

“DRAFT FOR REVIEW”

Cumberland Township
Chesapeake Bay Pollutant Reduction Plan
(2018-2023)

Cumberland Township, Adams County, PA

PREPARED BY:



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1. Introduction & Executive Summary

Cumberland Township is located in South Central Pennsylvania in Adams County. The Township is home to 6,162 residents as of the 2010 census and is comprised of a wide variety of land uses including a significant portion of the Gettysburg National Military Park.

Under the United States Clean Water Act, the Township is required to apply for coverage under the NPDES General MS4 Permit for its Municipal Separate Storm Sewer System contained within the identified Urbanized Area of the Township. In conjunction with application for the MS4 Permit Cumberland Township is required to prepare and implement a Chesapeake Bay Pollutant Reduction Plan (CBPRP) for stormwater discharges to Willoughby Run, Rock Creek, and unnamed tributaries (UNTs) to Rock Creek. Coverage of the MS4 Permit will begin March 2018.

The goal of the PRP is to reduce Total Sediment, Total Phosphorus and Total Nitrogen loading to the receiving waters by 10%, 5%, and 3% respectively within 5-years of coverage under the MS4 Permit. In accordance with guidance provided by the Pennsylvania Department of Environmental Protection (PA DEP) compliance with the 10% Sediment Load Reduction will satisfy the requirements for reduction in Total Phosphorus and Total Nitrogen.

In order to achieve 10% Sediment Load Reduction it is proposed to install Stormwater Management Best Management Practices (BMP's). Numerous previously installed BMP's were used to take credit for reduction to baseline Sediment Load. Additional BMP's are proposed to be installed over the next 5-year period in order to achieve the 10% Total Sediment Load Reduction. Proposed BMP's may include the retrofitting of existing stormwater detention basins, the incorporation of Riparian/Forest Stream Buffers, and other measures.

The Chesapeake Bay Pollutant Reduction Plan (CBPRP) represents Cumberland Township's efforts in complying with the Pennsylvania Department of Environmental Protection (PADEP) Municipal Separate Storm Sewer (MS4) permitting requirements. The permitting requirements cover the stormwater discharge to local surface waters impaired for nutrients and sediment by reducing total sediment load by 10% within 5-years of coverage under the MS4 Permit.

This document was prepared using the guidance of Pennsylvania Department of Environmental Protection (DEP) document 3800-PM-BCW0100k: National Pollutant Discharges Elimination Protection (NPDES) Stormwater Discharges from Small Municipal Septate Storm Sewer Systems Pollutant Reduction Plan (PRP) Instructions (rev. 3/2017).

2. Required PRP Elements

2.1 Public Participation

As part of the preparation of this MS4 PRP, Public Participation is required. A complete copy of the PRP was made available for public review at the Cumberland Township Municipal Building and on their website (<http://www.cumberlandtownship.com>) from July 27, 2017 to August 26, 2017. Public notice was placed in the in the Gettysburg Times. The advertisement contained a description of the plan, dates and locations where the plan was available for review, the duration of the comment period, and the dates/time/location of the public meetings shown in Appendix I.

Following the public notice, comments were accepted for 30 days. Appendix II contains copies of all public comments and responses issued to comments.

On August 22, 2017 at the Cumberland Township Municipal Building, a public meeting was held to present information to Township Residents and Officials and to accept any additional public comments. Appendix II contains a copy of all public meeting notes.

Appendix II (Public Participation) provides documentation of public comments and any specific changes to the PRP as a result of public comment.

Cumberland Township completed all requirements of Public Participation measures as included in Appendix II.

