



**WESTTOWN TOWNSHIP**  
*Chester County, Pennsylvania, United States*

# **Goose Creek TMDL and Pollutant Reduction Plan**

**for Plum Run, Radley Run, Brandywine Creek,  
Chester Creek, East Branch Chester Creek,  
Hunters Run, Ridley Creek**

**June 9, 2017**

**Prepared For:**

**Westtown Township**  
Chester County, PA  
1039 Wilmington Pike  
West Chester, PA 19382

**Prepared By:**



**CEDARVILLE**  
**Engineering Group, LLC**

Sustaining Communities by Design

1033 South Hanover Street, Suite 300  
Pottstown, PA 19465

152 E. High Street, Suite 410  
Pottstown, PA 19464

P. 610-705-4500 | F. 610-705-4900  
[www.cedarvilleeng.com](http://www.cedarvilleeng.com)

 @CEDARVILLE\_eng

 [facebook.com/cedarvilleeng](https://facebook.com/cedarvilleeng)

 [cedarville-engineering-group-llc](https://cedarville-engineering-group-llc)

## Table of Contents

<b>1.0 Purpose and Scope .....</b>	<b>1</b>
<b>2.0 Permit Requirements .....</b>	<b>1</b>
<b>3.0 Background/Setting .....</b>	<b>3</b>
3.1 Plum Run .....	4
3.2 Radley Run.....	5
3.3 Brandywine Creek.....	5
3.4 Chester Creek.....	6
3.5 Goose Creek (TMDL) .....	6
3.6 East Branch Chester Creek.....	7
3.7 Hunters Run .....	7
3.8 Ridley Creek .....	7
<b>4.0 Pollutant Reduction .....</b>	<b>8</b>
4.1 Public Participation .....	8
4.2 Storm Sewersheds/Planning Area.....	8
4.3 Pollutants of Concern .....	9
4.4 Existing Pollutant Loading.....	10
4.5 Proposed Best Management Practices (BMPs) .....	12
4.6 Funding Mechanisms.....	16
4.7 Operations and Maintenance.....	17
<b>5.0 Conclusion .....</b>	<b>18</b>
<b>6.0 Definitions.....</b>	<b>19</b>

<b>Appendix A Public Comment and Responses</b>	
<b>Appendix B Storm Sewershed Acreage by Outfall</b>	
<b>Appendix C Developed Land Loading Rates for PA Counties</b>	
<b>Appendix D Supporting Calculations</b>	
<b>Appendix E Proposed BMP Maps</b>	
<b>Appendix F Storm Sewershed/Planning Area Map</b>	
<b>Appendix G Land Cover Map</b>	

## 1.0 Purpose and Scope

Westtown Township is required to develop and implement a Total Maximum Daily Load (TMDL) Plan for phosphorous for Municipal Separate Storm Sewer System (MS4) discharges to Goose Creek and a Pollutant Reduction Plan (PRP) for sediment for MS4 discharges to Plum Run, Radley Run, Brandywine Creek, Chester Creek, East Branch Chester Creek, Hunters Run, and Ridley Creek. These plans are required as part of the 2018 National Pollutant Discharge Elimination System (NPDES) MS4 Individual Permit application to the Pennsylvania Department of Environmental Protection (PA DEP).

This document will serve as the single plan for both the TMDL and PRP. This plan has been prepared based on the best and most current guidance made available by PA DEP. Definitions of relevant regulatory terms are provided in Section 6.0.

## 2.0 Permit Requirements

To develop the Township's TMDL and Pollutant Reduction Plans, it is important to have an understanding of the Township's requirements and these are summarized in the following paragraphs.

### Goose Creek TMDL

Goose Creek has a TMDL established by the United States Environmental Protection Agency (EPA) for total phosphorous (TP), documented in a report entitled "Nutrient Total Maximum Daily Load in Goose Creek Watershed, Pennsylvania", dated June 30, 2008. The report cites Westtown Township's existing TP load as 1.40 lb/day and allocates a TP load of 0.64 lb/day, which is a required reduction of 53.9 percent. Table 1 below lists each MS4 in the Goose Creek watershed and the corresponding TMDL requirements, taken from Table 3-3 of the Goose Creek TMDL report entitled "Land Based Non-Point TP Load in the Goose Creek Watershed by MS4 Area." This TMDL was developed based on the 2001 National Land Cover Dataset, but does not cite pollutant loading rates by land cover.

**Table 1: Goose Creek TMDL MS4 Allocations and Required Reductions**

MS4 Permit Holder	Area by MS4 (acres)	Existing TP Load (lb/day)	Allocated TP Load (lb/day)	Required Reduction
West Goshen Township	1,488	1.16	0.54	53.9%
West Chester Borough	310	0.24	0.11	53.9%
Westtown Township	1,791	1.40	0.64	53.9%
Thornbury Township (Chester County)	772	0.60	0.28	53.9%
Thornbury Township (Delaware County)	113	0.09	0.04	53.9%
<b>TOTAL:</b>	<b>4,474</b>	<b>3.49</b>	<b>1.61</b>	<b>53.9%</b>

The Township's Goose Creek TMDL Plan must illustrate how the following two (2) objectives will be achieved through the implementation of projects or Best Management Practices (BMPs):

**1) Short-term TP reduction**

Per the PA DEP TMDL Plan Instructions (3800-PM-BCW0200d Rev. 3/2017), "short-term reduction" is defined as a plan for reducing TP by five (5) percent over the five (5) year permit term (March 16, 2018 to March 15, 2023), if the wasteload allocations (WLAs) or overall required percent reduction of 53.9 percent cannot be achieved during this timeframe.

**2) Long-term TP reduction**

"Long-term reduction" is defined by the PA DEP TMDL Plan Instructions as a general plan describing how WLAs or overall required percent reductions will ultimately be achieved.

Goose Creek drains to Chester Creek, which is listed as impaired for sediment. By complying with the Goose Creek TMDL requirements, the Township will simultaneously work towards achieving the required sediment reduction for Chester Creek, which is further described below.

**PRP for Discharges to Waters Impaired for Sediment**

Westtown has MS4 discharges or "outfalls" to Plum Run, Radley Run, Brandywine Creek, Chester Creek, East Branch Chester Creek, Hunters Run, and Ridley Creek, which are all listed by the 2014 Pennsylvania Integrated Water Quality Monitoring and Assessment Report (Integrated Report) as impaired for siltation (i.e. sediment) and highlighted in Table 2 below. Therefore, in addition to the Goose Creek TMDL requirement, Westtown Township is required by the PA DEP and Environmental Protection Agency (EPA) to reduce the sediment loading to Plum Run, Radley Run, Brandywine Creek, Chester Creek, East Branch Chester Creek, Hunters Run, and Ridley Creek by ten (10) percent over the five (5) year permit term (March 16, 2018 to March 15, 2023) by implementing projects or Best Management Practices (BMPs).

Westtown has no outfalls that discharge directly to Brandywine Creek. Brandywine Creek is listed because the Township has outfalls that discharge to Plum Run and Radley Run, which ultimately flow into Brandywine Creek, and the main stem of the Brandywine Creek is listed as impaired for sediment within five (5) miles downstream of the Township's most downstream outfall.

Table 2: PA DEP MS4 Requirements Table (Municipal) Excerpt (last revised May 9, 2017)

MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)	Other Cause(s) of Impairment
Westtown Twp, Chester County	PA1130528	Yes	TMDL Plan, SP, IP	Ridley Creek	Appendix E-Siltation (5)	Cause Unknown (5), Water/Flow Variability (4c)
				Radley Run	Appendix E-Siltation (4a)	Water Flow Variability (4c)
				Brandywine Creek	Appendix E-Siltation (4a)	
				Hunters Run	Appendix E-Siltation (5)	Cause Unknown (5), Water/Flow Variability (4c)
				Chester Creek	Appendix B-Pathogens (5), Appendix E-Siltation (5)	Cause Unknown (5), Flow Alterations, Other Habitat Alterations, Water Flow Variability (4c)
				East Branch Chester Creek	Appendix E-Siltation (5)	Cause Unknown (5), Other Habitat Alterations, Water/Flow Variability (4c)
				Goose Creek TMDL	TMDL Plan-Nutrients (4a)	Cause Unknown (4a)
				Plum Run	Appendix E-Siltation (4a)	Water/Flow Variability (4c)

### 3.0 Background/Setting

Westtown Township comprises approximately 8.8 square miles located near the eastern boundary of Chester County, in southeast Pennsylvania (Figure 1). The 2010 Urbanized Area (U.S. Census Bureau) covers the entire land area of the Township.

Figure 1: Westtown Township Location Map

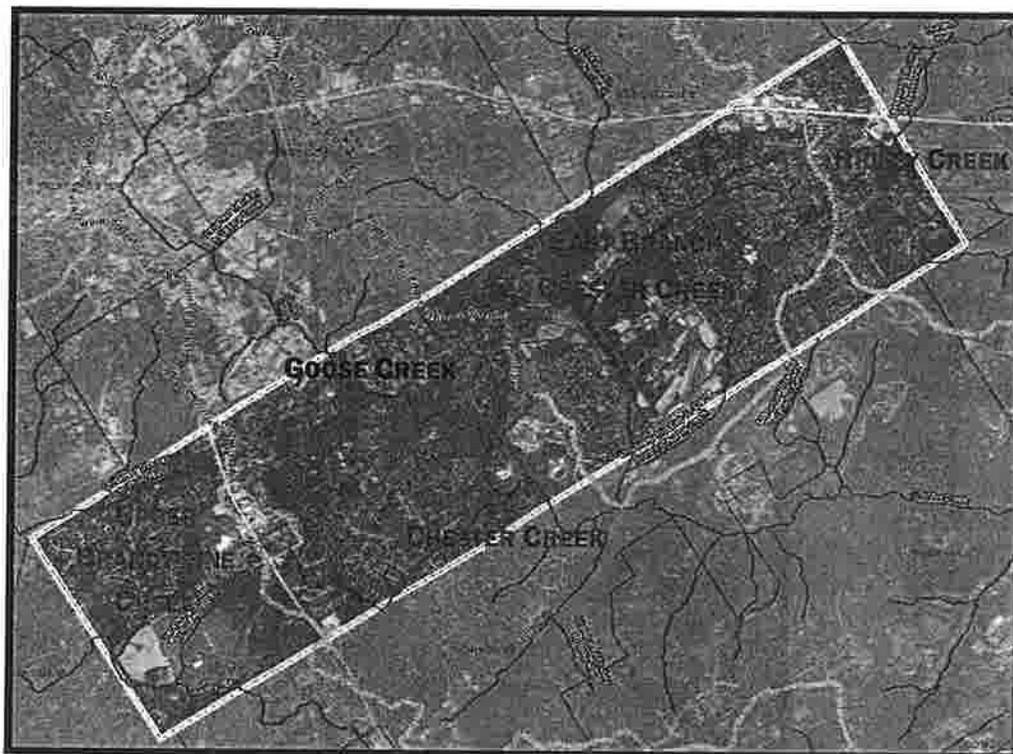


Figure 2 below displays a map of the streams that cross Westtown Township. Stream segments colored red indicate impaired streams. All streams mapped in Westtown and the surrounding communities are listed as impaired. The purple dashed line delineates the Goose Creek watershed and the turquoise dashed lines delineate U.S. Geological Survey (USGS) National Hydrography Dataset (NHD) Hydrologic Unit Code (HUC)-12 boundaries. From southwest to northeast, HUC-12s within Westtown include the following:

- Upper Brandywine Creek (contains Plum Run, Radley Run, and Brandywine Creek)
- Chester Creek (contains Goose Creek TMDL and Chester Creek)
- East Branch Chester Creek
- Ridley Creek (contains Hunters Run and Ridley Creek)

Westtown Township has 144 MS4 outfalls. These MS4 outfalls discharge to the sediment-impaired Plum Run, Radley Run, Brandywine Creek, Chester Creek (includes the 28 outfalls that discharge to Goose Creek), East Branch Chester Creek, Hunters Run, and Ridley Creek. A total of twenty-eight (28) of these 144 MS4 outfalls discharge to Goose Creek.

