North Wales PRP for Wissahickon Creek – Nutrients

July 14, 2017
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Prepared for:

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TABLE OF CONTENTS

INTRODUCTION 1

PUBLIC PARTICIPATION 1

MAPPING 2

POLLUTANT OF CONCERN 2

DETERMINE EXISTING LOAD 2

REQUIRED REDUCTION IN POLLUTANT LOADING / BMP SELECTION 3

FUNDING MECHANISMS 4

IMPLEMENTATION 4

OPERATIONS AND MAINTENANCE 4

APPENDIX I – MS4 REQUIREMENTS TABLE

APPENDIX II – PUBLIC NOTIFICATION / PUBLIC COMMENTS

APPENDIX III – MAPPING

APPENDIX IV – EXISTING LOAD CALCULATIONS / PARSED LOAD CALCULATIONS / EXISTING BMP LOAD REDUCTIONS CALCULATIONS / SUB BASIN LOAD CALCULATION

APPENDIX V – POLLUTANT LOAD REDUCTION REFERENCE

INTRODUCTION

Permittees with coverage under a Municipal Separate Storm Sewer System (MS4) that discharge to certain impaired waters are required to implement Pollutant Reduction Plans (PRP) as specified in the Pennsylvania Department of Environmental Protection's (PA DEP) MS4 Requirements Table. The applicable section of the Requirements Table is included in Appendix I.

The table requires North Wales Borough to develop a PRP for the Wissahickon Creek watershed for nutrients. Overall a five percent reduction in the current nutrient load is required.

A PRP is a planning document prepared by the permittee which guides the selection and implementation of specific BMPs to reduce pollutant loading to surface waters. The objective of a PRP is to improve the condition of surface waters such that the waters eventually attain water quality standards and its designated and existing uses in accordance with 25 Pa. Code Chapter 93. The pollutant reducing BMPs are to be completed within 5 years of DEP's permit approval.

PUBLIC PARTICIPATION

The PA DEP requires public participation as part of the development of a PRP. The requirements for the public participation are:

> "The permittee shall make a complete copy of the PRP available for public review. The permittee shall publish, in a newspaper of general circulation in the area, a public notice containing a statement describing the plan, where it may be reviewed by the public, and the length of time the permittee will provide for the receipt of comments. The permittee must accept written comments for a minimum of 30 days from the date of public notice. The permittee must accept comments from any interested member of the public at a public meeting or hearing, which may include a regularly scheduled meeting of the governing body of the municipality or municipal authority that is the permittee. The permittee shall consider and make a record of the consideration of each timely comment received from the public during the public comment period concerning the plan, identifying any changes made to the plan in response to the comment. Modified PRPs submitted to DEP must include a copy of the newspaper notice, a copy of all written comments received from the public and a copy of the permittee's record of consideration of all timely comments received in the public comment period."

A complete copy of the PRP was available for public review at the municipal offices. A public notice was published in a local newspaper which included a description of the plan, where it could be reviewed, the 30-day comment period and the municipal meeting at which public comments would be received.

Appendix II contains the public notification information.

MAPPING

Appendix III contains the PRP mapping for the borough. The appendix contains an overall map of the borough which includes the location of existing BMPs which can be used to reduce the WLA as well as parsed areas of the municipality.

Separate maps of the stormwater drainage sub-basins within the borough which were used to calculate the potential nutrient reductions from potential BMPs are also included in Appendix III.

POLLUTANT OF CONCERN

The PA DEP MS4 Requirements Table specifies the pollutant of concern as nutrients. A minimum five percent reduction of nutrients (phosphorus) is required.

DETERMINE EXISTING LOAD

The Stroud Water Research Center – Model My Watershed program was utilized to determine the watershed's land uses and loading rates. This information is compiled in Appendix IV on the Land Use Information and Pollutant Load Calculation table. The land use information is based on the current conditions in the watershed. Where recent land development has changed, the land use, as indicated in the Stroud program, differences are noted on the table.

Seven areas of the borough were suitable for parsing. Tables calculating the parsed areas land uses are included in Appendix IV. The parsed area totals are included in the Land Use Information and Pollutant Load Calculation table. Mapping of the parsed areas is shown on the PRP Plan in Appendix III. The parse areas consist of non-municipally owned properties where stormwater flows out of the borough, into the neighboring township, without entering the North Wales stormwater system.

The Land Use Information and Pollutant Load Calculation table also includes pollutant reduction for an existing BMP (North Wales Station) which reduces the

watershed's existing pollutant load. A spreadsheet calculating the net reduction from the existing BMP is included in Appendix IV.

The overall calculated pollutant load for Wissahickon Creek is 510.44 lbs/year of phosphorus. The PRP requires a five percent reduction in phosphorus. Therefore, the required phosphorus reduction is 25.52 lbs/year.

REQUIRED REDUCTION IN POLLUTANT LOADING / BMP SELECTION

The borough was evaluated for the potential for phosphorus removal BMPs. This included retrofits of existing BMPs, such as older basin modifications and new projects such as stream restorations.

When evaluating the potential BMPs the 'National Pollutant Discharge Elimination System (NPDES) Stormwater Discharges from Small Municipal Separate Storm Sewer Systems BMP Effectiveness Values' and the 'Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Retrofit Projects' were used to determine the effectiveness of the proposed BMP.

The built-out nature of the borough, as well as the lack of stormwater basins for potential modifications and few open channels due to past culverting, severely limits the ability of the borough to address the WLA.

To determine the feasibility of addressing the WLA, five of the largest stormwater drainage sub-basins within the borough were mapped and the pollutant loads calculated. The sub-basins are designated D1 through D5. These sub-basins encompass the majority of the borough. Drainage from the sub-basins discharge separately to the surface along the northwest border of the borough. The outfalls are all located inside the borough near the municipal boundary or just within the adjoining township. Individual plans showing the stormwater drainage subareas are included in Appendix III.

Treatment of the stormwater from one or more of the sub-basins is considered the best option for meeting the required pollutant load reductions. The chosen BMP would be installed near the sub-basin outfall within the borough limits, if possible. To document the potential to treat the required pollutant load, a table providing the pollutant load calculation for each of the sub-basins is included in Appendix IV. The table also includes pollutant removal rates in percentage (i.e. BMP Effectiveness Values) for a hypothetical BMP, in this case the removal rates for a Wet Ponds and Wetlands. This example shows that the required pollutant reduction can be addressed through a BMP associated with one or more of the outfalls. The pollutant removal rates or BMP Effectiveness Values were obtained from document 3800-PM-BCW0100m which is included in Appendix V.

Some stream channel restoration, associated with the outfalls for the above noted sub-basins, may also be undertaken although available channels are limited. In addition, the borough owns several properties in the neighboring Upper Gwynedd Township. These properties, mostly vacant land, were the location of the borough's former sewage treatment plant and are bisected by a stream. The use of these properties to treat stormwater is possible, however, additional study would be needed to confirm the effectiveness of BMP(s) on the properties.

FUNDING MECHANISMS

The borough will put money aside into their Capital Improvements Fund to pay for the proposed BMP(s).

Grants, if available, may also be used to help fund the pollutant reduction measures.

IMPLEMENTATION

A minimum nutrient reduction of five percent is expected within the first permit term. If more than five percent is achieved, the excess would be considered credit towards additional reductions in the future, should it be required by the PA DEP.

OPERATIONS AND MAINTENANCE

The municipality will be responsible for operation and maintenance of the proposed BMP(s). As noted above, the example calculations show Wet Ponds and Wetlands could address the required pollutant reductions, however, other BMPs may also be appropriate. Complete operation and maintenance information will be included with specific plans for the chosen BMP(s).

