jones Falls	High ammonia discovered during outfall assessment. Choked sanitary in alley next to 3600 Keystone Ave. Was not filling up the manhole. After the choke was relieved the leak continued infiltrate the storm drain. UMD replace a section of line and we went out to find the line was still leaking. They replaced another section of line and on 8/22/17 we checked with CCTV and it was still leaking at the coupling of the second service connection down from the top. They replaced that piece of pipe the was leaking and on 8/25/17 we dye tested the sanitary by forcing it and CCTV the storm and saw the leak again in the same place 64' down from the inlet in the storm drain. On 8/31/17 they exposed the sanitary line and were were able to locate and show them how the pipe was leaking with CCTV. On 9/1/17 we went there show the foreman how and where it was leaking by forcing the water again because he was not there the first time. Followup on 9/8/17 found sso has been abated.	OCAL	7/19/2017	SSO-Subsurface
2485	1240 N. Broadway	1240 N. Broadway	Baltimore Harbor	Resident using sump pit as a toilet. Resident at 1238 N. Broadway complained to the counsel person.	Citizen	8/1/2017	Private
2486	845 Glen Allen Dr. Water Leak	845 Glen Allen Dr	Gwynns Falls	water main break causing heavy flow of sediment laden water.	OCAL	8/2/2017	Potable Water

PST ID	PST Name	Location Description	Watershed	PST Comments	Complainant	Investigation Date	PST Discharge Classification
2487	3114 Artaban Pl Sediment	Parking area of apartment complex in front of 3114 Artaban Pl	Gwynns Falls	Cloudy water noticed in Pecks Branch while following up on repairs to another PST. Sediment laden water was observed discharging from the 36" outfall in Hanlon Park. The sediment was tracked through the storm drain system to a water leak repair in parking lot of Artaban Pl. Plumbers were pumping dirty water from the pit. OCAL staff advised them to redirect their discharge into a grassy area to avoid sediment from entering storm drain	OCAL	8/4/2017	Other
2489	6320 Oakleaf Ave Lassonde Pappas Juice	6320 Oakleaf Ave Clement Pappas Juice	Gwynns Falls	Abundance of Sphaerotilus natan growth in stream. Tracked the source to 6320 Oakleaf Ave. Found trash compactor dumpster in rear of building to be leaching fluid on to the ground. There is evidence that this has washed into a storm inlet in the rear of the building. Pollution Control inspected property on 8/17/17 found dumpster to still be leaking. Notified MDE on 8/10/17 of the discharge. MDE issued a complaint about being in noncompliance to their No Exposure permit. OCAL issued a letter of concern to the owner. Joint OCAL and MDE followup on 10/3 found problem still existing. On 10/16 OCAL received a response letter from owner saying problem has been resolved. Followup visit by OCAL 10/17 found area clean and compactor no longer leaking.	OCAL	8/9/2017	Other
2490	3208 Milford Ave	3208 Milford Ave north side of property	Gwynns Falls	House connected to 15" Storm. The city failed to connect this property to the sanitary system when the city took over the private utilities in the neighborhood. DPW is going to perform the repair work. Sent letter notifying resident. Spoke	OCAL	8/9/2017	SDUO
2491	3349 Falls Rd (SSO# 5007)	Front yard of 3349 Falls Rd at sidewalk	Jones Falls	Sewage coming from hole in bottom of wall. On 8/17/17 OCAL staff performed a dye test from the home's cleanout and the dye was present along with waste water debris discharging from the hole at the bottom of the retaining wall. UMD responded and cleared the house connection from the cleanout to the sanitary main. Although CCTV could not pass through the house connection from the cleanout, a follow up dye test was performed by UMD with water from a pressure truck and the dye remained absent from the hole in retaining wall. UMD will schedule the house connection to be inspected by lateral lunching from the main	OCAL	8/14/2017	SDUO, SSO-Surface
2492	4202 Maine Ave	NW side of house at 4202 Maine Ave	Gwynns Falls	Cityworks complaint received for "sewage coming from pipe". OCAL staff responded and found that two down spout connections were overflowing with waste water onto the yard. One downspout was disconnected, the other still connected. The house connection was CCTVed from the cleanout to the sanitary main in rear alley and found to be clean and clear. The homeowner was advised to hire a plumber to handle the issue and to have the down spouts disconnected. Referred to IDDE engineer. Visited home on 9/15/17 and found that resident hired a plumber and had the waste line replaced in the back yard. Back up issues and discharge into yard have been abated.	Citizen	8/15/2017	SDUO, Private
2494	2200 E Northern Parkway SSO# 5012	2200 E Northern Parkway	Herring Run	Overflowing sanitary on top of hill.	OCAL	8/22/2017	SSO-Surface
2495	2501 W. Lexington St SSO# 5024, 5051	2501 W. Lexington St	Gwynns Falls	Investigation into the cloudy water at Gwynns Run Carroll Park. Found four sections of sanitary pipe are leaking into the underdrain at W. Lexington and N Warwick. OAM is using a contractor to line the four leaking pipe segments. Lining contractors completed the job on 10/25/2017. Follow up on 10/26/17 found clear water flowing from the underdrain. Dye deployed in the sanitary line was absent. SSO Abated	OCAL	8/23/2017	SSO-Subsurface
2496	2918 Woodland Ave SSO#5038	2818 Woodland Ave	Jones Falls	Located leak at 21ft from cleanout by pulling a dye bag from the main. Used CCTV.	OCAL	9/5/2017	SSO-Subsurface
2498	709 Chesapeake Ave (SSO #5055)	Along stream at 800 Chesapeake Ave (709 Chesapeake was used because cityworks would not recognize 800 Chesapeake)	Baltimore Harbor	OCAL received a citizen complaint through OAM from MDE about suspected sewage flowing from the outfall at Masonville Cove at 1000 Frankfurst Ave. OCAL staff found a large sanitary bypass in the 700-800 Blocks of Chesapeake Ave as part of a sanitary rehabilitation project. One of the larger pumps was found to be leaking approximately 20GPM of sewage on the the ground and traveling to the stream below. The stream below was very grey and full of waste water debris. An onsite pump operator quickly turned off the leaking pump and began running two smaller ones in its place. A supervisor soon arrived and stated that the leaking pump was thought to have been previously fixed and his mechanics would tend to it immediately. OCAL staff also performed a dye test of the whole pump setup and found a small leak in one of the hoses. The contractors immediately began replacing the section of faulty hose.	Citizen	9/14/2017	SSO-Surface
2501	410 Brunswick St SSO# 5061	South side of Frederick Rd bridge between RR tracks and Gwynns Falls	Gwynns Falls	Overflowing Manhole into stream.	OAM	9/18/2017	SSO-Surface
2507	3500 Parkdale Ave SSO # 5073	3500 Parkdale Ave: Entry to the outfall is located at 2063 Clipper Park Rd. The problem begins 197' upstream of the outfall.	Jones Falls	Elevated ammonia (0.43 ppm) found during Stony Western Survey. When tracked the next day the ammonia value was still elevated (0.43 ppm) but the bacteria was not above our problematic threshold (1034 MPN). The day we started the PST there was additional city work upstream causing the stream to be higher than normal base flow. This needs to be investigated further. On 9/28/17 we located a severed sanitary inside of storm drain 197' upstream from the outfall. The sanitary line is traveling inside of the storm drain for approximately 575'. In addition to it being completely severed and detached under the eastside of Parkdale Ave sidewalk, it has multiple service connection failures and missing cleanout caps. Anchor construction repaired the connections and installed a bypass pump on the main. SSO is abated. OAM installed an electric sewage pump. OEC hired AECOM (Jim Foley 443-519-3975) to design a collection system. Ken Mumar Office 410-462-4400, Debbie Mumar (cell) 410-977-1452, Ken Mumar Jr (cell) 443-834-9414.	OCAL	9/20/2017	SSO-Subsurface

PST ID	PST Name	Location Description	Watershed	PST Comments	Complainant	Investigation Date	PST Discharge Classification
2511	6001 Harford Rd. (7-11 Convenience Store)	6001 Harford Rd	Herring Run	Elevated ammonia (0.28mg/L) value reported during Back River Survey on 10/11/17. Investigation on 10/12/17 found a much higher ammonia value at the outfall and tracked it to a clear water connection at an inlet discharging waste water. A dye test was conducted at 6001 Harford Rd and dye was present at the inlet connection and was absent in all nearby sanitary manholes. A direct sewer connection to the storm drain is suspected. On 10/25/17 OCAL staff met with a plumbing contractor to further investigate the suspected illicit connection. A push camera was used to confirm that the sanitary line ran directly to the inlet. The contractor noted that 7-11 sanitary lines often erode on the bottom due excessive soda in the pipes. Therefore, it is suspected that a past plumber connected to the clear water line instead of replacing a failed sanitary. Contractor will begin repairs ASAP. On 10/26/17 Atlantic General began exploratory excavation of the pipes with in the parking lot. Follow up on 11/3/2017 found that contractor reinstated the store's intended waste water line to the sanitary system. Contractor stated that the existing waste water line appeared to be in new condition and possibly never used. Abatement confirmed with dye test.	OCAL	10/16/2017	SDUO, Private
2514	JF 11.5 Outfall/BGE Substation Oil Leak	BGE substation at 2200 Huntingdon Ave	Jones Falls	OCAL and other agencies received reports of oil sheen entering the Jones Falls from outfall. OCAL staff arrived and found active oil sheen exiting the JF 11.5 outfall. At the time MDE was onsite deploying containment booms and absorbent pads. They noted that the oil was not absorbing like a petroleum product and that the plume occurs intermittently (approximately every 30 mins). OCAL staff began to track the oil in the storm drain and did not find any oil evidence in the up stream storm drain manholes. A return visit to the outfall an hour later found that the oil was no longer active. A follow up was recommended. Over the weekend staff from either the Coast Guard or MDE was contacted by BGE that a mineral oil lubricate spilled into their sump basin at the substation at 2200 Huntingdon Ave. MDE absorbent pad remain at the outfall until the problem subsides.	Citizen	10/20/2017	Other
2515	2585 Edmondson Ave Rear Alley SSO# 5099	2585 Edmondson Ave	Gwynns Falls	Choked sanitary in alley causing a discharge into the storm. Entering the storm pipe through a 6 inch weep-hole on the right side at the base of the wall 120 ft from the manhole on Lauretta. Discover collapse in the sanitary pipe in the alley. Anchor installed bypass and making the repair.	OCAL	10/25/2017	SSO-Subsurface
2517	1035 Wilmot Ct	Crawl space under 1035 Wilmot Ct. at Latrobe Homes	Jones Falls	High ammonia remains in the storm drain at E Madison & Ensor after abatement repairs were made at 1001 Wilmot Ct. After entry of the crawl space under the Wilmot Ct building a waste water trail from a new leak was observed coming from the direction of 1035 Wilmot Ct (opposite end of building as previous leak). Contact was made with HCD and their plumbers were to inspect the issue that evening. On 10/27/17 a follow up found that the conditions at Wilmot Ct have not changed. Waste water is still flowing through the crawl space. Latrobe management was showed the problem and corrective action has been requested. On 11/8/17 OCAL confirmed that the house connection to the sanitary main was open and active using CCTV. On 11/15/17 OCAL observed an overflowing cleanout in the crawlspace under 1101 Wilmot Ct. The sewage is flowing out of the pipe on to the ground and into a conduit tunnel that connects to the Latrobe Homes 1001-1035 Wilmot Ct building. From there the sewage travels all the way across the expanse of the building in the crawlspace and infiltrates the storm drain line that runs along the Ensor St side of the building. OCAL used CCTV to confirmed that the house connection to the sanitary main was open, however it had a large blockage and limited flow ability. Latrobe management was informed of the problem and corrective action has been requested. Latrobe Homes staff assisted OCAL with a CCTV attempt from within the building. In was determined that the house connection may be collapsed just beyond the building wall under the adjacent sidewalk. On 12/7/2017 Anchor Co. replaced the house connection form the building wall all the way to the sanitary main line. HABC has been asked to pump out crawl space of any remaining waste water and OCAL will follow up. Abatement has been confirmed. There are no more backups/overflowing in either building's crawl spaces and the ammonia values remain low in the downstream storm drain.	OCAL	10/19/2017	SDUO, Private
2518	2313 Madison Ave Sump Pump	2313 Madison Ave	Jones Falls	OCAL received a cityworks complaint about water discharging from a PVC pipe into alley from a residence. OCAL staff arrived and noticed alot of water in the alley. The origin of the water was the PVC pipe from 2313 Madison Ave as described in the complaint. Soon after arrival the pipe discharged and a sample was taken and found to be consistent with laundry wash water. Contact was made with the homeowner and it was found that a utility sink and washing machine have been draining into the sump basin and pumped out to the back alley. The homeowner will contact a plumber to make corrective actions. Visited the residence on 12/15/17 and homeowner had a plumber complete the requested repairs. A drain pump was installed to carry the wash water waste to the sanitary line.	Citizen	10/24/2017	Private

PST ID	PST Name	Location Description	Watershed	PST Comments	Complainant	Investigation Date	PST Discharge Classification
2521	4101 Patterson Ave (Carroll Fuel Car Wash)	4101 Patterson Ave; Outfall between 6100 Wabash Ave and Metro station was original pollution observation. Source is a car wash on the SE Corner of Reisterstown Rd & Patterson Ave	Gwynns Falls	Citizen complaint received though DPW executives about suspected intermittent water pollution from the outfall next to 6100 Wabash Ave that turns the stream colors. The citizen states that the water "glows" and is either the color of milk or blue/green. He also stated that the occurrence is usually either on a Wednesday or Thursday. OCAL received the complaint on a Friday and found the stream bed below the outfall to have a whitish deposition. The flowing water did not appear to have any sediment or particles present, the water chemistry did not indicate the presence of sewage or city water, however, a faint light blue color was noticed when viewing the outfall/stream from a few feet away. This faint light blue water was only noticeable in a grab sample if viewed in a white Styrofoam cup. The faint light blue water was tracked, using the Styrofoam cup, to between two manholes under a strip mall on Patterson Ave. A storm drain pipe walk will be the next step.Follow ups on 11/7 and 11/8 did not find the blue water actively discharging. On 11/9 brown sediment was observed deposited in the pool below the outfall. The source is believed to be a contractor pumping rain water from the previous day's storm out of a trench and into an inlet. No sediment bag was observed and therefore referred to SEC supervisor. This, however, is not the source of the original discolored water complaint. Staff will continue to follow up. Additionally, business cards were distributed to employees of 6100 Wabash whom will contact us when the discolored water is active. Follow up on 11/15/17 found the outfall to be flowing clear, however, the whitish-blue deposition was again present in the pool below. A pipe walk of the storm drain under the strip mall on Patterson Ave found an inlet connection discharging a low volume of blue water. The blue water was then tracked on the surface by way of sampling inlets to a pipe originating at the Carroll Fuel car wash at 4101 Patterson Ave. Owner contact information was acquired. On 11/16/17 COB Pollution Control Section confirmed that there was no application on file for a waste water discharge permit for the property. Additionally, MDE was contacted and will perform an additional inspection of the facility. On 12/6/2017 OCAL met with MDE staff and conducted a confirmatory dye test and tracked the path of vehicle wash water from the car wash inlet all the way to the outfall at 6100 Wabash Ave. It was confirmed that the car wash is in violation with an illicit discharge. On 12/9/17 MDE filed a report and violation to the property owners and owners of the car wash. On 1/3/18 MDE notified OCAL that corrective action had been completed at the car wash. On 1/9/2018 OCAL and MDE staff followed up and dye tested the car wash. The car wash waste water has been redirected to the sanitary system. Additionally, the convenience store bathroom was dye tested and also confirmed to be connected to the sanitary system. Problem resolved.	Citizen	11/3/2017	Other
2523	2231 Crest Rd SSO#5114	2231 Crest Rd	Jones Falls	HC pipe leaking into storm inlet pipe. Lateral inspection discovered pipe has a sag and multiple disjoints. UMD making repairs. Requested to have a complete run of pipe installed over the storm pipe.	OCAL	11/8/2017	SDUO
2524	5300 Plymouth Rd (SSO #5108)	Choked sanitary manhole is 5300 Plymouth Rd, the infiltration into the storm drain is at 2206 Echodale Ave	Herring Run	Watershed survey sample disclosed high ammonia levels of a value of 1.0 ml/g on 11/08/17. On 11/09/17 staff continued to track the ammonia to sewage infiltration into the storm drain at 2206 Echodale Ave as a result of a mainline choke at 5300 Plymouth. An SSO report was filed and UMD responded and cleared the choke. Flow was restored to the sanitary, however, a large amount of asphalt was stuck in the channel at the manhole. A work order was made for construction to clear the asphalt so future chokes do not reoccur.	OCAL	11/8/2017	SSO-Subsurface
2528	5400 York Rd Water Leak	5400 York Rd	Jones Falls	Water discharging from sump pump outlet at back of building. Determined to be service line leak in front of 5416 York Rd. On 1/9 spoke with owner of 5400 to let him know a WO has been generated for repair. Repair completed by Spinello on 2/9/2018	OCAL	11/22/2017	Potable Water
2532	Druid Lake Construction Sediment	2700 Madison Ave	Jones Falls	Stone for cofferdam is being rinsed for dust control. The sediment laden water is making it into the storm drain and discharging into the Jones Falls. Met with ESC inspector L. Boddy on site. All inlets on the lake side are sealed and all others have inlet protection. Walked the site with the site foreman whom was instructed to uncover the buried inlets and properly cover and maintain the inlet protection	OCAL	12/5/2017	Other
2534	Mt. Washington Elementary School	1801 Sulgrave Ave, Baltimore, MD 21209	Jones Falls	While conducting outfall assessments, high ammonia levels found discharging into Western Run stream. The high ammonia was tracked to Mt. Washington Elem. School. Flow of water coming up through sidewalk crack towards the inlet on school property. Dept of Ed and DPW knows about issues. School custodian stated he was told there are two sewage breaks, one on school property and the other on DPW property. Contact provided for Dept of Ed liaison William Levy 443-310-6452/6-8670 wplevy@bcps.kiz.md.us and Van was informed that work on site will begin 12/11/17. Second follow up on 12/28/17, the ammonia (0.11 mg/l) was low. Recommend another follow up, before confirming abatement. Followed up on 2/5/18. AO	OCAL	12/6/2017	SDUO, Private
2535	2801 Frederick Ave SSO#5144	2801 Frederick Ave at NE corner of field	Gwynns Falls	Choke in 8 inch pipe at the manhole is causing a discharge from a hole in the ground 3 ft from the manhole. The manhole is not holding. Referred to OAM whom is engaging UMD to make repairs. 12/21/17 met with McNair who is going to have a crew repair the section of pipe. Repair completed.	OCAL	12/7/2017	SSO-Surface
2536	410 Brunswick St SSO#5143	South side of Frederick Ave Bridge on the east bank of Gwynns Falls	Gwynns Falls	Overflowing manhole caused by obstructions in pipe. UMD said there are rocks jammed inside the pipe and they are unable to remove. Jetter hose is unable to pass into the pipe. Referred to OAM for repair by on-call contractor. 12/13 Anchor Construction on site repairing pipe and removing manhole, installing new drop connection. Repair complete.	OCAL	12/7/2017	SSO-Surface
2537	150 N Monastary Ave SSO#5048	150 N Monastary Ave	Gwynns Falls	Choking sanitary overflowing into storm drain.D09G_103ES	OCAL	12/7/2017	SSO-Subsurface