**Figure 2: Westtown Township Impaired Streams**



### **3.1 Plum Run**

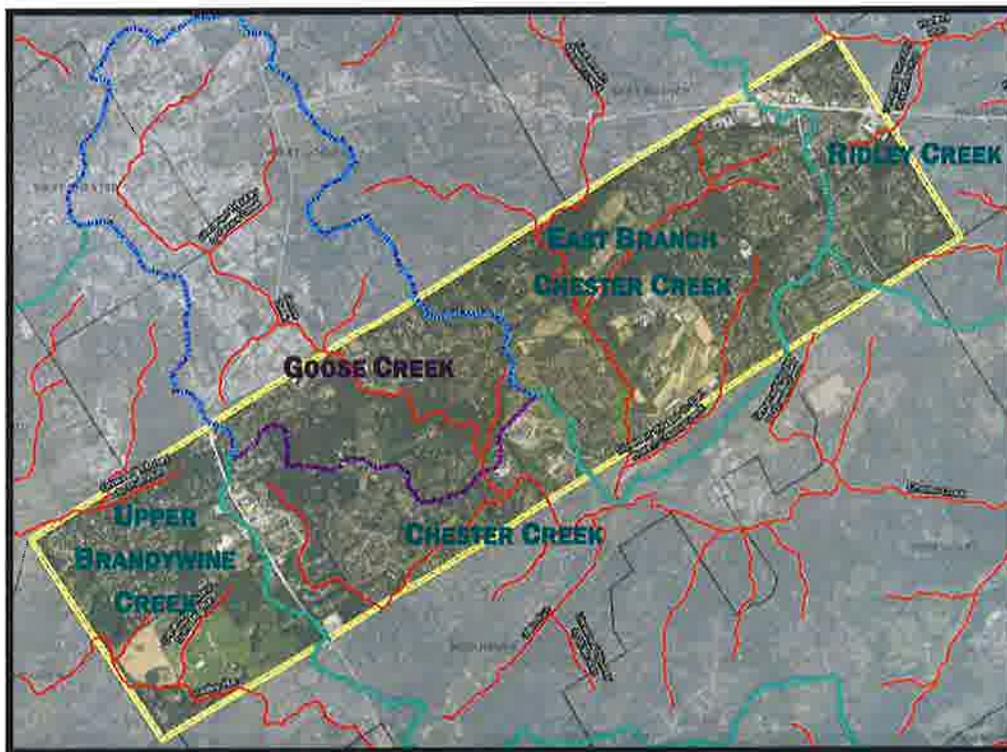
An unnamed tributary (UNT) to Plum Run originates in the western portion of Westtown Township and flows in a southwesterly direction where it meets another tributary that enters the main stem of Plum Run west of the Township boundary in East Bradford Township. The UNT tributaries are listed as

Figure 2 below displays a map of the streams that cross Westtown Township. Stream segments colored red indicate impaired streams. All streams mapped in Westtown and the surrounding communities are listed as impaired. The purple dashed line delineates the Goose Creek watershed and the turquoise dashed lines delineate U.S. Geological Survey (USGS) National Hydrography Dataset (NHD) Hydrologic Unit Code (HUC)-12 boundaries. From southwest to northeast, HUC-12s within Westtown include the following:

- Upper Brandywine Creek (contains Plum Run, Radley Run, and Brandywine Creek)
- Chester Creek (contains Goose Creek TMDL and Chester Creek)
- East Branch Chester Creek
- Ridley Creek (contains Hunters Run and Ridley Creek)

Westtown Township has 144 MS4 outfalls. These MS4 outfalls discharge to the sediment-impaired Plum Run, Radley Run, Brandywine Creek, Chester Creek (includes the 28 outfalls that discharge to Goose Creek), East Branch Chester Creek, Hunters Run, and Ridley Creek. A total of twenty-eight (28) of these 144 MS4 outfalls discharge to Goose Creek.

**Figure 2: Westtown Township Impaired Streams**



### **3.1 Plum Run**

An unnamed tributary (UNT) to Plum Run originates in the western portion of Westtown Township and flows in a southwesterly direction where it meets another tributary that enters the main stem of Plum Run west of the Township boundary in East Bradford Township. The UNT tributaries are listed as



impaired for sediment and water flow variability. Table 3 below lists the impairment information for the UNTs from the 2014 Integrated Report.

There are thirteen (13) MS4 outfalls that discharge to the UNTs to Plum Run. Plum Run discharges to Brandywine Creek and is part of the Upper Brandywine Creek HUC12. Refer to Appendices for MS4 mapping.

**Table 3: 2014 Integrated Report – Plum Run**

Impairment Cause	Impairment Source	Category	Assessed Use	Date Listed
Water/Flow Variability	Urban Runoff/Storm Sewers	4c	Aquatic Life	1998
Siltation	Urban Runoff/Storm Sewers	4a	Aquatic Life	1998
Siltation	Agriculture	4a	Aquatic Life	1998

### 3.2 Radley Run

Radley Run flows in a northwesterly direction through the southwestern corner of Westtown Township. Two (2) UNTs originate in the west-central portion of the Township and flow in a southwesterly direction into Radley Run within the boundaries of the Township. Both Radley Run and its tributaries are listed as impaired for sediment and water/flow variability. Table 4 below lists the impairment information from the 2014 Integrated Report.

There are nine (9) MS4 outfalls that discharge to Radley Run and its UNTs. Radley Run discharges to Brandywine Creek and is part of the Upper Brandywine Creek HUC12. Refer to Appendices for MS4 mapping.

**Table 4: 2014 Integrated Report – Radley Run**

Impairment Cause	Impairment Source	Category	Assessed Use	Date Listed
Water/Flow Variability	Urban Runoff/Storm Sewers	4c	Aquatic Life	2010
Siltation	Agriculture, Urban Runoff/Storm Sewers	4a	Aquatic Life	1998

### 3.3 Brandywine Creek

Brandywine Creek lies outside of the township to the west. Radley Run and UNTs to Plum Run flow through Westtown Township into Brandywine Creek, which is listed as impaired for sediment. Table 5 below lists the impairment information for Brandywine Creek from the 2014 Integrated Report.

No MS4 outfalls discharge directly to the Brandywine Creek; however, Radley Run and Plum Run both flow into the Brandywine Creek. Brandywine Creek is listed as impaired for sediment. Refer to Appendices for MS4 mapping.

**Table 5: 2014 Integrated Report – Brandywine Creek**

Impairment Cause	Impairment Source	Category	Assessed Use	Date Listed
Siltation (sediment)	Agriculture, Urban Runoff/Storm Sewers	4a	Aquatic Life	2010

### 3.4 Chester Creek

Chester Creek originates in the western portion of the Township where it flows in a south-southeasterly direction to the southern boundary of the Township, where it turns and begins flowing in a northeasterly direction. Goose Creek flows into Chester Creek before it turns south-southeast again and continues to flow out of the Township in a south-southeasterly direction. There are outfalls that drain to Chester Creek in the south-eastern half of the Township. Chester Creek is listed as impaired for sediment, other habitat alterations, water/flow variability and cause unknown. Table 6 below lists the impairment information from the 2014 Integrated Report.

There are thirty-five (35) MS4 outfalls that discharge to Chester Creek listed as impaired for sediment. Refer to Appendices for MS4 mapping.

**Table 6: 2014 Integrated Report – Chester Creek**

Impairment Cause	Impairment Source	Category	Assessed Use	Date Listed
Cause Unknown	Urban Runoff/Storm Sewers	4a	Aquatic Life	2014
Siltation	Urban Runoff/Storm Sewers	5	Aquatic Life	2014
Other Habitat Alterations	Habitat Modifications	4c	Aquatic Life	2014
Water/Flow Variability	Urban Runoff/Storm Sewers	4c	Aquatic Life	2014

### 3.5 Goose Creek (TMDL)

Goose Creek flows through the center of the Township in a southeasterly direction until it meets Chester Creek at the southern boundary of the Township. Goose Creek roughly parallels the railroad that transects the Township. Table 7 below lists the impairment information from the 2014 Integrated Report.

There are twenty-seven (27) MS4 outfalls that discharge to Goose Creek. Goose Creek has a TMDL for phosphorous as referenced in Section 2.0. It is also listed as impaired for sediment. Refer to Appendices for MS4 mapping.

**Table 7: 2014 Integrated Report – East Branch Chester Creek**

Impairment Cause	Impairment Source	Category	Assessed Use	Date Listed
Water/Flow Variability	Urban Runoff/Storm Sewers	4c	Aquatic Life	2014
Other Habitat Alterations	Habitat Modification	4c	Aquatic Life	2014
Cause Unknown	Urban Runoff/Storm Sewers	5	Aquatic Life	2014
Siltation	Urban Runoff/Storm Sewers	5	Aquatic Life	2014

### 3.6 East Branch Chester Creek

The East Branch Chester Creek flows through the center of the Township (east of Goose Creek), roughly paralleling the western side of Westtown Road. There are multiple unnamed tributaries to East Branch Chester Creek within the Township, all of which are listed as impaired for sediment, water/flow variability, other habitat alterations, and cause unknown. Table 8 below lists the impairment information from the 2014 Integrated Report.

There are forty-nine (49) MS4 outfalls that discharge to East Branch Chester Creek and its UNTs that are listed as impaired for sediment. Refer to Appendices for MS4 mapping.

**Table 8: 2014 Integrated Report – East Branch Chester Creek**

Impairment Cause	Impairment Source	Category	Assessed Use	Date Listed
Cause Unknown	Urban Runoff/Storm Sewers	5	Aquatic Life	2014
Other Habitat Alterations	Habitat Modification	4c	Aquatic Life	2014
Siltation	Urban Runoff/Storm Sewers	5	Aquatic Life	2014
Water/Flow Variability	Urban Runoff/Storm Sewers	4c	Aquatic Life	2014

### 3.7 Hunters Run

Hunters Run flows across the northeastern corner of the Township in a southeasterly direction. An unnamed tributary to Hunters Run originates in the eastern portion of the Township and flows in an east-northeasterly direction, eventually into Hunters Run outside of the Township boundary to the east. Hunters Run and its tributary are listed as impaired for sediment. This stream was listed as impaired for other water/flow variability, siltation and cause unknown in 2012. Table 9 below lists the impairment information from the 2014 Integrated Report.

There are ten (10) MS4 outfalls that discharge to Hunters Run and its UNT. Refer to Appendices for MS4 mapping.

**Table 9: 2014 Integrated Report – Hunters Run**

Impairment Cause	Impairment Source	Category	Assessed Use	Date Listed
Cause Unknown	Urban Runoff/Storm Sewers	5	Aquatic Life	2012
Water/Flow Variability	Urban Runoff/Storm Sewers	4c	Aquatic Life	2012
Siltation	Urban Runoff/Storm Sewers	5	Aquatic Life	2012

### 3.8 Ridley Creek

An unnamed tributary to Ridley Creek originates in the southeastern corner of the Township and flows in an easterly direction out of the Township eventually into Ridley Creek. This tributary is listed as impaired for sediment, water/flow variability, and cause unknown. Table 10 below lists the impairment information for the UNT from the 2014 Integrated Report.

There are two (2) MS4 outfalls that discharges to the UNT to Ridley Creek listed as impaired for sediment. Refer to Appendices for MS4 mapping.

**Table 10: 2014 Integrated Report – Ridley Creek**

Impairment Cause	Impairment Source	Category	Assessed Use	Date Listed
Cause Unknown	Urban Runoff/Storm Sewers	5	Aquatic Life	2012
Water/Flow Variability	Urban Runoff/Storm Sewers	4c	Aquatic Life	2012
Siltation	Urban Runoff/Storm Sewers	5	Aquatic Life	2012

## 4.0 Pollutant Reduction

Per the MS4 permit and PRP Instructions document (3800-PM-BCW0100k Rev. 3/2017), the following sections are addressed below: Public Participation, Storm Sewersheds, Pollutants of Concern, Existing Sediment Loading, Proposed Best Management Practices (BMPs), Funding Mechanisms, and Operations and Maintenance.

### 4.1 Public Participation

Westtown Township made this plan available to the public to review and provide comment for thirty (30) days. A copy of the public notice published in the Daily Local News is in Appendix A. All timely comments received and a record of consideration of these comments are in Appendix A.

The PRP was presented at the Board of Supervisors workshop meeting on June 5, 2017, and a regular Board of Supervisors meeting on June 19, 2017. Comments will be accepted at this meeting from any interested members of the public.

### 4.2 Storm Sewersheds/Planning Area

Storm sewersheds, the areas which drain to each of the 144 outfalls, were manually delineated in ArcMap 10.5 using two (2) foot topographic contours from the 2006-2008 PAMAP Program data published by the Pennsylvania Department of Conservation and Natural Resources (DCNR), while referencing Google Street View and multiple sources of aerial imagery.

“Parsing” provides an opportunity to eliminate areas within storm sewersheds from the existing pollutant load that do not drain to the MS4 and areas that are already covered by an NPDES permit for the control of stormwater. One (1) storm sewershed extends outside of the municipal boundary and was parsed out of the overall planning area. The drainage areas to existing, and/or proposed, BMPs located outside of the storm sewersheds were added to the overall planning area. Therefore, the storm sewersheds acreage does not equal the planning area acreage. The total storm sewershed area is 1,029.86 acres. The total (PRP) Planning Area acreage is 1,064.97 acres. A list of outfalls and the associated storm sewershed acreage that drain to each outfall is in Appendix B. Also listed is the receiving water for each outfall and United States Geological Survey (USGS) National

Hydrography Dataset (NHD) Hydrologic Unit Code (HUC) 12 watershed. A map illustrating the planning areas can be found in Appendix F.