APPENDIX I

MS4 REQUIREMENTS TABLE

MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)	Other Cause(s) of Impairment
Montgomery County						
NARBERTH BORO	PAG130080	No		East Branch Indian Creek	Appendix C-PCB (5), Appendix E-Siltation (5)	Cause Unknown (5), Other Habitat Alterations, Water/Flow Variability (4c)
				Gulley Run		Water/Flow Variability (4c)
				Indian Creek	Appendix C-PCB (5), Appendix E-Siltation (5)	Cause Unknown (5), Other Habitat Alterations, Water/Flow Variability (4c)
				Cobbs Creek	Appendix B-Pathogens (5), Appendix C-PCB (5), Appendix E-Siltation (5)	Cause Unknown (5), Other Habitat Alterations, Water/Flow Variability (4c)
				Schuylkill River	Appendix C-PCB (4a)	
NEW HANOVER TWP	PAG130020	No		Schuylkill River	Appendix C-PCB (4a)	
				Swamp Creek	Appendix E-Siltation (5)	Cause Unknown (5)
NORRISTOWN BORO	PAG130159	No		Schuylkill River	Appendix C-PCB (4a)	
				Sawmill Run	Appendix E-Siltation (5)	Turbidity (5), Water/Flow Variability (4c)
				Schuylkill River PCB TMDL	Appendix C-PCB (4a)	
				Stony Creek	Appendix E-Siltation (5)	Turbidity (5), Water/Flow Variability (4c)
				Unnamed Tributaries to Stony Creek		Cause Unknown (5)
NORTH WALES BORO	PAG130005	Yes	TMDL Plan	Wissahickon TMDL	TMDL Plan-Siltation, Suspended Solids (4a)	Cause Unknown (4a)
				Wissahickon Creek	Appendix E-Nutrients (4a), Appendix B-Pathogens (5)	Other Habitat Alterations, Water/Flow Variability (4c)
PENNSBURG BORO	PAG130063	No		Green Lane Reservoir	Appendix E-Organic Enrichment/Low D.O. (4a)	
PERKIOMEN TWP	PAG130069	No		Unnamed Tributaries to Perkiomen Creek	Appendix E-Siltation (5)	Water/Flow Variability (4c)
				Schoolhouse Run	Appendix E-Siltation (5)	
				Perkiomen Creek	Appendix B-Pathogens (5)	
PLYMOUTH TWP	PAG130008	No		Diamond Run	Appendix E-Siltation (5)	Water/Flow Variability (4c)
				Plymouth Creek	Appendix E-Siltation (5)	Water/Flow Variability (4c)
				Sawmill Run	Appendix E-Siltation (5)	Turbidity (5), Water/Flow Variability (4c)
				Schuylkill River	Appendix C-PCB (4a)	
				Schuylkill River PCB TMDL	Appendix C-PCB (4a)	
POTTSTOWN BORO	PAG130033	No		Unnamed Tributaries to Manatawny Creek	Appendix E-Siltation (5)	Flow Alterations, Other Habitat Alterations (4c)
				Schuylkill River	Appendix C-PCB (4a)	
				Schuylkill River PCB TMDL	Appendix C-PCB (4a)	
RED HILL BORO	PAG130164	No		Green Lane Reservoir	Appendix E-Organic Enrichment/Low D.O. (4a)	

APPENDIX II

PUBLIC NOTIFICATION / PUBLIC COMMENTS

Wissahickon Creek, North Wales Borough Public Notification

Notice is hereby given that North Wales Borough has prepared a Pollution Reduction Plan for nutrients and a TMDL plan for sediment for the Wissahickon Creek as required under the PA DEP MS4 program. The plans calculate pollutant loads and identifies strategies to reduce these loads by the prescribed amounts. The plans can be reviewed, and written comments accepted, at the municipal building located at 300 School Street, North Wales, PA 19454 during normal business hours. Comments will also be accepted at the Borough Council meeting on August 28th, 2018. The 30-day public comment period extends from August 10, 2018 to September 9, 2018.

Public Notification

The notification was published on August 10th, 2018 in The Reporter, a local newspaper. This report will be updated with the proof of publication, any public comments and consideration of these comments when they are received. The updated information will also be forwarded to the PA DEP.

APPENDIX III

MAPPING

LEGEND

– SURFACE WATERS / CHANNELS

A – PARSED AREAS

EXISTING BMPS

1 NORTH WALES REGIONAL RAIL STATION PARKING LOT EXPANSION

BASE MAP – PENNSYLVANIA DEPARTMENT OF TRANSPORTATION TYPE 5 B MAP, REVISED 12–16–03. ALL LOCATIONS APPROXIMATE.

0 800' 1,600'

PROJECT :

NORTH WALES PRP PLAN
300 SCHOOL STREET
NORTH WALES, PA 19454

APPLICANT :

NORTH WALES BOROUGH
300 SCHOOL STREET
NORTH WALES, PA 19454

JOB NO.: 1468010

DRAWN BY: TLH

CHECKED BY: PSG

SCALE: 1" = 800'

PLAN STATUS: FINAL

TITLE : PRP PLAN

Boucher & James, Inc.
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SHEET 1 OF 1

PROJECT NAME : **NORTH WALES PRP PLAN**

DATE: AUGUST 1, 2018

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M:\MS4s\North Wales PRP TMDL DWG\PRP TMDL Plan.dwg || Tabname :PRP Drainage D1 || Aug 06, 2018 – 2:23pm || tharris

PROJECT :

NORTH WALES PRP PLAN
NORTH WALES BOROUGH
MONTGOMERY COUNTY

APPLICANT :

NORTH WALES BOROUGH
300 SCHOOL STREET
NORTH WALES, PA 19454

JOB NO.: 1468010

DRAWN BY: TLH

CHECKED BY:

SCALE: NA

PLAN STATUS: FINAL

TITLE : DRAINAGE AREA D1

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SHEET 1 OF 1

PROJECT NAME : **NORTH WALES PRP PLAN**

DATE: AUGUST 1, 2018

PROJECT :

NORTH WALES PRP PLAN
NORTH WALES BOROUGH
MONTGOMERY COUNTY

APPLICANT :

NORTH WALES BOROUGH
300 SCHOOL STREET
NORTH WALES, PA 19454

JOB NO.: 1468010

DRAWN BY: TLH

CHECKED BY:

SCALE: NA

PLAN STATUS: FINAL

TITLE : DRAINAGE AREA D2

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SHEET 1 OF 1

PROJECT NAME : **NORTH WALES PRP PLAN**

DATE: AUGUST 1, 2018

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M:\MS4s\North Wales PRP TMDL DWG\PRP TMDL Plan.dwg || Tabname :PRP Drainage D3 || Aug 06, 2018 – 2:24pm || tharris

PROJECT : NORTH WALES PRP PLAN NORTH WALES BOROUGH MONTGOMERY COUNTY	JOB NO.: 1468010	TITLE : DRAINAGE AREA D3	
APPLICANT : NORTH WALES BOROUGH 300 SCHOOL STREET NORTH WALES, PA 19454	DRAWN BY: TLH CHECKED BY: SCALE: NA PLAN STATUS: FINAL	Boucher & James, Inc. CONSULTING ENGINEERS DOYLESTOWN ✦ STROUDSBURG ✦ LEHIGH VALLEY CORP. HEADQUARTERS: 1456 FERRY RD, BUILDING 500, DOYLESTOWN, PA. 18901 VOICE: (215) 345-9400 FAX: (215) 345-9401 www.bjengineers.com	SHEET 1 OF 1
		PROJECT NAME : NORTH WALES PRP PLAN	DATE: AUGUST 1, 2018

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PROJECT : NORTH WALES PRP PLAN NORTH WALES BOROUGH MONTGOMERY COUNTY		JOB NO.: 1468010	TITLE : DRAINAGE AREA D4
APPLICANT : NORTH WALES BOROUGH 300 SCHOOL STREET NORTH WALES, PA 19454		DRAWN BY: TLH CHECKED BY: SCALE: NA PLAN STATUS: FINAL	**Boucher & James, Inc.** CONSULTING ENGINEERS DOYLESTOWN ✦ STROUDSBURG ✦ LEHIGH VALLEY CORP. HEADQUARTERS: 1456 FERRY RD, BUILDING 500, DOYLESTOWN, PA. 18901 VOICE: (215) 345-9400 FAX: (215) 345-9401 www.bjengineers.com
			SHEET 1 OF 1
			PROJECT NAME : NORTH WALES PRP PLAN
			DATE: AUGUST 1, 2018

PROJECT : NORTH WALES PRP PLAN NORTH WALES BOROUGH MONTGOMERY COUNTY	JOB NO.: 1468010	TITLE : DRAINAGE AREA D5	
APPLICANT : NORTH WALES BOROUGH 300 SCHOOL STREET NORTH WALES, PA 19454	DRAWN BY: TLH CHECKED BY: SCALE: NA PLAN STATUS: FINAL	Boucher & James, Inc. CONSULTING ENGINEERS DOYLESTOWN ✦ STROUDSBURG ✦ LEHIGH VALLEY CORP. HEADQUARTERS: 1456 FERRY RD, BUILDING 500, DOYLESTOWN, PA. 18901 VOICE: (215) 345-9400 FAX: (215) 345-9401 www.bjengineers.com	SHEET 1 OF 1
		PROJECT NAME : NORTH WALES PRP PLAN	DATE: AUGUST 1, 2018