PST ID	PST Name	Location Description	Watershed	PST Comments	Complainant	Investigation Date	PST Discharge Classification
2541	410 Brunswick St SSO#5153	South side of Frederick Ave Bridge on the east bank of Gwynns Falls	Gwynns Falls	Overflow found while meeting with on-call contractor (Anchor) to plan for repair work.	OAM	12/12/2017	SSO-Surface
2543	4315 LaSalle Ave Overflowing Cleanout	4315 LaSalle Ave: on the right side of the house looking from the street there is a cleanout about half way up the side in the grass.	Herring Run	High ammonia was received at our Hamilton Ave sample site (10 ppm). The problem was tracked to at house at 4315 LaSalle Ave that had an overflowing cleanout. After talking with the resident of the home they informed us that they had not been using any water because it would not flow out it just backed up in their basement which was used as a daycare. With that information and the fact that the flow was more than a house would produce and it was constantly flowing. We determined their main sanitary line was holding and overflowing from their cleanout. We observed two holding manhole in the rear of 4311 and 4313 LaSalle Ave. We had UMD jet the main sanitary line using the manhole between 4313 & 4311 LaSalle Ave and jet toward the rear of the homes. This relieved the holding line and stopped the overflowing cleanout. After that we had UMD cleanup the yard at 4315 LaSalle Ave and we raked the yard, put lime down, put signs, and caution tape since it occurred at a daycare.	OCAL	12/11/2017	SSO-Surface
2545	Mulberry & Mt. Holly	OutfallGPS: 39.293220, -76.671536	Gwynns Falls	During weekly sampling, ammonia levels read at 0.84. Investigation resolved on 121517. Sanitary manhole chocked. City contractor (MIDAS) was conducting routine sanitary line cleaning and CCTV. Choke already reported to maintenance. Happened to encounter a choked manhole at Mulberry & Mt. Holly. After removal of choke, the storm drain had no flow. MIDAS Contact: Scott Dewey (OAM) 410-396-4212	OCAL	12/13/2017	SSO-Subsurface
2546	Hillen and Lydonlea	Downstream side Hillen and Lydonlea bridge	Herring Run	Overflowing sanitary manhole.Citizen discovered overflowing manhole and reported to PCA working in the area.	Citizen	12/11/2017	SSO-Surface
2547	3010 Rockwood Ave Water Leak	3010 Rockwood Ave	Jones Falls	Water leak discovered entering inlet pipe and manhole. Referred to L2L. 2/9/2018 Work completed by Spinello.	OCAL	12/18/2017	Potable Water
2550	Chesterfield Ave & Kavon Ave SSO#5167	3045 Chesterfield Ave	Herring Run	Increased sewage infiltration observed in storm drain at Kavon & Chesterfield West Inlet Connection while following up on repairs to a house connection in an effort to abate an ongoing SDUO. The sanitary main along Kavon Ave was then dye tested as it has in the past. However, this time it was found to be leaking into the storm drain. UMD responded with a CCTV Crew. On 12/22/2017 an attempt was made to isolate the leak in the sanitary main with the assistance of UMD. During the process of trying to isolate the leak, the leak into the storm drain reduced and then appeared to have stopped. OCAL will follow up to confirm. On 12/28/17 another dye test relieved that the leak was still active with only a small amount leaking from the sewer main line. On 1/22/2018 OCAL confirmed that OAM was adding this pipe segment to their list for CIPP. Waiting of SC974 to start, suspect 3/15 therefore CIPP may not be complete until April. 4/23/18 SAK Constr. completed CIPP under SC947. 4/24 dye test found no dye in storm. SSO abated.	OCAL	12/21/2017	SSO-Subsurface
2551	5300 Catalpha Rd Water Leak	5300 block of Catalpha Rd.	Herring Run	Citizen complaint of discolored water in the Herring Run at Harford Rd park tracked to several water main breaks carrying sediment including this one at 5300 Catalpha Rd. Follow up on 12/28/17 found the repair made, water no longer surfacing on the street.	Citizen	12/22/2017	Potable Water
2552	5000 Block of Plymouth Rd Water Leak	Sidewalk along the even number side of 5000 block of Plymouth Rd	Herring Run	Sediment laden water observed flowing on the street while in route between sites of another Sediment/Water leak PST. The sediment laden water was tracked to several leaks along the 5000 Block of Plymouth Rd. Follow up on 12/28/17 found leak still active. Follow up on 1/19/18 found the repairs have been made and the leak stopped.	Citizen	12/22/2017	Potable Water
2559	4100 Stokes Dr Water Main Break	4100 Stokes Dr.	Gwynns Falls	Elevated (0.32 mg/l) chlorine was recorded at the Dead Run AS site. On Franklintown Rd., about 150 from Wetheredsville Rd. roughly 200 GPM was potable water is cascading down the hill and crossing the road. The problem was tracked to a water main break at 4100 Stokes Dr. Water Maintenance crew is at site, making repairs.	OCAL	1/9/2018	Potable Water
2562	5601 Purlington Way SSO#5189	5601 Purlington Way: SSO found in manhole located in alley behind address.	Jones Falls	Ammonia screening survey at Homeland Ave site had ammonia levels over range. The investigation found that a sanitary sewer manhole was choked allowing sewage to discharge into the adjacent storm drain.	OCAL	1/16/2018	SSO-Subsurface
2565	5601 Purlington Way SSO#5195	5601 Purlington Way rear alley	Jones Falls	OAM is having the roots cut and CIPP installed.	OCAL	1/22/2018	SSO-Subsurface
2566	5601 Purlington Way SSO#5191	5601 Purlington Way rear alley	Jones Falls	Choked sanitary overflowing into adjacent storm drain pipe approximately 16 ft from inlet.	OCAL	1/18/2018	SSO-Subsurface
2571	3200 Carlisle Ave SSO#5198	Clogged manhole located at intersection of Carlisle and N. Rosedale.	Gwynns Falls	Choked sanitary pipe discovered while investigating and cctv of Artaban Place.	OCAL	1/24/2018	SSO-Subsurface

PST ID	PST Name	Location Description	Watershed	PST Comments	Complainant	Investigation Date	PST Discharge Classification
2574	4206 Frankford Ave Choked Private Sanitary System	4206 Frankford Ave manhole in front of Aldi	Herring Run	High ammonia (0.38 ppm) was found during SIS at our Hamilton site. It was tracked to shopping center parking lot at Belair Rd & Frankford Ave where a private sanitary line was holding. The backup of sewage was leaving sanitary system underground, entering their private storm drain system, then and entering the public storm drain system at Frankford Ave & Nuth Ave. The private storm drain line carrying the sewage could be seen entering at the manhole. UMD was called to attempt to relieve the choke from the public side working from the top sanitary manhole (S61GG1023MH) and going up but the jetter could not made the turn into the lateral. UMD then used their pressure truck to jet down from the choked sanitary manhole on the parking lot in front of Aldi after vacuuming out some of the holding sewage to locate the channel. They relieved the choke 130' feet down from the private manhole which seemed like it was just before the bend into the public sanitary main. The flow of sewage into the storm drain was about 2 GPM. We followed up on 1/26/18 to see if the problem had stopped and the private storm drain line was dry, we will follow up one more time. We followed up for the second time on 1/31/18 tand the private storm drain line was dry and the private sanitary was flowing so the PST is resolved.	OCAL	1/24/2018	SDUO, Private
2575	3000 Dupont Ave SSO#5202	3000 Dupont Ave	Jones Falls	The Jones Falls trail ammonia screening site had an elevated ammonia value. This persisted after sampling of the Garrison and Queensbury SSO event.	OCAL	1/29/2018	SSO-Subsurface
2577	2801 W Mulberry St (SSO#5206)	2801 W. Mulberry St.: Sanitary manhole is off the northeast corner of the house	Gwynns Falls	High ammonia (>3.34mg/l) recorded during ammonia screening survey on 1/31/2018. A choked sanitary main was found entering the storm drain in the alley next to 2801 W Mulberry St. UMD responded and cleared several sanitary line segments through the 2700 Block of W Franklin St until the main began to flow correctly. The overflow then stopped.	OCAL	1/31/2018	SSO-Subsurface
2578	Guilford Reservoir sediment	4430 Reservoir Lane	Jones Falls	Heavy sediment discharge for Stoneyford Outfall. Source found to be Guilford Reservoir construction project.	OCAL	2/1/2018	Other
2579	239 N. Culver St. SSO 5205	239 N. Culver St.	Gwynns Falls	High ammonia levels of 2.39 found during ammonia survey. Partial sanitary line choke found leaking into storm drain from the surrounding pipe of a storm inlet. SSO work order no.: 518653 Supervisor: Rob Johnson	OCAL	1/30/2018	SSO-Subsurface
2580	1233 Wicklow Rd at Seminole Ave (SSO#5209 and 5216)	1233 Wicklow Rd @ Seminole Ave	Gwynns Falls	Sewage discharge reported at an outfall near the Rognel Heights USGS station through Cityworks. Problem was tracked to several sanitary manholes holding water/choked along Seminole Ave and leaking into a storm drain inlet connection at 1233 Wicklow Ave. UMD also received the request and was already on site. UMD used pressure truck to relieve the choke. Follow up on 2/6/18 found that the sanitary line on Seminole Ave was still choked or had choked again over the weekend. Another SSO report was created. UMD night crew responded with a pressure truck. Follow up on 2/7/18 found that all sanitary mains were flowing clear and choke no longer causing an overflow.	Citizen	2/1/2018	SSO-Subsurface
2581	2700 Gwynns Falls Pkwy (Connexions Art School) (SSO#5210)	2700 Gwynns Falls Pkwy Rear of ConneXions Art School Parking Lot	Gwynns Falls	Cityworks complaint received for an overflowing sanitary in rear of school lot. The overflow was confirmed and UMD responded and cleared several segments of 4" sanitary main within the school's property. Flow was restored and the overflow stopped.	Citizen	2/1/2018	SSO-Surface
2584	4711 York Rd SSO# 5214	4711 York Rd	Herring Run	Refereed location to OAM for further inspection due to the repeated chokes. They are working with UMD to inspect and make necessary repairs to prevent further SSOs. The structural problems with the pipe is causing an SDUO. (See York Rd & E. Coldspring Ln)	OCAL	2/6/2018	SSO-Subsurface
2585	4000 Linkwood Rd	4000 Linkwood Rd	Jones Falls	Choked sanitary discharging into adjacent storm drain.	OCAL	2/8/2018	SSO-Subsurface
2586	4100 Ethland Ave. SSO 5223	4100 Ethland Ave	Gwynns Falls	High ammonia was recorded during watershed survey. Found choked sanitary manhole at 4100 Ethland Ave.	OCAL	2/8/2018	SSO-Subsurface
2591	Mannasota and Parkside Outfall 021418	Outfall underneath the Mannasota Ave. & Parkside Dr. bridge.	Herring Run	High ammonia encountered at outfall during routine back river survey. Ammonia was tracked upstream and sanitary sewer choke was discovered. Investigation completed by Amanda Oxendine and Kihoto Gitonga.	OCAL	2/14/2018	SSO-Subsurface
2603	2618 W. Fairmount Street SSO# 5275	Manhole located at 2501 W. Lexington St.	Gwynns Falls	High ammonia encountered during Dead Maiden Survey, an investigation was conducted to determine the source of ammonia. A sanitary choke was discovered upstream of the storm drain system. The sanitary choke was found at 2618 W. Fairmount Street. Sanitary choke was mitigated by Utilities Maintenance.	OCAL	3/5/2018	SSO-Subsurface
2605	3015 Piedmont Ave Pet Waste	3015 Piedmont Ave	Gwynns Falls	Change personnel to Hector & Umoja once the PST App is updated. High ammonia recorded during watershed survey. It was tracked to pet owner washing backyard of dog waste.	OCAL	2/26/2018	Other
2609	6308 Clearspring Rd SSO# 5279	Uncharted sanitary manhole located outside the property of 6308 Clearspring Rd.	Herring Run	Choked sanitary manhole discovered just outside the property of 6308 Clearspring Rd. The sanitary choke was relieved with the help of Utilities Maintenance.	OCAL	3/9/2018	SSO-Subsurface
2612	5417 Reisterstown Road SSO# 5286	Sanitary Sewer Manhole located at rear of MVA at 5417 Reisterstown Road	Gwynns Falls	A high ammonia reading was encountered during a watershed survey at the Powder Mill site. The investigation led to a choked sanitary sewer manhole located at the rear of the MVA building on 5417 Reisterstown Road. Utilities Maintenance arrived on site and flushed the clogged sanitary line.	OCAL	3/14/2018	SSO-Subsurface
2615	2300 Washington Blvd ALF Marble & Granite	2300 Washington Blvd: Side of building next to tracks	Gwynns Falls	Grey water with fine sediments discharging from three pvc pipes at base of building wall. Source if a granite and marble counter top company. MDE inspected the location. Owner in working on corrective actions. MDE report attached.	OCAL	3/19/2018	Other
2619	Wilkens Park	2403 Wilkens Ave	Gwynns Falls	Evidence of SSO and surcharged manhole. Refereed to OAM and UMD.	OCAL	3/26/2018	SSO-Surface

