Herbert, Rowland & Grubic, Inc.
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July 2017

CHESAPEAKE BAY POLLUTANT REDUCTION PLAN FOR MIDDLETOWN BOROUGH

PREPARED FOR:
MIDDLETOWN BOROUGH

DAUPHIN COUNTY, PENNSYLVANIA

HRG Project No. R000516.0459

CHESAPEAKE BAY POLLUTION REDUCTION PLAN
FOR
MIDDLETOWN BOROUGH,
DAUPHIN COUNTY, PENNSYLVANIA

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Introduction

Middletown Borough discharges stormwater to surface waters located within the Chesapeake Bay Watershed and is therefore regulated by a PAG-13 General Permit, Appendix D (nutrients and sediment in stormwater discharges to waters in the Chesapeake Bay watershed). The Borough also has watershed impairments regulated by PAG-13 General Permit, Appendix E (nutrients and/or sediment in stormwater discharges to impaired waterways). This Chesapeake Bay Pollutant Reduction Plan (CBPRP) was developed in accordance with both PAG-13 requirements and documents how the Borough intends to achieve the pollutant reduction requirements listed in the Pennsylvania Department of Environmental Protection (PADEP) Municipal MS4 Requirements Table[1].

This document was prepared following the guidance provided in the PADEP National Pollutant Discharges Elimination System (NPDES) Stormwater Discharges from Small Municipal Separate Storm Sewer Systems Pollutant Reduction Plan (PRP) Instructions[2].

GENERAL INFORMATION	
Permittee Name: Middletown Borough	**NPDES Permit No.:** PAG133645
Mailing Address: 60 W Emaus Street	**Effective Date:** March 16, 2018
City, State, Zip: Middletown, PA 17057-1407	**Expiration Date:** March 16, 2023
MS4 Contact Person: Ken Klinepeter	**Renewal Due Date:** Sept 16, 2022
Title: Borough Manager	**Municipality:** Middletown Borough
Phone: (717) 902-0706	**County:** Dauphin
Email: kklinepeter@middletownborough.com	**Consultant Name:** Herbert, Rowland & Grubic, Inc.
Co-Permittees (if applicable): N/A	**Consultant Contact:** Erin Letavic, P.E. 369 East Park Drive Harrisburg, PA 17109 (717)564-1121

Middletown Borough is a small MS4 community that will be starting its second permit term in March 2018. According to the United States Census Bureau's 2010 census, all of the Borough's 1,309 acres are classified as urbanized area (UA).

The majority of the Borough is located within the Swatara Creek-Susquehanna River Watershed, with a small portion of the southwestern corner of the Borough located within the Laurel Run-Susquehanna River Watershed. The Laurel Run-Susquehanna River has been classified as impaired by PADEP. The Pollution Reduction Plan (PRP) requirements for this impaired watershed are included as part of this CBPRP.

[1] PADEP, MS4 Requirements Table (Municipal) (rev. 5/9/2017)
[2] PADEP PRP Instructions; Document # 3800-PM-BCW0100k (rev. 3/2017)

Section A: Public Participation

A complete copy of this CBPRP was made available for the public to review at the Middletown Borough municipal office from August 1, 2017 to August 31, 2017. The availability of the document was publicized in *The Patriot News* on August 1, 2017. The published public notice contained a brief description of the plan, the dates and locations at which the plan was available for review by the public, and the length of time provided for the receipt of comments. Public comments will be accepted for 30 days following the publication date of the public notice. The final version of this plan will include a copy of the public notice, copies of all public comments, and the responses issued to each comment (Appendix A).

Section B: Mapping

The Middletown Borough Planning Area Map depicts the Borough's Municipal Separate Storm Sewer System (MS4), as required under MCM #3, BMPs 2 and 3 of the PAG-13 Notice of Intent (NOI). In addition to the MS4 infrastructure (inlets, pipes, outfalls, existing BMPs, etc.), the Planning Area Map also shows the CBPRP planning area, UA boundary, watershed boundaries, existing BMPs locations, and proposed BMP locations.

The Borough's Land Use Map was developed using the most recent National Land Cover Database[3]. The northernmost area portion of the Borough, north of the PA Turnpike is forested and relatedly undeveloped. The southern and central portions of the Borough are fully-developed as low to medium density residential areas, with areas of high density commercial and industrial development clustered in the most central portion of the Borough.

[3] Multi-Resolution Land Characteristics (MRLC) Consortium, *National Land Cover Database 2011* (NLCD 2011)

Section C: Pollutants of Concern

The pollutants of concern for Middletown Borough were determined by referencing the PADEP MS4 Municipal Requirements Table[4] (Table 1). The applicable section of this table is included for reference in Appendix C.

Table 1. Pollutants of Concern by Watershed Planning Area

Planning Area (Watershed)	Impaired Downstream Water	Pollutants of Concern
CBPRP	Chesapeake Bay Nutrients/Sediment	Appendix D - Nutrients, Siltation (4a)
Laurel Run - Susquehanna River	Unnamed Tributaries to Sherman Creek, Unnamed Tributaries to Susquehanna River	Appendix E - Siltation (5)

[4] PADEP, MS4 Requirements Table (Municipal) (rev. 5/9/2017)

Section D: Determine Existing Loading for Pollutants of Concern

D.1 Parsed Area Calculation

In order to calculate the actual pollutant loads applicable to the Borough MS4, the PRP Instructions allow areas that do not drain to the MS4 and areas that are already covered by an NPDES permit to be removed from the planning area through the parsing process[5].