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APPENDIX IV

EXISTING LOAD CALCULATIONS / PARSED LOAD CALCULATIONS / EXISTING BMP LOAD REDUCTIONS CALCULATIONS / SUB BASIN LOAD CALCULATION

Land Use Information and Pollutant Load Calculation
Wissahickon Creek - North Wales

Land Use	Area (m^2)	Area (acres)	Parsed Area (acres)	Adjusted Area (acres)	Nitrogen Loading Rate (lbs/acre/year)	Nitrogen Load (lbs/year)	Phosphorus Loading Rate (lbs/acre/year)	Phosphorus Load (lbs/year)	Sediment Loading Rate (lbs/acre/year)	Sediment Load (lbs/year)
Barren Land (Rock/Sand/Clay)	0.0	0.0	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Cultivated Crops	0.0	0.0	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Deciduous Forest	65,497.0	16.2	3.8	12.4	20.72	257.25	0.84	10.43	264.96	3,289.64
Developed, High Intensity	84,338.6	20.8	2.7	18.2	23.06	419.23	2.28	41.45	1,839.00	33,433.02
Developed, Low Intensity										
- Developed, Low Intensity (49% Impervious)	286,203.9	70.7	3.8	66.9	23.06	1,543.18	2.28	152.58	1,839.00	123,066.14
- Developed, Low Intensity (51% Pervious)	297,885.7	73.6	4.0	69.7	20.72	1,443.18	0.84	58.51	264.96	18,454.88
Developed, Medium Intensity										
- Developed, Medium Intensity (79% Impervious)	206,970.5	51.1	1.8	49.4	23.06	1,138.98	2.28	112.61	1,839.00	90,831.82
- Developed, Medium Intensity (21% Pervious)	55,017.5	13.6	0.5	13.1	20.72	272.04	0.84	11.03	264.96	3,478.79
Developed, Open Space										
- Developed, Open Space (19% Impervious)	94,611.8	23.4	2.0	21.4	23.06	493.47	2.28	48.79	1,839.00	39,353.11
- Developed, Open Space (81% Pervious)	403,344.9	99.7	8.4	91.2	20.72	1,890.25	0.84	76.63	264.96	24,171.81
Emergent Herbaceous Wetlands	0.0	0.0	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Evergreen Forest	0.0	0.0	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Grassland/Herbaceous	0.0	0.0	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Mixed Forest	0.0	0.0	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Open Water	0.0	0.0	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Pasture/Hay	0.0	0.0	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Perennial Ice/Snow	0.0	0.0	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Shrub/Scrub	0.0	0.0	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Woody Wetlands	0.0	0.0	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Totals:	**1,493,869.9**	**369.1**	**26.8**	**342.3**	**Total:**	---		**512.03**		---
					Existing BMP Pollutant Reduction	---		**1.59**		---
					Reduced Existing Load	---		**510.44**		---
					Required Reduction:	---		**5%**		---
					Required Load Reduction (lbs/year):	---	**Required Load Reduction (lbs/year):**	**25.52**	**Required Load Reduction (lbs/year):**	---

Notes:

Existing BMP Pollutant Reduction based on qualifying, currently installed and maintained structural BMPs. See separate sheet(s) for calculation.

Impairment for Nutrients, Excessive Algal Growth, Organic Enrichment / Low D.O. require a 5% Total Phosphorus reduction.

Adjusted Developed Land Use - Take into account the National Land Cover Database from 2011: Developed, Open Space - 19% Impervious; Developed, Low Intensity - 49% Impervious; Developed, Medium Intensity - 79% Impervious; Developed, High Intensity - 100% Impervious

Impervious developed land loading rates for nitrogen, phosphorus and sediment is 23.06, 2.28 and 1,839 lbs/acre/year, respectively.

Pervious developed land loading rates for nitrogen, phosphorus and sediment is 20.72, 0.84 and 264.96 lbs/acre/year, respectively.

Undeveloped land (outside urbanized area) loading rates for nitrogen, phosphorus and sediment is 10, 0.33 and 234.6 lbs/acre/year, respectively.

Loading rates obtained from Attachment B - Developed Land Loading Rates for PA Counties (3800-PM-BCW0100k 5/2016).

NA - Loading rate not applicable. The watershed does not have any of this type of Land Use.

Land use areas obtained from the Stroud Water Research Center - Model My Watershed program.

Land Use Information and Pollutant Load Calculation
Parse Area A - North Wales Borough - Wissahickon Creek

Land Use	Area (m^2)	Area (acres)	Nitrogen Loading Rate (lbs/acre/year)	Nitrogen Load (lbs/year)	Phosphorus Loading Rate (lbs/acre/year)	Phosphorus Load (lbs/year)	Sediment Loading Rate (lbs/acre/year)	Sediment Load (lbs/year)
Barren Land (Rock/Sand/Clay)	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Cultivated Crops	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Deciduous Forest	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Developed, High Intensity	6,280.5	1.6	20.72	32.16	0.84	1.30	264.96	411.21
Developed, Low Intensity								
- Developed, Low Intensity (49% Impervious)	0.0	0.0	23.06	0.00	2.28	0.00	1839.00	0.00
- Developed, Low Intensity (51% Pervious)	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Developed, Medium Intensity								
- Developed, Medium Intensity (79% Impervious)	708.8	0.2	23.06	4.04	2.28	0.40	1839.00	322.10
- Developed, Medium Intensity (21% Pervious)	188.4	0.0	20.72	0.96	0.84	0.04	264.96	12.34
Developed, Open Space								
- Developed, Open Space (19% Impervious)	0.0	0.0	23.06	0.00	2.28	0.00	1839.00	0.00
- Developed, Open Space (81% Pervious)	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Emergent Herbaceous Wetlands	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Evergreen Forest	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Grassland/Herbaceous	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Mixed Forest	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Open Water	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Pasture/Hay	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Perennial Ice/Snow	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Shrub/Scrub	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Woody Wetlands	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Totals:	**7,177.8**	**1.8**	**Total:**	**37.16**	**Total:**	**1.74**	**Total:**	**745.64**

Notes:

Adjusted Developed Land Use - Take into account the National Land Cover Database from 2011: Developed, Open Space - 19% Impervious; Developed, Low Intensity - 49% Impervious; Developed, Medium Intensity - 79% Impervious; Developed, High Intensity - 100% Impervious

Impervious developed land loading rates for nitrogen, phosphorus and sediment is 23.06, 2.28 and 1,839 lbs/acre/year, respectively.

Pervious developed land loading rates for nitrogen, phosphorus and sediment is 20.72, 0.84 and 264.96 lbs/acre/year, respectively.

Undeveloped land (outside urbanized area) loading rates for nitrogen, phosphorus and sediment is 10, 0.33 and 234.6 lbs/acre/year, respectively.

Loading rates obtained from Attachment B - Developed Land Loading Rates for PA Counties (3800-PM-BCW0100k 5/2016).

Land use areas obtained from the Stroud Water Research Center - Model My Watershed program.

Land Use Information and Pollutant Load Calculation
Parse Area B - North Wales Borough - Wissahickon Creek

Land Use	Area (m^2)	Area (acres)	Nitrogen Loading Rate (lbs/acre/year)	Nitrogen Load (lbs/year)	Phosphorus Loading Rate (lbs/acre/year)	Phosphorus Load (lbs/year)	Sediment Loading Rate (lbs/acre/year)	Sediment Load (lbs/year)
Barren Land (Rock/Sand/Clay)	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Cultivated Crops	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Deciduous Forest	5,383.3	1.3	20.72	27.56	0.84	1.12	264.96	352.46
Developed, High Intensity	4,486.1	1.1	20.72	22.97	0.84	0.93	264.96	293.72
Developed, Low Intensity								
- Developed, Low Intensity (49% Impervious)	3,956.7	1.0	23.06	22.55	2.28	2.23	1839.00	1,798.04
- Developed, Low Intensity (51% Pervious)	4,118.2	1.0	20.72	21.09	0.84	0.85	264.96	269.63
Developed, Medium Intensity								
- Developed, Medium Intensity (79% Impervious)	4,961.6	1.2	23.06	28.27	2.28	2.80	1839.00	2,254.69
- Developed, Medium Intensity (21% Pervious)	1,318.9	0.3	20.72	6.75	0.84	0.27	264.96	86.35
Developed, Open Space								
- Developed, Open Space (19% Impervious)	852.4	0.2	23.06	4.86	2.28	0.48	1839.00	387.33
- Developed, Open Space (81% Pervious)	3,633.7	0.9	20.72	18.60	0.84	0.75	264.96	237.91
Emergent Herbaceous Wetlands	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Evergreen Forest	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Grassland/Herbaceous	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Mixed Forest	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Open Water	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Pasture/Hay	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Perennial Ice/Snow	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Shrub/Scrub	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Woody Wetlands	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Totals:	**28,711.0**	**7.1**	**Total:**	**152.65**	**Total:**	**9.44**	**Total:**	**5,680.14**