- PRP Public notice was published in: Gettysburg Times
- Dates PRP public notice was published: July 27, 2017; August 3, 2017
- Date PRP was made available for public review/comment: July 26, 2017
- End date for written comments: August 26, 2017
- Date PRP comments were accepted at a public meeting: August 22, 2017

2.2 Mapping

The Planning Area Map shows the streams, storm sewershed boundaries, roads, piping, basins, outfalls, inlets and municipal boundaries. In addition, the proposed location(s) of structural BMP(s) that will be implemented to achieve the required pollutant load reductions. The maps included 2010 Census Urbanized Area and topography using two (2) foot contours; this map will be used to meet MCM#3. Cumberland Township Planning Area (Urbanized Area) covers approximately 2,153 acres. No areas were parsed from the Planning Area. Appendix III contains the Planning Area Map and Land Use map referenced from Wiki Watershed.

The maps provided in Appendix III are as follows:

- Overall Planning Area Map to show boundaries of the urbanized area within Cumberland Township.
- Detailed Planning Areas Map to show streams, outfalls, inlets, pipes, basins, and storm sewer sheds.
 - The Detailed Planning Map was broken down into the following:
 - North 1
 - North 2
 - West
 - South
- Land Use Map to show areas of impervious and pervious land use/cover.
- Potential BMP Projects Map to achieve compliance with sediment load reduction.

2.3 Pollutants of Concern

Cumberland Township, in accordance with PA DEP MS4 Requirements Table and the impaired waters mapping, the pollutant reduction must follow Appendix D and Appendix E of the MS4 permit.

Appendix D – Pollutant Reduction Plan Requirement for Discharges to the Chesapeake Bay Watershed

Appendix D is the requirement for development of a Chesapeake Bay Pollutant Reduction Plan (CBPRP). In accordance with the PRP guidelines, the goal of the CBPRP is for the following reductions:

- 3% reduction of Total Nitrogen (TN)
- 5% reduction of Total Phosphorus (TP)
- 10% reduction of Sediment (TSS)

The PA DEP PRP instructions state: “Permittees are encouraged to select appropriate BMP to achieve the ten (10%) percent sediment loading reduction objective, as it is expected that, overall with the Bay watershed, the TP five percent (5%) and TN three (3%) percent goals will be achieved when a 10% reduction in sediment is achieved.” The PRP has been prepared as sediment being the pollutant of concern.

Appendix E –Pollutant Reduction Plan Requirement for Discharges to Waters Impaired for Nutrients and/or Sediment

Under Appendix E ten (10%) percent reduction sediment load and five (5%) percent total phosphorus are required to be achieved within the next five years. It has been concluded that since the Township will achieve the ten (10%) percent sediment reduction, in accordance with PA DEP Guidance, that Appendix E will be satisfied with implementation of the Chesapeake Bay Pollutant Reduction Plan (under Appendix D).

Table 1. MS4 Requirements

MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirements	Other Cause(s) of Impairment
Adams County						
Cumberland Township		No		Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
				Willoughby Run	Appendix E-Organic Enrichment/Low D.O., Siltation (5)	Other Habitat Alterations (4c)
				Unnamed Tributaries to Rock Creek	Appendix E-Siltation	Water/Flow Variability (4c)
				Rock Creek	Appendix E-Nutrients (5)	

2.4 Existing Loading for Pollutants of Concern

2.4.1 Existing Pollutant Load Calculation

To calculate the sediment load, the Stroud Watershed Tool Wiki Watershed was used by delineating each storm sewer shed and retrieving subsequent the land cover data. Based upon the land cover within Wiki Watershed a pervious and impervious coverage was calculated and used with the Developed Land Loading Rates for PA Counties (Attachment B of the PRP instructions).

Table 2. Existing Baseline Pollutant Loading

Category	Urbanized Area Acres	Developed Land Loading Rates (lbs/ac/yr)	Existing Baseline Pollutant Load Calculated (lbs/yr)
Impervious	398	1,398.77	556,241
Pervious	1,756	207.67	364,601
Total	2,153		920,842

2.4.2 Baseline Reduction for Existing BMPs

In previous years, multiple water quality structural BMPs were installed in Cumberland Township. Several of these existing BMP were identified in order to take credit for reducing the existing pollutant loading. Appendix V provides a summary of the prior installed BMPs used for the existing baseline load reduction. To determine the load reduction of various BMPs, an effectiveness value was used given by DEP per form number 3800-PM-BCW100m, BMP Effectiveness Values. The sediment load was re-calculated for existing baseline load and shown in Table 3.