Per the “Pollutant Aggregation Suggestions for MS4 Requirements Table Instructions” (dated April 4, 2017) and the “Pollutant Aggregation Suggestions for MS4 Requirements Table (Municipal)” (revised May 9, 2017), Westtown Township may achieve the ten (10) percent sediment pollutant reduction in the following aggregated Planning Areas, as opposed to a 10 percent reduction in the Planning Areas for each receiving impaired surface water.

**Table 11: Pollutant Aggregation Suggestions for MS4 Requirements Table (Municipal) Excerpt**

MS4 Name	NPDES ID	HUC-12	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)
Westtown Twp, Chester County	PAI130528	Middle Brandywine Creek, Upper Brandywine Creek	Brandywine Creek, Plum Run, Radley Run	Appendix E-Siltation
		Chester Creek	Chester Creek, Goose Creek TMDL	Appendix B-Pathogens, TMDL Plan-Nutrients
		Chester Creek, East Branch Chester Creek, Ridley Creek	Chester Creek, East Branch Chester Creek, Hunters Run, Ridley Creek	Appendix E-Siltation

To simplify planning and reporting efforts, from this point forward the report will reference the Middle Brandywine Creek/ Upper Brandywine Creek PRP Planning Area, the Chester Creek/East Branch Chester Creek/Ridley Creek PRP Planning Area, and the Goose Creek TMDL Planning Area (which is also contained within the Chester Creek/East Branch Chester Creek/Ridley Creek PRP Planning Area, since Goose Creek drains to Chester Creek). These Planning Areas comprise all 144 storm sewersheds.

### 4.3 Pollutants of Concern

Westtown Township is required to reduce total phosphorous loading for MS4 outfalls that discharge to Goose Creek per the TMDL. Additionally, for the PRPs, Westtown Township is required to reduce sediment loading for MS4 outfalls that discharge to waters impaired by sediment, which includes all receiving streams within the Township.

To meet the PRP requirements, a minimum of ten (10) percent sediment reduction over the five (5) year permit term has been demonstrated in this plan. Though not required, existing loading and BMP reduction calculations were also provided for phosphorous and nitrogen in Appendix D.

To meet the short and long term Goose Creek TMDL reduction objectives, the entire 53.9 percent total phosphorous reduction required has been demonstrated as being implemented over the five (5) year permit term in this plan.

#### 4.4 Existing Pollutant Loading

To determine existing sediment loading to Plum Run, Radley Run, Brandywine Creek, Chester Creek, East Branch Chester Creek, Hunters Run, and Ridley Creek, the general methodology described in the DEP guidance document entitled "Pollution Reduction Plan: A Methodology" was used. To provide a consistent calculation methodology across the Goose Creek TMDL and the PRP requirements, the total phosphorous allocation for Goose Creek was recalculated for the Goose Creek Planning Area per the same methodology. The short and long-term reduction objectives of the TMDL were then applied to the recalculated load.

Utilizing ArcGIS 10.5, 2011 National Land Cover Dataset (NLCD) data, the acreage of each land cover classification type within the Planning Area was calculated.

The aggregate National Land Cover Data (NLCD) statistics within the Planning Areas for each aggregation group is compiled in Table 12 below with a breakdown of the area by land cover classification type. Refer to Appendix H for the Land Cover Map.

**Table 12: NLCD 2011 Land Cover by PRP Planning Area**

PRP Planning Area/Aggregated HUC-12s	Aggregated Receiving Sediment-Impaired Surface Waters	NLCD 2011 Land Cover Classification within Planning Area	Area (acres)	Percent Impervious	Impervious Area (acres)	Pervious Area (acres)
Middle Brandywine Creek/ Upper Brandywine Creek	Brandywine Creek, Plum Run, Radley Run	Developed, Open Space	99.08	19	18.83	80.25
		Developed, Low Intensity	2.77	49	1.36	1.41
		Developed, Medium Intensity	0.36	79	0.28	0.08
		Developed, High Intensity		100		
		Deciduous Forest	10.75	0		10.75
		Evergreen Forest	1.93	0		1.93
		Mixed Forest	1.04	0		1.04
		Shrub/Scrub	9.67	0		9.67
		Hay/Pasture	24.49	0		24.49
		Cultivated Crop	5.92	0		5.92
		Woody Wetlands	0.96	0		0.96
<b>TOTAL:</b>			<b>156.97</b>		<b>20.47</b>	<b>136.50</b>
Chester Creek/East Branch Chester Creek/Ridley Creek	Chester Creek, East Branch Chester Creek, Hunters Run, Ridley Creek	Developed, Open Space	619.85	19	117.77	502.08
		Developed, Low Intensity	88.77	49	43.50	45.27
		Developed, Medium Intensity	8.21	79	6.49	1.72
		Developed, High Intensity	1.20	100	1.20	
		Deciduous Forest	125.48	0		125.48
		Evergreen Forest	4.67	0		4.67
		Mixed Forest	12.84	0		12.84
		Shrub/Scrub	24.34	0		24.34
		Hay/Pasture	21.59	0		21.59
		Cultivated Crop	0.53	0		0.53
		Woody Wetlands	0.18	0		0.18
		Emergent Herbaceous Wetland	0.34			0.34
<b>TOTAL:</b>			<b>908.00</b>		<b>168.95</b>	<b>739.05</b>

The Goose Creek TMDL Planning Area is located within and included in the Chester Creek/East Branch Chester Creek/Ridley Creek PRP Planning Area. However, because Goose Creek has a separate TMDL requirement, this information is provided separately in Table 13 below.

**Table 13: NLCD 2011 Land Cover within Goose Creek TMDL Planning Area**

TMDL Planning Area	NLCD 2011 Land Cover Classification within Planning Area	Area (acres)	Percent Impervious	Impervious Area (acres)	Pervious Area (acres)
Goose Creek	Developed, Open Space	148.91	19	28.29	120.62
	Developed, Low Intensity	17.98	49	8.81	9.17
	Developed, Medium Intensity	3.28	79	2.59	0.69
	Developed, High Intensity	0.67	100	0.67	
	Deciduous Forest	52.89	0		52.89
	Evergreen Forest	2.13	0		2.13
	Mixed Forest	1.16	0		1.16
	Shrub/Scrub	10.85	0		10.85
	Hay/Pasture	2.38	0		2.38
	Woody Wetlands	0.17	0		0.17
	<b>TOTAL:</b>	<b>240.42</b>		<b>40.36</b>	<b>200.06</b>

“Developed” land cover classifications were then converted to percent impervious coverage based on the NLCD 2011 definitions. The impervious percentages used are as follows:

- Developed, Open Space – 19% impervious
- Developed, Low Intensity – 49% impervious
- Developed, Medium Intensity – 79% impervious
- Developed, High Intensity – 100% impervious

All other land cover classifications were assumed to be 100 percent pervious. The “Developed Land Loading Rates for PA Counties” (Attachment B of the PRP Instructions) for Chester County were then applied for impervious developed and pervious developed land categories. This table is attached as Appendix C.

The existing PRP sediment loading is in Table 14 below. Please refer to Appendix D for supporting calculations. Calculations for phosphorous and nitrogen loading have also been provided, though not required. The recalculated total phosphorous loading for Goose Creek is in Table 15 below.

The existing sediment loading quantified from the Middle Brandywine Creek/Upper Brandywine Creek PRP Planning Area is 56,071.73 lbs/yr. The existing sediment loading quantified from the Chester Creek/East Branch Chester Creek/Ridley Creek PRP Planning Area is 391,045.52 lbs/yr. A more detailed breakdown is in the table below. Please refer to Appendix D for supporting calculations.

**Table 14: Existing Sediment Loading for PRP Planning Areas**

PRP Planning Area	Category	Area (ac)	TSS [Sediment] (lbs/yr)
Middle Brandywine Creek/ Upper Brandywine Creek	Impervious, Developed	20.47	30,802.85
	Pervious, Developed	136.50	25,268.88
<b>TOTAL:</b>		<b>156.97</b>	<b>56,071.73</b>
<b>Required 10% Sediment Reduction</b>			<b>5,607.17</b>
Chester Creek/East Branch Chester Creek/Ridley Creek	Impervious, Developed	168.95	254,232.58
	Pervious, Developed	739.05	136,812.94
<b>TOTAL:</b>		<b>908.00</b>	<b>391,045.52</b>
<b>Required 10% Sediment Reduction</b>			<b>39,104.55</b>

The existing (recalculated) total phosphorous loading for the Goose Creek TMDL is 130.95 lbs/yr and is provided separately in Table 15 below. Please refer to Appendix D for supporting calculations.

**Table 15: Existing Phosphorous Loading for Goose Creek TMDL Planning Area**

TMDL Planning Area	Category	Area (ac)	TP [Phosphorous] (lbs/yr)
Goose Creek	Impervious, Developed	40.36	58.93
	Pervious, Developed	200.06	72.02
<b>TOTAL:</b>		<b>240.42</b>	<b>130.95</b>
<b>Required Short-Term 5% Phosphorous Reduction</b>			<b>6.55</b>
<b>Required Long-Term 53.9% Phosphorous Reduction</b>			<b>70.58</b>

#### 4.5 Proposed Best Management Practices (BMPs)

Proposed BMP locations were identified by analyzing the most fiscally responsible solutions that will provide a water quality improvement and real-world benefit, while meeting the mandated pollutant reduction requirements. This analysis was performed in ArcMap 10.5 using aerial imagery, two (2)-foot topographic contours, and hydrologic data. Site visits were conducted to verify project viability and to collect information and measurements of existing BMPs.

Where possible, BMPs that treat a larger drainage area were selected to reduce the number of BMPs to be implemented. Existing BMPs on Township-owned property within the Planning Areas were assessed for retrofit. After those opportunities were exhausted, existing BMPs on homeowner's association (HOA)-owned property within the Planning Areas were assessed for retrofit. Lastly, new BMPs on Township-owned and HOA-owned property within the Planning Area were explored.

Pollutant reductions resulting from the proposed BMPs were quantified using the same methodology described above for existing sediment loading within the drainage area for each BMP, then applying reduction rates. Reductions from new BMPs (infiltration trenches and bioretention swale) were calculated using the efficiency rates specified in the NPDES Stormwater Discharges from Small MS4s BMP Effectiveness Values table (May 2016). Reductions from retrofits of existing BMPs were calculated using the methodology in the "Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Retrofit Projects" (revised January 20, 2015). Please refer to Appendix D for supporting calculations.

### TMDL and PRP Objectives

Westtown Township proposes to meet the entire Goose Creek TMDL total phosphorous reduction requirement of 53.9 percent through an existing BMP and by implementing a stream restoration project and two (2) basin retrofit projects over the next five (5) year permit term for the Goose Creek TMDL Planning Area. Because Goose Creek drains to Chester Creek, these BMPs will also satisfy the ten (10) percent sediment load reduction requirements within the Chester Creek/East Branch Chester Creek/Ridley Creek PRP Planning Area.

The Township will meet its ten (10) percent sediment load reduction requirements within the Middle Brandywine Creek/Upper Brandywine Creek PRP Planning Area through the implementation of a stream restoration project along Radley Run and its tributaries.

Maps of the proposed BMPs and the land cover within their drainage areas are in Appendix E. The BMP locations are also illustrated on the Storm Sewershed/Planning Area Map in Appendix F and the Land Cover Map in Appendix G.

### Pollutant Load Reductions through Proposed BMP Implementation

Phosphorous load reductions achieved through the implementation of the proposed BMPs in the Goose Creek TMDL Planning area are documented in Table 16.

**Table 16: Goose Creek TMDL Planning Area: Total Phosphorous Load Reductions from Proposed BMPs**

Timeline	BMP Name	Drainage Area (ac)	TP Reduction		
			lbs/yr	% Reduction	% of Required Reduction to meet 53.9%
Existing	Tyson Park Bioswale (installed 2015)	36.63	14.65	11	21
<b>SUB-TOTAL:</b>		<b>36.63</b>	<b>14.65</b>	<b>11%</b>	<b>21%</b>
2018-2023	Coventry Village Stream Restoration	600 L.F.	40.80	31	58
	Thorne Drive Basin Retrofit	19.86	9.02	7	13
	Sage Road Basin Retrofit	20.59	7.01	5	10
<b>SUB-TOTAL:</b>		<b>40.45</b>	<b>56.83</b>	<b>43%</b>	<b>81%</b>
<b>TOTAL:</b>		<b>77.08</b>	<b>71.48</b>	<b>55%</b>	<b>101%</b>

Sediment load reductions achieved through the implementation of the proposed BMPs in each PRP Planning Area are in Table 17 below. Because the Goose Creek TMDL Planning Area is contained within the Chester Creek/ East Branch Chester Creek/ Ridley Creek PRP Planning Area, these BMPs were counted towards the PRP sediment reduction requirements.