The following areas were parsed from the CBPRP and PRP planning areas:

- PennDOT Roadways/PA Turnpike – The impervious areas attributed to PennDOT roadways and the portion of the Pennsylvania Turnpike located within the Borough were parsed from the existing pollutant base load, as PennDOT and the Turnpike Commission maintain their own MS4 permits to account for stormwater runoff generated from their facilities.
- Private Properties – Portions of the Susquehanna Regional Airport and Penn State University (Harrisburg campus) are located within the Borough. As these facilities are operated and maintained under their owner permits, they were removed from the Borough planning areas.
- General Permit for Stormwater Associated with Industrial Activity (PAG-03) – The Borough contains one property, First Student Inc. No 20576, already covered by existing NPDES PAG-03 permit. The area for this facility's property was removed from the Borough's planning areas.
- Direct Discharge Areas – Direct discharge areas are areas in which stormwater runoff does not enter the MS4. There are several areas along the Swatara Creek and Susquehanna River in which stormwater drains directly to these waterways and does not enter the MS4. Additionally, the area north of the PA Turnpike was removed from the Borough's planning areas as this area is minimally developed, contains no MS4 infrastructure, and drains directly to the Swatara Creek.

A summary of areas parsed from the Borough planning areas is shown in Tables 2A and 2B. Parsed areas are shown on the Planning Area Map (Appendix B) and supporting calculations for the pollutant loads associated with each parsed area are included in Appendix D.

Table 2A. Parsed Area Summary - CBPRP Planning Area

Planning Area	**Urbanized Area** (acres)
CBPRP	1309
Parsed Area (PennDOT/PA Turnpike)	- 64
Parsed Area (Private Properties)	- 75
Parsed Area (PAG-03)	- 1
Parsed Area (Direct Discharge)	- 388
Adjusted Planning Area	**781**

[5] PADEP - PRP Instructions, Attachment A: Parsing Guidelines for MS4s in Pollutant Reduction Plans (rev. 3/2017)

Table 2B. Parsed Area Summary – Laurel Run Planning Area

Planning Area	**Urbanized Area** (acres)
Laurel Run PRP	176
Parsed Area (PennDOT)	- 2
Parsed Area (Private Properties)	-70
Parsed Area (Direct Discharge)	- 38
Adjusted Planning Area	**66**

D.3 Existing Pollutant Load Calculation

The existing pollutant loadings were calculated using the Simplified Method[6]. In accordance with this method, the adjusted UA from Tables 2A and 2B was multiplied by the percent pervious and impervious land use values for Middletown Borough listed in the Statewide MS4 Land Cover Estimates[7] guidance document from PADEP. This calculation evaluates the acres of impervious and pervious land within the given planning area. The impervious and pervious acreages were then multiplied by the Developed Land Loading Rates for Dauphin County[8] to determine the total existing pollutant load attributed to each planning area. The existing pollutant loading was determined for the CBPRP planning area as well as for the Laurel Run impaired watershed (PRP planning area).

As stated previously in Section C, the pollutants of concern are TSS, TN, and TP, however, it is presumed that within the overall Bay watershed, the TP and TN goals will be achieved when the permit-required sediment reduction is achieved[9]. Therefore, only the TSS pollutant loading was calculated (Table 3). Detailed pollutant load calculations are provided in Appendix D.

Table 3. Pollutant Loading for Middletown Borough

Planning Area	**Urbanized Area** (acres)	**Regulated Pollutant Load TSS** (lbs/yr)
Laurel Run PRP	66	17,873
CBPRP	781	802,264

As the Laurel Run PRP planning area is located within the overall CBPRP planning area, the pollutant loads associated with this impaired watershed planning areas are a portion of, and not in addition to, the CBPRP planning area pollutant load.

[6] PADEP PRP Instructions, Attachment C: Chesapeake By PRP Exampled Using DEP Simplified Method (rev. 3/2017)
[7] PADEP - Statewide MS4 Land Cover Estimates
[8] PADEP - PRP Instructions, Attachment B: Developed Land Loading Rates for PA Counties (rev. 3/2017)
[9] PADEP - PRP Instructions, Document # 3800-PM-BCW0100k (rev. 3/2017)

D.3 Existing Pollutant Loading Adjustment for Previously Implemented BMPs

Middletown Borough contains two recently constructed sites that contain existing BMPs; Westporte Center (underground detention) and AutoZone #6430 (infiltration). Spring Street Student Housing is partially located within the Laurel Run PRP Planning area. The pollutant load reductions from these existing BMPs are being claimed as credit to reduce the Borough's existing pollutant load. Additionally, Middletown Borough owns multiple property parcels along Few Ave in the northern part of the Borough and along Susquehanna in the southern part of the Borough that were purchased through FEMA hazard mitigation funding. The flood damaged properties were removed and the empty parcels are currently maintained by the Borough as lawn. The pollutant load reduction associated with the removal of impervious area from these properties is also being used as credit toward reducing the Borough's baseline pollutant load.

The pollutant loading reduction for existing BMPs and impervious area reduction was calculated using the Simplified Method in terms of pounds per year using PADEP's standard BMP Effectiveness Values[10]. Additional information for the existing BMPs and impervious area reductions from FEMA-funded property buyouts are included in Appendix D.

Table 4A: Adjusted Baseline Load Summary by Planning Area

Planning Area	**Urbanized Area** (acres)	**Regulated Pollutant Load TSS** (lbs/yr)	**Existing BMP Load Reduction TSS** (lbs/yr)	**Adjusted Pollutant Load TSS** (lbs/yr)
Laurel Run PRP	66	17,873	4,173	13,700
CBPRP	781	823,328	17,601	805,757

[10] PADEP Document 3899-PM-BCW0100M, NPDES Stormwater Discharges from Small MS4s, BMP Effectiveness Values (5/2015)

Section E: BMPs to Achieve the Required Pollutant Load Reductions

E.1 Required Pollutant Load Reduction Calculation

Middletown Borough discharges stormwater to surface water located within the Chesapeake Bay watershed and is regulated by PAG-13 General Permit, Appendix D (nutrients and sediment in stormwater discharges to waters in the Chesapeake Bay watershed). The pollutants of concern for Appendix D are TSS, TP, and TN with required loading reductions of 10-percent, 5-percent, and 3-percent, respectively. However, as stated previously, it is presumed that within the overall Bay watershed, the TP and TN goals will be achieved when a 10-percent reduction in sediment is achieved[11]. Therefore, only the required 10-percent TSS reduction is calculated herein as a requirement for planning area load reductions (Table 5). The pollutant load reduction requirements listed below take into account adjustments to baseline loading from the parsed areas and existing BMPs discussed in Section D.