Table 3. Adjusted Baseline Pollutant Loading

Baseline	Pollutant Load (lbs/yr)
Baseline Pollutant Loading	920,842
Prior Installed BMP Reduction	86,306
Adjusted Baseline	834,536

2.4.3 Pollution Reduction Requirements

In accordance with Appendix D & E a ten (10%) percent sediment load reduction is required along with three (3%) percent Total Nitrogen and five (5%) percent Total Phosphorus load reductions. As previously discussed in accordance within PA DEP guidance, if a ten (10%) percent sediment reduction is achieved, the five (5%) percent Phosphorus and three (3%) Percent Nitrogen load reduction requirements will have been achieved as well.

Table 4. Required Load Reduction Goal

Baseline	Pollutant Load (lbs/yr)
Adjusted Baseline Pollutant Loading	834,536
Required Reduction Percentage	10%
Load Sediment Reduction Goal	83,454

2.5 BMP Selection to Achieve Minimum Reduction in Pollutant Loading

Multiple variables were taken into consideration when selecting which BMPs to use in order to meet the ten (10%) percent sediment load reduction of 83,454 lbs. /year. The identification of potential BMPs were determined by cost effectiveness, location within the Urbanized Area, drainage area, and the location of the impaired stream. The ability to implement both construction and long term operation and maintenance are other primary criteria for BMP selection. Ultimately, the selected projects should be the most cost effective and sustainable solution to achieve the required sediment load reduction. Table 5 shows the Range of BMPs identified to achieve the sediment load reduction goal. Appendix III shows a map of potential projects and locations available to the Township.

Table 5. Selected BMPs for Ten (10%) Percent Sediment Load Reduction

Proposed BMP Type	Total Drainage Area (acres)	Area (acres)	Pollutant Load Reduction (lbs/yr)
Riparian/Forest Buffers	414	16	74491
Basin Retrofits	79	4	14899
Total Proposed Sediment Load Reduction			89,390

While we are proposing that much of the anticipated sediment load reduction will occur from implementation of Riparian/Forest Buffers it is recommended that the Township thoroughly evaluate other available BMP's as part of implementing the PRP (since the Township has a multitude of potential projects to select from – above and beyond the minimum required). Appendix V provides a detailed table along with the calculations and results.

2.5.1 BMPs Description

Basin Retrofits

Basins will be retrofitted to enhance infiltration opportunities, extend detention time, and provide additional travel time to limit short circuiting. For example, berms may be installed to create ponding or a “forebay” in conjunction with installing sand/soil mixture to encourage and enhance infiltration in the basins.

Riparian/Forest Buffers

Riparian/Forest Buffers are areas of at least 35 feet wide on one or both sides of a stream, accompanied by trees, shrubs, and other vegetation. If trees and vegetation is limited, additional tree planting will occur. It is recommended that riparian/forest buffers be protected with an easement and agreement between property owners and the Township.

Adams County Greenway Plan

Adams County began planning the development of a county wide greenway system in the adopted 1992 county comprehensive plan. The comprehensive plan mapped and defined a permanent network of open place. The plan recommended a widespread pattern of parks, forests, game lands, protected environmental features, permanent open spaces, and conservation areas to be preserved as the backbone of a permanent open space system. Cumberland Township partnering with Adams County could potentially be a step towards protecting an important linear greenway with the use of proposed riparian/forest buffers.

New BMP's

Construction of new BMP's could include the installation of a variety of Best Management Practices such as rain gardens, detention/retention/infiltration basins, bio-swales, etc. The Township may be able to partner with Harrisburg Area Community College, other schools, or the Adams County Conservation District to install BMP's which could become part of an environmental Education Program.