**Table 17: PRP Planning Areas: Sediment Load Reductions from Proposed BMPs**

PRP Planning Area	BMP Name	Drainage Area (ac)	TSS Reduction		
			lbs/yr	% Reduction	% of Required Reduction
Chester Creek/ East Branch Chester Creek/ Ridley Creek (contains Goose Creek TMDL Planning Area)	Coventry Village Stream Restoration	600 L.F.	26,928.00	7	71
	Thorne Drive Basin Retrofit	19.86	7,389.28	2	19
	Sage Road Basin Retrofit	20.59	5,716.42	2	15
<b>TOTAL:</b>		<b>40.45</b>	<b>40,033.70</b>	<b>11%</b>	<b>105%</b>
Middle Brandywine Creek/Upper Brandywine Creek	Radley Run Stream Restoration	815 L.F.	36,577.20	65%	652%
<b>TOTAL:</b>		<b>815 LF</b>	<b>36,577.20</b>	<b>65%</b>	<b>652%</b>

### Detailed BMP Descriptions

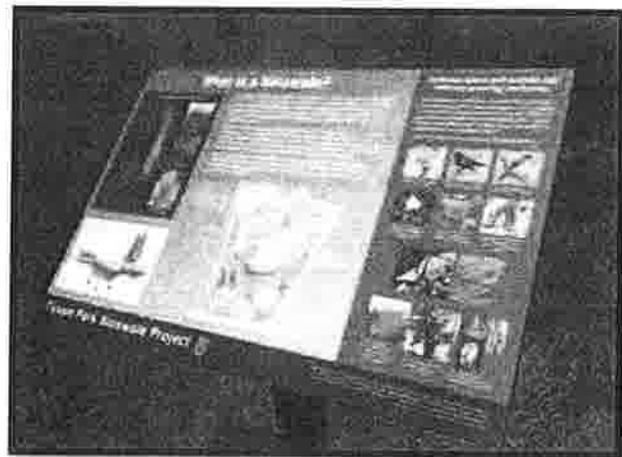
Each of the proposed BMPs are described in more detail below.

#### Tyson Park Bioswale (Existing)

A bioswale was designed and constructed in Tyson Park, a Township-owned park property, in 2015, in anticipation of the TMDL Plan requirements. The drainage area to the bioswale is 36.63 acres. This existing BMP has been properly maintained by the Township as illustrated in the photograph below. The Township has also installed educational signage as a component of the project.

It is being credited as reducing the existing sediment loading for the Chester Creek/East Branch Chester Creek/Ridley Creek PRP Planning Area and towards achieving the long-term total phosphorous reduction of 53.9 percent in the Goose Creek TMDL Planning Area, reducing total phosphorous loading by 14.65 lbs/year (11 percent).

**Figure 3: Tyson Park Bioswale and Signage**



### **Coventry Village Stream Restoration**

A stream restoration project is proposed along a small unnamed tributary to Goose Creek that originates at a headwall on the northeast side of S. Matlack Street, just south of Coventry Lane, and flows in a northeasterly direction through HOA-owned property under S. Coventry Lane and Coventry Lane and into a pond. This stream is severely eroded through this 1,100-linear foot reach. For the purposes of this plan, it has been assumed that approximately 600 linear feet of restoration will be completed at a sediment reduction rate of 44.88/lbs/ft/yr and a total phosphorous removal rate of 0.068 lb/ft/year. This project will provide an estimated removal of 26,928 lbs/yr of sediment (7 percent) within the Chester Creek/East Branch Chester Creek/Ridley Creek PRP Planning Area and an estimated removal of 40.8 lbs/yr of total phosphorous (31 percent) within the Goose Creek TMDL Planning Area.

### **Thorne Drive Basin Retrofit**

This existing basin is located in the southwest quadrant of the intersection of Thorne Drive and Little Shiloh Road in the west-central portion of the Township. The basin has a drainage area of 19.86 acres. The existing basin is located outside of the Planning Area as the outfall is located to the north in West Goshen Township. Therefore, the drainage area has been added to the Goose Creek TMDL Planning Area and the Chester Creek/East Branch Chester Creek/Ridley Creek PRP Planning Area, and accounted for in the existing loading.

The basin is overgrown and has reduced volume capacity. In addition, a defined channel has eroded through it causing the basin to short-circuit. The existing outlet of the basin is an open pipe that is the same elevation as the basin bottom. The basin effectively holds no water during smaller storm events, providing no water quality benefit.

The scope of the proposed retrofit includes removing the trees, vegetation, and sediment accumulation, regrading/removing the defined channel, and installing a new outlet structure that has a low-flow orifice to provide infiltration and extended detention. This project will provide an estimated removal of 7,389.28 lbs/yr of sediment (2 percent) within the Chester Creek/East Branch Chester Creek/Ridley Creek PRP Planning Area and an estimated removal of 9.02 lbs/yr of total phosphorous (7 percent) within the Goose Creek TMDL Planning Area.

### **Sage Road Basin Retrofit**

This existing basin is located at the southern end of a cul-de-sac off Sage Road. It has been proposed to retrofit this existing basin. The basin has a drainage area of 20.59 acres. Goose Creek is the receiving stream for this area, which lies within the Chester Creek Hydrologic Unit Code (HUC) 12.

The basin is overgrown and has accumulated mounds of sediment in some areas. The scope of the proposed retrofit includes removing trees and shrubs as well as accumulated sediment. The orifice of this basin will be reduced from 12 inches to 6 inches through the installation of a steel plate and

coring a 6-inch orifice 2 feet above the basin bottom to increase volume treated through infiltration and extended detention. This project will provide an estimated removal of 5716.42 lbs/yr of sediment (2 percent) within the Chester Creek/East Branch Chester Creek/Ridley Creek PRP Planning Area and an estimated removal of 7.01 lbs/yr of total phosphorus (5 percent) within the Goose Creek TMDL Planning Area.

### Radley Run Stream Restoration

Radley Run and its UNTs flow through a large, currently undeveloped property between W. Street Road (Route 926), S. New Street, W. Pleasant Grove road, and Wilmington Pike (Route 202) in a westerly direction. This property is proposed for development and is an ideal candidate for stream restoration. Radley Run is the receiving stream for this area, which lies within the Upper Brandywine Creek Hydrologic Unit Code (HUC) 12.

Radley Run and its UNTs comprise a total of approximately 17,000 linear feet of stream through this property. For the purposes of this plan, it has been assumed that approximately 815 linear feet of restoration will be completed at a sediment reduction rate of 44.88/lbs/ft/yr. This project will provide an estimated removal of 36,577.20 lbs/yr of sediment (65 percent) within the Middle Brandywine Creek/Upper Brandywine Creek PRP Planning Area, far exceeding the total ten (10) percent sediment reduction required within this planning area.

### 4.6 Funding Mechanisms

The funding mechanisms and estimated costs for the implementation of each proposed BMP over the five (5) year permit period are included in Table 18. The costs provided are conceptual, to be utilized for preliminary planning purposes only, and subject to change.

**Table 18: Proposed BMP Funding Mechanisms**

Proposed BMP	Property Owner	Funding Mechanism	Estimated Design Cost <sup>1</sup>	Estimated Construction Cost <sup>2</sup>	Total Estimated Cost
Tyson Park Bioswale	Westtown Township	Existing BMP	n/a	n/a	n/a
Coventry Village Stream Restoration	Coventry Village HOA	Westtown Township	\$110,000	\$205,000	\$315,000
Thorne Drive Basin Retrofit	Westtown Township	Westtown Township	\$25,000	\$60,000	\$85,000
Sage Road Basin Retrofit	Westtown Township	Westtown Township	\$10,000	\$20,000	\$30,000
Radley Run Stream Restoration	Toll Brothers		n/a	n/a	n/a
<b>TOTAL:</b>			<b>\$145,000</b>	<b>\$285,000</b>	<b>\$430,000</b>

<sup>1</sup>Estimated Design Cost includes survey, design, engineering, any anticipated permitting, bid administration, and construction inspection. Developed based on 2017 costs/rates.

<sup>2</sup>Estimated Construction Cost includes construction, materials, and as-built survey. Developed based on 2017 costs/rates. It does NOT include costs associated with operations and maintenance (O&M).

## 4.7 Operations and Maintenance

To ensure the long-term effectiveness of these proposed BMPs, operation and maintenance (O&M) is crucial. Table 19 below outlines the responsible party and the necessary O&M practices required for each proposed BMP (Pennsylvania Stormwater BMP Manual, December 30, 2006).

**Table 19: Proposed BMP O&M Responsibilities**

BMP	Owner	Responsible Party for O&M	O&M Responsibilities
Tyson Park Bioswale (Installed in 2015)	Westtown Township	Westtown Township	<ul style="list-style-type: none"> <li>• Inspect at least 2x per year</li> <li>• Pruning, weeding, watering</li> <li>• Re-spread mulch every 2-3 years</li> <li>• Remove sediment buildup</li> <li>• Repair and restabilize areas of erosion</li> <li>• Maintain vegetation</li> </ul>
Coventry Village Stream Restoration	Coventry Village HOA	Coventry Village HOA	<ul style="list-style-type: none"> <li>• Inspect at least 2x per year</li> <li>• Avoid excess use of fertilizers, pesticides, or other chemicals</li> <li>• Mow surrounding area as appropriate (remove clippings)</li> <li>• Remove invasive species</li> <li>• Remove debris</li> </ul>
Thorne Drive Basin Retrofit	Westtown Township	Westtown Township	<ul style="list-style-type: none"> <li>• Inspect at least 2x per year</li> <li>• Clean inlets at least 2x per year</li> <li>• Maintain vegetation</li> <li>• Remove invasive species</li> <li>• Prohibit vehicular access</li> <li>• Avoid excessive compaction by mowers</li> <li>• Drain-down time &lt; 72 hours</li> <li>• Mow as appropriate (remove clippings)</li> <li>• Remove accumulated sediment</li> </ul>
Sage Road Basin Retrofit	Westtown Township	Westtown Township	<ul style="list-style-type: none"> <li>• Inspect at least 2x per year</li> <li>• Clean inlets at least 2x per year</li> <li>• Maintain vegetation</li> <li>• Remove invasive species</li> <li>• Prohibit vehicular access</li> <li>• Avoid excessive compaction by mowers</li> <li>• Drain-down time &lt; 72 hours</li> <li>• Mow as appropriate (remove clippings)</li> <li>• Remove accumulated sediment</li> </ul>
Radley Run Stream Restoration	Toll Brothers / Community HOA	Toll Brothers / Community HOA	<ul style="list-style-type: none"> <li>• Inspect at least 2x per year</li> <li>• Avoid excess use of fertilizers, pesticides, or other chemicals</li> <li>• Mow surrounding area as appropriate (remove clippings)</li> <li>• Remove invasive species</li> <li>• Remove debris</li> </ul>

## **5.0 Conclusion**

The required ten (10) percent sediment reduction for the PRP Planning Areas and overall 53.9 percent total phosphorous reduction to meet the Goose Creek TMDL WLA has been demonstrated through the existing bioswale and proposed implementation of two (2) basin retrofits, a stream restoration project along an UNT to Goose Creek, and a stream restoration project along Radley Run and UNTs. These BMPs will be implemented by March 15, 2023.

## 6.0 Definitions

**Best Management Practices (BMPs):** Schedules of activities, prohibitions of practices, structural controls (e.g., infiltration trenches), design criteria, maintenance procedures, and other management practices to prevent or reduce pollution to the waters of the Commonwealth. BMPs include Erosion and Sedimentation Control Plans, Post Construction Stormwater Management Plans, MS4 TMDL Plans, Stormwater Management Act Plans, and other treatment requirements, operating procedures and practices to control runoff, spillage or leaks, sludge or waste disposal, drainage from raw material storage, and methods to reduce pollution, to recharge groundwater, to enhance stream base flow and to reduce the threat of flooding and stream bank erosion. [NPDES Stormwater Discharges from Small MS4s General Permit 5/2016 (PAG-13)]

**Municipal Separate Storm Sewer System (MS4):** All separate storm sewers that are defined as “large” or “medium” or “small” municipal separate storm sewer systems pursuant to 40 CFR §§ 122.26(b)(18), or designated as regulated under 40 CFR § 122.26(a)(1)(v). [PAG-13]

**National Pollutant Discharge Elimination System (NPDES):** A permit issued under 25 Pa. Code Chapter 92a (relating to National Pollutant Discharge Elimination System permitting, monitoring and compliance) for the discharge or potential discharge of pollutants from a point source to surface waters. [PAG-13]

**Outfall:** A “Point Source” as defined by 40 CFR § 122.2 is the point where an MS4 discharges stormwater to other surface waters of this Commonwealth. This does not include open conveyances connecting two municipal separate storm sewers, or pipes, tunnels or other conveyances which connect segments of the same stream and are used to convey waters of the Commonwealth (40 CFR § 122.26 (b) (9)). [PAG-13]

**Owner or operator:** The owner or operator of any “facility” or “activity” subject to regulation under the NPDES program. [PAG-13]

**Parsing:** A process in which land area is removed from a Planning Area in order to calculate the actual or target pollutant loads that are applicable to an MS4. [NPDES from Small MS4 PRP Instructions- Attachment A]