PST ID	PST Name	Location Description	Watershed	PST Comments	Complainant	Investigation Date	PST Discharge Classification
2620	3330 Benson Ave SSO	3330 Benson Ave	Gwynns Falls	SSO occurring on private sanitary system. Estimate 50-10 gpm discharging from manhole into nearby inlet. Property Maintenance was notified and plumber was onsite the next morning to relieve the SSO. Discharges into the stream near Unetta Ave.	Citizen	3/27/2018	Private
2627	3601 Keystone Ave (SSO#5324)	Corner of Keystone Ave and Druid Park Dr	Jones Falls	Elevated ammonia in recent weeks at the Union Ave ammonia screening site was tracked to a choked sanitary line at Keystone Ave & Druid Park Dr. Wastewater was infiltrating an electrical conduit vault and then the storm drain at 3601 Keystone Ave. UMD cleared the choked sanitary and pumped down the sewage in the electrical vaults.	OCAL	4/10/2018	SSO-Subsurface
2629	500 N Hilton SSO# 5321	Wooded area at the 500 Block of Hilton St, just south of ramp to Edmondson Ave.	Gwynns Falls	HM & UM found an overflowing sanitary manhole (S09C_041MH), while heading to Franklin & Hilton sampling site. Approximately 10 GPM	OCAL	4/9/2018	SSO-Surface
2631	3316 Bancroft Rd SSO#5338	3316 Bancroft Rd	Jones Falls	Sanitary pipe leaking into adjacent storm. Part of 3316 Bancroft Rd SDUO investigation. Pipe was grouted to stop infiltration then lined. The dye test verified the pipe SSO is abated.	OCAL	4/18/2018	SSO-Subsurface
2633	Echodale Ave & Herring Run Drive OF SSO 540914	Outfall below intersection of Echodale Ave and Herring Run drive.	Herring Run	During routine sampling, ammonia was elevated to at .50. An investigation led to a choked sanitary manhole on Gibbons Ave. This site also currently has an active chlorine issue as well. Amanda Oxendine also participated in this investigation.	OCAL	4/17/2018	SSO-Subsurface
2640	222 N Calverton Rd SSO# 5356	222 N Calverton Rd	Gwynns Falls	Property owner discovered sewage discharging on his property. He excevated the the pipe and found a 8 " vc pipe leading towards the adjacent property which is DPW Storm Water maint yard. The pipe leads to a sanitary manhole pipe in the entrance of 249 N Calverton. This pipe is not in GIS or on any maps. UMD flush the pipe that crosses the road and removed an abundance of gravel. UMD then vacuumed out the pit at 222 N Calverton. The 8" pipe had a small hole in it which UMD ran the jetter through. They flushed about 10' of pipe. Dye was deployed in the pipe at the hole and was present in the lower Manhole. UMD will return for cctv and repair. Repair completed on 5/9/18	Citizen	4/26/2018	SSO-Surface
2647	1700 S Caton St SSO# 5368	1700 S Caton St	Baltimore Harbor	Complaint from 3322 James St. about a SSO. UMD relieved problem prior to arrival. Sent to OAM for further investigation for the reoccurring SSO at the location.	Citizen	5/9/2018	SSO-Surface
2648	N. Franklintown St. & W. Fairmount Ave. SSO# 5367	Sanitary Manhole located at intersection of N. Franklintown St. and W. Fairmount Ave.	Gwynns Falls	During regular ammonia screening, OCAL discovered a high ammonia reading at the 2501 W. Lexington St. Manhole Dead Maiden Site. The high ammonia reading initiated an investigation which lead to OCAL discovering a choked sanitary manhole on the intersection of N. Franklintown St. and W. Fairmount Ave. Control 1 was notified of the choked manhole and arrived on site to mitigate the issue. The cause of the sanitary choke was oils and grease.	OCAL	5/9/2018	SSO-Subsurface
2649	2560 Lauretta Ave. Manhole	Manhole located in the middle of the road at the address 2560 Lauretta Ave.	Gwynns Falls	While during routine ammonia screening, a high ammonia concentration was discovered at 2560 Lauretta Avenue manhole. The high concentration initiated an investigation to determine the cause of high ammonia in the storm drain. OCAL sampled several storm drain manholes and discovered that the concentration of ammonia was decreasing as the investigation commenced upstream. The cold trace of low ammonia readings lead OCAL to sample the initial site once again, finally discovering that the concentration had decreased. The storm drain system linked to the initial site has a large number of rusted storm drain manholes, which cause a false positive during ammonia screening.	OCAL	5/9/2018	SSO-Subsurface
2652	Guilford Reservoir sediment		Jones Falls	Heavy sediment from reservoir construction project entering Stony Run.	OCAL	5/21/2018	Other
2653	N. Howard St & Dolphin St (SSO #5387)	West side of intersection of N. Howard St & Dolphin St	Jones Falls	High ammonia (0.32mg/L) was reported on 5/9/18 during the Jones Falls Lateral Survey. Investigation led to a choked sanitary line at N. Howard St & Dolphin St causing wastewater to infiltration the storm drain. UMD cleared the sanitary line and stopped the overflow.	OCAL	5/9/2018	SSO-Subsurface
2660	3636 Woodland Ave SSO#5439	3636 Woodland Ave	Gwynns Falls	HC backed up. UMD cleared line. FIlled with rags and paper towels. UMD said they have been to this address multiple times previously for the same issue.	OCAL	6/13/2018	SSO-Surface
2662	4600 E Wabash Ave SSO#	4600 E Wabash Ave	Gwynns Falls	HC pipe leaking into the inlet pipe. Discharge of 0.03 gpm determined by 20% leaving the pipe and the water bill average daily use 193 gpd. Later pipe was lined. Followup on 9/5/18 verified sso is abated.	OCAL	6/13/2018	SSO-Subsurface
2671	301 Light Street Outfall Clarks Construction Sediment Discharge 062718	301 Light Street: Outfall discharging into the harbor located in front of pavilion with Ripley's Believe It Or Not museum.	Baltimore Harbor	Multiple cityworks complaints were received from both BWB and citizens regarding a discolored brown discharge pluming from outfall D35K_215ES into the harbor between 6/27-6/28. Initial complaint was regarding the concern that sewage was entering into the harbor. Analysts sampled discharge for ammonia and bacteria. No sewage problem found and investigation was stopped. The following day the analysts revisited the site for a sediment concern. The analysts tracked the problem with the turbidity meter and tracked the problem back to a construction problem on Howard and Camden. MDE inspector Joseph Miller accompanied the analysts on site. Clark's Construction was drilling to be able enlarge and drop the storm drain 5 feet to eliminate the flooding issue that currently occurs within the Howard tunnel. During their drilling process they have been discharging around 50-70 gpm of ground water sediment directly into the storm drain. MDE issued the company with a violation and citation for their illicit sediment discharge practices. He then ensured that they installed a sediment filter bag onto the discharge pipe and discharge into the drain is now clear. Photos attached.	Blue Water Baltimore	6/27/2018	Other

Appendix P: GROW Center reports

Spring 2018 - Report

Baltimore GROW Center

The Baltimore GROW Center is a program of

Mayor
Catherine E. Pugh

BALTIMORE CITY
DPW
DEPARTMENT OF PUBLIC WORKS

RUDOLPH S. CHOW, P. E.
DIRECTOR

Funding kindly provided by

Support from our partners

Reported prepared by Travis Lageman.
UMBC Peaceworker Fellow, GROW Center Coordinator
Department of Public Works
June 2018

Contact Information:
Travis.lageman@baltimorecity.gov
410-396-0732

Table of Contents:

Executive Summary 3

Background 4

- Guiding Questions 5
- Funding 5
- Promotion 5
- Programming 9
- Promotion 11

Data/Analysis 11

- GIS Analysis 12
- Maps 14

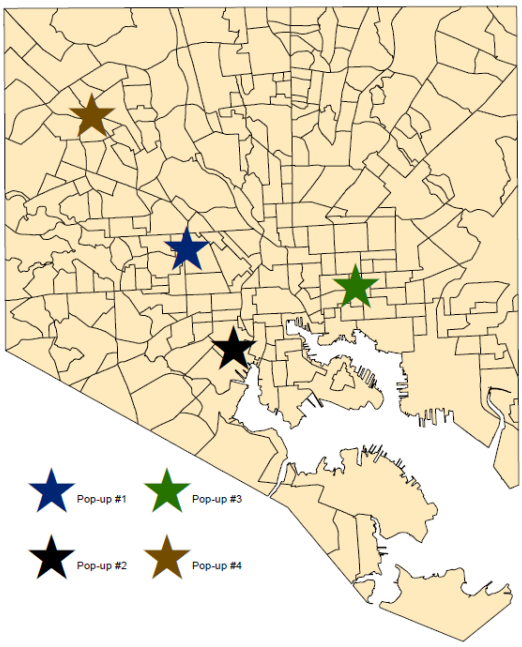
Lessons Learned 17

Concluding Remarks 19

Appendices

Executive Summary

From April to May 2018, the Department of Public Works (DPW) collaborated with federal, city, non-profit and community partners to hold four pop-up GROW (**G**reen **R**esources and **O**utreach for **W**atersheds) Centers across Baltimore City (see map):



Baltimore GROW Centers are intended to be greening resource hubs aimed at increasing citizen capacity for implementing community greening and stormwater management projects. These hubs would provide people with access to free/low cost materials as well as plants, training, and/or information to develop skills and connections for undertaking greening projects.

With funding from USDA/Forest Service, the four GROW Center pop-ups were visited by 206 participants, representing 86 neighborhoods in Baltimore City and a few from Baltimore County. Over the course of four consecutive Saturdays, 110 trees and 10 yd^3 of mulch were given away, over $700 worth of native plants were sold, nine workshops on community greening and stormwater management were offered, and over 200 people were able to network with various greening experts.

Pop-up #1	**Pop-up #2**
Easterwood/Sandtown Park & Playground April 14th, 2018 10am-12pm	Baltimore Community ToolBank April 21st, 2018 10am-2pm
Pop-up #3	**Pop-up #4**
400 Block N. Duncan St. C.A.R.E. Community April 28th, 2018 10am-2pm	Langston Hughes Community Center May 5th, 2018 10am-2pm

The Spring 2018 pop-ups were a continuation of a GROW Center pilot held in April/May 2016 (See *The Neighborhood GROW Center 2016 Pilot Project – Final Report*). The purpose of these and future pop-ups is to test different delivery models and gather insights into what a permanent GROW Program might resemble. Data collected will inform implementation of pop-ups in Fall 2018 and Spring 2019. The work will also be used to inform a GROW Center feasibility study.

A community member transports materials to nearby residences.

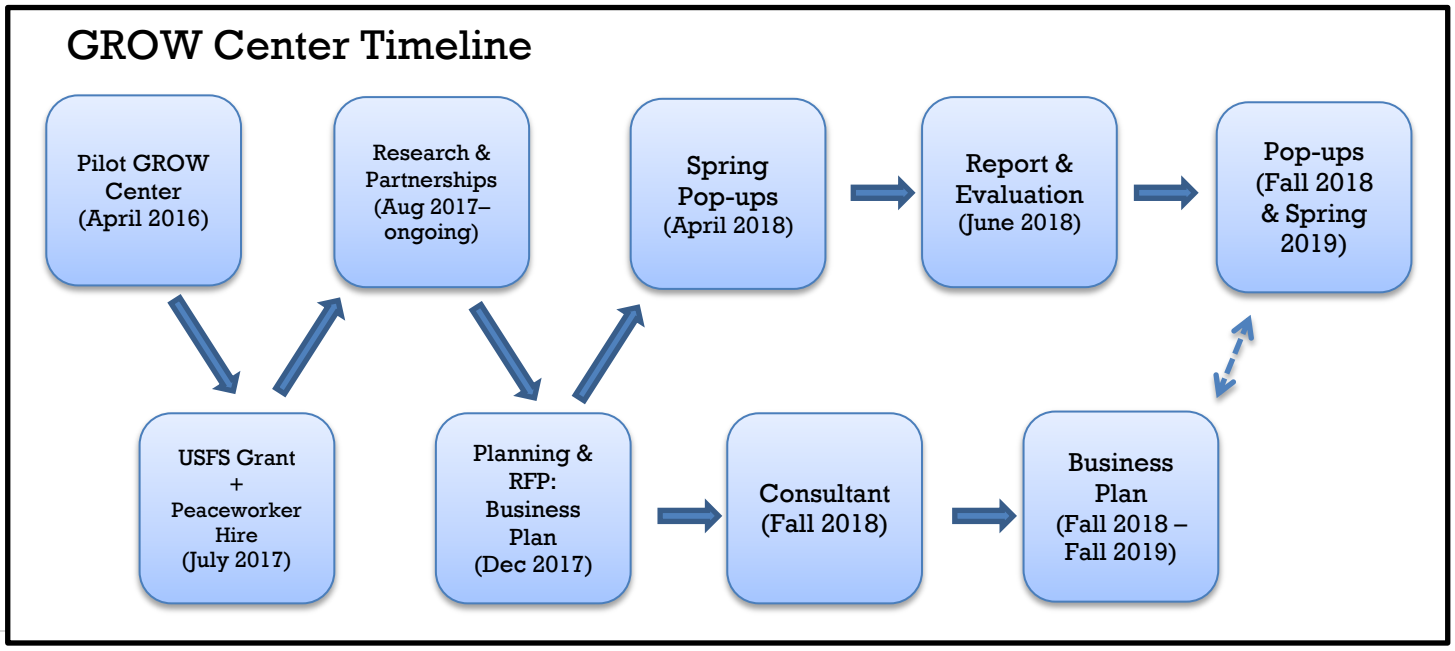
Background

The GROW Center concept originated with the intersection of four city-wide initiatives: Waste-To-Wealth Initiative, promoting a reuse economy to mitigate city wood, food and construction waste streams; increasing the urban tree canopy to 40%; MS4 Permit goals to encourage stormwater management on private property and to reduce polluted runoff; and the Growing Green Initiative to promote the revitalization and greening of Baltimore's many vacant lots. In order to support these four initiatives, the GROW Center concept was conceived.

The interconnectedness of these initiatives is illustrated by the following example. By promoting the reuse of materials, residents can access affordable materials that can be used in vacant lot greening projects. These may include reclaimed lumber or mulch to create or maintain rain gardens, community gardens or plant trees. Performing these activities subsequently benefits community revitalization while also supporting stormwater management through increased greenspace, permeable surfaces, and more trees planted.

After the GROW Center idea percolated for a couple of years, the Baltimore Office of Sustainability organized a pilot project at Baltimore Community ToolBank in April 2016. This pilot consisted of workshops every Saturday and Sunday for five consecutive weekends. Reuse/greening materials were also available through purchase and giveaways. The success of this pilot showed promise for the concept's feasibility. (Appendix Seven)

The USDA/Forest Service, one of the collaborators on the GROW Center idea, is also linking the centers with their efforts to collaboratively develop an Urban Wood and Land Restoration Economy. The goal of this effort is to turn urban wood from deconstruction and urban forestry activities into a source of revenue and social impact on a large scale – by creating jobs, improving lives and livelihoods, and promoting sustainability at local and regional



scales. Among other things, the effort connects residents with materials from deconstruction and urban forestry operations that can be used to green lots - thereby creating new community green space, reducing pollutant runoff, and increasing Baltimore's urban tree canopy.

DPW, an original partner of the 2016 pilot, took up the GROW Center concept for further development. After securing grant funding from USDA/Forest Service to match already designated funds, DPW was selected to receive a University of Maryland, Baltimore County Peaceworker Fellow to act as GROW Center Coordinator in July 2017. The responsibility of the GROW Center Coordinator was to further test this GROW Center concept by organizing "pop-up" events. These pop-ups were temporary events that would test different delivery models, partners, and programs. The pop-ups held in Spring 2018 are the first of three planned series including Fall 2018 and Spring 2019.

Guiding Questions

In the early planning stages of the Spring 2018 pop-ups, GROW Center staff developed five guiding questions that would be explored through the pop-ups:

1. What greening materials are of interest and how are they accessed?
2. What training/education is of most interest?
3. What are best practices for information dispersal?
4. What resources are needed to implement GROW Center activities?
5. Who are GROW Center partners?

Funding

DPW was awarded a $100,000 USDA/Forest Service Grant. Specifically, the funding supports: (1) preparing a feasibility study and business plan for GROW Centers, and (2) testing and refining the delivery model of GROW Centers through a second round of 'pop-up" events in the community. In line with the second purpose, funding from the USDA/Forest Service paid for workshop facilitation and location use of all four Spring pop-ups. Other logistical items were paid with a combination of DPW and Forest Service funds.

Final Budget (Detailed in Appendix One)	
Workshop Facilitation	1000
Venue Stipend	800
Logistics/Other Materials	886
Printing/Advertisements	656
Total	**$3342**

Residents with Greening Experts at Easterwood/Sandtown GROW Center.

Partners

In Baltimore City, many non-profits and community groups perform work related to greening, stormwater management, and

community development. Following the advice of Andy Cook, the organizer of the 2016 Pilot, GROW Center planners aimed to avoid competing with already existing groups and instead supplement their efforts. GROW Centers sought to bring partners together to showcase work already happening and resources available to residents and community leaders. In doing so, GROW Centers made use of partners' technical expertise and knowledge. This gave residents a taste of what Baltimore has available, while also fostering new connections between residents and GROW Center partners. Therefore, DPW engaged partners in the following four ways: 1) Host Sites 2) Materials Suppliers 3) Greening Experts 4) Workshop Facilitators.