Notes:
Adjusted Developed Land Use - Take into account the National Land Cover Database from 2011: Developed, Open Space - 19% Impervious; Developed, Low Intensity - 49% Impervious; Developed, Medium Intensity - 79% Impervious; Developed, High Intensity - 100% Impervious
Impervious developed land loading rates for nitrogen, phosphorus and sediment is 23.06, 2.28 and 1,839 lbs/acre/year, respectively.
Pervious developed land loading rates for nitrogen, phosphorus and sediment is 20.72, 0.84 and 264.96 lbs/acre/year, respectively.
Undeveloped land (outside urbanized area) loading rates for nitrogen, phosphorus and sediment is 10, 0.33 and 234.6 lbs/acre/year, respectively.
Loading rates obtained from Attachment B - Developed Land Loading Rates for PA Counties (3800-PM-BCW0100k 5/2016).
Land use areas obtained from the Stroud Water Research Center - Model My Watershed program.

Land Use Information and Pollutant Load Calculation
Parse Area C - North Wales Borough - Wissahickon Creek

Land Use	Area (m^2)	Area (acres)	Nitrogen Loading Rate (lbs/acre/year)	Nitrogen Load (lbs/year)	Phosphorus Loading Rate (lbs/acre/year)	Phosphorus Load (lbs/year)	Sediment Loading Rate (lbs/acre/year)	Sediment Load (lbs/year)
Barren Land (Rock/Sand/Clay)	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Cultivated Crops	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Deciduous Forest	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Developed, High Intensity	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Developed, Low Intensity								
- Developed, Low Intensity (49% Impervious)	1,318.9	0.3	23.06	7.52	2.28	0.74	1839.00	599.35
- Developed, Low Intensity (51% Pervious)	1,372.7	0.3	20.72	7.03	0.84	0.28	264.96	89.88
Developed, Medium Intensity								
- Developed, Medium Intensity (79% Impervious)	0.0	0.0	23.06	0.00	2.28	0.00	1839.00	0.00
- Developed, Medium Intensity (21% Pervious)	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Developed, Open Space								
- Developed, Open Space (19% Impervious)	1,363.8	0.3	23.06	7.77	2.28	0.77	1839.00	619.73
- Developed, Open Space (81% Pervious)	5,814.0	1.4	20.72	29.77	0.84	1.21	264.96	380.66
Emergent Herbaceous Wetlands	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Evergreen Forest	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Grassland/Herbaceous	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Mixed Forest	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Open Water	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Pasture/Hay	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Perennial Ice/Snow	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Shrub/Scrub	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Woody Wetlands	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Totals:	**9,869.4**	**2.4**	**Total:**	**52.08**	**Total:**	**3.00**	**Total:**	**1,689.62**

Notes:

Adjusted Developed Land Use - Take into account the National Land Cover Database from 2011: Developed, Open Space - 19% Impervious; Developed, Low Intensity - 49% Impervious; Developed, Medium Intensity - 79% Impervious; Developed, High Intensity - 100% Impervious

Impervious developed land loading rates for nitrogen, phosphorus and sediment is 23.06, 2.28 and 1,839 lbs/acre/year, respectively.

Pervious developed land loading rates for nitrogen, phosphorus and sediment is 20.72, 0.84 and 264.96 lbs/acre/year, respectively.

Undeveloped land (outside urbanized area) loading rates for nitrogen, phosphorus and sediment is 10, 0.33 and 234.6 lbs/acre/year, respectively.

Loading rates obtained from Attachment B - Developed Land Loading Rates for PA Counties (3800-PM-BCW0100k 5/2016).

Land use areas obtained from the Stroud Water Research Center - Model My Watershed program.

Land Use Information and Pollutant Load Calculation
Parse Area D - North Wales Borough - Wissahickon Creek

Land Use	Area (m^2)	Area (acres)	Nitrogen Loading Rate (lbs/acre/year)	Nitrogen Load (lbs/year)	Phosphorus Loading Rate (lbs/acre/year)	Phosphorus Load (lbs/year)	Sediment Loading Rate (lbs/acre/year)	Sediment Load (lbs/year)
Barren Land (Rock/Sand/Clay)	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Cultivated Crops	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Deciduous Forest	6,280.5	1.6	20.72	32.16	0.84	1.30	264.96	411.20
Developed, High Intensity	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Developed, Low Intensity								
- Developed, Low Intensity (49% Impervious)	3,517.1	0.9	23.06	20.04	2.28	1.98	1839.00	1,598.26
- Developed, Low Intensity (51% Pervious)	3,660.7	0.9	20.72	18.74	0.84	0.76	264.96	239.67
Developed, Medium Intensity								
- Developed, Medium Intensity (79% Impervious)	0.0	0.0	23.06	0.00	2.28	0.00	1839.00	0.00
- Developed, Medium Intensity (21% Pervious)	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Developed, Open Space								
- Developed, Open Space (19% Impervious)	3,750.4	0.9	23.06	21.37	2.28	2.11	1839.00	1,704.27
- Developed, Open Space (81% Pervious)	15,988.4	4.0	20.72	81.86	0.84	3.32	264.96	1,046.81
Emergent Herbaceous Wetlands	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Evergreen Forest	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Grassland/Herbaceous	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Mixed Forest	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Open Water	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Pasture/Hay	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Perennial Ice/Snow	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Shrub/Scrub	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Woody Wetlands	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Totals:	**33,197.1**	**8.2**	**Total:**	**174.17**	**Total:**	**9.48**	**Total:**	**5,000.22**

Notes:

Adjusted Developed Land Use - Take into account the National Land Cover Database from 2011: Developed, Open Space - 19% Impervious; Developed, Low Intensity - 49% Impervious; Developed, Medium Intensity - 79% Impervious; Developed, High Intensity - 100% Impervious

Impervious developed land loading rates for nitrogen, phosphorus and sediment is 23.06, 2.28 and 1,839 lbs/acre/year, respectively.

Pervious developed land loading rates for nitrogen, phosphorus and sediment is 20.72, 0.84 and 264.96 lbs/acre/year, respectively.

Undeveloped land (outside urbanized area) loading rates for nitrogen, phosphorus and sediment is 10, 0.33 and 234.6 lbs/acre/year, respectively.

Loading rates obtained from Attachment B - Developed Land Loading Rates for PA Counties (3800-PM-BCW0100k 5/2016).

Land use areas obtained from the Stroud Water Research Center - Model My Watershed program.

Land Use Information and Pollutant Load Calculation
Parse Area E - North Wales Borough - Wissahickon Creek

Land Use	Area (m^2)	Area (acres)	Nitrogen Loading Rate (lbs/acre/year)	Nitrogen Load (lbs/year)	Phosphorus Loading Rate (lbs/acre/year)	Phosphorus Load (lbs/year)	Sediment Loading Rate (lbs/acre/year)	Sediment Load (lbs/year)
Barren Land (Rock/Sand/Clay)	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Cultivated Crops	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Deciduous Forest	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Developed, High Intensity	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Developed, Low Intensity								
- Developed, Low Intensity (49% Impervious)	2,198.2	0.5	23.06	12.53	2.28	1.24	1839.00	998.91
- Developed, Low Intensity (51% Pervious)	2,287.9	0.6	20.72	11.71	0.84	0.47	264.96	149.80
Developed, Medium Intensity								
- Developed, Medium Intensity (79% Impervious)	708.8	0.2	23.06	4.04	2.28	0.40	1839.00	322.10
- Developed, Medium Intensity (21% Pervious)	188.4	0.0	20.72	0.96	0.84	0.04	264.96	12.34
Developed, Open Space								
- Developed, Open Space (19% Impervious)	681.9	0.2	23.06	3.89	2.28	0.38	1839.00	309.87
- Developed, Open Space (81% Pervious)	2,907.0	0.7	20.72	14.88	0.84	0.60	264.96	190.33
Emergent Herbaceous Wetlands	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Evergreen Forest	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Grassland/Herbaceous	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Mixed Forest	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Open Water	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Pasture/Hay	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Perennial Ice/Snow	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Shrub/Scrub	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Woody Wetlands	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Totals:	**8,972.2**	**2.2**	**Total:**	**48.01**	**Total:**	**3.14**	**Total:**	**1,983.34**