**Planning Area:** All of the storm sewersheds that an MS4 must calculate existing loads and plan load reductions for. [NPDES from Small MS4 PRP Instructions]

**Pollutant:** Any contaminant or other alteration of the physical, chemical, biological, or radiological integrity of surface water which causes or has the potential to cause pollution as defined in section 1 of The Clean Streams Law, 35 P.S. § 691.1. [PAG-13]

**Storm Sewershed:** The catchment area that drains into the storm sewer system based on the surface topography in the area served by the storm sewer. (Source: NPDES Stormwater Discharges from Small MS4s General Permit [PAG-13])

**Stormwater:** Runoff from precipitation, snow melt runoff and surface runoff and drainage. "Stormwater" has the same meaning as "Storm Water." (Source: NPDES Stormwater Discharges from Small MS4s General Permit [PAG-13])

**Urbanized Area (UA):** Land area comprising one or more places (central place(s)) and the adjacent densely settled surrounding area (urban fringe) that together have a residential population of at least 50,000 and an overall population density of at least 1,000 people per square mile, as defined by the United States Bureau of the Census and as determined by the latest available decennial census. The UA outlines the extent of automatically regulated areas. UA maps are available at: <http://www.epa.gov/npdes/stormwater/urbanmaps>, or at: <http://www.epa.gov/enviro/html/em/index.html>. [PAG-13]

# Appendix A

## Public Comment and Responses

## **Appendix B**

### **Storm Sewershed Acreage by Outfall**

County: [illegible]



### Storm Sewershed Acreage by Outfall

Receiving Impaired Water	HUC 12	Outfall Number	Storm Sewershed (acres)
		1	28.19
		2	18.51
		3	34.18
		6(Goose Creek)	4.62
		11	41.47
		12(Goose Creek)	6.63
		13(Goose Creek)	5.62
		14(Goose Creek)	12.45
		15(Goose Creek)	1.97
		16	13.55
		25	7.16
		34	4.91
		44	4.45
		54	0.70
		55	5.84
		57(Goose Creek)	4.63
		61	1.71
		62(Goose Creek)	41.70
		63(Goose Creek)	2.67
		64(Goose Creek)	1.29
		65(Goose Creek)	0.47
		66	13.70
		67	2.91
		68(Goose Creek)	8.46
		69	7.76
		70(Goose Creek)	6.50
		71(Goose Creek)	2.82
		76	2.98
		77	0.38
		78	2.13
		79	19.15
		80	3.01
		81	3.38
		82	1.29
		83	11.23
		97	3.65
		98	3.91
		99	2.90
		100(Goose Creek)	6.06
		101(Goose Creek)	5.16
		102(Goose Creek)	2.98
		106	7.97
		107	11.11
		122(Goose Creek)	19.70
		124(Goose Creek)	5.20
		125(Goose Creek)	1.00
		126(Goose Creek)	2.02
		127(Goose Creek)	1.78

Chester Creek

Chester Creek

**Storm Sewershed Acreage by Outfall (continued)**

Receiving Impaired Water	HUC 12	Outfall Number	Storm Sewershed (acres)	
Chester Creek	Chester Creek	128(Goose Creek)	8.02	
		129(Goose Creek)	6.12	
		130(Goose Creek)	5.28	
		131	1.83	
		132	0.57	
		133	6.62	
		134	3.24	
		135	10.92	
		139(Goose Creek)	12.33	
		140(Goose Creek)	6.46	
		141	8.48	
		151(Goose Creek)	20.59	
			161	7.70
			80	3.01
East Branch Chester Creek	East Branch Chester Creek	5	3.44	
		9	8.71	
		10	5.91	
		22	6.11	
		24	12.69	
		26	9.17	
		27	0.76	
		27	4.13	
		28	4.41	
		29	12.53	
		30	3.63	
		31	9.91	
		32	4.83	
		33	20.26	
		35	0.42	
		36	1.01	
		37	4.21	
		38	5.91	
		39	3.82	
		40	1.48	
		41	8.96	
		42	5.6	
		43	5.90	
		45	26.49	
		46	0.60	
		47	2.76	
		48	3.49	
		56	2.11	
		59	2.42	
		72	3.79	
		73	10.69	
85	7.42			
103	4.10			
104	7.65			
105	0.97			
108	0.70			
109	2.92			

**Storm Sewershed Acreage by Outfall (continued)**

Receiving Impaired Water	HUC 12	Outfall Number	Storm Sewershed (acres)
East Branch Chester Creek	East Branch Chester Creek	110	3.13
		113	0.93
		114	5.13
		115	13.66
		115	13.66
		116	0.63
		117	6.77
		118	11.59
		119	1.37
		120	23.39
		121	0.66
		123	14.71
Hunters Run	Ridley Creek	142	5.49
		17	8.81
		21	1.64
		23	19.77
		49	1.40
		50	1.95
		51	5.43
		52	4.73
Plum Run	Upper Brandywine Creek	53	0.27
		111	5.02
		60	1.00
		74	5.74
		75	10.56
		86	1.67
		87	1.77
		88	1.53
		89	13.67
		90	14.85
		91	0.59
Radley Run	Upper Brandywine Creek	92	2.28
		93	9.89
		137	2.21
		138	3.07
		4	8.08
		7	18.67
		8	11.76
		20	6.59
UNTs to Ridley Creek	Ridley Creek	58	23.47
		94	6.61
		95	7.36
		96	2.47
		136	3.18
		18	4.01
		112	9.89
143	8.07		
<b>TOTAL:</b>		<b>144 outfalls</b>	<b>1029.86</b>

## **Appendix C**

### **Developed Land Loading Rates for PA Counties**

ATTACHMENT B

DEVELOPED LAND LOADING RATES FOR PA COUNTIES<sup>1,2,3</sup>

County	Category	Acres	TN lbs/acre/yr	TP lbs/acre/yr	TSS (Sediment) lbs/acre/yr
Adams	impervious developed	10,373.2	33.43	2.1	1,398.77
	pervious developed	44,028.6	22.99	0.8	207.67
Bedford	impervious developed	9,815.2	19.42	1.9	2,034.34
	pervious developed	19,425	17.97	0.68	301.22
Berks	impervious developed	1,292.4	36.81	2.26	1,925.79
	pervious developed	5,178.8	34.02	0.98	264.29
Blair	impervious developed	3,587.9	20.88	1.73	1,813.55
	pervious developed	9,177.5	18.9	0.62	267.34
Bradford	impervious developed	10,423	14.82	2.37	1,880.87
	pervious developed	23,709.7	13.05	0.85	272.25
Cambria	impervious developed	3,237.9	20.91	2.9	2,155.29
	pervious developed	8,455.4	19.86	1.12	325.3
Cameron	impervious developed	1,743.2	18.46	2.98	2,574.49
	pervious developed	1,334.5	19.41	1.21	379.36
Carbon	impervious developed	25.1	28.61	3.97	2,177.04
	pervious developed	54.2	30.37	2.04	323.36
Centre	impervious developed	7,828.2	19.21	2.32	1,771.63
	pervious developed	15,037.1	18.52	0.61	215.84
Chester	impervious developed	1,838.4	21.15	1.46	1,504.78
	pervious developed	10,439.8	14.09	0.36	185.12
Clearfield	impervious developed	9,638.5	17.54	2.78	1,902.9
	pervious developed	17,444.3	18.89	1.05	266.62
Clinton	impervious developed	7,238.5	18.02	2.80	1,856.91
	pervious developed	11,153.8	16.88	0.92	275.81
Columbia	impervious developed	7,343.1	21.21	3.08	1,929.18
	pervious developed	21,848.2	22.15	1.22	280.39
Cumberland	impervious developed	8,774.8	28.93	1.11	2,065.1
	pervious developed	26,908.6	23.29	0.34	306.95
Dauphin	impervious developed	3,482.4	28.59	1.07	1,999.14
	pervious developed	9,405.8	21.24	0.34	299.62
Elks	impervious developed	1,317.7	18.91	2.91	1,556.93
	pervious developed	1,250.1	19.32	1.19	239.85
Franklin	impervious developed	13,832.3	31.6	2.72	1,944.85
	pervious developed	49,908.6	24.37	0.76	308.31
Fulton	impervious developed	3,712.9	22.28	2.41	1,586.75
	pervious developed	4,462.3	18.75	0.91	236.54
Huntington	impervious developed	7,321.9	18.58	1.63	1,647.53
	pervious developed	11,375.4	17.8	0.61	260.15
Indiana	impervious developed	589	19.29	2.79	1,621.25
	pervious developed	972	20.1	1.16	220.68
Jefferson	impervious developed	21.4	18.07	2.76	1,369.63
	pervious developed	20.4	19.96	1.24	198.60
Juniata	impervious developed	3,770.2	22.58	1.69	1,903.96
	pervious developed	8,928.3	17.84	0.55	260.68
Lackawana	impervious developed	2,969.7	19.89	2.84	1,305.05
	pervious developed	7,783.9	17.51	0.76	132.98
Lancaster	impervious developed	4,918.7	38.53	1.55	1,480.43
	pervious developed	21,649.7	22.24	0.36	190.93
Lebanon	impervious developed	1,192.1	40.58	1.85	1,948.53
	pervious developed	5,150	27.11	0.4	269.81
Luzerne	impervious developed	5,857	20.43	3	1,648.22
	pervious developed	13,482.9	19.46	0.98	221.19
Lycoming	impervious developed	10,031.7	16.48	2.57	1,989.64
	pervious developed	19,995.5	16	0.84	277.38

County	Category	Acres	TN lbs/acre/yr	TP lbs/acre/yr	TSS (Sediment) lbs/acre/yr
McKean	impervious developed	38.7	20.93	3.21	1,843.27
	pervious developed	5.3	22.58	1.45	249.26
Mifflin	impervious developed	5,560.2	21.83	1.79	1,979.13
	pervious developed	16,405.5	21.13	0.71	296.07
Montour	impervious developed	5,560.2	21.83	1.79	1,979.13
	pervious developed	16,405.5	21.13	0.71	296.07
Northumberland	impervious developed	8,687.3	25.73	1.54	2,197.08
	pervious developed	25,168.3	24.63	0.54	367.84
Perry	impervious developed	5,041.1	26.77	1.32	2,314.7
	pervious developed	9,977	23.94	0.51	343.16
Potter	impervious developed	2,936.3	16.95	2.75	1,728.34
	pervious developed	2,699.3	17.11	1.09	265.2
Schuylkill	impervious developed	5,638.7	30.49	1.56	1,921.08
	pervious developed	14,797.2	29.41	0.57	264.04
Snyder	impervious developed	4,934.2	28.6	1.11	2,068.16
	pervious developed	14,718.1	24.35	0.4	301.5
Somerset	impervious developed	1,013.6	25.13	2.79	1,845.7
	pervious developed	851.2	25.71	1.14	293.42
Sullivan	impervious developed	3,031.7	19.08	2.85	2,013.9
	pervious developed	3,943.4	21.55	1.31	301.58
Susquehanna	impervious developed	7,042.1	19.29	2.86	1,405.73
	pervious developed	14,749.7	20.77	1.21	203.85
Tioga	impervious developed	7,966.9	12.37	2.09	1,767.75
	pervious developed	18,090.3	12.22	0.76	261.94
Union	impervious developed	4,382.6	22.98	2.04	2,393.55
	pervious developed	14,065.3	20.88	0.69	343.81
Wayne	impervious developed	320.5	18.69	2.89	1,002.58
	pervious developed	509	21.14	1.31	158.48
Wyoming	impervious developed	3,634.4	16.03	2.53	2,022.32
	pervious developed	10,792.9	13.75	0.7	238.26
York	impervious developed	10,330.7	29.69	1.18	1,614.15
	pervious developed	40,374.8	18.73	0.29	220.4
All Other Counties	impervious developed	-	23.06	2.28	1,839
	pervious developed	-	20.72	0.84	264.96

**Notes:**

- 1 These land loading rate values may be used to derive existing pollutant loading estimates under DEP's simplified method for PRP development. MS4s may choose to develop estimates using other scientifically sound methods.
- 2 Acres and land loading rate values for named counties in the Chesapeake Bay watershed are derived from CAST. (The column for Acres represents acres within the Chesapeake Bay watershed). For MS4s located outside of the Chesapeake Bay watershed, the land loading rates for "All Other Counties" may be used to develop PRPs under Appendix E; these values are average values across the Chesapeake Bay watershed.
- 3 For land area outside of the urbanized area, undeveloped land loading rates may be used where appropriate. When using the simplified method, DEP recommends the following loading rates (for any county) for undeveloped land:
  - TN – 10 lbs/acre/yr
  - TP – 0.33 lbs/acre/yr
  - TSS (Sediment) – 234.6 lbs/acre/yr

These values were derived by using the existing loads for each pollutant, according to the 2014 Chesapeake Bay Progress Run, and dividing by the number of acres for the unregulated stormwater subsector.