A resident picks up a truckload of mulch from GROW Center #2.

1) Host Sites

Several criteria were used for selecting pop-up locations. These included targeting different areas of Baltimore (specifically underserved areas), sites with sufficient outdoor space and/or positive indicators of community greening, previous revitalization projects and recommendations by partner organizations from their own work in a given neighborhood, and a combination of outdoor and indoor locations.

Greenspaces

Two of the pop-up events were located at community managed green spaces. The first pop-up was located at Easterwood/Sandtown Park & Playground of West Baltimore. This space was a Parks & People Foundation project in collaboration with the Matthew Henson Community Association, which turned a series of vacant lots into a new community space. The third pop-up was located in the C.A.R.E. community in East Baltimore at 400 Block N. Duncan St, a community space created in collaboration with Civic Works. Both of these sites were chosen for their geographic location, walkability, noted community greening engagement, and opportunity to showcase vacant lot revitalization projects.

Baltimore Community ToolBank

The ToolBank served as the venue for the second pop-up, and provided some tools and equipment for all pop-up events. The ToolBank was a clear fit for a GROW Center due to their experience with the 2016 Pilot. It also was an opportunity to locate a pop-up in South Baltimore with ample indoor venue space.

Langston Hughes Community, Business & Resource Center

Langston Hughes Community Center occupies the former Langston Hughes Elementary School, located along Reisterstown Road in the Park Heights neighborhood of Northwest Baltimore. The

location was selected for its experience in hosting various community programs, ample outdoor and indoor space, and a community identified as interested in greening.

2) Materials Suppliers

These partners provided GROW Centers with various materials for giveaway, purchase and/or display. Each supplying partner was responsible for transporting their materials to/from the pop-up site. Materials for sale transactions were handled exclusively by the respective supplier.

Tree Baltimore/Camp Small

Tree Baltimore, which is staffed by the Department of Recreation & Parks, is the city umbrella organization for increasing the tree canopyT hey hold numerous tree giveaways and plantings, and encourage residents to become "Tree Keepers" by caring for forest patches and educating others. Camp Small, part of Tree Baltimore, is Baltimore's wood waste processing facility. Wood waste from tree maintenance in the city is brought to Camp Small where it is sorted as logs or processed into mulch and woodchips. This material is free to community groups or at cost to individuals who can pick it up from the facility (located on Cold Springs Ave near I-83). At all four pop-ups, Tree Baltimore and Camp Small provided free trees and mulch along with information on tree types and planting suggestions.

Blue Water Baltimore/Herring Run Nursery

Blue Water Baltimore (BWB) is a local non-profit working to restore the quality of Baltimore's waterways including removing impervious pavement, monitoring water quality, and advocating for water pollution reduction. Herring Run Nursery, a part of

BWB leads residents in a Rain Barrel building workshop at Baltimore Community ToolBank, GROW Center #2.

BWB, specializes in plants native to the Chesapeake Bay watershed. Herring Run offered a variety of native plants for sale at each pop-up. This provided opportunity for new markets as opposed to selling only at the nursery located near Mt. Pleasant Park in Northeast Baltimore.

Details Deconstruction

Details is a social enterprise project of the non-profit Humanim, Inc. that performs deconstruction of vacant buildings. Deconstruction allows the reclamation of materials that are then sold for reuse. Details displayed samples of various deconstruction materials including reclaimed bricks and their new brick aggregate pieces that could be used in various greening projects. Pricing sheets were also available for residents interested in purchasing from Details at a later time.

3) Greening Experts

Several government and non-profit organizations participated as greening experts in an "Ask an Expert" capacity. The purpose was to provide information about gardening, vacant lot adoption, and other city initiatives.

- *Bmore Beautiful*, a mayoral initiative, works on beautification efforts in communities by partnering with residents. Many participants signed up with Bmore Beautiful, making a pledge to keep their communities cleaner and greener.
- *Department of Housing and Community Development* representatives were available to address questions related to adopting vacant lots and recent changes to the process.
- *University of Maryland Extension – Master Gardeners* brought free seeds and a wealth of knowledge related to gardening. They also shared information about the Master Gardener program, and how to enroll in it.
- *Baltimore Office of Sustainability / Department of Planning* discussed the city's new Green Network Plan to address vacancies through greenspaces. They also made use of the Green Pattern Book, discussing ways to revitalize vacant lots with residents.

At Langston Hughes GROW Center #4, a resident learns about the Bmore Beautiful Initiative.

4) Workshop Facilitators

In order to build community capacity for performing vacant lot greening and stormwater management, workshops were identified as an important component of the GROW Center. Workshop topics were sourced from a survey of city residents and through collaboration with partners.

The following partners facilitated workshops at GROW Center Pop-ups:

- Baltimore Orchard Project (Civic Works)
- Blue Water Baltimore
- Tree Baltimore
- Edible Eden Foodscapes
- UMD-Extension – Master Gardeners
- UMD-Extension – Watershed Protection and Restoration Program
- Department of Housing and Community Development
- Parks and People Foundation
- Your Baltimore Community Development

Programming

GROW Center pop-ups encompassed combinations of three main programmatic components: 1) Materials, 2) Greening Experts, and 3) Workshops. All pop-ups were four hours long (with the exception of the first pop-up, which was only two hours) and had Materials and Greening Experts available. Pop-ups #2 and #4 included a series of workshops in addition to the other two components.

Mulch from Camp Small provided in buckets for residents to take away.

1) Materials

Materials were provided for both free and at cost. Free items included mulch from CampSmall, empty 5-10 gallon planter buckets (provided by Tree Baltimore) to carry mulch away, and trees of 1-2 gallon size. The tree giveaway was a replication of Tree Baltimore's many tree giveaways.

Herring Run Nursery offered native plants for sale at each pop-up.

Native plants were available for purchase from Blue Water Baltimore's Herring Run Nursery. Sizes consisted mostly of quart and gallon pots, ranging from $7 to $17 per pot.

Display of different brick products by Details Deconstruction.

Details Deconstruction displayed different brick products (full, dinged, and crushed/aggregate) as well as some larger stone. Originally, reclaimed lumber was to be available, but it was discovered that the lower grade lumber targeted for the GROW Center was no longer being collected.

An example sheet for reclaimed materials use was provided at the Details table (See Appendix Five). Residents also collected Details contact info if they were interested in making an order at a later date. At the close of each pop-up, some residents were able to take away the small samples of materials on display for free. Recycling bins were also at the first pop-up, sold at a discounted rate (bins were to be available at the last pop-up but failed to arrive).

Master Gardeners share knowledge and free seeds with GROW Center attendees.

2) Greening Experts

Greening Experts were available at each pop-up. A raffle was introduced at the 3rd and 4th pop-ups to encourage GROW Center participants to visit all materials and experts, as well as fill out a feedback survey. Residents were given the survey at check-in and told about the raffle. If a resident visited each table and had each representative initial the back of the survey, they entered the raffle for a $20 Gift Certificate to Herring Run Nursery and a free Tree Baltimore t-shirt.

3) Workshops

As noted earlier, the workshops were organized around two themes: residential stormwater management and community greening. Most workshops were 1 hour lecture-style with demonstrations, while some were hands-on (i.e. Tree Planting, Rain Barrel). Pre-registration was encouraged through EventBrite and all workshops were offered for free.

Participants in the Baltimore Orchard Project-led Rain Garden workshop examine rain gardens on site at Baltimore Community ToolBank.

GROW Center Workshop List

	Workshop	Facilitator
Pop-up #2: Stormwater Management	**Intro to Rain Gardens**	Baltimore Orchard Project – Civic Works
	Rain Barrels	Blue Water Baltimore
	Downspout Disconnection	UMD – Extension Watershed
	Pollinator Gardening	Edible Eden Foodscapes
Pop-up #4: Community Greening	**Intro to Urban/Community Gardening**	Your Baltimore Community Development
	Container Gardening	UMD – Extension Master Gardeners
	Tree Planting/Care	Tree Baltimore
	Placemaking for Greenspaces	Parks & People Foundation
	Adopt-a-Lot	Department of Housing and Community Development

Miscellaneous

- While tables and chairs were provided to the material suppliers and experts, an additional table and tent was set up to

provide drinking water for attendees. This table also had coloring and a trash - themed corn-hole game for children.

The "kids" table at each GROW Center offered coloring and a trash themed corn hole game.

- Participants in the Rain Barrel Workshop had the cost of their rain barrel subsidized to only $25 (vs. $70)
- Participants in the Pollinator Garden workshop had the opportunity to choose one quart-sized pollinator plant for free from Herring Run Nursery.
- At pop-up #4, Master Gardeners demonstrated/helped attendees make seed starters to take home.

UME Master Gardeners help attendees make their own seed starters.

Promotion

Promotion of GROW Center pop-ups was carried out through the following avenues:

- DPW Social Media Accounts: Facebook, Twitter and NextDoor
- DPW Customer Report (newsletter included in the Water Bill for every customer in Baltimore City)
- Partner Social Media Accounts & Newsletters
- Flyers in select cafes/businesses around each pop-up location
- Lawn Signs around each pop-up location
- Host Site communications with local communities
- Cold calls to Faith Organizations
- Tabling at Baltimore Office of Sustainability Annual Open House
- WBAL-TV 11 aired an interview with GROW Center Staff after Pop-up #2

Data & Analysis

Various forms of data collection were performed to assess this particular GROW Center delivery model. Data was collected through the following means:

- Feedback Surveys: Completed by Participants, Greening Experts, Facilitators, Host Sites, and Materials Suppliers
- Registration Forms at Check-in/Pre-Registration Forms from EventBrite
- Materials Purchase/Pick-up Forms from Material partners: BWB and TreeBaltimore

Surveys were given to the above groups by GROW Center staff to gather general feedback of the event. For example,

- ✓ **4 Pop-up GROW Centers**
- ✓ **12 partners** from federal, city, and non-profit groups
- ✓ **206 Participants** (*at least **46 new greeners**)
- ✓ **86 Neighborhoods**
- ✓ **29 Community, Non-profit or Faith Groups**
- ✓ **Over 10 yd^3 of free mulch**
- ✓ **110 free trees**
- ✓ **75 Native Plants ($700+)**
- ✓ **9 workshops** on **community greening & stormwater management**
- ✓ Made **15 rain barrels**, **30 seed starters** & more!

attendees were asked to use a Likert Scale of 1-5 to indicate how they enjoyed the GROW Center, or experts were asked how good of a fit they felt the GROW Center was for their organization. Surveys also probed for prevalent topics during materials and greening expert interfaces with attendees (Surveys in Appendix Four).

All other data was cleaned and organized in Mircosoft Excel, and analyzed using Excel and ArcMap. Maps were produced to perform analyses and see where GROW Center attendees orginated.

- 35% of Pre-registered attendees showed up to GROW Centers
- 204 total registrations for workshops with 65 (est.) actually attending
- 2,341 Individuals reached through DPW Facebook Event
- 14,392 page views of events thru DPW NextDoor Promotion
- 130 unique material users in total
- 78.5% of attendees used their own vehicle to transport materials
- 81% of attendees intended to use materials for residential purpose
- 30% of all attendees had 1 year or less of community greening experience vs. 28% with more than 1 year. (42% didn't respond, who are likely novice greeners)

GIS Analysis

Collecting addresses allowed for analysis using Geographic Information Systems software, ArcMap. This analysis revealed neighborhoods attendees originated from, characteristics of these neighborhoods, and travel distance (Table 1). It appears that attendees traveled further to GROW Centers

with workshops (Pop-ups 2 & 4) as compared to those without (1 & 3). Map 3 shows that attendees tended to visit pop-ups that were nearby. As shown in Map 1, attendees came from 86 different neighborhoods. The five neighborhoods with the most attendees were: Frankford, Hampden, Glen, CARE, and Mt. Washington. The respective attendee count for each was 6, 5, 5, 4, 4. The remaining neighborhoods attracted 1-4 attendees each. This was also shown using community statistical areas (Appendix Six).

Table 1: (*All numbers in miles)*

Pop-up Number	**1**	**2**	**3**	**4**
Average Distance	2.04	2.87	2.12	2.76
Max Distance	5.68	6.05	5.96	9.26
Min Distance	0.06	0.00	0.06	0.05

A density analysis was performed to determine areas of high attendee density, as shown in Map 2. High density areas tended to be near pop-up locations: West Baltimore, East Baltimore, and Park Heights. The ToolBank did not have as many local attendees due to the nature of the industrial area in which ToolBank is located.

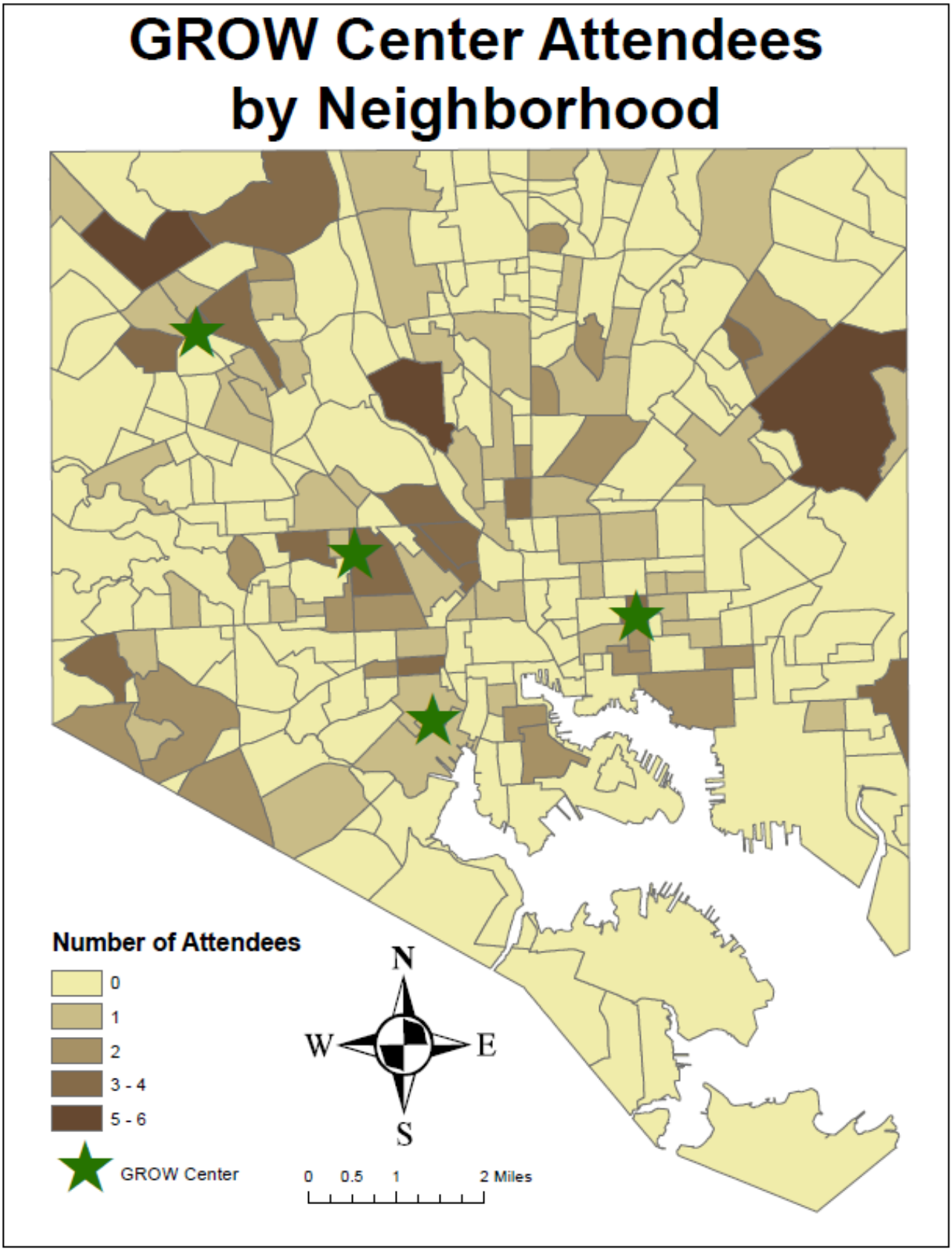
Density analysis allowed further analysis by comparing areas of high to medium density of attendees to those with little or none. Indicator data from Baltimore Neighborhood Indicators Alliance was sourced to perform comparison with data related to GROW Center goals. These goals include increasing the tree canopy and promoting vacant lot revitalization/community managed green spaces. The following datasets were used:

- Tree Canopy Cover
- Number of Community Managed Open Spaces
- Median Household Income
- Percentage of Residential Properties Vacant & Abandoned.