2.6 Funding Mechanisms

2.6.1 Identified Funding Mechanisms

The PRP has identified alternatives for BMP projects which would provide the required 10% reduction in sediment load over the 5-year period. Estimates of cost for the recommended BMP's have been prepared and upon review are considered reasonable. It is estimated that Cumberland Township will need to plan for spending an annual amount of \$16,250 to \$33,250.

The following Funding Sources have been identified as potential options for generating the revenues required for funding the implementation of the PRP.

A. Grant Funding

Cumberland Township will explore options for Grant Acquisition. Feasibility of grant acquisition will be improved by the potential Partnership with other quasi-public/public institutions. As an example, the Harrisburg Area Community College (HACC), Gettysburg Campus is located in Cumberland Township which could be an opportunity for possible grant funds to be used for design and installations of BMP's which could then serve as part of an Engineering or Environmental Science Education program.

B. Public Private Partnerships

The Township is open to working with local developer's to either install additional BMP's or enhance BMP's that are part of proposed future development plans. By partnering with developers, land costs will be significantly reduced or eliminated and the developer or future homeowner's association will be responsible for O & M via Agreement with the Township.

C. General Fund / Tax Revenue

The Township has the option to use existing General Funds or to increase taxes in order to generate additional funds however we do NOT anticipate this will be favored alternative

D. Stormwater Management (MS4) Fee

The Township may also consider the implementation of a Specific MS4 Fee to be levied on properties within the Urbanized Area in order to fairly and equitably generate funds for the responsible implementation of the PRP. Fees could be based on the Equivalent Residential Unit (ERU) for single family residential properties and by impervious/pervious area ratio fees for non-residential properties or multi-family residential properties.

e. Municipal Authority

An existing or newly created Authority would be able to either take on the MS4 program or participate in the generation of fees to be used in conjunction with implementing the MS4 program.

As seen in the Implementation Schedule, the Township is planning to use Year-1 to conduct the evaluation of funding alternatives and put into place any necessary plans, ordinances, etc. to begin generating funds. In addition to the PRP costs there will be other "program" costs such as implementing the Minimum Control Measures (MCM's), Operation & Maintenance (O&M), etc. All costs will be considered when evaluating the required cost and funding alternatives.

2.6.2 Cost Estimate for Potential BMPs Implementation

The following cost of potential BMPs were estimated by taking into consideration materials, installation, and construction with planning, permits, administration, engineering, and legal fees separate shown in Table 6.

Estimated Range of Cost by Project Type:

Basin Retrofits:	\$10,000 - \$20,000/each
Riparian/Forest Buffers:	\$1,000 - \$2,000/parcel
New BMP:	\$10,000 - \$25,000/each

Table 6. Proposed BMPs Cost Estimate

Proposed BMP	Projects	Estimated Cost Range
Basin Retrofits	4 basins	\$ 40,000 - \$ 80,000
Riparian/Forest Buffers	15 parcels	\$ 15,000 - \$ 30,000
New BMP	1 New Basin	\$ 10,000 - \$25,000
Total		\$65,000 - \$ 135,000
Total x 1.25 (Planning, Permits, Admin., Engr/Legal fees)		\$81,250 - \$ 168,750
Yearly Total Expenditure		\$ 16,250 - \$33,750

2.7. BMP Operation & Maintenance

To ensure the long-term effectiveness of BMPs, operation and maintenance (O&M) is crucial. Proposed BMPs may be implemented on both private and Township or publicly owned properties. A program for Operation and Maintenance of the proposed BMPs will be prepared along with their design. It is proposed that the retrofit projects will be completed on existing facilities with already established ownership, operation and maintenance plans. Additional operation and maintenance procedures and requirements will be incorporated to be consistent with the specific retrofits. Due to current operation and maintenance of these BMPs, the anticipated increase of operation and maintenance expenses of the new and/or retrofitted facilities will be minimal. BMPs will be inspected to verify that operation and maintenance agreements are enforced.