Notes:
Adjusted Developed Land Use - Take into account the National Land Cover Database from 2011: Developed, Open Space - 19% Impervious; Developed, Low Intensity - 49% Impervious; Developed, Medium Intensity - 79% Impervious; Developed, High Intensity - 100% Impervious
Impervious developed land loading rates for nitrogen, phosphorus and sediment is 23.06, 2.28 and 1,839 lbs/acre/year, respectively.
Pervious developed land loading rates for nitrogen, phosphorus and sediment is 20.72, 0.84 and 264.96 lbs/acre/year, respectively.
Undeveloped land (outside urbanized area) loading rates for nitrogen, phosphorus and sediment is 10, 0.33 and 234.6 lbs/acre/year, respectively.
Loading rates obtained from Attachment B - Developed Land Loading Rates for PA Counties (3800-PM-BCW0100k 5/2016).
Land use areas obtained from the Stroud Water Research Center - Model My Watershed program.

Land Use Information and Pollutant Load Calculation
Parse Area F - North Wales Borough - Wissahickon Creek

Land Use	Area (m^2)	Area (acres)	Nitrogen Loading Rate (lbs/acre/year)	Nitrogen Load (lbs/year)	Phosphorus Loading Rate (lbs/acre/year)	Phosphorus Load (lbs/year)	Sediment Loading Rate (lbs/acre/year)	Sediment Load (lbs/year)
Barren Land (Rock/Sand/Clay)	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Cultivated Crops	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Deciduous Forest	1,794.4	0.4	20.72	9.19	0.84	0.37	264.96	117.49
Developed, High Intensity	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Developed, Low Intensity								
- Developed, Low Intensity (49% Impervious)	3,956.7	1.0	23.06	22.55	2.28	2.23	1839.00	1,798.05
- Developed, Low Intensity (51% Pervious)	4,118.2	1.0	20.72	21.09	0.84	0.85	264.96	269.63
Developed, Medium Intensity								
- Developed, Medium Intensity (79% Impervious)	708.8	0.2	23.06	4.04	2.28	0.40	1839.00	322.10
- Developed, Medium Intensity (21% Pervious)	188.4	0.0	20.72	0.96	0.84	0.04	264.96	12.34
Developed, Open Space								
- Developed, Open Space (19% Impervious)	1,022.8	0.3	23.06	5.83	2.28	0.58	1839.00	464.80
- Developed, Open Space (81% Pervious)	4,360.5	1.1	20.72	22.33	0.84	0.91	264.96	285.49
Emergent Herbaceous Wetlands	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Evergreen Forest	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Grassland/Herbaceous	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Mixed Forest	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Open Water	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Pasture/Hay	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Perennial Ice/Snow	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Shrub/Scrub	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Woody Wetlands	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Totals:	**16,150.0**	**4.0**	**Total:**	**85.98**	**Total:**	**5.38**	**Total:**	**3,269.90**

Notes:
Adjusted Developed Land Use - Take into account the National Land Cover Database from 2011: Developed, Open Space - 19% Impervious; Developed, Low Intensity - 49% Impervious; Developed, Medium Intensity - 79% Impervious; Developed, High Intensity - 100% Impervious
Impervious developed land loading rates for nitrogen, phosphorus and sediment is 23.06, 2.28 and 1,839 lbs/acre/year, respectively.
Pervious developed land loading rates for nitrogen, phosphorus and sediment is 20.72, 0.84 and 264.96 lbs/acre/year, respectively.
Undeveloped land (outside urbanized area) loading rates for nitrogen, phosphorus and sediment is 10, 0.33 and 234.6 lbs/acre/year, respectively.
Loading rates obtained from Attachment B - Developed Land Loading Rates for PA Counties (3800-PM-BCW0100k 5/2016).
Land use areas obtained from the Stroud Water Research Center - Model My Watershed program.

Land Use Information and Pollutant Load Calculation
Parse Area G - North Wales Borough - Wissahickon Creek

Land Use	Area (m^2)	Area (acres)	Nitrogen Loading Rate (lbs/acre/year)	Nitrogen Load (lbs/year)	Phosphorus Loading Rate (lbs/acre/year)	Phosphorus Load (lbs/year)	Sediment Loading Rate (lbs/acre/year)	Sediment Load (lbs/year)
Barren Land (Rock/Sand/Clay)	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Cultivated Crops	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Deciduous Forest	1,794.4	0.4	20.72	9.19	0.84	0.37	264.96	117.49
Developed, High Intensity	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Developed, Low Intensity								
- Developed, Low Intensity (49% Impervious)	439.6	0.1	23.06	2.51	2.28	0.25	1839.00	199.78
- Developed, Low Intensity (51% Pervious)	457.6	0.1	20.72	2.34	0.84	0.09	264.96	29.96
Developed, Medium Intensity								
- Developed, Medium Intensity (79% Impervious)	0.0	0.0	23.06	0.00	2.28	0.00	1839.00	0.00
- Developed, Medium Intensity (21% Pervious)	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Developed, Open Space								
- Developed, Open Space (19% Impervious)	340.9	0.1	23.06	1.94	2.28	0.19	1839.00	154.93
- Developed, Open Space (81% Pervious)	1,453.5	0.4	20.72	7.44	0.84	0.30	264.96	95.16
Emergent Herbaceous Wetlands	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Evergreen Forest	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Grassland/Herbaceous	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Mixed Forest	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Open Water	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Pasture/Hay	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Perennial Ice/Snow	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Shrub/Scrub	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Woody Wetlands	0.0	0.0	20.72	0.00	0.84	0.00	264.96	0.00
Totals:	**4,486.1**	**1.1**	**Total:**	**23.42**	**Total:**	**1.21**	**Total:**	**597.33**

Notes:
Adjusted Developed Land Use - Take into account the National Land Cover Database from 2011: Developed, Open Space - 19% Impervious; Developed, Low Intensity - 49% Impervious; Developed, Medium Intensity - 79% Impervious; Developed, High Intensity - 100% Impervious
Impervious developed land loading rates for nitrogen, phosphorus and sediment is 23.06, 2.28 and 1,839 lbs/acre/year, respectively.
Pervious developed land loading rates for nitrogen, phosphorus and sediment is 20.72, 0.84 and 264.96 lbs/acre/year, respectively.
Undeveloped land (outside urbanized area) loading rates for nitrogen, phosphorus and sediment is 10, 0.33 and 234.6 lbs/acre/year, respectively.
Loading rates obtained from Attachment B - Developed Land Loading Rates for PA Counties (3800-PM-BCW0100k 5/2016).
Land use areas obtained from the Stroud Water Research Center - Model My Watershed program.

Land Use Information and Pollutant Load Calculation / Reduction Calculation
Sub-basin D1
Wissahickon Creek - North Wales Borough

Land Use	Area (m^2)	Area (acres)	Nitrogen Loading Rate (lbs/acre/year)	Nitrogen Load (lbs/year)	Phosphorus Loading Rate (lbs/acre/year)	Phosphorus Load (lbs/year)	Sediment Loading Rate (lbs/acre/year)	Sediment Load (lbs/year)
Barren Land (Rock/Sand/Clay)	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Cultivated Crops	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Deciduous Forest	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Developed, High Intensity	897.2	0.2	20.72	4.59	0.84	0.19	264.96	58.74
Developed, Low Intensity								
- Developed, Low Intensity (49% Impervious)	11,430.6	2.8	23.06	65.13	2.28	6.44	1839.00	5,194.35
- Developed, Low Intensity (51% Pervious)	11,897.1	2.9	20.72	60.91	0.84	2.47	264.96	778.94
Developed, Medium Intensity								
- Developed, Medium Intensity (79% Impervious)	7,088.0	1.8	23.06	40.39	2.28	3.99	1839.00	3,220.99
- Developed, Medium Intensity (21% Pervious)	1,884.2	0.5	20.72	9.65	0.84	0.39	264.96	123.36
Developed, Open Space								
- Developed, Open Space (19% Impervious)	2,898.0	0.7	23.06	16.51	2.28	1.63	1839.00	1,316.94
- Developed, Open Space (81% Pervious)	12,354.7	3.1	20.72	63.26	0.84	2.56	264.96	808.90
Emergent Herbaceous Wetlands	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Evergreen Forest	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Grassland/Herbaceous	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Mixed Forest	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Open Water	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Pasture/Hay	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Perennial Ice/Snow	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Shrub/Scrub	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Woody Wetlands	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Totals:	**48,449.9**	**12.0**	**Total:**	**260.45**		**17.68**		**11,502.22**
			Pollutant Removal Rate:	**20.0%**		**45.0%**		**60.0%**
			Load Reduction (lbs/year):	**52.09**	**Load Reduction (lbs/year):**	**7.95**	**Load Reduction (lbs/year):**	**6,901.33**

Notes:

Adjusted Developed Land Use - Take into account the National Land Cover Database from 2011: Developed, Open Space - 19% Impervious; Developed, Low Intensity - 49% Impervious; Developed, Medium Intensity - 79% Impervious; Developed, High Intensity - 100% Impervious

Impervious developed land loading rates for nitrogen, phosphorus and sediment is 23.06, 2.28 and 1,839 lbs/acre/year, respectively.