## Appendix D

### Supporting Calculations

**Conversion from NLCD 2011 Land Use Designation to Impervious and Pervious Areas**

MUNICIPALITY: Westtown Township  
 TMDL PLANNING AREA: Goose Creek  
 COUNTY: Chester

Developed Land:

Land Use <sup>1</sup>	Area (ac)	% Impervious <sup>2</sup>	Impervious Area (ac)	Pervious Area (ac)
Developed, Open Space	148.91	19	28.29	120.62
Developed, Low Intensity	17.98	49	8.81	9.17
Developed, Medium Intensity	3.28	79	2.59	0.69
Developed, High Intensity	0.67	100	0.67	
Hay/Pasture	2.38	0		2.38
Shrub/Scrub	10.85	0		10.85
Woody Wetlands	0.17	0		0.17
Deciduous Forest	52.89	0		52.89
Evergreen Forest	2.13	0		2.13
Mixed Forest	1.16	0		1.16
<b>Total</b>	<b>240.42</b>		<b>40.36</b>	<b>200.06</b>



**Existing Loads using Chesapeake Bay Loading Rates without BMPs**

MUNICIPALITY: Westtown Township  
 TMDL PLANNING AREA: Goose Creek  
 COUNTY: Chester

**Developed Land:**

Land Use	Area (ac)	Pollutant Loading Rates <sup>1</sup>				Pollutant Load		
		TN (lbs/ac/yr)	TP (lbs/ac/yr)	TSS (Sediment) (lbs/ac/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS [Sediment] (lbs/yr)	
Impervious, Developed	40.36	21.15	1.46	1,504.78	853.61	58.93	60732.92	
Pervious, Developed	200.06	14.09	0.36	185.12	2818.85	72.02	37035.11	
<b>Goose Creek Total Pollutant Load</b>					<b>3,672.46</b>	<b>130.95</b>	<b>97,768.03</b>	

1. From PADEP PRP Instructions Attachment B - Developed Land Loading Rates for PA Counties



**Pollutant Removal Reductions using PADEP BMP Effectiveness Value Table for Existing BMPs**

**BMP NAME:** Tyson Park Bioswale  
**MUNICIPALITY:** Westtown Township  
**TMDL PLANNING AREA:** Goose Creek  
**COUNTY:** Chester  
**BMP TYPE:** Existing BMP  
**LOCATION:** 901 Oakbourne Road  
**GPS LOCATION:** Lat: 39.9463/ Long: -75.5628  
**TOTAL DRAINAGE AREA TREATED (ac):** 36.63  
**TYPE OF BMP:** Bioswale

**Developed Land - Pollutant Reduction:**

Land Use <sup>1,2</sup>	Pollutant Loading Rates <sup>3</sup>			BMP Effectiveness Value <sup>4</sup>			Pollutant Load Reduction			
	Area (ac)	TN (lbs/ac/yr)	TP (lbs/ac/yr)	TSS (Sediment) (lbs/ac/yr)	TN	TP	Sediment	TN (lbs/yr)	TP (lbs/yr)	TSS (Sediment) (lbs/yr)
Impervious, Developed	5.77	21.15	1.46	1,504.78	70%	75%	80%	85.42	6.32	6946.06
Pervious, Developed	30.86	14.09	0.36	185.12	70%	75%	80%	304.37	8.33	4570.24
<b>Total</b>								<b>389.80</b>	<b>14.65</b>	<b>11,516.31</b>

1. NLCD 2011 Land Use and Areas  
 2. Highest % of impervious used from each NLCD 2011 definition per PADEP  
 3. From PADEP PRP Instructions Attachment B - Developed Land Loading Rates for PA Counties  
 4. Per PADEP NPDES BMP Effectiveness Values Table



**Pollutant Removal Reductions using PADEP BMP Effectiveness Value Table for New BMPs**

**BMP NAME:** Coventry Village Stream Restoration  
**MUNICIPALITY:** Westtown Township  
**TMDL PLANNING AREA:** Goose Creek  
**COUNTY:** Chester  
**BMP TYPE:** New Retrofit Facility  
**LOCATION:** Coventry Village  
**GPS LOCATION:** Lat: 39.9427 / Long: -75.5786  
**TOTAL DRAINAGE AREA TREATED (ac):**  
**TYPE OF BMP:** Stream Restoration

**Stream Restoration - Pollutant Reduction:**

Location	Restoration Length (ft)	BMP Effectiveness Value <sup>1</sup>			Pollutant Load Reduction		
		TN (lbs/ft/yr)	TP (lbs/ft/yr)	Sediment (lbs/ft/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS [Sediment] (lbs/yr)
UNT to Goose Creek	600	0.075	0.068	44.88	45.00	40.80	26928.00
<b>Total</b>					<b>45.00</b>	<b>40.80</b>	<b>26,928.00</b>

Note: There is approximately 1,100 l.f. of stream in the Coventry Village area. It is proposed that 55% of this stream channel will be restored.

1. Per PADEP NPDES BMP Effectiveness Values Table



**Efficiency Rates for Stormwater Retrofit Projects using Chesapeake Bay Panel Report**

BMP NAME: Thorne Drive Basin Retrofit  
 MUNICIPALITY: Westtown Township  
 TMDL PLANNING AREA: Goose Creek  
 COUNTY: Chester  
 BMP TYPE: Existing BMP Conversion  
 LOCATION: 901 Thorne Drive  
 GPS LOCATION: Lat: 39.9477 / Long: -75.6703  
 TOTAL DRAINAGE AREA TREATED (ac): 18.86  
 TYPE OF BMP: Ex. Surface Basin  
 CLASSIFICATION OF BMPs BASED ON RUNOFF REDUCTION CAPABILITY: Runoff Reduction Practice (RRP)

Amount of Runoff Volume treated (In) =  $\frac{RS \times I2}{IA}$  where:  
 RS = Runoff Storage Volume (ec-ft)  
 IA = Impervious Area (ac)

Impervious area treated (ac)	Runoff Storage Volume (ec-ft)	Amount of Runoff Volume treated (In)	Proposed Removal Rates <sup>1</sup>		
			TN (%)	TP (%)	TSS (Sediment) (%)
3.94	0.620	1.888	67	79	84

**Pollutant Load to Thorne Drive Basin Retrofit:**

Land Use	Pollutant Loading Rates <sup>2</sup>				Pollutant Load		
	Area (ac)	TN (lbs/ac/yr)	TP (lbs/ac/yr)	TSS (Sediment) (lbs/ec/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (Sediment) (lbs/yr)
Impervious, Developed	3.88	21.15	1.46	1,504.78	82.06	5.66	5836.55
Perivious, Developed	15.98	14.09	0.36	185.12	225.15	5.75	2953.22
<b>Total</b>					<b>307.22</b>	<b>11.42</b>	<b>8,796.76</b>

Pollutant Load reduced with Thorne Drive Basin Retrofit:		
TN (lbs/yr)	205.84	
TP (lbs/yr)	9.02	
TSS (Sediment) (lbs/yr)	7,389.28	

Note: Existing basin is overgrown and has reduced volume capacity. Basin also has a defined channel which is causing short curcuting of the basin. Existing efficiency rate considered to be zero. It is proposed to clean out the basin, remove built up sediment and vegetation to create meandering channels to increase the storage capacity as well as replace outflow structure to a riser with a low flow orifice.

1. Percentages determined by using Expert Panel Report for Urban Stormwater Retrofit Projects - Figures 3, 4, & 5 Removal Adjustor Curves  
 2. From PADEP PRP Instructions Attachment B - Developed Land Loading Rates for PA Counties



**Efficiency Rates for Stormwater Retrofit Projects using Cheasapeake Bay Panel Report**

BMP NAME: Sage Road Basin Retrofit;  
 MUNICIPALITY: Westtown Township  
 TMDL PLANNING AREA: Goose Creek  
 COUNTY: Chester  
 BMP TYPE: Existing BMP Conversion  
 LOCATION: Sage Road, West Chester, Pa  
 GPS LOCATION: Lat: 39.9432 / Long: -75.5653  
 TOTAL DRAINAGE AREA TREATED (ac): 20.59  
 TYPE OF BMP: Ex. Surface Basin to be retrofitted to extended detention basin  
 CLASSIFICATION OF BMPs BASED ON RUNOFF REDUCTION CAPABILITY: Runoff Reduction Practice (RR)

Amount of Runoff Volume treated (m) =  $\frac{RS \times I2}{IA}$  where:  
 RS = Runoff Storage Volume (ac-ft)  
 IA = Impervious Area (ac)

	Impervious area treated (ac)	Runoff Storage Volume (ac-ft)	Projected Removal Rates <sup>1</sup>		
			Amount of Runoff Volume treated (m)	TN (%)	TSS (Sediment) (%)
	3.88	0.210	0.649	52	64

**Pollutant Load to Sage Road Basin Retrofit:**

Land Use	Area (ac)	TN (lbs/ac/yr)	Pollutant Loading Rates <sup>1</sup>			Pollutant Load		
			TP (lbs/ac/yr)	TSS (Sediment) (lbs/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (Sediment) (lbs/yr)	TN (lbs/yr)
Impervious, Developed	3.88	21.15	1.46	1,504.78	82.06	5.66	5838.55	
Previous, Developed	16.71	14.09	0.36	185.12	235.44	6.02	3093.36	
<b>Total</b>					<b>317.51</b>	<b>11.68</b>	<b>8,931.90</b>	

Pollutant Load reduced with Sage Road Basin Retrofit:		
TN (lbs/yr)	165.10	7.01
TP (lbs/yr)	7.01	5716.42
TSS (Sediment) (lbs/yr)		

**Note:** The basin outlet structure must be modified to detain runoff from the stormwater quality design storm for extended periods. Since the 12" orifice at the bottom of the outlet structure is large for water quality improvements, we will be suggesting to remove the orifice by utilizing a steel plate. A new 6" orifice will be cored at an elevation of 2 feet, increasing the storage volume capacity of the basin. Furthermore, the benefits were assumed minimal as the basin was only designed for peak flow control, the existing basin has zero removal rate. It was assumed that since the basin was dry during inspection, the soils beneath the basin have naturally good infiltration rate and do not require an infiltration bed.

1. Percentages determined by using Expert Panel Report for Urban Stormwater Retrofit Projects - Figures 3.4, & 5 Removal Adjustor Curves



**Goose Creek TMDL  
Phosphorous Load Reduction by BMPs**

MUNICIPALITY: Westtown Township  
 TMDL PLANNING AREA: Goose Creek  
 COUNTY: Chester

BMP Name	BMP Drainage Area (ac)	Pollutant Reduction by BMPs		
		TN (lbs/yr)	TP (lbs/yr)	TSS (Sediment) (lbs/yr)
<b>Goose Creek Years 0-1</b>				
Tyson Park Bioswale	36.63	389.80	14.65	11,516.31
<b>Sub Total</b>	<b>36.63</b>	<b>389.80</b>	<b>14.65</b>	<b>11,516.31</b>
<b>Goose Creek Years 1-5</b>				
Coventry Village Stream Restoration	600 l.f.	45	40.8	26,928.00
Thorne Drive Basin Retrofit	19.86	205.84	9.02	7,389.28
Sage Road Basin Retrofit	20.59	165.1	7.01	5,716.42
<b>Sub Total</b>	<b>40.45</b>	<b>415.94</b>	<b>56.83</b>	<b>40,033.70</b>
<b>Total</b>	<b>77.08</b>	<b>805.74</b>	<b>71.48</b>	<b>51,550.01</b>

TMDL	Storm sewershed Area (ac)	Existing Pollutant without BMPs			Pollutant Load with BMPs			% Reduction		
		TN (lbs/yr)	TP (lbs/yr)	TSS (Sediment)	TN (lbs/yr)	TP (lbs/yr)	TSS (Sediment)	TN	TP	TSS
Goose Creek - Years 0-1	240.42	3,672.46	130.95	97,768.03	3,282.66	116.30	86,254.72	11%	11%	12%
Goose Creek - Years 1-5	240.42	3,672.46	130.95	97,768.03	3,256.52	74.12	57,734.33	11%	43%	41%
<b>Total Reduction</b>	<b>240.42</b>	<b>3,672.46</b>	<b>130.95</b>	<b>97,768.03</b>	<b>2,866.72</b>	<b>59.47</b>	<b>46,218.02</b>	<b>22%</b>	<b>55%</b>	<b>53%</b>



**Conversion from NLCD 2011 Land Use Designation to Impervious and Pervious Areas**

MUNICIPALITY: Westtown Township  
 PRP PLANNING AREA: Chester Creek/East Branch Chester Creek/Ridley Creek (contains Goose Creek TMDL)  
 COUNTY: Chester

Developed Land:

Land Use <sup>1</sup>	Area (ac)	% Impervious <sup>2</sup>	Impervious Area (ac)	Pervious Area (ac)
Developed, Open Space	619.85	19.1	117.77	502.08
Developed, Low Intensity	88.77	49.4	43.50	45.27
Developed, Medium Intensity	8.21	79	6.49	1.72
Developed, High Intensity	1.20	100	1.20	
Hay/Pasture	21.59	0		21.59
Cultivated Crops	0.53	0		0.53
Shrub/Scrub	24.34	0		24.34
Woody Wetlands	0.18	0		0.18
Emergent Herbaceous Wetlands	0.34	0		0.34
Deciduous Forest	125.48	0		125.48
Evergreen Forest	4.67	0		4.67
Mixed Forest	12.84	0		12.84
<b>Total</b>	<b>908.00</b>		<b>168.95</b>	<b>739.05</b>



**Existing Loads using Chesapeake Bay Loading Rates without BMPs**

MUNICIPALITY: Westtown Township  
 PRP PLANNING AREA: Chester Creek/East Branch Chester Creek/Ridley Creek (contains Goose Creek TMDL)  
 COUNTY: Chester

Developed Land:

Land Use	Area (ac)	Pollutant Loading Rates <sup>1</sup>			Pollutant Load		
		TN (lbs/ac/yr)	TP (lbs/ac/yr)	TSS [Sediment] (lbs/ac/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS [Sediment] (lbs/yr)
Impervious, Developed	168.95	21.15	1.46	1,504.78	3573.29	246.67	254232.58
Pervious, Developed	739.05	14.09	0.36	185.12	10413.21	266.06	136812.94
Total Pollutant Load					13,986.51	512.73	391,045.52



**Conversion from NLCD 2011 Land Use Designation to Impervious and Pervious Areas**

MUNICIPALITY: Westtown Township  
 PRP PLANNING AREA: Middle Brandywine Creek/Upper Brandywine Creek  
 COUNTY: Chester

Developed Land:

Land Use <sup>1</sup>	Area (ac)	% Impervious <sup>2</sup>	Impervious Area (ac)	Pervious Area (ac)
Developed, Open Space	99.08	19	18.83	80.25
Developed, Low Intensity	2.77	49	1.36	1.41
Developed, Medium Intensity	0.36	79	0.28	0.08
Developed, High Intensity		100		
Hay/Pasture	24.49	0		24.49
Cultivated Crops	5.92	0		5.92
Shrub/Scrub	9.67	0		9.67
Woody Wetlands	0.96	0		0.96
Deciduous Forest	10.75	0		10.75
Evergreen Forest	1.93	0		1.93
Mixed Forest	1.04	0		1.04
<b>Total</b>	<b>156.97</b>		<b>20.47</b>	<b>136.50</b>



**Existing Loads using Chesapeake Bay Loading Rates without BMPs**

**MUNICIPALITY:**

Westtown Township

**PRP PLANNING AREA:**

Middle Brandywine Creek/Upper Brandywine Creek

**COUNTY:**

Chester

**Developed Land:**

Land Use	Area (ac)	Pollutant Loading Rates <sup>1</sup>				Pollutant Load		
		TN (lbs/ac/yr)	TP (lbs/ac/yr)	TSS [Sediment] (lbs/ac/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS [Sediment] (lbs/yr)	
Impervious, Developed	20.47	21.15	1.46	1,504.78	432.94	29.89	30802.85	
Pervious, Developed	136.50	14.09	0.36	185.12	1923.29	49.14	25268.88	
		Total Pollutant Load				2,356.23	79.03	56,071.73



**Pollutant Removal Reductions using PADEP BMP Effectiveness Value Table for Existing BMPs**

**BMP NAME:** Tyson Park Bioswale  
**MUNICIPALITY:** Westtown Township  
**PRP PLANNING AREA:** Chester Creek/East Branch Chester Creek/Ridley Creek (contains Goose Creek TMDL)  
**COUNTY:** Chester  
**BMP TYPE:** Existing BMP  
**LOCATION:** 901 Oakbourne Road  
**GPS LOCATION:** Lat: 39.9463/ Long: -75.5628  
**TOTAL DRAINAGE AREA TREATED (ac):** 36.63  
**TYPE OF BMP:** Bioswale

**Developed Land - Pollutant Reduction:**

Land Use <sup>1,2</sup>	Area (ac)	Pollutant Loading Rates <sup>3</sup>			BMP Effectiveness Value <sup>4</sup>			Pollutant Load Reduction		
		TN (lbs/ac/yr)	TP (lbs/ac/yr)	TSS [Sediment] (lbs/ac/yr)	TN	TP	Sediment	TN (lbs/yr)	TP (lbs/yr)	TSS [Sediment] (lbs/yr)
Impervious, Developed	5.77	21.15	1.46	1,504.78	70%	75%	80%	85.42	6.32	6946.06
Pervious, Developed	30.86	14.09	0.36	185.12	70%	75%	80%	304.37	8.33	4570.24
<b>Total</b>								<b>389.80</b>	<b>14.65</b>	<b>11,516.31</b>

1. NLCD 2011 Land Use and Areas
2. Highest % of impervious used from each NLCD 2011 definition per PADEP
3. From PADEP PRP Instructions Attachment B - Developed Land Loading Rates for PA Counties
4. Per PADEP NPDES BMP Effectiveness Values Table



**Pollutant Removal Reductions using PADEP BMP Effectiveness Value Table for New BMPs**

**BMP NAME:** Coventry Village Stream Restoration  
**MUNICIPALITY:** Westtown Township  
**PRP PLANNING AREA:** Chester Creek/East Branch Chester Creek/Ridley Creek (contains Goose Creek TMDL)  
**COUNTY:** Chester  
**BMP TYPE:** New Retrofit Facility  
**LOCATION:** Coventry Village  
**GPS LOCATION:** Lat: 39.9427 / Long: -75.5786  
**TOTAL DRAINAGE AREA TREATED (ac):**  
**TYPE OF BMP:** Stream Restoration

**Stream Restoration - Pollutant Reduction:**

Location	Restoration Length (ft)	BMP Effectiveness Value <sup>1</sup>			Pollutant Load Reduction		
		TN (lbs/ft/yr)	TP (lbs/ft/yr)	Sediment (lbs/ft/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS [Sediment] (lbs/yr)
UNT to Goose Creek	600	0.075	0.068	44.88	45.00	40.80	26928.00
<b>Total</b>					<b>45.00</b>	<b>40.80</b>	<b>26,928.00</b>

Note: There is approximately 1,100 l.f. of stream in the Coventry Village area. It is proposed that 55% of this stream channel will be restored.

1. Per PADEP NPDES BMP Effectiveness Values Table



**Efficiency Rates for Stormwater Retrofit Projects using Chesapeake Bay Panel Report**

**BMP NAME:** Thorne Drive Basin Retrofit  
**MUNICIPALITY:** Westtown Township  
**PRP PLANNING AREA:** Chester Creek/East Branch Chester Creek/Ridley Creek (contains Goose Creek TMDL)  
**COUNTY:** Chester  
**BMP TYPE:** Existing BMP Conversion  
**LOCATION:** 901 Thorne Drive  
**GPS LOCATION:** Lat: 39.9477 / Long: -75.5703  
**TOTAL DRAINAGE AREA TREATED (ac):** 19.86  
**TYPE OF BMP:** Ex. Surface Basin  
**CLASSIFICATION OF BMPs BASED ON RUNOFF REDUCTION CAPABILITY:** Runoff Reduction Practices (RR)

Amount of Runoff Volume treated (In) =  $\frac{RS \times I2}{IA}$  where:  
 RS = Runoff Storage Volume (ac-ft)  
 IA = Impervious Area (ac)

Impervious area treated (ac)	Runoff Storage Volume (ac-ft)	Amount of Runoff Volume treated (In)	Proposed Removal Rates <sup>1</sup>		
			TN (%)	TP (%)	TSS [Sediment] (%)
3.94	0.620	1.888	67	79	84

**Pollutant Load to Thorne Drive Basin Retrofit:**

Land Use	Area (ac)	Pollutant Loading Rates <sup>2</sup>			Pollutant Load		
		TN (lbs/ac/yr)	TP (lbs/ac/yr)	TSS [Sediment] (lbs/ac/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS [Sediment] (lbs/yr)
Impervious, Developed	8.88	21.15	1.46	1,504.78	82.06	5.66	5838.55
Perivous, Developed	15.98	14.09	0.36	185.12	225.16	5.75	2958.22
<b>Total</b>					<b>307.22</b>	<b>11.42</b>	<b>8,796.76</b>

Pollutant Load reduced with Thorne Drive Basin Retrofit:	
TN (lbs/yr)	205.84
TP (lbs/yr)	9.02
TSS [Sediment] (lbs/yr)	7389.28

Note: Existing basin is overgrown and has reduced volume capacity. Basin also has a defined channel which is causing short curcuting of the basin. Existing efficiency rate considered to be zero. It is proposed to clean out the basin, remove built up sediment and vegetation to create meandering channels to increase the storage capacity as well as replace outflow structure to a riser with a low flow orifice.

1. Percentages determined by using Expert Panel Report for Urban Stormwater Retrofit Projects - Figures 3.4, & 5 Removal Adjustor Curves  
 2. From PADEP PRP Instructions Attachment B - Developed Land Loading Rates for PA Counties



**Efficiency Rates for Stormwater Retrofit Projects using Chesapeake Bay Panel Report**

BMP NAME: Sage Road Basin Retrofit  
 MUNICIPALITY: Westtown Township  
 PRP PLANNING AREA: Chester Creek/East Branch Chester Creek/Ridley Creek (contains Goose Creek TMDL)  
 COUNTY: Chester  
 BMP TYPE: Existing BMP Conversion  
 LOCATION: Sage Road, West Chester, Pa  
 GPS LOCATION: Lat: 39.9432 / Long: -75.5659  
 TOTAL DRAINAGE AREA TREATED (ac): 20.89  
 TYPE OF BMP: Ex. Surface Basin to be retrofitted to extended detention basin  
 CLASSIFICATION OF BMPs BASED ON RUNOFF REDUCTION CAPABILITY: Runoff Reduction Practice (RR)

Amount of Runoff Volume treated (In) =  $\frac{RS \times I2}{IA}$  where:  
 RS = Runoff Storage Volume (ac-ft)  
 IA = Impervious Area (ac)

Impervious area treated (ac)	Runoff Storage Volume (ac-ft)	Amount of Runoff Volume treated (In)	Projected Removal Rates*		
			TN (%)	TP (%)	TSS (Sediment) (%)
3.88	0.210	0.649	52	60	84

**Pollutant Load to Sage Road Basin Retrofit**

Land Use	Area (ac)	Pollutant Loading Rates*			Pollutant Load		
		TN (lbs/ac/yr)	TP (lbs/ac/yr)	TSS (Sediment) (lbs/ac/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (Sediment) (lbs/yr)
Impervious, Developed	3.88	21.15	1.46	1,504.78	82.06	5.66	5838.55
Pervious, Developed	16.71	14.09	0.36	185.12	235.44	6.02	3093.36
<b>Total</b>					<b>317.51</b>	<b>11.68</b>	<b>8,931.90</b>

**Pollutant Load reduced with Sage Road Basin Retrofit**

TN (lbs/yr)	165.10
TP (lbs/yr)	7.01
TSS (Sediment) (lbs/yr)	5716.42

**Note:** The basin outlet structure must be modified to detain runoff from the stormwater quality design storm for extended periods. Since the 12" orifice at the bottom of the outlet structure is large for water quality improvements, we will be suggesting to remove the orifice by utilizing a steel plate. A new 6" orifice will be cored at an elevation of 2 feet, increasing the storage volume capacity of the basin. Furthermore, the earthen mound created by deposition of sediments will be graded to ensure clear pathway to the outlet structure. It is also recommended to remove some of the vegetation within the basin. Additionally, water quality benefits were assumed minimal as the basin was only designed for peak flow control, the existing basin has zero removal rate. It was assumed that the since the basin was dry during inspection, the soils beneath the basin have naturally good infiltration rate and do not require an infiltration bed.