Table 5: Required Pollutant Load Reduction Goals – CBPRP Planning Area

Planning Area	**UA** (acres)	**Required Load Reduction TSS** (lbs/yr)
CBPRP	781	80,573

In addition to meeting the PAG-13 General Permit, Appendix D requirements listed in Table 5, the Laurel Run Watershed has two streams (Unnamed Tributaries to Susquehanna River and Unnamed Tributaries to Sherman Creek) with impairments regulated by PAG-13 General Permit, Appendix E (nutrients and/or sediment in stormwater discharges to impaired waterways). Appendix E siltation impairments require a minimum 10-percent reduction in sediment load. The pollutant load reduction requirement in pounds per year required for the Laurel Run watershed is shown below in Table 6. The required pollutant load takes into account adjustments to baseline loading from the parsed areas and existing BMPs discussed in Section D.

Table 6: Required Pollutant Load Reduction Goals – PRP Planning Areas

Planning Area	**UA** (acres)	**Required Load Reduction TSS** (lbs/yr)
Laurel Run	66	1,370

As stated previously, the load reduction requirements for the Laurel Run planning area are included as a portion of, and not in addition to, the CBPRP pollutant load reduction. Of the total CBPRP planning area required sediment load reduction (80,573 lbs/yr), 2-percent (1,370 lbs/yr) is to be achieved within the Laurel Run watershed.

[11] PADEP - PRP Instructions, Document # 3800-PM-BCW0100k (rev. 3/2017)

E.2 Proposed BMPs

The following section outlines the BMP implementation strategy developed to achieve the required pollutant load reduction goals stated in Section E.1. The proposed BMPs were determined through discussions with the public works employees and municipal staff, in-field site assessments, and public outreach meetings.

The proposed strategy (Table 6) consists of one large-scale bioretention BMP type to meet the majority of the Borough's pollutant load reduction and one smaller-scale infiltration BMP to meet the pollutant load reduction requirements for the Lauren Run planning area. The pollutant loading reduction for these BMPs were calculated in terms of pounds per year using PADEP's standard BMP Effectiveness Values[12]. Complete calculations for the anticipated pollutant load reductions for each of the BMPs listed below is provided in Appendix E.

Table 6: BMP Strategy Summary

Site	BMP ID	BMP Type	Planning Area	Drainage Area (acres)	Length (ft)	Load Reduction TSS (lbs/yr)
Hoffer Park	BMP-1	Bioretention and Outfall Stabilization	CBPRP	77	300	74,941
				n/a	100	4,488
Susquehanna Street Park	BMP-2	Infiltration	Laurel Run PRP	1.8	n/a	1,849
Total						**81,278**

E.3 BMP Project Descriptions

As one of the oldest communities in Dauphin County, Middletown Borough's roadway and utility infrastructure is ageing and being incrementally repaired and updated as needed. It is anticipated that during the permit term, other municipal infrastructure projects will arise. As the Borough understands the importance of stormwater management, any large-scale infrastructure improvement projects that come up will be evaluated to determine if there is the potential to incorporate green infrastructure or other stormwater improvements into the project. If the opportunity becomes available to meet the pollutant load reduction goals of this plan through modifications or expansions to other infrastructure projects, rather than through the stand alone BMPs descripted below, the municipality may choose to do so. If this route of meeting the pollutant load reduction requirements is chosen, all plans, details, and associated pollutant load reduction calculations for the new project will be included in future Annual Status Reports.

The proposed BMP projects described below have not been fully designed. The following project descriptions are conceptual and intended for planning purposes only. When designed, the proposed BMP projects will be in accordance with the Pennsylvania BMP Manual and all local ordinances and regulations, as well as any applicable DEP guidance documents. The proposed projects have been evaluated in terms of preliminary feasibility and estimated pollutant load reductions in order to meet the goals of this plan.

[12] PADEP Document 3899-PM-BCW0100M, NPDES Stormwater Discharges from Small MS4s, BMP Effectiveness Values (5/2015)

Hoffer Park Bioretention and Streambank Stabilization – The majority of the Borough's pollutant load reduction requirement can be met through the installation of one large-scale BMP along the east side of Hoffer Park. Stormwater from a large drainage area (more than 75 acres) in the southeastern side of the Borough is conveyed to a stormwater pool located in the northeastern corner of the park (outfall B8).