Pervious developed land loading rates for nitrogen, phosphorus and sediment is 20.72, 0.84 and 264.96 lbs/acre/year, respectively.

Undeveloped land (outside urbanized area) loading rates for nitrogen, phosphorus and sediment is 10, 0.33 and 234.6 lbs/acre/year, respectively.

Loading rates obtained from Attachment B - Developed Land Loading Rates for PA Counties (3800-PM-BCW0100k 5/2016).

NA - Loading rate not applicable. The watershed does not have any of this type of Land Use.

Land use areas obtained from the Stroud Water Research Center - Model My Watershed program.

Land Use Information and Pollutant Load Calculation / Reduction Calculations
Sub-basin D2
Wissahickon Creek - North Wales Borough

Land Use	Area (m^2)	Area (acres)	Nitrogen Loading Rate (lbs/acre/year)	Nitrogen Load (lbs/year)	Phosphorus Loading Rate (lbs/acre/year)	Phosphorus Load (lbs/year)	Sediment Loading Rate (lbs/acre/year)	Sediment Load (lbs/year)
Barren Land (Rock/Sand/Clay)	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Cultivated Crops	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Deciduous Forest	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Developed, High Intensity	7,177.8	1.8	20.72	36.75	0.84	1.49	264.96	469.95
Developed, Low Intensity								
- Developed, Low Intensity (49% Impervious)	25,499.0	6.3	23.06	145.30	2.28	14.37	1839.00	11,587.40
- Developed, Low Intensity (51% Pervious)	26,539.8	6.6	20.72	135.88	0.84	5.51	264.96	1,737.64
Developed, Medium Intensity								
- Developed, Medium Intensity (79% Impervious)	14,176.1	3.5	23.06	80.78	2.28	7.99	1839.00	6,441.98
- Developed, Medium Intensity (21% Pervious)	3,768.3	0.9	20.72	19.29	0.84	0.78	264.96	246.72
Developed, Open Space								
- Developed, Open Space (19% Impervious)	4,602.7	1.1	23.06	26.23	2.28	2.59	1839.00	2,091.60
- Developed, Open Space (81% Pervious)	19,622.2	4.8	20.72	100.47	0.84	4.07	264.96	1,284.72
Emergent Herbaceous Wetlands	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Evergreen Forest	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Grassland/Herbaceous	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Mixed Forest	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Open Water	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Pasture/Hay	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Perennial Ice/Snow	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Shrub/Scrub	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Woody Wetlands	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Totals:	**101,385.8**	**25.1**	**Total:**	**544.70**		**36.80**		**23,860.01**
			Pollutant Removal Rate:	**20.0%**		**45.0%**		**60.0%**
			Load Reduction (lbs/year):	**108.94**	**Load Reduction (lbs/year):**	**16.56**	**Load Reduction (lbs/year):**	**14,316.01**

Notes:

Adjusted Developed Land Use - Take into account the National Land Cover Database from 2011: Developed, Open Space - 19% Impervious; Developed, Low Intensity - 49% Impervious; Developed, Medium Intensity - 79% Impervious; Developed, High Intensity - 100% Impervious

Impervious developed land loading rates for nitrogen, phosphorus and sediment is 23.06, 2.28 and 1,839 lbs/acre/year, respectively.

Pervious developed land loading rates for nitrogen, phosphorus and sediment is 20.72, 0.84 and 264.96 lbs/acre/year, respectively.

Undeveloped land (outside urbanized area) loading rates for nitrogen, phosphorus and sediment is 10, 0.33 and 234.6 lbs/acre/year, respectively.

Loading rates obtained from Attachment B - Developed Land Loading Rates for PA Counties (3800-PM-BCW0100k 5/2016).

NA - Loading rate not applicable. The watershed does not have any of this type of Land Use.

Land use areas obtained from the Stroud Water Research Center - Model My Watershed program.

Land Use Information and Pollutant Load Calculation / Reduction Calculation
Sub-basin D3
Wissahickon Creek - North Wales Borough

Land Use	Area (m^2)	Area (acres)	Nitrogen Loading Rate (lbs/acre/year)	Nitrogen Load (lbs/year)	Phosphorus Loading Rate (lbs/acre/year)	Phosphorus Load (lbs/year)	Sediment Loading Rate (lbs/acre/year)	Sediment Load (lbs/year)
Barren Land (Rock/Sand/Clay)	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Cultivated Crops	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Deciduous Forest	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Developed, High Intensity	15,252.7	3.8	20.72	78.09	0.84	3.17	264.96	998.64
Developed, Low Intensity								
- Developed, Low Intensity (49% Impervious)	32,533.2	8.0	23.06	185.38	2.28	18.33	1839.00	14,783.92
- Developed, Low Intensity (51% Pervious)	33,861.1	8.4	20.72	173.37	0.84	7.03	264.96	2,216.98
Developed, Medium Intensity								
- Developed, Medium Intensity (79% Impervious)	34,022.6	8.4	23.06	193.87	2.28	19.17	1839.00	15,460.74
- Developed, Medium Intensity (21% Pervious)	9,044.0	2.2	20.72	46.31	0.84	1.88	264.96	592.14
Developed, Open Space								
- Developed, Open Space (19% Impervious)	3,579.9	0.9	23.06	20.40	2.28	2.02	1839.00	1,626.80
- Developed, Open Space (81% Pervious)	15,261.7	3.8	20.72	78.14	0.84	3.17	264.96	999.23
Emergent Herbaceous Wetlands	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Evergreen Forest	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Grassland/Herbaceous	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Mixed Forest	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Open Water	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Pasture/Hay	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Perennial Ice/Snow	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Shrub/Scrub	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Woody Wetlands	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Totals:	**143,555.1**	**35.5**	**Total:**	**775.56**		**54.75**		**36,678.45**
			Pollutant Removal Rate:	**20.0%**		**45.0%**		**60.0%**
			Load Reduction (lbs/year):	**155.11**	**Load Reduction (lbs/year):**	**24.64**	**Load Reduction (lbs/year):**	**22,007.07**

Notes:

Adjusted Developed Land Use - Take into account the National Land Cover Database from 2011: Developed, Open Space - 19% Impervious; Developed, Low Intensity - 49% Impervious; Developed, Medium Intensity - 79% Impervious; Developed, High Intensity - 100% Impervious

Impervious developed land loading rates for nitrogen, phosphorus and sediment is 23.06, 2.28 and 1,839 lbs/acre/year, respectively.

Pervious developed land loading rates for nitrogen, phosphorus and sediment is 20.72, 0.84 and 264.96 lbs/acre/year, respectively.

Undeveloped land (outside urbanized area) loading rates for nitrogen, phosphorus and sediment is 10, 0.33 and 234.6 lbs/acre/year, respectively.

Loading rates obtained from Attachment B - Developed Land Loading Rates for PA Counties (3800-PM-BCW0100k 5/2016).

NA - Loading rate not applicable. The watershed does not have any of this type of Land Use.

Land use areas obtained from the Stroud Water Research Center - Model My Watershed program.