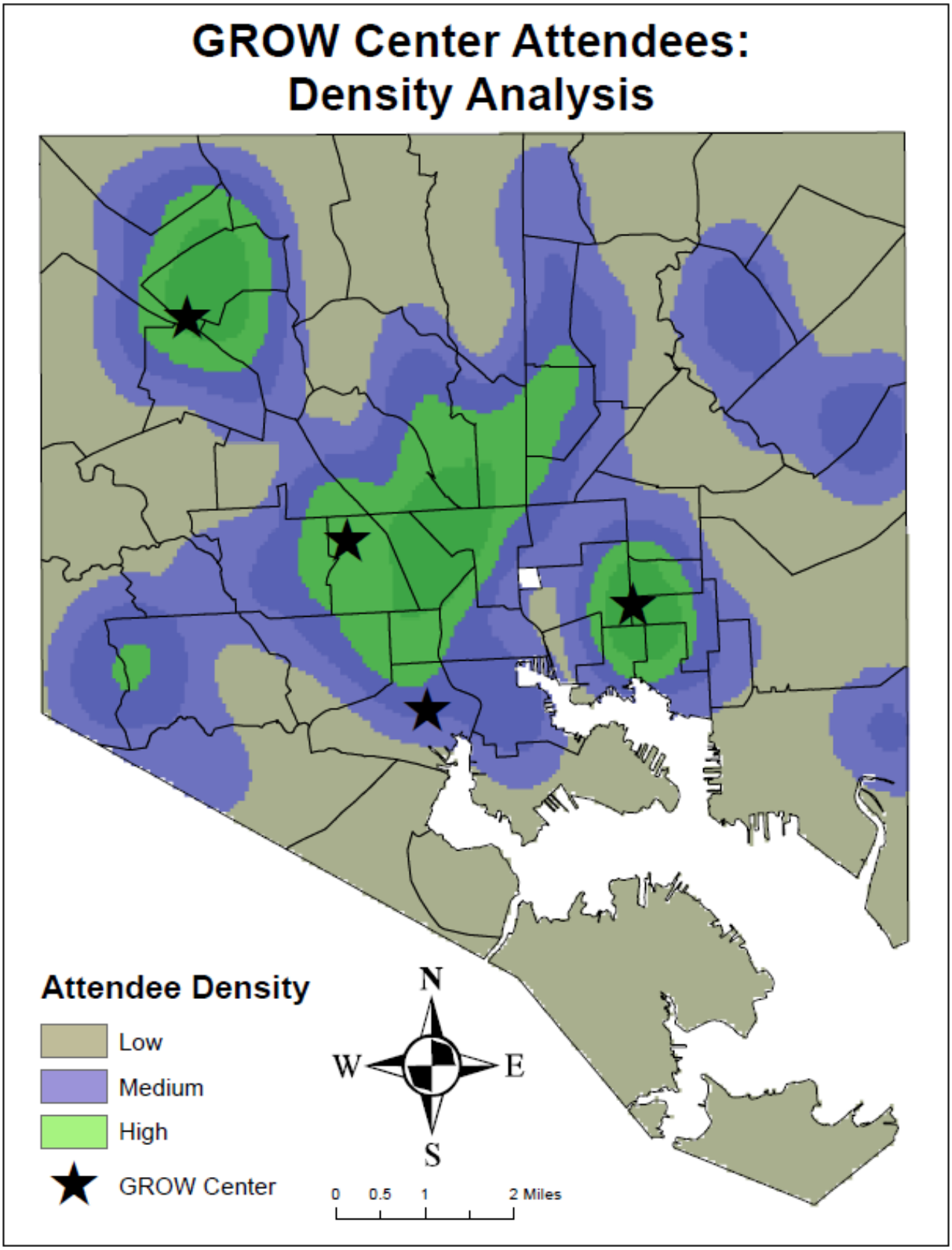
This data was used to determine average values of residents in each density zone as

Participants in the Tree Baltimore-led "Tree Planting/Care" workshop next to one of the newly planted trees at Langston Hughes Community Center, GROW Center #4.

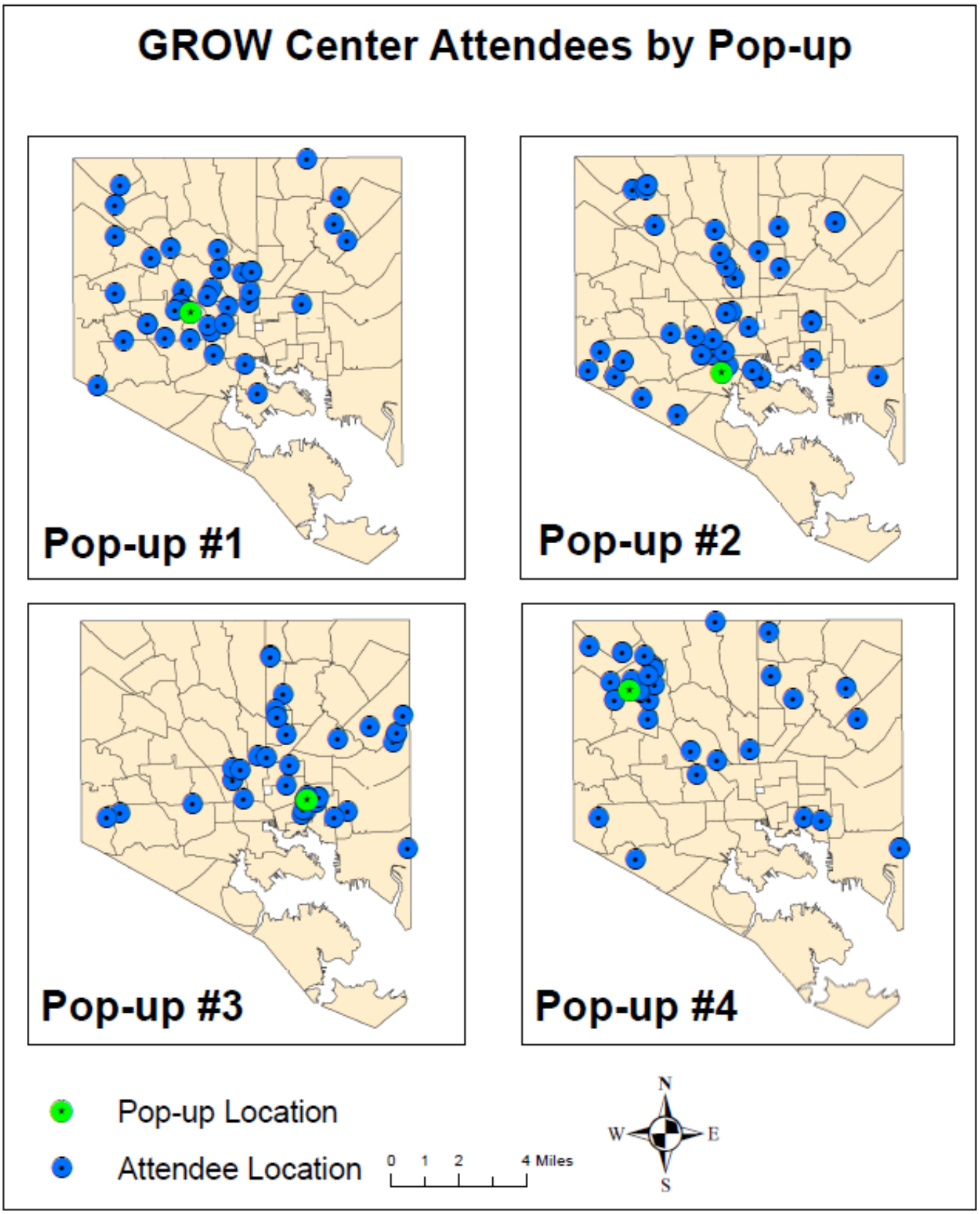
Map 1


GROW Center Attendees
by Neighborhood
Number of Attendees
0
1
2
3 - 4
5 - 6
GROW Center
N
W
E
S
0
0.5
1
2 Miles

Map 2


GROW Center Attendees:
Density Analysis
Attendee Density
Low
Medium
High
GROW Center
N
W
E
S
0
0.5
1
2 Miles

Map 3


GROW Center Attendees by Pop-up
Pop-up #1
Pop-up #2
Pop-up #3
Pop-up #4
Pop-up Location
Attendee Location
0 1 2 4 Miles
N
W
E
S

found in Table 2. Analysis showed areas of higher attendee density are areas characterized by less tree canopy, lower median income, higher numbers of community managed open spaces and higher percentages of vacant lots. This result gives some confidence that through targeted siting, GROW Centers can reach areas of high potential impact. This impact may be realized thru opportunities to perform vacant lot greening and increase tree canopy goals.

Table 2

Year	Indicator	Attendance		
		High	Med	Low
2016	Median Household Income ($)	38,325	47,926	50,267
2015	% Residential Properties that are Vacant & Abandoned	12.83	6.56	3.03
2015	# of Community Managed Open Spaces	27.81	13	3.75
2011	% Tree Canopy Cover	21.31	27.96	28.65

Lessons Learned

After data collection and analysis, it was important for GROW Center staff to reflect on the overall process and efficacy by returning to the guiding questions set beforehand.

1. What greening materials are of most interest and how did people access/transport them?

- Most popular were trees, mulch and native plants that were to be for residential use.
- This pop-up model was capable of providing resources to a large number (200+) people.
- People prefer free items while at cost items (i.e. native plants) can be barriers to many residents. Making at cost items cheaper or free/subsidized (i.e. rain barrels) should be considered in order to increase accessibility.
- Most materials were taken in smaller quantities (i.e. 1 or 2 trees, 1 or 2 buckets of mulch). This correlates with the intended residential use noted by attendees.
- Residents tended to travel to nearby GROW Centers to get materials

Attendees learning about Details reclaimed materials: brick, stone, & brick aggregate.

2. What training/ education is of most interest?

- Interest exists for many types of training and education such as rain barrels, composting and tree-related programming. (See Appendix Four)

- Despite pre-registration interest, the percentage of pre-registered people who attended was low. This might be contributed to busy times of the year (i.e. Spring), conflicting commitments and having no registration fee.
- Future workshops might omit registration limits in order to realize more actual attendees while still being free.
- Instituting a fee could add unnecessary complication and restrict some from attending, but should be considered if free workshops continue to falter.
- Although workshop turnout was low, facilitators gave positive feedback about meaningful interactions with participants.
- The $200 facilitation stipend copied from the 2016 pilot is difficult to justify if funding is an issue and workshop attendance is low.

3. What are best means for dispersing information about the GROW Center?

- Social Media (i.e. DPW Twitter/Facebook) and word-of-mouth proved effective while print adverts are important for reaching individuals without internet access.
- Methods of attracting residents passing by. For example, a drummer showed up at a pop-event and some residents attended after hearing the drums.
- EventBrite worked well for GROW Center pre-registration. Managing online event pages, registration processes and data collection was seamless.
- An important consideration is to ensure all partner advertising is received by GROW Center staff for consistency. This can bolster outreach.
- Promotion by partners may need to be discussed further in partner meetings to set clear expectations.
- The raffle/passport encouraged attendees to visit each partner, and proved very useful for providing opportunities for outreach by each partner.
- The prepared list of spring events (Appendix Five) also allowed for attendees to learn about other GROW Center related events.
-

Attendees happy with the information and free tree from GROW Center #3.

4. What resources are needed to implement GROW Center activities?

- With partner involvement, resources required by GROW Center are mostly logistical including: tables, chairs, printouts, water, electronic equipment, print advertisements, transportation, and staff.

- Working with DPW's legal department took 2 months to prepare agreements. Getting paperwork signed by partners and the DPW Director took another 2 weeks, while checks written by the City Foundation took another 2-3 weeks. If creating new agreements, schedule ample time (~3 months) to ensure quick payment of stipends.
- Depending on GROW Center funding source, different processes may need to be undergone to allow for timely payment to partners and should be considered.
- Reducing the amount of paperwork would be helpful. Due to Federal funding, agreements required additional paperwork that confused many partners.
- Having at least two GROW Center staff at events is absolutely necessary. One at check-in and one floating around to assist partners and workshops.
- Partnering with sites that held other concurrent activities was a "double-edged sword." Outreach potential increased, but sometimes GROW Center event operations were not given the proper attention.
- Four hours for GROW Centers was too long when considering non-workshop pop-ups. Most people arrived in the first two hours, with some arriving before the scheduled start time to get materials.

5. What GROW Center partners are needed?

- Every partner worked with expressed interest in being part of future GROW Center events.
- When searching for partners they can be classified into four categories: workshop facilitators, material suppliers, experts and host sites.
- Appropriate partners can be identified through the robust greening network in Baltimore based on goals/needs of GROW Centers

Attendee checking in at GROW Center #3, C.A.R.E. Community.

6. Miscellaneous

- Data collected at check-in was often difficult to accurately discern due to poor hand-writing/recording by attendees. Promulgating different means of collection will be beneficial (i.e. Tablet Check-in)
- The use of a raffle for collecting participant surveys and ensuring attendees visited all partners was very successful. (13 surveys pre-raffle vs. 56 post-raffle)

Concluding Remarks

While this GROW Center pop-up model proved successful in many ways, it was noted that 81% of GROW Center attendees who

came for materials intended to use them at their homes. While providing residents with access to materials is a central component of the GROW Center, it is also a priority to have these resources used in community greening (i.e. vacant lot revitalization).

In this regard, GROW Center programming could be targeted towards new community groups who have recently adopted vacant lots or are applying for grant funding from Parks & People Foundation. Targeting community groups could also foster potential for larger usage of materials and more robust workshop turnout.

GROW Center users were more likely to attend the pop-up location closest to them. Targeted areas included lower median income, less tree canopy, higher vacant lot percentages and higher numbers of community managed open spaces. These areas are desirable for GROW Center programming goals and should be considered in future planning of GROW Center pop-ups.

Dispersing GROW Center pop-ups across Baltimore City afforded access to a large number of people (200+) and neighborhoods (86). Part of this success is likely due to the effectiveness of partner and DPW city-wide promotions. Developing a GROW Center network based on this outreach is potentially invaluable, considering the abundance of "new greeners" the pop-ups attracted.

Finally, the main hurdles encountered by GROW Center staff during planning were cumbersome bureaucratic procedures. While some may have been slow due to first-time growing pains, finding ways to avoid this altogether in permanent GROW Center programming is worth considering.

Partners from the first pop-up GROW Center at Easterwood/Sandtown Park & Playground.

Appendices

A1 – Final Budget

A2 – Flyers

A3 – Data Collected

A4 – Survey Results

A5 – Handouts

A6 – Additional Maps

A1 – Final Budget

Item	Item Description	QTY	RATE	SUBTOTAL	DPW	USFS/DPW	USFS/City Fdn	Other
Workshop Stipend	Stipend for 5 workshop facilitators.	5	200	1000			1,000	
Location Stipend	Event space rental.	4	200	800			800	
Printing Shop Items	1 Banner, 6 Lawn Signs, 2 Large Welcome Posters	1	656	656	656			
Rain Barrel Subsidy	Subsidized cost of rain barrels for workshop participants	15	45	675		675		
Pollinator Plant Giveaway	Gave away free pollinator plant to workshop participants	8	7	56		56		
Raffle Gift Certificates	Two Herring Run Nursery Gift Certificates for raffle winners	2	20	40		40		
Compost/Garden Mix	3 bags of mix from Baltimore Community ToolBank for workshop	3	5	15		15		
Porta-John	1 porta-john for GROW Center pop-up #3	1	40	40	40			
Chairs Rental	20 Chairs rented from Baltimore Community ToolBank for 4 weeks	4	15	60		60		
Snacks	Light snacks for partners at 3 GROW Center pop-ups	4	8	32				X
Mileage	Personal vehicle usage for GROW Center pop-up preparations	139.9	0.535	74.846				X
DPW Truck (Mileage)	Transport of pop-up materials at 4 pop-up events + 1 pre-pop-up materials transport to ToolBank	41	0.535	21.935		X		
Tents	Tents for pop-up events from DOT Special Events	2	0	0				X
Tables	Tables for pop-up events from Prettyboy Reservoir Facility	10	0	0		X		
Facilitators (free)	4 free workshop facilitators at 4 pop-up events	1	8 Hrs	0		X		
Experts	4 Experts Organizations at 4 pop-up events	1	44 Hrs	0				X
DPW	2 OCAL Staff and 1 Peaceworker Staff for 4 pop-up events	1	66 Hrs	0				X
Materials	4 Materials Suppliers at 4 pop-up events	1	56 Hrs	0				X
	X = in-kind		**Total**	**$3470.78**				

Blue = Workshop; Purple = Location; Red = Printing; Orange = Logistics; Green = Staff
*City Fdn = Baltimore City Foundation

A2 – Flyers

Flyer 1(Also translated to Spanish)

GROWCenter

April 14, 2018
10am – 12pm
Easterwood/ Sandtown
Park n' Playground
1515-1557 McKean Avenue,
21217
Featuring: Garden & Vacant Lot experts, mulch, trees, and more.