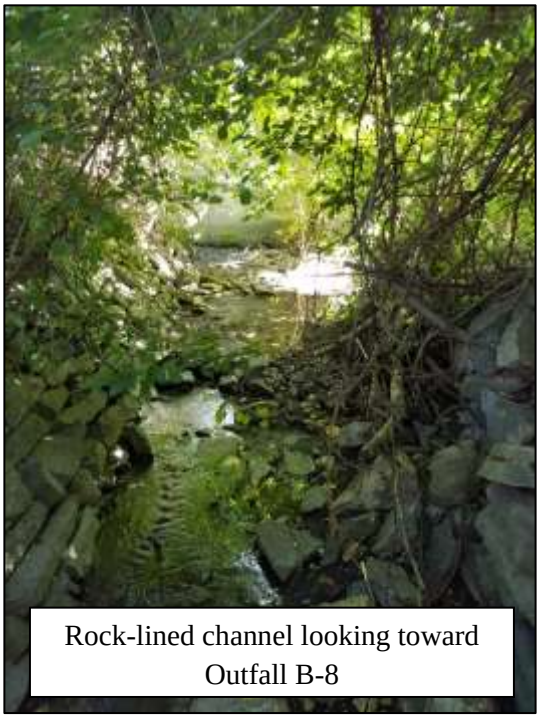
Outfall B-8

Outfall B8 is a 24-inch corrugated metal pipe (CMP) that collects and conveys stormwater from the branch of the Borough MS4 that extends through the industrial area to the east of the park, and north through the Pineford Village apartment complex.

Outfall B-8, North and East sides of stormwater pool

The north and east sides of the stormwater pool where outfall B8 discharges are concrete. The other sides of the pool are steep earthen embankments. Another stormwater pipe, also a 24-inch CMP, outfalls into the stormwater pool opposite from Outfall B-8. Stormwater from this outfall is conveyed into the stormwater pool via a small rock-lined channel. This outfall conveys stormwater from the branch of MS4 that extends north from Hoffer Park along Courtland Avenue and Adelia Street.

The stormwater pool is approximately 75-feet long and 10-feet wide. The pool is surrounded on the southern and western sides by shrubs and other low vegetation. Stormwater from this pool channel flows into a 24-inch CMP and is conveyed underground along the length of Hoffer Park (approximately 400 feet) and discharges to the Swatara Creek.



Rock-lined channel looking toward Outfall B-8

South end of stormwater pool
(Pipe to Swatara Creek)

This project proposes to remove the 24-inch CMP that conveys stormwater from the pool to the Swatara Creek and replace it with an approximately 300 feet by 50 feet bioretention basin that will extend the length of the park. The bioretention basin will allow stormwater to infiltrate rather than being discharged directly into the Swatara Creek.

When the existing pipe is excavated the trench will be backfilled with layers of bioretention bed components including engineered media, topsoil, and mulch. The basin will be planted with water-tolerant native plantings. Stormwater quality treatment will be provided when stormwater filters through the bed components and through biological and biochemical reaction with the soil matrix and around the root zones of the plants.

Along with the installation of the bioretention bed, the project will also restore and stabilize approximately 100 feet of Swatara Creek streambank during the removal of the existing outfall.

The proposed location of the bioretention basin within Hoffer Park is currently an unused section of the park, the lawn area between the parking lot and the property boundary with the neighboring industrial area. Therefore, the addition of this facility to the park will not affect any recreational activities at the park.

Susquehanna Street Park Infiltration – Stormwater in the Laurel Run PRP planning area flows north to south across the southernmost portion of the Borough. This proposed BMP project will install a small infiltration trench along the municipally-owned land north of Susquehanna Street to capture and infiltrate overland flow. The infiltration areas will be a shallow depression filled with sand and vegetative cover that function by trapping sediment and allowing runoff to infiltrate into the soil.

Section F: Identify Funding Mechanisms

Funding for the design and construction of the BMPs proposed herein will be funded through a variety of sources including the Borough's General Fund, available grants, and public donation of materials and manpower.

Section G: BMP Operations and Maintenance (O&M)

Stream Restoration/Riparian Restoration

Operation and maintenance requirements for the streambank stabilization and buffer restoration projects include:

- Ensure disturbed areas are kept free of foot and/or vehicular traffic until full stabilization has occurred.
- Regular watering of plantings during the first growing season. Planting in the fall may reduce the need for additional watering.
- Conduct monthly site visits to ensure plantings are healthy and sufficiently watered, weeds are properly managed, sufficient mulch is in place until site is stabilized and plantings have become established.
- Conduct monthly site visits to ensure all disturbed earth remains stabilized and erosion or cutting of the streambank has not taken place. Any destabilized earth or active streambank erosion shall be repaired immediately upon discovery.
- Conduct annual inspections once streambank is stabilized and plants have become established.
- Immediately upon notice; repair any rills, gullies, or streambank cutting that may occur.
- Remove weeds and invasive plant species during each growing season. Naturally growing native vegetation should be left intact to promote stabilization of the streambank and surrounding area.
- Replace mulch as needed.
- Remove accumulated trash and debris weekly.
- Remove and replace dead and diseased plantings annually.
- Keep machinery and vehicles away from stabilized areas.

The contractor shall be responsible for the operation and maintenance of the streambank restoration and buffer project(s) until all features of the project have been successfully constructed to the specifications and design standards set forth by the Borough Engineer. The Contractor shall remain responsible for operation and maintenance of the streambank restoration and buffer project(s) until 70% permanent stabilization has been achieved.

Once construction of the project(s) is complete and stabilization has occurred, the Borough shall be responsible for long term implementation of all Operation and Maintenance procedures to ensure the streambank stabilization and buffer improvements remain operationally functional and physically consistent with the original design.

Bioretention/Infiltration Areas

Operation and maintenance requirements for the bioretention projects include:

- Ensure disturbed areas are kept free of foot and/or vehicular traffic until full stabilization has occurred. Properly designed and installed Bioretention areas require some regular maintenance.
- While vegetation is being established, pruning and weeding may be required.
- Detritus may also need to be removed every year. Perennial plantings may be cut down at the end of the growing season.
- Mulch should be re-spread when erosion is evident and be replenished as needed. Once every 2 to 3 years the entire area may require mulch replacement.
- Bioretention areas should be inspected at least two times per year for sediment buildup, erosion, vegetative conditions, etc.
- During periods of extended drought, Bioretention areas may require watering.
- Trees and shrubs should be inspected twice per year to evaluate health.