Land Use Information and Pollutant Load Calculation / Reduction Calculation
Sub-basin D4
Wissahickon Creek - North Wales Borough

Land Use	Area (m^2)	Area (acres)	Nitrogen Loading Rate (lbs/acre/year)	Nitrogen Load (lbs/year)	Phosphorus Loading Rate (lbs/acre/year)	Phosphorus Load (lbs/year)	Sediment Loading Rate (lbs/acre/year)	Sediment Load (lbs/year)
Barren Land (Rock/Sand/Clay)	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Cultivated Crops	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Deciduous Forest	7,177.8	1.8	20.72	36.75	0.84	1.49	264.96	469.95
Developed, High Intensity	39,477.6	9.8	20.72	202.13	0.84	8.19	264.96	2,584.72
Developed, Low Intensity								
- Developed, Low Intensity (49% Impervious)	56,713.2	14.0	23.06	323.17	2.28	31.95	1839.00	25,771.96
- Developed, Low Intensity (51% Pervious)	59,028.0	14.6	20.72	302.22	0.84	12.25	264.96	3,864.74
Developed, Medium Intensity								
- Developed, Medium Intensity (79% Impervious)	94,270.8	23.3	23.06	537.18	2.28	53.11	1839.00	42,839.11
- Developed, Medium Intensity (21% Pervious)	25,059.3	6.2	20.72	128.30	0.84	5.20	264.96	1,640.71
Developed, Open Space								
- Developed, Open Space (19% Impervious)	9,205.5	2.3	23.06	52.45	2.28	5.19	1839.00	4,183.20
- Developed, Open Space (81% Pervious)	39,244.4	9.7	20.72	200.93	0.84	8.15	264.96	2,569.44
Emergent Herbaceous Wetlands	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Evergreen Forest	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Grassland/Herbaceous	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Mixed Forest	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Open Water	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Pasture/Hay	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Perennial Ice/Snow	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Shrub/Scrub	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Woody Wetlands	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Totals:	**330,176.6**	**81.6**	**Total:**	**1,783.13**		**125.53**		**83,923.83**
			Pollutant Removal Rate:	**20.0%**		**45.0%**		**60.0%**
			Load Reduction (lbs/year):	**356.63**	**Load Reduction (lbs/year):**	**56.49**	**Load Reduction (lbs/year):**	**50,354.30**

Notes:

Adjusted Developed Land Use - Take into account the National Land Cover Database from 2011: Developed, Open Space - 19% Impervious; Developed, Low Intensity - 49% Impervious; Developed, Medium Intensity - 79% Impervious; Developed, High Intensity - 100% Impervious

Impervious developed land loading rates for nitrogen, phosphorus and sediment is 23.06, 2.28 and 1,839 lbs/acre/year, respectively.

Pervious developed land loading rates for nitrogen, phosphorus and sediment is 20.72, 0.84 and 264.96 lbs/acre/year, respectively.

Undeveloped land (outside urbanized area) loading rates for nitrogen, phosphorus and sediment is 10, 0.33 and 234.6 lbs/acre/year, respectively.

Loading rates obtained from Attachment B - Developed Land Loading Rates for PA Counties (3800-PM-BCW0100k 5/2016).

NA - Loading rate not applicable. The watershed does not have any of this type of Land Use.

Land use areas obtained from the Stroud Water Research Center - Model My Watershed program.

Land Use Information and Pollutant Load Calculation / Reduction Calculation
Sub-basin D5
Wissahickon Creek - North Wales Borough

Land Use	Area (m^2)	Area (acres)	Nitrogen Loading Rate (lbs/acre/year)	Nitrogen Load (lbs/year)	Phosphorus Loading Rate (lbs/acre/year)	Phosphorus Load (lbs/year)	Sediment Loading Rate (lbs/acre/year)	Sediment Load (lbs/year)
Barren Land (Rock/Sand/Clay)	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Cultivated Crops	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Deciduous Forest	25,122.1	6.2	20.72	128.63	0.84	5.21	264.96	1,644.82
Developed, High Intensity	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Developed, Low Intensity								
- Developed, Low Intensity (49% Impervious)	87,927.4	21.7	23.06	501.03	2.28	49.54	1839.00	39,956.51
- Developed, Low Intensity (51% Pervious)	91,516.3	22.6	20.72	468.56	0.84	19.00	264.96	5,991.84
Developed, Medium Intensity								
- Developed, Medium Intensity (79% Impervious)	17,720.1	4.4	23.06	100.97	2.28	9.98	1839.00	8,052.46
- Developed, Medium Intensity (21% Pervious)	4,710.4	1.2	20.72	24.12	0.84	0.98	264.96	308.40
Developed, Open Space								
- Developed, Open Space (19% Impervious)	35,628.5	8.8	23.06	203.02	2.28	20.07	1839.00	16,190.54
- Developed, Open Space (81% Pervious)	151,890.1	37.5	20.72	777.68	0.84	31.53	264.96	9,944.69
Emergent Herbaceous Wetlands	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Evergreen Forest	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Grassland/Herbaceous	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Mixed Forest	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Open Water	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Pasture/Hay	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Perennial Ice/Snow	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Shrub/Scrub	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Woody Wetlands	0.0	0.0	NA	0.0	NA	0.0	NA	0.0
Totals:	**414,515.0**	**102.4**	**Total:**	**2,204.01**		**136.31**		**82,089.27**
			Pollutant Removal Rate:	**20.0%**		**45.0%**		**60.0%**
			Load Reduction (lbs/year):	**440.80**	**Load Reduction (lbs/year):**	**61.34**	**Load Reduction (lbs/year):**	**49,253.56**

Notes:

Adjusted Developed Land Use - Take into account the National Land Cover Database from 2011: Developed, Open Space - 19% Impervious; Developed, Low Intensity - 49% Impervious; Developed, Medium Intensity - 79% Impervious; Developed, High Intensity - 100% Impervious

Impervious developed land loading rates for nitrogen, phosphorus and sediment is 23.06, 2.28 and 1,839 lbs/acre/year, respectively.

Pervious developed land loading rates for nitrogen, phosphorus and sediment is 20.72, 0.84 and 264.96 lbs/acre/year, respectively.

Undeveloped land (outside urbanized area) loading rates for nitrogen, phosphorus and sediment is 10, 0.33 and 234.6 lbs/acre/year, respectively.

Loading rates obtained from Attachment B - Developed Land Loading Rates for PA Counties (3800-PM-BCW0100k 5/2016).

NA - Loading rate not applicable. The watershed does not have any of this type of Land Use.

Land use areas obtained from the Stroud Water Research Center - Model My Watershed program.

Pollutant Load Reduction
Wissahickon Creek PRP
North Wales Borough

Project: North Wales Station
Date of Project: 2015
Pollutant: Phosphorus

Pre-Development Conditions

Land Use	Area (acres)	Loading Rate (lbs/ac/yr)	Sub Totals
Developed, Medium Intensity			
- 79% Impervious	0.74	2.28	1.69
- 21% Pervious	0.20	0.84	0.17
Grassland / Herbaceous	0.28	0.33	0.09
		Total Pre-Development	**1.95**

Post-Development Conditions

Developed, Medium Intensity			
- 79% Impervious	0.96	2.28	2.19
- 21% Impervious	0.26	0.84	0.22
		Total Post-Development Before BMP Reduction	**2.41**
		Nutrient Reduction for Raingarden BMP	85%
		Total Post-Development	**0.36**

Net Nutrient Reduction (Pre minus Post) lbs/yr **1.59**

Notes:
Adjusted Developed Land Use - Take into account the National Land Cover Database from 2011: Developed, Open Space - 19% Impervious; Developed, Low Intensity - 49% Impervious; Developed, Impervious developed land loading rates for nitrogen, phosphorus and sediment is 23.06, 2.28 and 1,839 lbs/acre/year, respectively. Pervious developed land loading rates for nitrogen, phosphorus and sediment is 20.72, 0.84 and 264.96 lbs/acre/year, respectively. Undeveloped land (outside urbanized area) loading rates for nitrogen, phosphorus and sediment is 10, 0.33 and 234.6 lbs/acre/year, respectively. Loading rates obtained from Attachment B - Developed Land Loading Rates for PA Counties (3800-PM-BCW0100k 5/2016).
Pre-development conditions determined from historic Google aerial photographs and plans prepared by the Southeastern Pennsylvania Transportation Authority (9/4/14)

APPENDIX V

POLLUTANT LOAD REDUCTION REFERENCE

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) STORMWATER DISCHARGES FROM SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS BMP EFFECTIVENESS VALUES