April 21, 2018
10am – 2 pm
Baltimore Community Tool Bank
1224 Wicomico Street, 21230
Featuring: Workshops on rain & pollinator gardens. Materials include native plants, trees, mulch and more.

April 28, 2018
10am – 2pm
CARE Community
400 Block of
N. Duncan Street, 21231
Featuring: Garden & Vacant Lot experts, mulch, trees, and more.

May 5, 2018
10am – 2pm
Langston Hughes
Community Center
5011 Arbutus Avenue, 21215
Featuring: Community gardening, placemaking workshops. Materials include reclaimed lumber, mulch, trees, and more.

Baltimore City Department of Public Works brings you GROW Centers!! Baltimore GROW Centers are your neighborhood **greening resource hubs**. Over four weekends this Spring, GROW Centers will pop-up in Baltimore City with **green products for free/sale** and **free workshops** on topics including rain barrels; tree plantings; container, community, & pollinator gardening; and green space placemaking. Visit a GROW Center to transform that vacant lot, spruce up a community garden or make your block greener!

Sign-up to see all materials and workshops available!!!

baltimoregrowcenter.eventbrite.com

Mayor
Catherine E. Pugh

Our Participating Partners:

USDA/ Forest Service, Tree Baltimore, Bmore Beautiful, Baltimore Office of Sustainability, Baltimore Housing and Community Development, Baltimore Community Tool Bank, Blue Water Baltimore, Civic Works/Baltimore Orchard Project, Details Deconstruction, Parks & People Foundation, UMD Extension

BALTIMORE CITY DPW DEPARTMENT OF PUBLIC WORKS

For more information visit the website, call 410-396-0732, or email travis.lageman@baltimorecity.gov . Funding for GROW Centers was provided through a USDA Forest Service Grant.

A3 – Data Collected

Collection Method	Data Collected
Event Check-in/EventBrite Registration	• Name • Address • Phone Number • E-mail Address • How did you find out about GROW Center? • What materials are you here to get? • Are you here as a resident or part of a Community, Faith or Business group? • Years of community greening experience?
Materials Purchase/Pick-up Sheet	• Name • Amount of Material • Transport Method (Car, Walking, Public Transport) • Intended Use of Material (Residential, community, business, school, faith, other) • Intended Use Address
Feedback Survey – Participants	• How would you rate the GROW Center? (Likert Scale: 1-5) • What other workshops and/or materials would you like to see at GROW Centers? • Any other comments or suggestions?
Feedback Survey – Materials Suppliers	• How did the space work for giving out your materials? Anything lacking or needing improvement? • What were prevalent topics/conversations had with individuals regarding material use? • Any other comments?
Feedback Survey – Host Sites	• How did you feel about hosting the GROW Center? • Are there any recommendations you would make for future GROW Centers? • How did you feel about the overall planning process? • Any other comments?
Feedback Survey - Facilitators	• How did the space work for facilitating your workshop? • Is there anything the GROW Center could have provided to improve facilitation? • Any other comments?
Feedback Survey – Greening Experts	• Please estimate the number of people who asked questions • Were there any prevalent topics asked? • Was the GROW Center a good fit for your organization? • Any other comments?

*All methods carried out by DPW/GROW Center staff with the exception of the Materials, collected by each Material Supplier on behalf of DPW/GROW Center staff. All data provided voluntarily.

A4 – Survey Results

Participants	• Rankings: 5 out of 5 (x47); 4 out of 5 (x17); 1 out of 5 (x2) * both had positive remarks, may have chosen wrong number • Overall: Great event with lots of knowledgeable people. Very informative • Plants were pricy. • Recommendation for a series of classes on basics of gardens around town for a month or two. • Other Materials/Topics: Tools, Recycling, Bonsai, Rain Barrels, Trees (x6), Green Roofs, More Plants for Sale (x3), Kid Activities, How to start a garden (x2), Centrally located, brick & mortar year round GROW Center, Composting (x3), Container Gardening (x3), Planting Schedule Creation, Planting Incentives, "How to" demos, Soil Education (x3)
Facilitators	• Overall: Space worked very well • Having tools on site made workshop very easy. • It is important to meet people halfway. Get resources in their hands even if they arrive late to a workshop. • Ensure facilitator is best suited for particular workshop topic.
Experts	• Overall: Great event with lots of people. • Prevalent Topics: Adopt-a-lot (x2), Water Access (x2), Side Yard Program, Purchasing Property (x2), [Vacant lot] Gardening (x5), Baltimore Green Network, Container Planting (x2), Soil Testing (x3), Seeds/Planting (x4), Pest Management, Connecting youth to clean-ups/green-ups
Materials Suppliers	• Overall: Space worked well for materials giveaway/selling. • Selling plants out of back of pick-up truck is ideal. • Prevalent Topics: Perennial vs. Annual, Soil Quality, Competing Plants, Tree Height, Tree ID, Tree Care, Who is this organization?, Benefits of Natives, Tree Planting Locations
Host Sites	• Overall: Happy with event and being included. Good for the community • Wished it was a little bigger with more vendors • Ensure that partners clean-up well • Print flyers for community distribution (by host site) • Planning process was easy and worked well. (x3)

*Survey results sorted and aggregated.

A5 – Handouts

Handout 1

Reclaimed Materials Uses

1. Container Gardens/Planters

2. Tables, Chairs, Benches, furniture

3. Garden Edging

4. Brick Paths

5. Bird Baths

6. Tree ring

7. Crushed Brick/Stone Paths & Mulching

Handout 2

SPRING 2018 GREENING EVENTS:

$$ = Registration Fee | Parks & People | Tree Baltimore

Blue Water Baltimore | Charm City Farms | Civic Works

MAY 6 – Herring Run Nursery Sale
MAY 6 – Plants & People (Parks & Recreation – Every Sunday until October)
MAY 8 – Solar Workshop
MAY 9 – Pollinator Gardens
MAY 9 – Herring Run Nursery Workday Wednesday
MAY 10/11- Outfall Screening Blitz
MAY 12 – TreeGiveaway @ Waverly Farm Market
MAY 12 – TreeGiveaway @ Cylburn Arboretum "Market Day"
MAY 12 – Edible, Medicinal, & Useful Plant and Mushroom Walk **$$**
MAY 12 – Paint & Plant a Pot for Mom @ Herring Run Nursery **$$**
MAY 17 – Getting Grounded: Forest Bathing Walk (Cylburn Arboretum) $$
MAY 19 – Notable Tree Bus Tour
MAY 19 – Tree Giveaway @ Herring Run Nursery
MAY 22 – Storm Drain Art Workshop **$$**
MAY 23 – Carroll Park Stewardship
MAY 24 – Getting Grounded: Forest Bathing Walk (Cylburn Arboretum) $$
MAY 26 – Low Tech Mushroom Growing **$$**
MAY 26 – Forestry Board TreeGiveaway @ Herb Fest
JUNE 1 – Tree Giveaway @ Summer Sounds, Belvedere Square
JUNE 2 – Pollution 101 & Outfall Screening Blitz Training
JUNE 3 – TreeGiveaway @ "Under the JFX"
JUNE 5 – Tree Giveaway @ Farmers Market in Lauraville
JUNE 6 – Soil & Water Management Workshop
JUNE 9 – Edible, Medicinal, & Useful Plant and Mushroom Walk **$$**
JUNE 9 – 3rd Annual Baltimore Floatilla $$
JUNE 16 – Mushroom Growing 101: Beyond Low-Tech **$$**
JULY 18 – Event Management 101

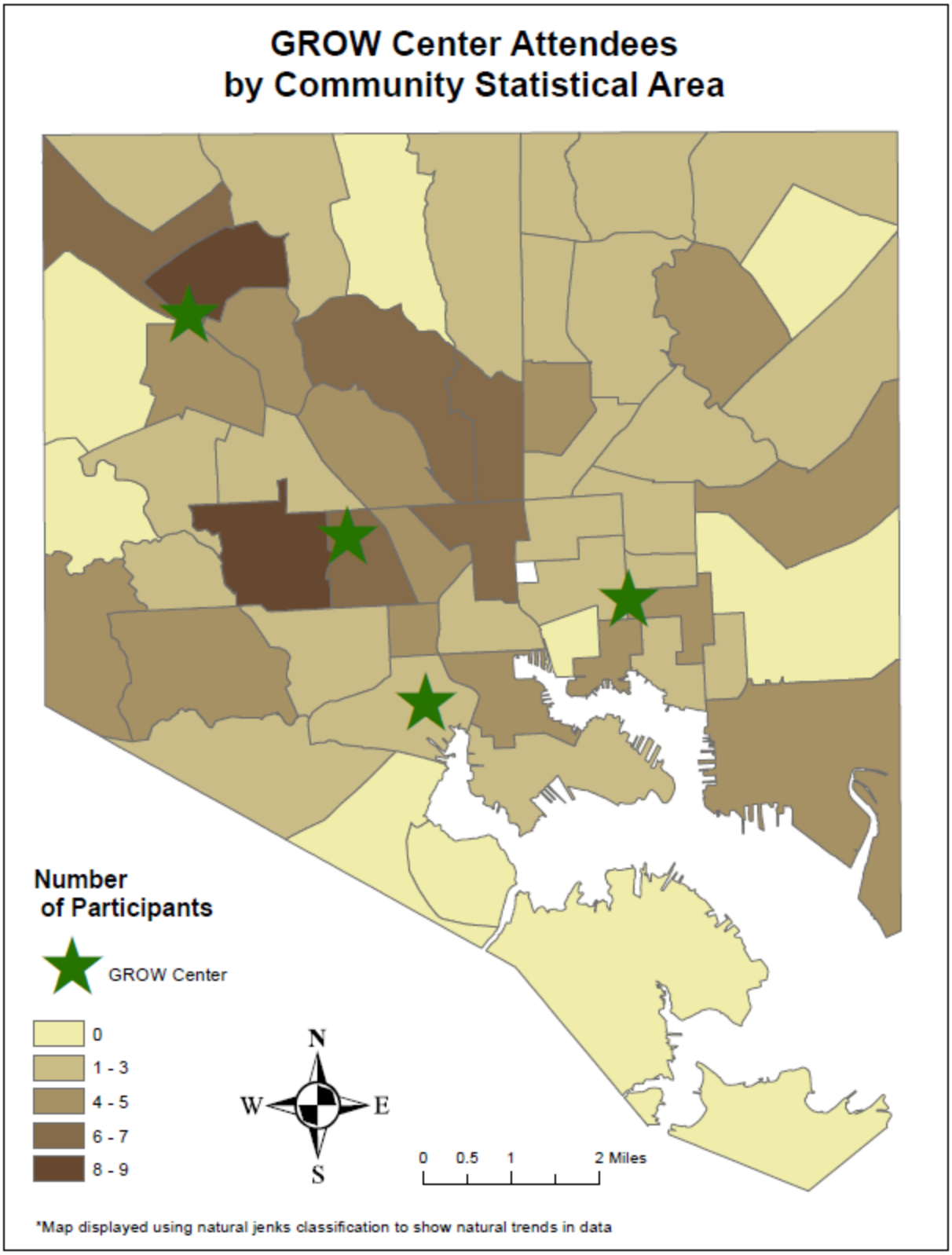
Mayor
Catherine E. Pugh

***For more info on a particular workshop/event, visit the organizer's website. ***

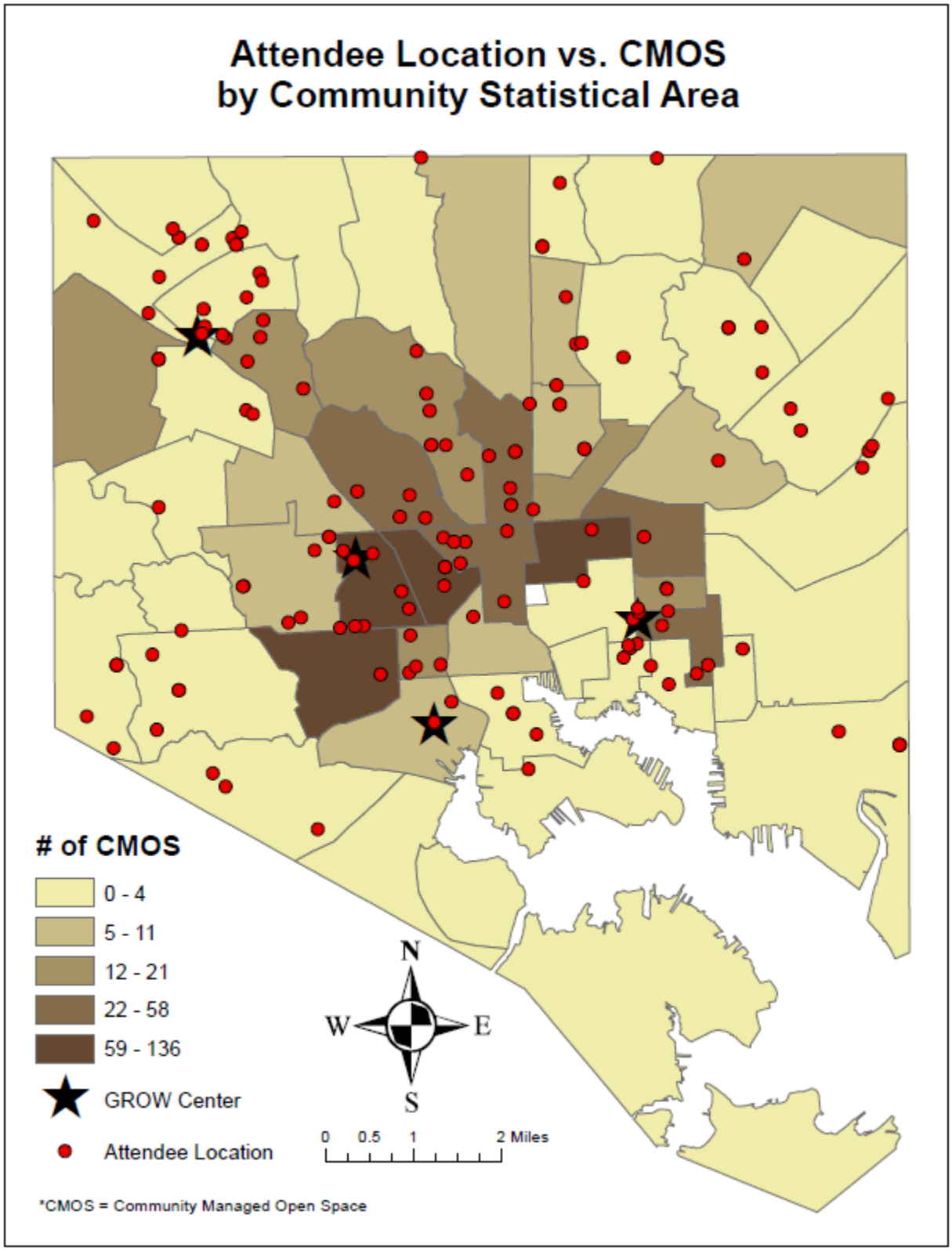
BALTIMORE CITY
DPW
DEPARTMENT OF PUBLIC WORKS

A6 – Additional Maps

Map 1:

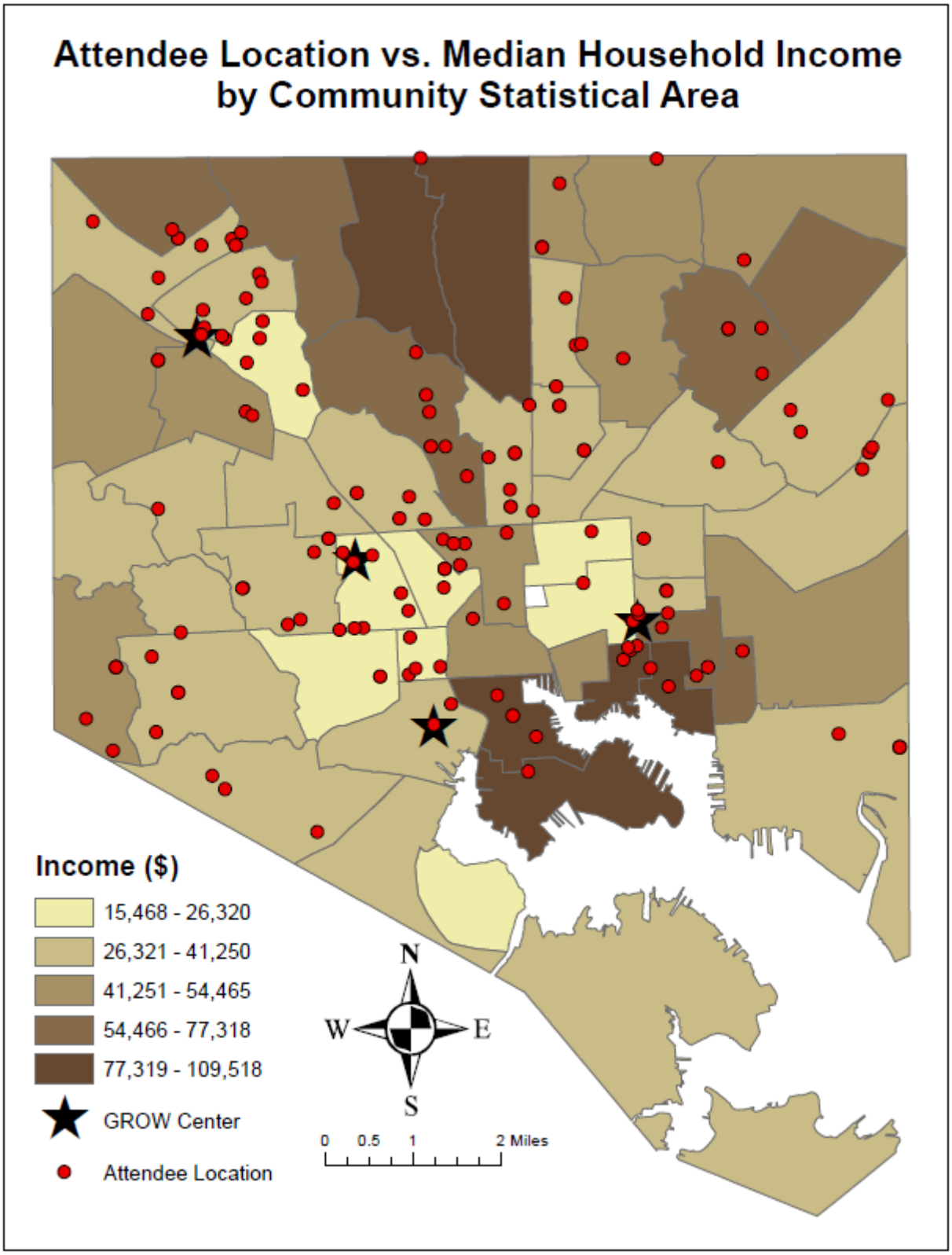


Map 2



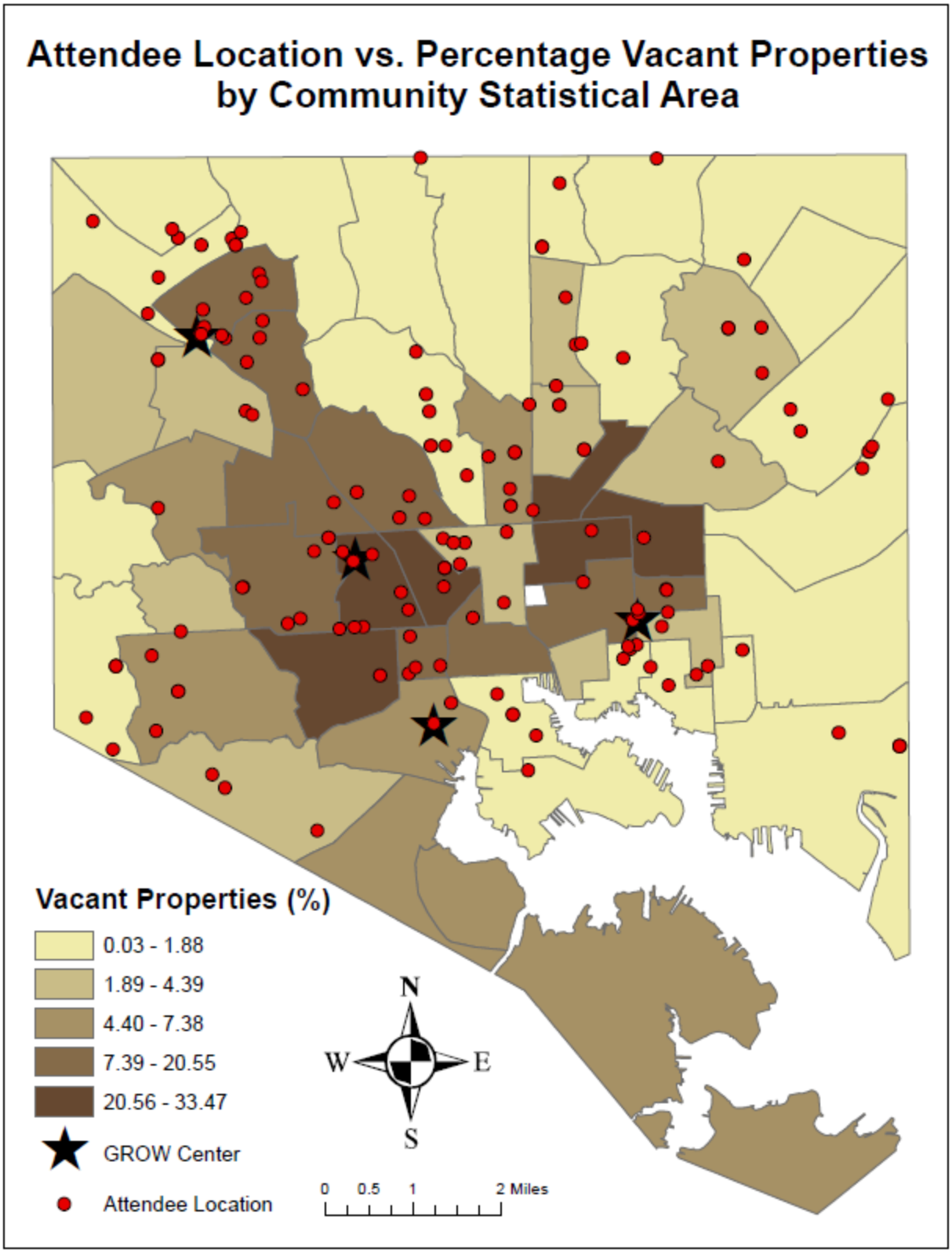
*Data from BNIA-JFI Vital Signs (Sustainability 2015 Dataset): https://bniajfi.org/vital_signs/data_downloads/

Map 3



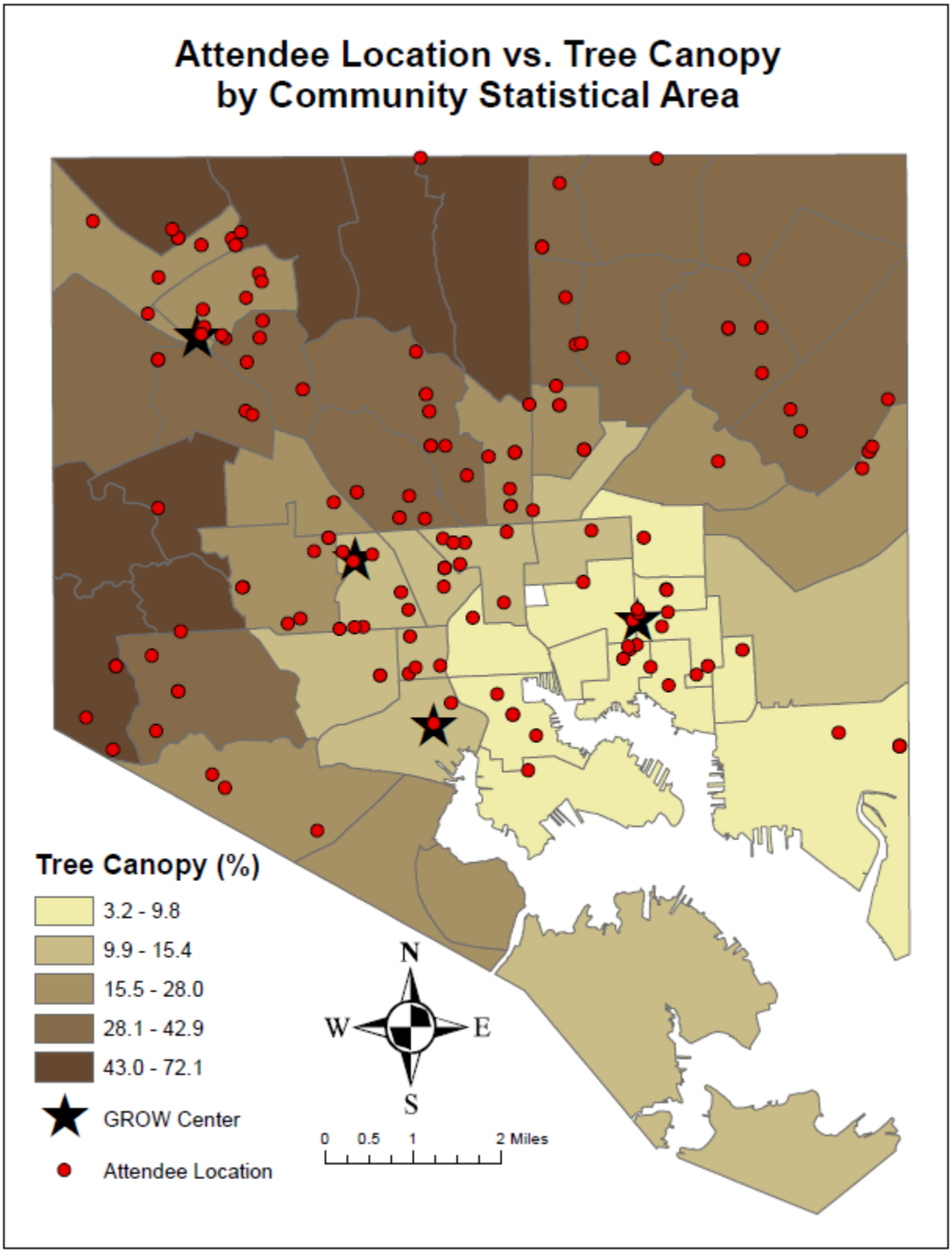
*Income data from BNIA-JFI Vital Signs (Census Demographics 2016 Dataset): https://bniajfi.org/vital_signs/data_downloads/

Map 4



*Data from BNIA-JFI Vital Signs (Housing 2015 Dataset): https://bniajfi.org/vital_signs/data_downloads/

Map 5



*Data from BNIA-JFI Vital Signs (Sustainability 2011 Dataset): https://bniajfi.org/vital_signs/data_downloads/

Appendix Q: Progress Status of Milestones

Table Q-1: Progress Status of MS4 and TMDL WIP Milestones for FY 2018

Program Milestones	Status
Complete studies for relationships for IDDE, education, and other non-traditional BMPs with impervious area restoration, nutrient, sediment, and bacteria reduction.	Complete. Result for IDDE relationship will be submitted to MDE as part of the MS4 Accounting Guidance work group in January 2018. Education has been proposed as co-benefit for same work group.
Implement a pet waste campaign.	Pet waste campaign was initiated in 2015 with a public service announcement and continued as part of the BMORE Beautiful Initiative.
Project Milestones (construction initiated)	
5.9 miles of stream restoration	Construction was initiated on Lower Lower Stony Run and Chinquapin Run (2.65 miles). Design completed on 6 other stream restoration projects (4.36 miles), scheduled for bid in FY 2019.
475 acres restored using Traditional BMPs	Wetland (20 ac) completed as part of Lower Lower Stony Run. Traditional BMPs decreased to only 18.3 acres, to be completed by FY 2022, due to feasibility.
35 acres restored using ESD Practices	Design is complete for 29.8 acres of restoration by ESD, scheduled for bid in FY 2019.
21.0 acres of impervious removal and greening projects	Design is complete for 17.2 acres of restoration by impervious area removal, scheduled for bid in FY 2019.
5,000 trees planted	Approximately 1,793 trees were planted in the 2017 planting season; however this data did not include efforts from Baltimore Tree Trust so the amount could be higher.

Table Q-2: Progress Status of Trash WIP Milestones for FY 2018

Milestones	Status
Launch Clean Corps Anti-Litter marketing campaign (FY 17-18)	Research was initiated. Clean Corps has transitioned into B'More Baltimore campaign.
Study options for the repair and/or replacement of Alluvion and Gwynns Run Debris Collectors	Alluvion bags have been replaced. Gwynns Run debris collector repairs will be part of

Appendix R: Progress Status of Projects, Programs, and Partnerships for 20% Impervious Surface Restoration

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		Delayed due to other construction in vicinity.
				23	15	79	10	9,315	$1,116,000	2017	2020	Under Design	
S02	SW Pond Retrofit	Gwynns Falls	Seton Business Park Park	62	41	214	27	25,169	$795,000	2016	2018		Not viable based on access and potential for retro-fit.
												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		Access problems. Project deemed not practicable.
												Removed	
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	$955,080	2016	2019	Under Design	
S10	Bioretention Area	Gwynns Falls	Park Hts Virginia + Homer	3	2	11	2	1,135	$60,000	2016	2018		Access problems.
												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		Access problems.
												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	
			Subtotal Structural / Traditional (WIP):	**475**	**309**	**1,455**	**243**	**181,986**	**$10,002,000**				
			Subtotal Structural / Traditional (Current):	**59**	**39**	**203**	**30**	**21,663**	**$2,071,080**				

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	$138,728	2016	2019	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	$530,276	2016	2019	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	$883,183	2016	2019	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	$129,926	2016	2019	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	$64,693	2016	2019	Under Design	

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	$346,821	2016	2019	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	$569,043	2016	2019	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	$371,114	2016	2019	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	$208,092	2016	2019	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		
				1.9	1.5	8.9	1.40	906	$1,233,400	2015	2019	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	$408,851	2016	2019	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		
				0.5	0.4	2.4	0.37	242	$324,364	2016	2019	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		
				1.0	0.8	4.8	0.75	483	$2,140,081	2016	2019	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		
				0.4	0.3	1.8	0.28	181	$1,284,405	2016	2019	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	$664,040	2016	2019	Under Design	
E36	Micro-bioretention	Back River	De Wees Park	1.3	1.0	5.9	0.93	604	$180,000	2017	2019		No viable projects founds.
												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		No viable projects founds.
												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		
				5.0	4.0	23.8	3.74	2,416	$454,742	2016	2019	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		
				7.5	6.0	35.6	5.61	3,623	$1,437,153	2016	2019	Under Design	

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):	**39**	**31**	**184**	**29**	**18,715**	**$11,600,712**				
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 A43.
				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	$6,140,947	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	$10,447,503	2014	2018	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	$2,611,876	2015	2019	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	$5,515,082	2015	2019	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		Project no longer viable.
												Removed	
A09	Stream Restoration	Back River	Biddison Run Project 2	3,030 LF	45	227	206	90,900	$3,590,000	2014	2018		
				3,060 LF	46	230	208	91,800	$3,748,949	2014	2019	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	$5,294,935	2016	2019	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 and access issues.
												Removed	

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		Will be advertised with A09 - Biddison Run Project 2.
				3,850 LF	58	289	262	115,500	$4,726,935	2014	2019	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	56	278	252	111,000	$4,909,153	2016	2019	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	42	210	190	84,000	$3,681,864	2016	2019	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	9	45	41	18,000	$2,589,956	2017	2019	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		
				2,700 LF	41	203	184	81,000	$3,112,295	2017	2019	Under design	
A20	Stream Restoration	Gwynns Falls	Dead Run	2,200 LF	33	165	150	66,000	$2,702,000	2016	2019		
				2,700 LF	41	203	184	81,000	$3,493,124	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		
				4,300 LF	65	323	292	129,000	$6,932,857	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):	**53,290 LF**	**799**	**3,997**	**3,624**	**1,598,700**	**$69,240,176**				
Alternative BMPs (Other)													
A22	Regenerative Step Pool Storm Conveyance	Gwynns Falls	Seamon Avenue	20	6	139	11	5,068	$1,168,000	2015	2017		IA reduced based on design.
				20	6	139	11	5,120	$1,403,750	2015	2019	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		
				0.3	0.35	1.8	0.40	262	$48,800	2016	2019	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	