The contractor shall be responsible for the operation and maintenance of the bioretention basin until all features of the project have been successfully constructed to the specifications and design standards set forth by the Borough Engineer. The Contractor should provide a one-year 80% care and replacement warranty for all plantings beginning after installation and inspection of all plants.

Once construction of the project(s) is complete, the Borough shall be responsible for long term implementation of all Operation and Maintenance procedures to ensure the basin remains operationally functional and physically consistent with the original design.

APPENDIX A

Public Participation Documentation

Page to be replaced with the following (as applicable):

Copy of the public notice from newspaper

Copies of all public comments and the responses issued to each comment

Meeting minutes for the meeting at which the CBPRP/PRPs were presented

A record of the incorporated changes as a result of public comment

APPENDIX B

Mapping

450 0 450 Feet

Mapping derived from data provided by Middletown Borough, PA DEP, PennDOT, US Census, and USGS.

7/28/2017	PM: EGL	GIS: BLS	QA: MDW	R000516.0459

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- Existing BMP
- Proposed BMP
- Storm Outfall
- Storm Inlet
- Storm Manhole
- Storm Gravity Main
- State Road
- Local Road
- Sediment Impaired Stream
- Non-Impaired Stream
- Municipal Boundary
- Urbanized Area (2010)
- Parsed Areas
- Watershed (HUC-12)

CBPRP Planning Area

Middletown Borough
Dauphin County, Pennsylvania

P:\000\05\000516.0459\GIS\Projects\Middletown_CBPRP_PlanningArea_24x36port.mxd

OBERLIN RD
VINE ST
W 76 INT
N UNION ST
Iron Run
MIDDLETOWN BOROUGH
LOWER SWATARA TOWNSHIP
E MAIN ST
E HARRISBURG PKE
W MAIN ST
W HARRISBURG PKE
ANN ST
S UNION ST
Swatara Creek
MIDDLETOWN BOROUGH
ROYALTON BOROUGH
CANAL ST
HILLSDALE RD
RIVER RD

1,000 0 1,000 Feet

Mapping derived from data provided by Dauphin County, USGS, US Census, and MRLC.

5/5/2017	PM: EGL	GIS: BLS/ HMG	QA: HSH	R000257.0439

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- Road
- Municipal Boundary
- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land (Rock/Sand/Clay)
- Deciduous Forest
- Mixed Forest
- Shrub/Scrub
- Grassland/Herbaceous
- Pasture/Hay
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetlands
- Urban Areas (2010)

Land Use Map

Middletown Borough
Dauphin County, Pennsylvania

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APPENDIX C

PADEP Municipal 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
Dauphin County						
LONDONDERRY TWP	PAG133547	No		Unnamed Tributaries to Conewago Creek	Appendix E-Organic Enrichment/Low D.O. (4a)	Other Habitat Alterations (4c)
				Unnamed Tributaries to Swatara Creek	Appendix E-Siltation (5)	
				Iron Run	Appendix E-Siltation (5)	
				Susquehanna River	Appendix C-PCB (5)	
				Conewago Creek	Appendix E-Nutrients, Siltation, Suspended Solids (4a)	
				Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
				Lynch Run	Appendix E-Siltation (4a)	Cause Unknown, Turbidity (4a)
LOWER PAXTON TWP	PAG133643	Yes	TMDL Plan	Slotznick Run		Cause Unknown (5)
				Asylum Run	Appendix B-Pathogens (5)	Water/Flow Variability (4c)
				Spring Creek		Cause Unknown (5)
				Susquehanna River	Appendix C-PCB (5)	
				Paxton Creek TMDL	TMDL Plan-Siltation, Suspended Solids (4a)	
				Paxton Creek	Appendix B-Pathogens (5)	Other Habitat Alterations, Water/Flow Variability (4c)
				Nyes Run	Appendix B-Pathogens (5)	
				Unnamed Tributaries to Nyes Run		Flow Alterations, Other Habitat Alterations (4c)
				Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
LOWER SWATARA TWP	PAG133543	No		Susquehanna River	Appendix C-PCB (5)	
				Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
				Burd Run		Cause Unknown (5)
				Unnamed Tributaries to Sherman Creek	Appendix E-Siltation (5)	Other Habitat Alterations (4c)
				Unnamed Tributaries to Susquehanna River	Appendix E-Siltation (5)	Cause Unknown (5), Other Habitat Alterations (4c)
MIDDLE PAXTON TWP	PAG133688*	Yes	SP	Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
				Susquehanna River	Appendix C-PCB (5)	
MIDDLETOWN BORO	PAG133645	No		Unnamed Tributaries to Susquehanna River	Appendix E-Siltation (5)	Other Habitat Alterations (4c)
				Unnamed Tributaries to Sherman Creek	Appendix E-Siltation (5)	Other Habitat Alterations (4c)
				Susquehanna River	Appendix C-PCB (5)	
				Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
PAXTANG BORO	PAG133554	No		Susquehanna River	Appendix C-PCB (5)	
				Unnamed Tributaries to Spring Creek	Appendix E-Siltation (5)	
				Spring Creek		Cause Unknown (5)
				Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	