This table of BMP effectiveness values (i.e., pollutant removal efficiencies) is intended for use by MS4s that are developing and implementing Pollutant Reduction Plans and TMDL Plans to comply with NPDES permit requirements. The values used in this table generally consider pollutant reductions from both overland flow and reduced downstream erosion, and are based primarily on average values within the Chesapeake Assessment Scenario Tool (CAST) (www.casttool.org). Design considerations, operation and maintenance, and construction sequences should be as outlined in the Pennsylvania Stormwater BMP Manual, Chesapeake Bay Program guidance, or other technical sources. The Department of Environmental Protection (DEP) will update the information contained in this table as new information becomes available. Interested parties may submit information to DEP for consideration in updating this table to DEP's MS4 resource account, RA-EPPAMS4@pa.gov. Where an MS4 proposes a BMP not identified in this document or in Chesapeake Bay Program expert panel reports, other technical resources may be consulted for BMP effectiveness values. Note – TN = Total Nitrogen and TP = Total Phosphorus.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Wet Ponds and Wetlands	20%	45%	60%	A water impoundment structure that intercepts stormwater runoff then releases it to an open water system at a specified flow rate. These structures retain a permanent pool and usually have retention times sufficient to allow settlement of some portion of the intercepted sediments and attached nutrients/toxics. Until recently, these practices were designed specifically to meet water quantity, not water quality objectives. There is little or no vegetation living within the pooled area nor are outfalls directed through vegetated areas prior to open water release. Nitrogen reduction is minimal.
Dry Detention Basins and Hydrodynamic Structures	5%	10%	10%	Dry Detention Ponds are depressions or basins created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Hydrodynamic Structures are devices designed to improve quality of stormwater using features such as swirl concentrators, grit chambers, oil barriers, baffles, micropools, and absorbent pads that are designed to remove sediments, nutrients, metals, organic chemicals, or oil and grease from urban runoff.
Dry Extended Detention Basins	20%	20%	60%	Dry extended detention (ED) basins are depressions created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Dry ED basins are designed to dry out between storm events, in contrast with wet ponds, which contain standing water permanently. As such, they are similar in construction and function to dry detention basins, except that the duration of detention of stormwater is designed to be longer, theoretically improving treatment effectiveness.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Infiltration Practices w/ Sand, Veg.	85%	85%	95%	A depression to form an infiltration basin where sediment is trapped and water infiltrates the soil. No underdrains are associated with infiltration basins and trenches, because by definition these systems provide complete infiltration. Design specifications require infiltration basins and trenches to be built in good soil, they are not constructed on poor soils, such as C and D soil types. Engineers are required to test the soil before approval to build is issued. To receive credit over the longer term, jurisdictions must conduct yearly inspections to determine if the basin or trench is still infiltrating runoff.
Filtering Practices	40%	60%	80%	Practices that capture and temporarily store runoff and pass it through a filter bed of either sand or an organic media. There are various sand filter designs, such as above ground, below ground, perimeter, etc. An organic media filter uses another medium besides sand to enhance pollutant removal for many compounds due to the increased cation exchange capacity achieved by increasing the organic matter. These systems require yearly inspection and maintenance to receive pollutant reduction credit.
Filter Strip Runoff Reduction	20%	54%	56%	Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.4 design ratio of filter strip length to impervious flow length is recommended for runoff reduction urban filter strips.
Filter Strip Stormwater Treatment	0%	0%	22%	Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.2 design ratio of filter strip length to impervious flow length is recommended for stormwater treatment urban filter strips.
Bioretention – Raingarden (C/D soils w/ underdrain)	25%	45%	55%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in C or D soil.
Bioretention / Raingarden (A/B soils w/ underdrain)	70%	75%	80%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in A or B soil.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Bioretention / Raingarden (A/B soils w/o underdrain)	80%	85%	90%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has no underdrain and is in A or B soil.
Vegetated Open Channels (C/D Soils)	10%	10%	50%	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in C or D soil.
Vegetated Open Channels (A/B Soils)	45%	45%	70%	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in A or B soil.
Bioswale	70%	75%	80%	With a bioswale, the load is reduced because, unlike other open channel designs, there is now treatment through the soil. A bioswale is designed to function as a bioretention area.
Permeable Pavement w/o Sand or Veg. (C/D Soils w/ underdrain)	10%	20%	55%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in C or D soil.
Permeable Pavement w/o Sand or Veg. (A/B Soils w/ underdrain)	45%	50%	70%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in A or B soil.
Permeable Pavement w/o Sand or Veg. (A/B Soils w/o underdrain)	75%	80%	85%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, no sand or vegetation and is in A or B soil.
Permeable Pavement w/ Sand or Veg. (A/B Soils w/ underdrain)	50%	50%	70%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in A or B soil.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Permeable Pavement w/ Sand or Veg. (A/B Soils w/o underdrain)	80%	80%	85%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, has sand and/or vegetation and is in A or B soil.
Permeable Pavement w/ Sand or Veg. (C/D Soils w/ underdrain)	20%	20%	55%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in C or D soil.
Stream Restoration	0.075 lbs/ft/yr	0.068 lbs/ft/yr	44.88 lbs/ft/yr	An annual mass nutrient and sediment reduction credit for qualifying stream restoration practices that prevent channel or bank erosion that otherwise would be delivered downstream from an actively enlarging or incising urban stream. Applies to 0 to 3rd order streams that are not tidally influenced. If one of the protocols is cited and pounds are reported, then the mass reduction is received for the protocol.
Forest Buffers	25%	50%	50%	An area of trees at least 35 feet wide on one side of a stream, usually accompanied by trees, shrubs and other vegetation that is adjacent to a body of water. The riparian area is managed to maintain the integrity of stream channels and shorelines, to reduce the impacts of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals. (Note – the values represent pollutant load reductions from stormwater draining through buffers).
Tree Planting	10%	15%	20%	The BMP effectiveness values for tree planting are estimated by DEP. DEP estimates that 100 fully mature trees of mixed species (both deciduous and non-deciduous) provide pollutant load reductions for the equivalent of one acre (i.e., one mature tree = 0.01 acre). The BMP effectiveness values given are based on immature trees (seedlings or saplings); the effectiveness values are expected to increase as the trees mature. To determine the amount of pollutant load reduction that can credited for tree planting efforts: 1) multiply the number of trees planted by 0.01; 2) multiply the acreage determined in step 1 by the pollutant loading rate for the land prior to planting the trees (in lbs/acre/year); and 3) multiply the result of step 2 by the BMP effectiveness values given.
Street Sweeping	3%	3%	9%	Street sweeping must be conducted 25 times annually. Only count those streets that have been swept at least 25 times in a year. The acres associated with all streets that have been swept at least 25 times in a year would be eligible for pollutant reductions consistent with the given BMP effectiveness values.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Storm Sewer System Solids Removal	0.0027 for sediment, 0.0111 for organic matter	0.0006 for sediment, 0.0012 for organic matter	1 – TN and TP concentrations	This BMP (also referred to as "Storm Drain Cleaning") involves the collection or capture and proper disposal of solid material within the storm system to prevent discharge to surface waters. Examples include catch basins, stormwater inlet filter bags, end of pipe or outlet solids removal systems and related practices. Credit is authorized for this BMP only when proper maintenance practices are observed (i.e., inspection and removal of solids as recommended by the system manufacturer or other available guidelines). The entity using this BMP for pollutant removal credits must demonstrate that they have developed and are implementing a standard operating procedure for tracking the material removed from the sewer system. Locating such BMPs should consider the potential for backups onto roadways or other areas that can produce safety hazards. To determine pollutant reductions for this BMP, these steps must be taken: 1) Measure the weight of solid/organic material collected (lbs). Sum the total weight of material collected for an annual period. Note – do not include refuse, debris and floatables in the determination of total mass collected. 2) Convert the annual wet weight captured into annual dry weight (lbs) by using site-specific measurements (i.e., dry a sample of the wet material to find its weight) or by using default factors of 0.7 (material that is predominantly wet sediment) or 0.2 (material that is predominantly wet organic matter, e.g., leaf litter). 3) Multiply the annual dry weight of material collected by default or site-specific pollutant concentration factors. The default concentrations are shown in the BMP Effectiveness Values columns. Alternatively, the material may be sampled (at least annually) to determine site-specific pollutant concentrations. DEP will allow up to 50% of total pollutant reduction requirements to be met through this BMP. The drainage area treated by this BMP may be no greater than 0.5 acre unless it can be demonstrated that the specific system proposed is capable of treating stormwater from larger drainage areas. For planning purposes, the sediment removal efficiency specified by the manufacturer may be assumed, but no higher than 80%.