Table 7. Proposed BMP O&M Responsibilities

Proposed BMP	Responsible Party	O&M Responsibilities
Riparian/Forest Buffer	Landowner or other assigned party	<ul style="list-style-type: none"> • Inspection after rainfall of 1" or greater • Inspections quarterly • Mow as appropriate • Pruning/Weeding • Drain-down time < 72 hours • Removing trash and debris • Clean inlets • Repair eroded areas
Basin Retrofits/New Basins		<ul style="list-style-type: none"> • Inspection • Invasive Species Removal • Tree Planting when necessary • Weed control • Maintenance as needed from wildlife damage

3. PRP Implementation Schedule

<u>Task</u>	<u>Implementation Date</u>
MS4 Permit Authorization	March 2018 *
BMP Selection, Design/Funding Programs	March 2018 – March 2019 – Year 1
BMP Implementation	March 2019 – March 2022 – Years 2-4
Complete BMP, Installation, Review/ O&M Implementation to Achieve Compliance	March 2022 – March 2023 – Year 5

Progress reports along with review of the status for implementation of the PRP will be provided annually in conjunction with submission of the annual report to PA DEP.

* Assumed date for PA DEP Permit Authorization.

Appendix I

MS4 Advertisement

NOTICE OF PUBLIC COMMENT PERIOD AND PUBLIC MEETING FOR NPDES STORMWATER DISCHARGE POLLUTANT REDUCTION PLAN

Cumberland Township is hereby giving notice of the 30-day public comment period for its National Pollutant Discharge Elimination (NPDES) Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) Chesapeake Bay Pollutant Reduction Plan (PRP). The Plan proposes best management practices to satisfy the PRP requirements for reducing total sediment and nutrient loading to the Chesapeake Bay, Willoughby Run, Rock Creek, and unnamed tributaries (UNTs) to Rock Creek.

The PRP includes the following: public participation, mapping, pollutants of concern, existing loading for pollutants of concern, BMP selection to achieve loading reduction, funding mechanisms, BMP operation and maintenance, and an implementation schedule.

The Draft PRP is available for public review at the Cumberland Township Building located at 1370 Fairfield Road Gettysburg, PA 17325, Monday through Thursday 8:00 a.m. to 4:00p.m. The public is invited to review these documents and provide comments on the draft PRP up through August 26, 2017. A public meeting will be held on August 22, 2017 at which time the public is invited to attend and provide additional comments.

Comments must be in writing and may be provided via email to micaelaz@kpitech.net or via United States Post Office or hand delivered to Cumberland Township, 1370 Fairfield Road Gettysburg, PA 17325.

Appendix II

Public Participation Documents

Appendix III

Mapping

Appendix IV

**Existing Pollutant Loading
Calculations**

Cumberland Township Urbanized Area was cut in four for the ease of calculating land covers to determine the existing sediment loading. The example of the North 1 map is shown below with the Sewershed numbers used for our convenience. Wiki Watershed was used to find the developed and undeveloped land uses. To convert to land covers of pervious and impervious, the National Land Cover Database 2011 was used with the percentages shown below:

- Developed, Open Space: 19% Impervious
- Developed, Medium Intensity: 79% Impervious
- All Undeveloped: 0% Impervious
- Developed, Low Intensity: 49% Impervious
- Developed, High Intensity: 100% Impervious

Table 8. Example North 1 Map Developed and Undeveloped Land Uses Taken from Wiki Watershed