MS4 Name	Permit Number	HUC 12 Name	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)
Dauphin County				
LOWER PAXTON TWP	PAG133643	Beaver Creek	Nyes Run	Appendix B-Pathogens
		Laurel Run-Susquehanna River, Paxton Creek	Asylum Run, Paxton Creek, Paxton Creek TMDL	Appendix B-Pathogens, Appendix E-Siltation, Suspended Solids, TMDL Plan-Siltation, Suspended Solids
		Laurel Run-Susquehanna River, Paxton Creek, Spring Creek	Asylum Run, Chesapeake Bay Nutrients\Sediment, Paxton Creek, Paxton Creek TMDL	Appendix D-Siltation/Nutrients, Appendix E-Siltation, Suspended Solids, TMDL Plan-Siltation, Suspended Solids
		Laurel Run-Susquehanna River	Susquehanna River	Appendix C-PCB
		Beaver Creek, Swatara Creek-Susquehanna River	Chesapeake Bay Nutrients\Sediment	Appendix D-Siltation/Nutrients
LOWER SWATARA TWP	PAG133543	Laurel Run-Susquehanna River	Chesapeake Bay Nutrients\Sediment, Susquehanna River, Unnamed Tributaries to Sherman Creek, Unnamed Tributaries to Susquehanna River	Appendix C-PCB, Appendix D-Siltation/Nutrients, Appendix E-Siltation
		Swatara Creek-Susquehanna River	Chesapeake Bay Nutrients\Sediment	Appendix D-Siltation/Nutrients
MIDDLE PAXTON TWP	PAG133688	Clark Creek, Cove Creek-Susquehanna River, Fishing Creek-Dauphin County, Fishing Creek-Perry County, Laurel Run-Susquehanna River, Stony Creek	Chesapeake Bay Nutrients\Sediment	Appendix D-Siltation/Nutrients
		Cove Creek-Susquehanna River, Laurel Run-Susquehanna River	Susquehanna River	Appendix C-PCB
MIDDLETOWN BORO	PAG133645	Laurel Run-Susquehanna River	Chesapeake Bay Nutrients\Sediment, Susquehanna River, Unnamed Tributaries to Sherman Creek, Unnamed Tributaries to Susquehanna River	Appendix C-PCB, Appendix D-Siltation/Nutrients, Appendix E-Siltation
		Swatara Creek-Susquehanna River	Chesapeake Bay Nutrients\Sediment	Appendix D-Siltation/Nutrients
PAXTANG BORO	PAG133554	Laurel Run-Susquehanna River, Spring Creek	Chesapeake Bay Nutrients\Sediment, Unnamed Tributaries to Spring Creek	Appendix D-Siltation/Nutrients, Appendix E-Siltation
		Laurel Run-Susquehanna River	Susquehanna River	Appendix C-PCB
		Spring Creek	Unnamed Tributaries to Spring Creek	Appendix E-Siltation
PENBROOK BORO	PAG133555	Laurel Run-Susquehanna River	Susquehanna River	Appendix C-PCB
		Laurel Run-Susquehanna River, Paxton Creek	Asylum Run, Paxton Creek, Paxton Creek TMDL	Appendix B-Pathogens, TMDL Plan-Siltation, Suspended Solids
		Laurel Run-Susquehanna River, Paxton Creek, Spring Creek	Asylum Run, Chesapeake Bay Nutrients\Sediment, Paxton Creek, Paxton Creek TMDL, Unnamed Tributaries to Spring Creek	Appendix D-Siltation/Nutrients, Appendix E-Siltation, Suspended Solids, TMDL Plan-Siltation, Suspended Solids
ROYALTON BORO	PAG133641	Hartman Run-Susquehanna River	Chesapeake Bay Nutrients\Sediment, Susquehanna River	Appendix C-PCB, Appendix D-Siltation/Nutrients
		Laurel Run-Susquehanna River	Chesapeake Bay Nutrients\Sediment, Susquehanna River	Appendix C-PCB, Appendix D-Siltation/Nutrients
		Swatara Creek-Susquehanna River	Chesapeake Bay Nutrients\Sediment	Appendix D-Siltation/Nutrients
SOUTH HANOVER TWP	PAG133500	Beaver Creek	Unnamed Tributaries to Beaver Creek	Appendix E-Siltation
		Beaver Creek, Manada Creek, Swatara Creek-Susquehanna River	Chesapeake Bay Nutrients\Sediment, Unnamed Tributaries to Beaver Creek	Appendix D-Siltation/Nutrients, Appendix E-Siltation
		Manada Creek, Swatara Creek-Susquehanna River	Manada Creek	Appendix B-Pathogens
		Beaver Creek, Manada Creek, Swatara Creek-Susquehanna River	Chesapeake Bay Nutrients\Sediment, Unnamed Tributaries to Beaver Creek	Appendix D-Siltation/Nutrients, Appendix E-Siltation
STEELTON BORO	PAG133625	Laurel Run-Susquehanna River	Chesapeake Bay Nutrients\Sediment, Pennsylvania Canal, Susquehanna River, Unnamed Tributaries to Spring Creek, Unnamed Tributaries to Susquehanna River, Unnamed Tributaries to Swatara Creek	Appendix C-PCB, Appendix D-Siltation/Nutrients, Appendix E-Siltation

APPENDIX D

Existing Pollutant Loading Calculations

Appendix D – Table 1A: Existing Pollutant Load Calculation Summary, CBPRP Planning Area

Planning Area	Urbanized Area*					Loading Rate TSS** (lb/ac/yr)		Total Load TSS (lb/yr)
	UA (acres)	% Imperv.	% Perv.	Imperv. (acres)	Perv. (acres)	Imperv.	Perv.	
Middletown Boro CBPRP	1,309	46%	54%	602.0	706.7	1999.14	299.62	1,415,227
Parsed Areas (State Roads)	64	n/a	n/a	0.0	0.0	1999.14	299.62	90,508
Parsed Areas (Properties)	75	46%	54%	31.4	36.9	1999.14	299.62	80,878
Parsed Areas (PAG-03)	0.96	46%	54%	0.4	0.5	1999.14	299.62	1,038
Parsed Areas (Direct Drainage)	387.9	46%	54%	178.4	209.5	1999.14	299.62	419,476
Existing BMPs	n/a	n/a	n/a	n/a	n/a	n/a	n/a	17,601
Adjusted Baseline Total	**781**							**805,727**