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		
				1.4	1.00	5.6	1.54	877	$484,417	2016	2019	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		
				0.7	0.81	4.2	0.94	616	$266,985	2016	2019	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	$585,554	2016	2019	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		
			1	5.2	6.25	32.0	7.24	4,751	$199,697	2016	2019	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		
				0.6	0.7425	3.8	0.86	565	$1,060,164	2016	2019	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		
				0.1	0.2	0.4	0.11	62	$149,788	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		
				4.9	4.88	19.0	5.27	3,002	$3,609,904	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		
				0.4	0.37	1.4	0.40	228	$530,083	2016	2019	Under Design	

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		
				4.4	4.40	47.8	6.99	3,601	$340,150	2016	2018	Completed	
A40	Aforestation of IA	Gwynns Falls	TreeBaltimore Street Trees	8.3	5.81	90.2	13.19	6,793	$496,000	NA	2017		
				5.8	4.06	63.0	9.21	4,747	$340,150	NA	2017	Completed	
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	2019	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 Construction	
			Subtotal Alternative BMPs (Other) (WIP):	**72**	**50**	**531**	**82**	**45,696**	**7,739,600**				
			Subtotal Alternative BMPs (Other) (Current):	**64**	**46**	**512**	**73**	**39,380**	**9,763,442**				
			Total Projects (WIP):		**1,202**	**6,230**	**3,927**	**1,827,491**	**$77,536,600**	**84**	**Projects**	**Proposed**	
			Total Projects (Current):		**915**	**4,896**	**3,756**	**1,678,459**	**$92,675,410**	**52**	**Projects**	**Proposed**	
					9	135	20	10,189	$744,000	2	Projects	Pending	
					608	3,176	2,500	1,118,296	$74,357,107	41	Projects	Under Design	
					246	1,253	1,023	454,694	$14,647,203	3	Projects	Under Construction	
					53	332	213	95,279	$2,927,100	6	Projects	Completed	

Project No. / Type	Debris Collected	Equivalent Impervious Surface 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):	**13,483 tons**	**3,775**	**110,655**	**lane miles**	**33,033**	**13,213**	**3,964,002**	Equivalent Impervious Area Restoration is based on debris collected.
Street Sweeping - Back River	*1,470 tons*	*412*	*9,828*	*lane miles*	*3,602*	*1,441*	*432,180*	*Equivalent Impervious Area Restoration is based on debris collected.*
Street Sweeping - Baltimore Harbor	*4,063 tons*	*1,138*	*38,923*	*lane miles*	*9,954*	*3,982*	*1,194,522*	*Equivalent Impervious Area Restoration is based on debris collected.*
Street Sweeping -Gwynns Falls	*4,411 tons*	*1,235*	*34,227*	*lane miles*	*10,807*	*4,323*	*1,296,834*	*Equivalent Impervious Area Restoration is based on debris collected.*
Street Sweeping - Jones Falls	*2,996 tons*	*839*	*24,237*	*lane miles*	*7,340*	*2,936*	*880,824*	*Equivalent Impervious Area Restoration is based on debris collected.*
Street Sweeping - L.N. Branch Patapsco	*543 tons*	*152*	*3,440*	*lane miles*	*1,330*	*532*	*159,642*	*Equivalent Impervious Area Restoration is based on debris collected.*
Street Sweeping (Planned increase since Dec. 2009)	*10,911 tons*	*3,055*	*40,512*	lane miles	26,732	10,693	3,207,834	*Ref: MS4 Annual Report for CY 2009. Reported tonnage of 8,186 tons. Used for CB TMDL and local TMDL.*
Street Sweeping (Current increase since Dec. 2009)	*5,297 tons*	*1,483*	*40,512*	lane miles	12,978	5,191	1,557,318	
Inlet Cleaning & Debris Collection								
Collection within CY 2012	926 tons	259	9,222	inlet cleanings	2,269	907	272,244	Ref: MS4 Annual Report (Jan. 2011 to Dec. 2012). Inlet amount is total inlet cleaning.
Anticipated Increase after Asset Management (4% Inlets cleaned quarterly):	990 tons	860	4,300	inlet cleanings	2,426	970	291,060	Ref: Preliminary Asset Management Program and CIP Schedule for Inlet Screens.
Sub-total Preventive Inlet Cleaning (WIP):	**1916 tons**	**1,119**			**4,694**	**1,878**	**563,304**	
Sub-total Inlet Cleaning (Current Annual Total):	**566 tons**	**226.4**	**1,128**	**inlet cleanings**	**1,387**	**555**	**166,404**	Tonnage reflects dry weight, due to procedure change in 2016. Water not included in est. ISR.
Reactive Inlet Cleaning (daily operation):	*468 tons*	*187.2*	*5,940*	inlet cleanings	*1,147*	*459*	*137,592*	
Targeted preventive cleaning (quarterly):	*98 tons*	*39.2*	*5,192*	inlet cleanings	*240*	*96*	*28,812*	*1,298 inlets on targeted quarterly inlet cleaning.*
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.
Sewage Exfiltration**			13	miles lined				Lining complete from January 2018 to June 2018. Nutrient reduction pending MDE approval.

Project No. / Type	Debris Collected	Equivalent Impervious Surface Restoration (ac)	Reference Metric		Estimated Pollutant Removal (lbs / yr)			NOTES
					TN	TP	TSS	
Drinking Water Transmission**		**NA**	60	miles lined / replaced	1,500	273	**NA**	Estimated water line lining / replacement by 2018.
Drinking Water Transmission**			66	miles lined / replaced				Nutrient reduction pending MDE approval.
Dry Weather SSO**		**NA**	30	SSOs / yr red	350	64	**NA**	Asset management / FOG program, education, enforcement, and enhanced 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.
TOTAL Programs (WIP):		**6,466**			**58,432**	**21,856**	**6,177,822**	
TOTAL Programs (Current):		**4,006**			**35,410**	**13,948**	**4,130,406**	

* 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 Guidelines).

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
				277.4	749	42	25,239
Treatment by Traditional	DPW Plans Review	City-wide	City-wide	54.7	260	26	21,805
				187.5	506	28	17,063
			Sub-total Development (WIP):	**150**	**713**	**70**	**59,770**
Sub-total Development (Actual Completed in Jan. 2010 to June 2015):				**465**	**1,255**	**70**	**42,301**
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

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

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

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 -6/2018):	**471**	**1,369**	**75**	**43,578**

Appendix S: Progress of Chesapeake Bay TMDL

Watershed	Area within City (sq. mi.)[1]	(acres)	Imp. Area[3]	TN (lbs)	TP (lbs)	TSS (tons)
Back River	19.1	12,224	4,584	152,647	11,032	2,552
Baltimore Harbor	22.5	14,400	5,949	182,291	13,688	3,209
Gwynns Falls	20.7	13,248	5,605	168,301	12,759	3,001
Jones Falls	17.5	11,200	4,816	142,632	10,884	2,566
LNB Patapsco	1.8	1,152	502	14,701	1,128	266
Total	**81.6**	**52,224**	**21,456**	**660,571**	**49,491**	**11,594**
Urban Impervious Loading Rate (/ acre)[2]				15.3	1.69	0.44
Urban Pervious Loading Rate (/ acre)[2]				10.8	0.43	0.07

Reference:

1 -Baltimore City MS4 and TMDL WIP, Table 1, August 2015

2 - Table A.1, Appendix C from MS4 Accounting Guidelines, August 2014

3 - Baltimore City MS4 and TMDL WIP, Table 1, August 2015, total = 21,456 ac uncontrolled IA.

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
Reduction Goal for Urban Stormwater:	84,903	9,960	418,490	Maryland's Phase II WIP for Bay TMDL, Oct. 2012, Executive Summary
	20.3%	*30.3%*	*1.9%*	
Analysis based on MS4 Accounting Guidelines				
Total Loading	**660,571**	**49,491**	**23,188,800**	Table S-1
Comparison of loading with CB Model	*158%*	*151%*	*105%*	
Projects proposed within current MS4 permit:				
Total Projects (WIP):	6,230	3,927	1,827,491	Table R-1. Current planned projects will be completed by FY 2021.
Total Projects (Current Planned):	4,896	3,756	1,668,218	
Total Projects (Current Completed):	272	159	71,279	
Programs proposed within current MS4 permit:				
Total Programs (WIP):	26,732	10,693	3,207,834	Modified as only the street sweeping after 2009
Total Programs (Current):	**12,978**	**5,191**	**1,557,318**	
Partnerships proposed within current MS4 permit:				
Total Partnerships (WIP):	1,164	119	86,325	
Total Partnerships (Current):	**1,369**	**75**	**43,578**	
Total Reduction (planned):	32,792	14,567	4,962,377	Per current planned projects, Table K-1
% Reduction by end of MS4 Permit:	5%	29%	21%	
Total Reduction Current Completed:	14,619	5,425	1,672,175	
% Reduction Current Completed:	2%	11%	7%	

Appendix T: Progress of Local TMDLs for Nutrients and Sediment

BMP Type	Estimated Pollutant Removal (lbs / yr) TN	TP	NOTES
TMDL Baseline Load:	**73,429**	**8,315**	TMDL for Back River (2005)
Reduction Goal:	*15%*	*15%*	TMDL for Back River (2005)
Baseline Load using MDE Accounting Guidelines	**152,647**	**11,032**	See Table S-1 for baseline loads for Back River
BMPs installed between 2005 and 2010:			
Stream Restoration	113	102	Previous MS4 Annual Reports. 1,500 LF restored.
Private / Other City BMPs	24	3	Appendix B of WIP.
Total	**136**	**105**	
Projects proposed within current MS4 permit:			
Total Projects (WIP):	3,011	1,895	Table R-1. Current planned projects will be completed by FY 2021.
Total Projects (Current Planned):	2,332	2,077	
Total Projects (Current Completed):	0	0	
Programs proposed within current MS4 permit:			
Total Programs (WIP):	2,915	1,166	Modified as only the street sweeping after 2009
Total Programs (Current):	1,415	566	
Partnerships proposed within current MS4 permit:			
Total Partnerships (WIP):	263	26	
Total Partnerships (Current):	82	5	
Total Reduction by end of MS4 Permit:	5,646	3,374	Per current planned projects, Table R-1.
% Reduction compared to TMDL Load:	8%	41%	
% Reduction compared to MDE-AG:	4%	31%	
Total Reduction Current Completed:	1,633	676	
% Reduction compared to TMDL Load:	**2%**	**8%**	
% Reduction compared to MDE-AG:	**1%**	**6%**	

BMP Type		Watershed	Estimated Pollutant Removal (lbs / yr)		NOTES
			TN	TP	
TMDL Baseline Load:			**260,323**	**28,177**	TMDL for Baltimore Harbor (2007), includes GF, JF, and LNBP
Reduction Goal:			*15%*	*15%*	TMDL for Baltimore Harbor (2007), includes GF, JF, and LNBP
Baseline Load using MDE Accounting Guidelines			**507,924**	**38,459**	See Table S-1 for baseline loads for Back River
BMPs installed between 2005 and 2010:					
	ESD Practices	Gwynns Falls	20	3	Previous MS4 Annual Reports.
	Stream Restoration	Jones Falls	139	126	Previous MS4 Annual Reports. 1,850 LF restored.
	Stream Restoration	Gwynns Falls	203	184	Previous MS4 Annual Reports. 2,700 LF restored.
	Private / Other City BMPs	Gwynns Falls	4	1	Appendix B of WIP.
	Private / Other City BMPs	Jones Falls	84	10	Appendix B of WIP.
	Private / Other City BMPs	Baltimore Harbor	34	5	Appendix B of WIP.
	Private / Other City BMPs	Back River	24	3	Appendix B of WIP.
	Total		**508**	**331**	
Projects proposed within current MS4 permit:					
	Total Projects (WIP):		3,415	2,372	Table R-1. Current planned projects will be completed by FY 2021.
	Total Projects (Current Planned):		1,981	2,590	
	Total Projects (Current Completed):		272	159	
Programs proposed within current MS4 permit:					
	Total Programs (WIP):		**23,817**	**9,527**	Modified as only the street sweeping after 2009
	Total Programs (Current):		**11,563**	**4,625**	
Partnerships proposed within current MS4 permit:					
	Total Partnerships (WIP):		**901**	**93**	
	Total Partnerships (Current):		**1,287**	**70**	
Total Reduction by end of MS4 Permit:			27,207	12,540	Per current planned projects, Table R-1.
% Reduction by end of MS4 Permit:			10%	45%	
% Reduction compared to MDE-AG:			5%	33%	
Total Reduction Current Completed:			13,630	5,185	
% Reduction compared to TMDL Load:			**5%**	**18%**	
% Reduction compared to MDE-AG:			**3%**	**13%**	

Location	Estimated Pollutant TSS (lb/ year)	NOTES
MS4 Baseline Load (TMDL Report)	14,410,000	TMDL for Gwynns Falls (2010)
Reduction Goal (TMDL Report)	*49%*	TMDL for Gwynns Falls (2010)
Baseline Load using MDE Accounting Guidelines	**6,002,420**	See Table S-1
Projects proposed within current MS4 permit:		
Total Projects (WIP):	477,927	Table R-1. Planned projects are scheduled for completion by FY 2021.
Total Projects (Current Planned):	477,875	
Total Projects (Current Completed):	70,748	
Programs proposed within current MS4 permit:		
Total Programs (WIP):	1,049,452	Table R-2. Modified as only the street sweeping after 2009.
Total Programs (Current):	509,481	
Partnerships proposed within current MS4 permit:		
Total Partnerships (WIP):	21,581	Table R-3, estimated distribution based on Table 1 of WIP.
Total Partnerships (Current):	11,414	
Total Reduction by end of MS4 Permit:	1,548,960	Per current planned projects, Table R-1.
% Reduction by end of MS4 Permit:	26%	
Total Reduction Current Completed:	**591,643**	
% Reduction Current Completed:	**10%**	Based on MDE-Accounting Guidelines Load, since TMDL load was not based on direct sampling.
Remaining Reduction to Complete	**2,319,531**	

Location	Estimated Pollutant TSS (lb/ year)	NOTES
MS4 Baseline Load (TMDL Report)	9,466,000	TMDL for Jones Falls (2011)
Reduction Goal (TMDL Report)	*26.3%*	TMDL for Jones Falls (2011)
Baseline Load using MDE Accounting Guidelines	**5,131,840**	See Table S-1
Projects proposed within current MS4 permit:		
Total Projects (WIP):	296,825	Table R-1. Planned projects are scheduled for completion by FY 2021.
Total Projects (Current Planned):	257,460	
Total Projects (Current Completed):	24,000	
Programs proposed within current MS4 permit:		
Total Programs (WIP):	712,799	Table R-2. Modified as only the street sweeping after 2009.
Total Programs (Current):	346,045	
Partnerships proposed within current MS4 permit:		
Total Partnerships (WIP):	18,128	Table R-3, estimated distribution based on Table 1 of WIP.
Total Partnerships (Current):	9,151	
Total Reduction by end of MS4 Permit:	1,027,752	Per current planned projects, Table R-1.
% Reduction by end of MS4 Permit:	20%	
Total Reduction Current Completed:	**379,196**	
% Reduction Current Completed:	**7%**	Based on MDE-Accounting Guidelines Load, since TMDL load was not based on direct sampling.
Remaining Reduction to Complete	**970,478**	

Location	Estimated Pollutant TSS (lb/ year)	NOTES
MS4 Baseline Load (TMDL Report)	**1,220,000**	TMDL for Lower North Branch Patapsco (2011)
Reduction Goal (TMDL Report)	*25.1%*	TMDL for Gwynns Falls (2010)
Baseline Load using MDE Accounting Guidelines	**532,760**	See Table S-1
Projects proposed within current MS4 permit:		
Total Projects (WIP):	3,663	Table R-1. Planned projects are scheduled for completion by FY 2021.
Total Projects (Current Planned):	906	
Total Projects (Current Completed):	0	
Programs proposed within current MS4 permit:		
Total Programs (WIP):	129,189	Table R-2. Modified as only the street sweeping after 2009.
Total Programs (Current):	62,718	
Partnerships proposed within current MS4 permit:		
Total Partnerships (WIP):	1,899	Table R-3, estimated distribution based on Table 1 of WIP.
Total Partnerships (Current):	959	
Total Reduction by end of MS4 Permit:	134,751	Per current planned projects, Table R-1.
% Reduction by end of MS4 Permit:	25.3%	
Total Reduction Current Completed:	**63,676**	
% Reduction Current Completed:	**12.0%**	Based on MDE-Accounting Guidelines Load, since TMDL load was not based on direct sampling.
Remaining Reduction to Complete	**70,046**	