Sewershed	Area (m ²)	Area (acre)	Developed				Undeveloped					
			Open Space	Low Intensity	Medium Intensity	High Intensity	Deciduous Forest	Shrub	Grassland	Pasture	Cultivated Crops	Woody Wetland
1	64,356	15.90	19,739.87	21,534.87	6,280.87	4,486.33	0.00	0.00	0.00	13,459.00	0.00	0.00
2	16,785	4.15	3,589.07	3,589.07	2,691.80	0.00	0.00	0.00	0.00	7,178.14	0.00	0.00
3	100,239	24.77	17,048.07	15,253.53	7,178.13	0.00	52,938.74	0.00	8,075.40	0.00	0.00	0.00
4	23,866	5.90	14,356.27	4,486.34	0.00	0.00	0.00	0.00	5,383.60	0.00	0.00	0.00
5	36,806	9.09	24,226.20	9,869.93	2,691.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	119,215	29.46	41,274.26	29,609.80	3,589.07	897.27	46,657.86	0.00	0.00	0.00	0.00	0.00
7	103,038	25.46	41,274.26	30,507.06	3,589.07	897.27	28,712.53	0.00	0.00	0.00	0.00	0.00
8	31,392	7.76	17,048.06	10,767.20	3,589.07	0.00	3,589.07	0.00	0.00	0.00	0.00	0.00
9	136,058	33.62	33,198.84	36,787.91	21,534.39	0.00	16,150.79	5,383.60	8,075.39	0.00	12,561.73	0.00
10	76,133	18.81	45,760.58	22,431.66	897.27	0.00	0.00	0.00	0.00	0.00	3,589.07	2,691.80
11	6,018	1.49	897.27	897.27	4,486.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	145,100	35.85	24,226.17	20,637.11	15,253.52	0.00	15,253.52	12,561.72	15,253.52	5,383.59	38,582.43	0.00
13	89,509	22.12	17,048.05	5,383.59	0.00	0.00	891.27	16,150.78	0.00	8,075.39	39,479.69	0.00
14	42,966	10.62	13,458.98	1,794.53	0.00	0.00	0.00	3,589.06	0.00	0.00	24,226.16	0.00
15	67,448	16.67	24,226.15	14,356.24	0.00	0.00	0.00	23,328.89	897.26	0.00	5,383.59	0.00
16	318,246	78.64	16,150.77	11,664.44	897.26	0.00	0.00	168,685.77	69,986.65	897.26	48,452.30	0.00
17	102,764	25.39	34,993.31	20,637.08	897.26	0.00	3,589.06	28,712.46	12,561.70	0.00	0.00	0.00
Area	Total (m ²)		388,516.18	260,207.63	73,575.84	6,280.87	167,782.84	258,412.28	120,233.52	34,993.38	172,274.97	2,691.80
	Acres		96.00	64.30	18.18	1.55	41.46	63.86	29.71	8.65	42.57	0.67

To calculate the Total Sediment Load Reduction the land covers were multiplied by the Developed Land Loading Rates for PA Counties, shown in Table 2.

Table 9. Land Covers Using the National Land Cover Database 2011 for Developed Land Uses

	Open Space		Low Intensity		Medium Intensity		High Intensity	
	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious
Area (acre)	18.2	77.8	31.5	32.8	14.4	3.8	1.6	0.0
Total DOS Sediment Load (Lbs sediment/yr.)	25,514.7	16,149.2	44,070.1	6,810.0	20,090.5	792.9	2,170.9	0.0

Table 10. Land Covers Using the National Land Cover Database 2011 for Undeveloped Land Uses

	Deciduous Forest		Shrub		Grassland		Pasture		Cultivated Crops		Woody Wetland	
	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious
Area (acre)	0	29.7	0.0	8.6	0.0	42.6	0.0	0.7	0.0	41.5	0.0	63.9
Total DOS Sediment Load (Lbs sediment/yr.)	0	6169.9	0.0	1795.7	0.0	8840.5	0.0	138.1	0.0	8610.0	0.0	13260.8

Table 11. The Total Existing Base Load for Cumberland Township

Total Existing Base Load		
North 1	154,413	lbs sediment/year
North 2	207,746	lbs sediment/year
West	516,407	lbs sediment/year
South	42,275	lbs sediment/year
Total	920,842	lbs sediment/year