*PADEP - Statewide MS4 Land Cover Estimates
**PADEP PRP Instructions - Attachment B, Developed Land Loading Rates for PA Counties

Appendix D – Table 1B: Existing Pollutant Load Calculation Summary, Laurel Run Planning Area

Planning Area	Urbanized Area*					Loading Rate TSS** (lb/ac/yr)		Total Load TSS (lb/yr)
	UA (acres)	% Imperv.	% Perv.	Imperv. (acres)	Perv. (acres)	Imperv.	Perv.	
Laurel Run	176	46%	54%	81.0	95.1	1999.14	299.62	190,370
Parsed Areas (State Roads)	1.63	100%	0%	9.6	0.0	1999.14	299.62	3,268
Parsed Areas (Properties)	70.3	46%	54%	32.3	38.0	1999.14	299.62	76,012
Direct Drainage	38.6	46%	54%	39.7	46.5	1999.14	299.62	93,217
Existing BMPs	n/a	n/a	n/a	n/a	n/a	n/a	n/a	4,173
Adjusted Baseline Total	**66**							**13,700**

*PADEP - Statewide MS4 Land Cover Estimates
**PADEP PRP Instructions - Attachment B, Developed Land Loading Rates for PA Counties

Appendix D – Table 2A: Parsed Area Load Reductions - State Roadways (PennDOT), CBPRP Planning Area

Parsed Area (Roadway Name)	UA Length (ft)	UA Width (ft)	Road Surface Width (ft)	Urbanized Area					Loading Rate TSS* (lb/ac/yr)		Total Load TSS (lb/yr)
				UA (acres)	% Imperv.	% Perv.	Imperv. (acres)	Perv. (acres)	Imperv.	Perv.	
PA Turnpike	6,700	200	60	30.7	n/a	n/a	9.2	21.5	1999.14	299.62	24,901
Vine St	4,234.7	36	36	3.5	100%	0%	3.5	0.0	1999.14	299.62	6,993
E High St	2,180.7	40	40	2.0	100%	0%	2.0	0.0	1999.14	299.62	4,001
E Main St	6,735.1	42	42	6.5	100%	0%	6.5	0.0	1999.14	299.62	12,976
Adelia St	2,552.4	42	42	2.5	100%	0%	2.5	0.0	1999.14	299.62	4,918
Emaus St	3615	42	42	3.5	100%	0%	3.5	0.0	1999.14	299.62	6,965
S/N Union St	9,835.5	38	38	8.6	100%	0%	8.6	0.0	1999.14	299.62	17,145
Old Canal St	240.5	34	34	0.2	100%	0%	0.2	0.0	1999.14	299.62	375
Airport Dr	1438	36	36	1.2	100%	0%	1.2	0.0	1999.14	299.62	2,375
Ann St	2,790.1	36	36	2.3	100%	0%	2.3	0.0	1999.14	299.62	4,608
Wood St	825.2	38	38	0.7	100%	0%	0.7	0.0	1999.14	299.62	1,439
N Race St	2,597.5	32	32	1.9	100%	0%	1.9	0.0	1999.14	299.62	3,813
Total				**63.6**			**42.1**	**21.5**			**90,509**

*PADEP PRP Instructions - Attachment B, Developed Land Loading Rates for PA Counties

Appendix D – Table 2B: Parsed Area Load Reductions - State Roadways (PennDOT), Laurel Run Planning Area

Parsed Areas	Urbanized Area							Loading Rate TSS* (lbs/ac/yr)		Total Load TSS (lbs/yr)
	UA (acres)	Length (ft)	Width (ft)	% Imperv.	% Perv.	Imperv. (acres)	Perv. (acres)	Imperv.	Perv.	
Airport Drive	1.2	1,738	36	100%	0%	1.2	0.0	1999.14	299.62	2,375
Ann St	0.4	541	36	100%	0%	0.4	0.0	1944.85	308.31	893
Total	**1.6**					**1.6**				**3,268**

*PADEP PRP Instructions - Attachment B, Developed Land Loading Rates for PA Counties

Appendix D – Table 3A: Parsed Area Load Reductions – Private Properties, CBPRP Planning Area

Parsed Areas	Urbanized Area*					Loading Rate TSS** (lb/ac/yr)		Total Load TSS (lb/yr)
	UA (acres)	% Imperv.	% Perv.	Imperv. (acres)	Perv. (acres)	Imperv.	Perv.	
Susquehanna Regional Airport	68.3	46%	54%	32.4	38.01	1999.14	299.62	73,849
Penn State Harrisburg	6.5	46%	54%	2.99	3.51	1999.14	299.62	7,029
Total	**74.8**							**80,878**

* PADEP - Statewide MS4 Land Cover Estimates

**PADEP PRP Instructions - Attachment B, Developed Land Loading Rates for PA Counties

Appendix D – Table 3B: Parsed Area Load Reductions – Private Properties, Laurel Run Planning Area

Parsed Areas	Urbanized Area*					Loading Rate TSS** (lb/ac/yr)		Total Load TSS (lb/yr)
	UA (acres)	% Imperv.	% Pervious	Imperv. (acres)	Pervious (acres)	Imperv.	Pervious	
Airport	68.3	46%	54%	32.3794	38.0106	1999.14	299.62	73,849
Penn State Harrisburg	2.0	46%	54%	0.92	1.08	1999.14	299.62	2,163
Total	**70.3**							**76,012**

* PADEP - Statewide MS4 Land Cover Estimates

**PADEP PRP Instructions - Attachment B, Developed Land Loading Rates for PA Counties

Appendix D - Table 4: Parsed Area Load Reductions - PAG-03 Discharge of Stormwater Associated with Industrial Activities,

Site*	Permit Date	Site Address	Urbanized Area**					Loading Rate TSS*** (lbs/ac/yr)		Total Load TSS (lbs/yr)
			Acres	% Imperv.	% Perv.	Imperv. (acres)	Perv. (acres)	Imperv.	Perv.	
First Student Inc No 20576	11/19/15	461 Spruce St Middletown, PA 17057-1942	0.96	54%	46%	0.52	0.44	1944.85	308.31	1,829
Total										**1,829**

*As listed on EFACTS (6/2017)

**PADEP - Statewide MS4 Land Cover Estimates

***PADEP PRP Instructions - Attachment B, Developed Land Loading Rates for PA Counties

Appendix D – Table 6: Parsed Area Load Reductions – Direct Discharge Areas by Planning Area

Planning Area	Urbanized Area*					Loading Rate TSS** (lbs/ac/yr)		Total Load TSS (lbs/yr)
	UA (acres)	% Imperv.	% Perv.	Imperv. (acres)	Perv. (acres)	Imperv.	Perv.	
Laurel Run PRP	38.6	46%	54%	39.5	46.5	1999.14	299.62	93,217
CBPRP	387.9	46%	54%	178.4	209.5	1999.14	299.62	419,475

*PADEP - Statewide MS4 Land Cover Estimates

**PADEP PRP Instructions - Attachment B, Developed Land Loading Rates for PA Counties

Appendix D – Table 7: Baseload Reduction Documentation - Previously Installed BMPs

Map ID	BMP Type	Location	Plan Date	Address	Lat	Long	Planning Area	Project Area (acres)	Drainage Area Characteristics				Loading Rate TSS** (lbs/ac/yr)		Total Load TSS (lbs/yr)	BMP Effectiveness ***	Pollutant Load Reduction TSS (lb/yr)
									% Imperv.	Imperv. (acres)	% Perv.	Perv. (acres)	Imperv.	Perv.			
Ex-1	Underground Detention	Westporte Center	4/25/2011	North Wood St at Nissley St, Middletown	40.196875	-76.736186	CBPRP	13.939	46%	54%	6.41	7.53	1999.14	299.62	15,073.6	60%	9,044
Ex-2	Biofiltration Basin	AutoZone #6430	06/10/205	East Main St, Middletown	40.201029	-76.723084	CBPRP	0.81	46%	54%	0.37	0.43	1999.14	299.62	870.5	95%	827
See Attached Map	Removed Impervious Area	Susquehanna St Properties	2013	Few Ave	40.205555	-76.718266	CBPRP	2.09	100%	0%	2.09	0.00	1999.14	299.62	4,173	n/a	4,173
See Attached Map	Removed Impervious Area	Few Ave	2013	Susquehanna St	40.187807	-76.737832	CBPRP/ Laurel Run	1.78	100%	0%	1.78	0.00	1999.14	299.62	3,557	100%	3,557
Total																	**17,601**

*Plan on file in municipal office
**PADEP - Statewide MS4 Land Cover Estimates
***PADEP PRP Instructions - Attachment B, Developed Land Loading Rates for PA Counties

IMPERVIOUS AREA = 90,920 SQ. FT

GRAPHIC SCALE

200' 100' 0' 200'

SCALE: 1"= 200'

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MIDDLETOWN BOROUGH

60 W. EMAUS STREET

MIDDLETOWN, PA 17057

(717) 902-0706

PROPERTY LOCATIONS

FOR

FEMA HAZARD MITIGATION HOME DEMOLITION

MIDDLETOWN BOROUGH DAUPHIN COUNTY PENNSYLVANIA

PROJ. MGR. –	SMF
DESIGN–	EGL
CADD–	PMF
CHECKED–	EGL
SCALE–	1" = 200'
DATE–	JULY 2013

DRAWING NO.

EXH-1

SHEET NO.

1 OF **2**

PROJECT R000516.0431

IMPERVIOUS AREA = 77,506 SQ. FT

GRAPHIC SCALE

200' 100' 0' 200'

SCALE: 1"= 200'

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FEMA HAZARD MITIGATION HOME DEMOLITION

MIDDLETOWN BOROUGH DAUPHIN COUNTY PENNSYLVANIA

PROJ. MGR. –	SMF
DESIGN–	EGL
CADD–	PMF
CHECKED–	EGL
SCALE–	1" = 200'
DATE–	JULY 2013

DRAWING NO.

EXH-2

SHEET NO.

2 OF **2**

PROJECT R000516.0431

APPENDIX E

Proposed BMP Pollutant Load Reduction Calculations

Appendix E – Table 1: Proposed BMPs

Site	BMP ID	BMP Type	Planning Area	Lat	Long	Drainage Area (acres)	Length (ft)	Drainage Area Characteristics				Loading Rate TSS* (lbs/ac/yr)		Total Load TSS (lbs/yr)	BMP Effectiveness **	Pollutant Load Reduction TSS (lb/yr)
								% Imperv.	Imperv. (acres)	% Perv.	Perv. (acres)	Imperv.	Perv.			
Hoffer Park	BMP-1	Bioretention	CBPRP	40.193040	-76.721918	77	300	46%	35.42	54%	41.58	1999.14	299.62	83,268	90%	74,941
		Stream Restoration				n/a	100	n/a	n/a	n/a	n/a	n/a	n/a	n/a	44.88 lb/ft	4,488
Susquehanna Street Park	BMP-2	Infiltration	CBPRP/Laurel Run	40.186689	-76.735464	1.8	n/a	46%	0.82	54%	0.97	1999.4	299.62	1,947	95%	1,849
Total																**81,278**

*PADEP - Statewide MS4 Land Cover Estimates

**PADEP PRP Instructions - Attachment B, Developed Land Loading Rates for PA Counties