Appendix V

BMP Pollutant Load Reduction

Table 12. Structural BMP claimed as Initial Credit Reduction

BMP Type	Location			Installation		O&M		Drainage Area			Pollutant Reduction Calculations (Lb/Yr)		
	Latitude	Longitude	Map Location	Date	NPDES Permit #	Is the BMP still functioning to design? (Yes or No)	Responsible person/agency for inspections	Pervious (acres)	Impervious (acres)	Soil Class	TN	TP	TSS
Detention Basin	-77.241785	39.864964	North 1	Summer 2006		Yes	HOA	6.23	2.86	C/D	48	2	3,175
Detention Basin	-77.242756	39.864919	North 1	Summer 2006		Yes	HOA	23.71	6.45	C/D	152	7	8,363
Detention Basin	-77.242649	39.865602	North 1	Summer 2006		Yes	HOA	5.84	2.80	C/D	46	2	3,081
Detention Basin	-77.241415	39.867544	North 1	Summer 2006		Yes	HOA	18.83	10.22	C/D	155	7	10,921
Detention Basin	-77.243158	39.8698	North 1	Summer 2008		Yes	Owner	2.90	2.27	C/D	29	1	2,266
Detention Basin	-77.24058	39.868603	North 1	Summer 2006		Yes	Owner	0.98	0.33	C/D	7	0.3	394
Vegetated Channel	-77.242439	39.870464	North 1	Summer 2009		Yes	Owner	4.17	0.40	C/D	11	0.4	713
Vegetated Channel	-77.242439	39.870464	North 1	Summer 2009		Yes	Owner	2.88	1.50	C/D	12	0.5	1,348
Detention Basin	-77.242187	39.870079	North 1	Summer 2009		Yes	Owner	0.21	0.152	C/D	6	0.1	153
Detention Basin	-77.241817	39.87013	North 1	Summer 2009		Yes	Owner	0.142	0.195	C/D	5	0.1	181
Pervious Pavement	-77.241898	39.87274	North 1	Summer 2009		Yes	Owner	0.02	0.03	C/D	0.5	0.02	48
Pervious Pavement	-77.241316	39.870357	North 1	Summer 2009		Yes	Owner	0.0012	0.08	C/D	0.3	0.04	119
Pervious Pavement	-77.242069	39.870284	North 1	Summer 2009		Yes	Owner	0.0	0.08	C/D	0.3	0.03	113
Pervious Pavement	-77.224911	39.839563	North 2	2010		Yes	Owner	0.14	1.19	C/D	7.2	0.5	932
Detention Basin	-77.232271	38.854083	North 2	2008		Yes	HOA	0.32	0.04	C/D	8	0.1	68
Detention Basin	-77.230222	39.854719	North 2	2008		Yes	HOA	3.55	1.11	C/D	89	1	1,261
Detention Basin	-77.230248	39.853436	North 2	2008		Yes	HOA	5.59	3.9	C/D	155	3	3,636
Detention Basin	-77.223622	39.837887	North 2	2015		Yes	Owner	0.21	0.39	C/D	7	0.2	324
Detention Basin	-77.223249	39.837969	North 2	2015		Yes	Owner	1.06	1.1	C/D	32	1	967
Detention Basin	-77.273011	39.823705	West	2008		Yes	HOA	24.41	0.42	C/D	564	4	2,264
Detention Basin	-77.268324	39.823349	West	2000		Yes	HOA	25.06	4.43	C/D	606	6	6,842
Detention Basin	-77.266866	39.826867	West	2006		Yes	HOA	46.2	15	C/D	1162	14	18,345
Detention Basin	-77.269686	39.827466	West	2008		Yes	HOA	6.53	0.13	C/D	151	1	919
Detention Basin	-77.271554	39.827475	West	2008		Yes	HOA	1.77	0.13	C/D	42	0.3	327
Detention Basin	-77.27086	39.826026	West	2008		Yes	HOA	5.69	0.29	C/D	133	1	957
Pervious Pavement	-77.25408	39.825488	West	2005		Yes	Owner	0.14	0.53	C/D	5	0.2	420
Detention Basin	-77.253753	39.826273	West	2005		Yes	Owner	0.45	0.43	C/D	13	0.3	421
Detention Basin	-77.254322	39.824799	West	2005		Yes	Owner	1.13	1.09	C/D	33	1	1,053
Detention Basin	-77.255269	39.821333	West	2003		Yes	Owner	2.27	1.5	C/D	62	1	1,539
Detention Basin	-77.258931	39.822817	West	2003		Yes	Owner	8.49	3.49	C/D	219	3	3,984
Detention Basin	-77.268618	39.834937	West	2005		Yes	HOA	0.39	1.38	C/D	18	1	1208
Detention Basin	-77.268869	39.833896	West	2004		Yes	HOA	5.71	4.71	C/D	163	3	4663
Detention Basin	-77.26995	39.834544	West	2005		Yes	HOA	1.41	2.14	C/D	47	1	1970
Reforestation	-77.233891	39.818445	South	2016		Yes	National Park Service (NPS)	6.85	4.01	C/D	184	4	2813
Infiltration Basin	-77.227284	39.818345	South	2009		Yes	Owner	0.41	0.26	C/D	17	0.7	425
Pervious Pavement	-77.227065	39.816915	South	2009		Yes	Owner	0.45	0.22	C/D	12	0.2	218

Operation and Maintenance activities by agreement with land owner per approved plan.

Sample Calculations for Ten (10%) Percent Sediment Load Reduction

Basin Retrofits

Basins effectiveness values where used from the DEP form number 3800-PM-BCW100m, BMP Effectiveness Values. The pervious and impervious land covers of the basin drainage areas were taken from engineering reports.

Table 12. Basin Retrofits Sediment Load Reductions

	60% Reduction	95% Reduction	Reduction
Basin 1	3,175	5,027	1,852
Basin 2	8,363	13,242	4,879
Basin 3	3,082	4,880	1,798
Basin 4	10,921	17,291	6,370
Total Reduction			14,899

Riparian/Forest Buffers

Drainage areas for the Riparian/Forest Buffers were delineated and land uses were taken from Wiki Watershed. National Land Cover Database 2011 was used to calculate land covers, along with BMP Effective Values and the Developed Land Loading Rates for PA Counties for the sediment load reductions.

	Riparian 1		Riparian 2		Riparian 3		Riparian 4		Riparian 5	
	Total Acres	Total TSS (lbs sediment/yr)	Total Acres	Total TSS (lbs sediment/yr)	Total Acres	Total TSS (lbs sediment/yr)	Total Acres	Total TSS (lbs sediment/yr)	Total Acres	Total TSS (lbs sediment/yr)
Impervious	9.01	12604.29	5.56	7775.09	0.04	58.93	1.82	2552.41	3.93	5499.08
Pervious	10.06	2088.83	21.27	4417.05	15.48	3214.37	19.24	3995.28	42.19	8761.44
Total	19.07	14693.13	26.83	12192.14	15.52	3273.29	21.06	6547.69	46.12	14260.52
Reduce	7346.56		6096.07		1636.65		3273.84		7130.26	

	Riparian 6		Riparian 7		Riparian 8		Riparian 9		Riparian 10	
	Total Acres	Total TSS (lbs sediment/yr)	Total Acres	Total TSS (lbs sediment/yr)	Total Acres	Total TSS (lbs sediment/yr)	Total Acres	Total TSS (lbs sediment/yr)	Total Acres	Total TSS (lbs sediment/yr)
Impervious	7.79	10898.16	8.83	12346.51	9.00	12591.50	3.04	4251.96	7.59	10615.96
Pervious	100.85	20943.86	25.76	5349.93	70.60	14660.61	23.79	4940.13	6.82	1416.80
Total	108.64	31842.02	34.59	17696.44	79.60	27252.11	26.83	9192.09	14.41	12032.75
Reduce	15921.01		8848.22		13626.05		4596.04		6016.38	

Total Sediment Reduction	89,390.10	lbs sediment/yr
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