1. Percentages determined by using Expert Panel Report for Urban Stormwater Retrofit, Projects - Figures 3, 4, & 5 Removal Adjustor Curves



**Pollutant Removal/Reductions using PADEP BMP Effectiveness Value Table for New BMPs**

**BMP NAME:** Radley Run Stream Restoration  
**MUNICIPALITY:** Westtown Township  
**PRP PLANNING AREA:** Middle Brandywine Creek/Upper Brandywine Creek  
**COUNTY:** Chester  
**BMP TYPE:** New Retrofit Facility  
**LOCATION:** W Street Road & S New Street  
**GPS LOCATION:** Lat: 39.9173 / Long: -75.5906  
**TOTAL DRAINAGE AREA TREATED (ac):**  
**TYPE OF BMP:** Stream Restoration

**Stream Restoration - Pollutant Reduction:**

Location	Restoration Length (ft)	BMP Effectiveness Value <sup>1</sup>			Pollutant Load Reduction		
		TN (lbs/ft/yr)	TP (lbs/ft/yr)	Sediment (lbs/ft/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS [Sediment] (lbs/yr)
Radley Run	200	0.075	0.068	44.88	15.00	13.60	8976.00
UNT to Radley Run	615	0.075	0.068	44.88	46.13	41.82	27601.20
<b>Total</b>					<b>61.13</b>	<b>55.42</b>	<b>36,577.20</b>

1. Per PADEP NPDES BMP Effectiveness Values Table



**Pollutant Load Reduction by Existing BMPs**

MUNICIPALITY:  
MS4 SEWER SHED:  
COUNTY:

Westtown Township  
Chester Creek/East Branch Chester Creek/Ridley Creek (contains Goose Creek TMDL)  
Chester

Existing BMP Name	BMP Drainage Area (ac)	Pollutant Reduction by BMPs		
		TN (lbs/yr)	TP (lbs/yr)	TSS [Sediment] (lbs/yr)
Tyson Park Bioswale	36.63	389.8	14.65	11516.31
<b>Total</b>	<b>36.63</b>	<b>389.8</b>	<b>14.65</b>	<b>11516.31</b>

PRP	Planning Area (ac)	Existing Pollutant without BMPs			Pollutant Load with BMPs		
		TN (lbs/yr)	TP (lbs/yr)	TSS [Sediment] (lbs/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS [Sediment] (lbs/yr)
Chester Creek/Chester Creek/East Branch	908	13986.51	512.73	391045.52	13596.71	498.08	379529.21
Chester Creek/Ridley Creek	908	13,986.51	512.73	391,045.52	13,596.71	498.08	379,529.21
<b>Total</b>							



**Pollutant Load Reduction by Proposed BMPs**

MUNICIPALITY:  
COUNTY:

Westtown Township  
Chester

BMP Name	BMP Drainage Area (ac)	Pollutant Reduction by BMPs		
		TN (lbs/yr)	TP (lbs/yr)	TSS (Sediment) (lbs/yr)
<b>Chester Creek/East Branch Chester Creek/Ridley Creek (contains Goose Creek TMDL)</b>				
Thorne Drive Basin Retrofit	19.86	205.64	9.02	7,389.28
Coventry Village Stream Restoration	600 I.F.	45	40.8	26,928.00
Sege Road Basin Retrofit	20.59	165.1	7.01	5,716.42
<b>Sub Total</b>	<b>40.45</b>	<b>415.94</b>	<b>56.83</b>	<b>40,033.70</b>
<b>Middle Brandywine Creek/Upper Brandywine Creek</b>				
Radley Run Stream Restoration	815 I.F.	61.13	55.42	36,577.20
<b>Sub Total</b>		<b>61.13</b>	<b>55.42</b>	<b>36,577.20</b>
<b>Total</b>	<b>40.45</b>	<b>477.07</b>	<b>112.25</b>	<b>76,610.90</b>

PRP	Planning Area (ac)	Existing Pollutant without BMPs			Pollutant Load with BMPs			% Reduction		
		TN (lbs/yr)	TP (lbs/yr)	TSS (Sediment) (lbs/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (Sediment) (lbs/yr)	TN	TP	TSS (Sediment)
<b>PRP</b>										
<b>Planning Area</b>										
Chester Creek/East Branch Chester Creek/Ridley Creek (contains Goose Creek TMDL)	908.00	13,596.71	498.08	379,529.21	13,180.77	441.25	339,495.51	3%	11%	11%
Middle Brandywine Creek/Upper Brandywine Creek (Plum/Radley)	156.97	2,356.23	79.03	56,074.73	2,295.10	23.61	19,494.53	3%	70%	65%
<b>Total</b>	<b>1,064.97</b>	<b>15,952.94</b>	<b>577.11</b>	<b>435,603.94</b>	<b>15,475.87</b>	<b>464.86</b>	<b>358,990.04</b>	<b>3%</b>	<b>19%</b>	<b>18%</b>



# Appendix E

## Proposed BMP Maps

Table of Contents	Page
1. Introduction	1
2. Methodology	2
3. Results	3
4. Discussion	4
5. Conclusion	5
6. Appendix A	6
7. Appendix B	7
8. Appendix C	8
9. Appendix D	9
10. Appendix E	10



**CHESTER CREEK/GOOSE CREEK  
TMDL/PRP PROPOSED BMP**

**Legend**

- Streams
  - Non-impaired
  - Impaired
- Roads
  - Township
  - State
  - Private
- MS4 Outfalls
  - ▲
- BMP
  - ★
- Stormwater Structures
  - Inlet, Township
  - Manhole, Township
  - Outflow, Township
  - Inflow, Township
  - ⊕ Inflow/Outflow, Township
  - ⊕ Inlet, State
  - Manhole, State
  - Outflow, State
  - Inflow, State
  - ⊕ Inflow/Outflow, State
  - Inlet, Private
  - ◆ Manhole, Private
  - ◇ Outflow, Private
  - ◇ Inflow, Private
  - ⊕ Inflow/Outflow, Private
- Stormwater Conveyances
  - To Township
  - State
  - Private
- Zit Contours
  - Parcels
  - Township Owned Parcels
  - Township Boundary



**Coventry Village  
Stream Restoration**

1 inch = 150 feet  
0 75 150 300 Feet

**DISCLAIMER:**

This product is for informational purposes and may not have been prepared for, or be suitable for, legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.



**CEDARVILLE**  
Engineering Group, LLC

Westtown, Township,  
Chester County,  
Pennsylvania

MAP UPDATED: June 2017

**NOTES:**

1. Property Owners:  
-Coventry Village HOA  
67-4C-80

# CHESTER CREEK/GOOSE CREEK TMDL/PRP PROPOSED BMP

- Legend**
- MS4 Outfalls
  - BMP
  - Drainage Area
  - Stormwater Structures
  - Inlet, Township
  - Manhole, Township
  - Outflow, Township
  - Inflow, Township
  - Inflow/Outflow, Township
  - Riser, Township
  - Inlet, State
  - Manhole, State
  - Outflow, State
  - Inflow, State
  - Inflow/Outflow, State
  - Inlet, Private
  - Manhole, Private
  - Outflow, Private
  - Inflow, Private
  - Inflow/Outflow, Private
  - Riser, Private
  - Stormwater Conveyances
  - Township
  - State
  - Private
- Streams
  - Non-impaired
  - Impaired
  - Roads
  - Township
  - State
  - Private
  - ZR Contours
  - Parcels
  - Township Owned Parcels
  - Township Boundary

## Thorne Drive Basin Retrofit



**DISCLAIMER:**  
This product is for informational purposes and may not have been prepared for, or be suitable for, legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.

**CEDARVILLE**  
Engineering Group, LLC

Westtown Township,  
Chester County,  
Pennsylvania

MAP UPDATED: June 2017



**NOTES:**  
1. Property Owners:  
- Westtown Township  
67-1-3.2K

**CHESTER CREEK/GOOSE CREEK  
TMDL/PRP PROPOSED BMP**

- Legend**
- MS4 Outfalls
  - BMP
  - Drainage Area
  - Stormwater Structures
  - Inlet, Township
  - Manhole, Township
  - Outflow, Township
  - Inflow, Township
  - Inflow/Outflow, Township
  - Riser, Township
  - Inlet, State
  - Manhole, State
  - Outflow, State
  - Inflow, State
  - Inflow/Outflow, State
  - Inlet, Private
  - Manhole, Private
  - Outflow, Private
  - Inflow, Private
  - Inflow/Outflow, Private
  - Riser, Private
  - Stormwater Conveyances
  - Township
  - State
  - Private
- Streams
  - Non-impaired
  - Impaired
  - Roads
  - Township
  - State
  - Private
  - 2ft Contours
  - Parcels
  - Township Owned Parcels
  - Township Boundary

**Sage Road  
Basin Retrofit**

1 inch = 175 feet  
0 87.5 175 350 Feet

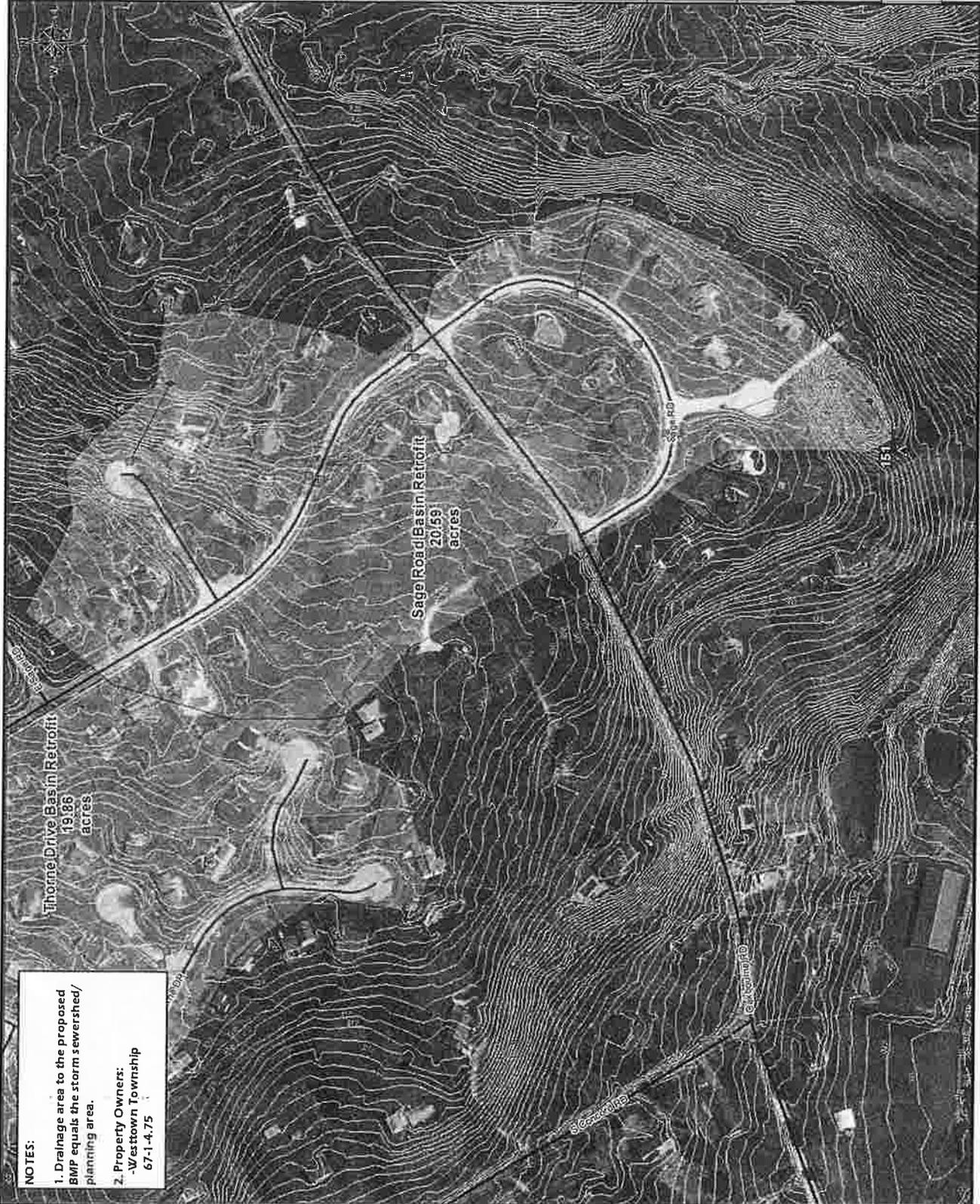
**DISCLAIMER:**

This product is for informational purposes and may not have been prepared for, or be suitable for, legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.

**CEDARVILLE**  
Engineering Group, LLC

Westtown Township,  
Chester County,  
Pennsylvania

MAP UPDATED: June 2017



**NOTES:**

1. Drainage area to the proposed BMP equals the storm watershed/ planning area.
2. Property Owners:  
- Westtown Township  
67-1-4.75

# UPPER BRANDYWINE CREEK PRP PROPOSED BMP

## Legend

- |                          |                        |
|--------------------------|------------------------|
| Streams                  | Non-Impaired           |
| Impaired                 |                        |
| Roads                    | Township               |
| State                    | Private                |
| Zft Contours             |                        |
| Parcels                  | Township Owned Parcels |
| Township Boundary        |                        |
| BMP                      |                        |
| MS4 Outfalls             |                        |
| Stormwater Structures    |                        |
| Inlet, Township          |                        |
| Manhole, Township        |                        |
| Outflow, Township        |                        |
| Inflow, Township         |                        |
| Inflow/Outflow, Township |                        |
| Riser, Township          |                        |
| Inlet, State             |                        |
| Manhole, State           |                        |
| Outflow, State           |                        |
| Inflow, State            |                        |
| Inflow/Outflow, State    |                        |
| Inlet, Private           |                        |
| Manhole, Private         |                        |
| Outflow, Private         |                        |
| Inflow, Private          |                        |
| Inflow/Outflow, Private  |                        |
| Riser, Private           |                        |
| Stormwater Conveyances   |                        |
| Township                 |                        |
| State                    |                        |
| Private                  |                        |

## Radley Run Stream Restoration



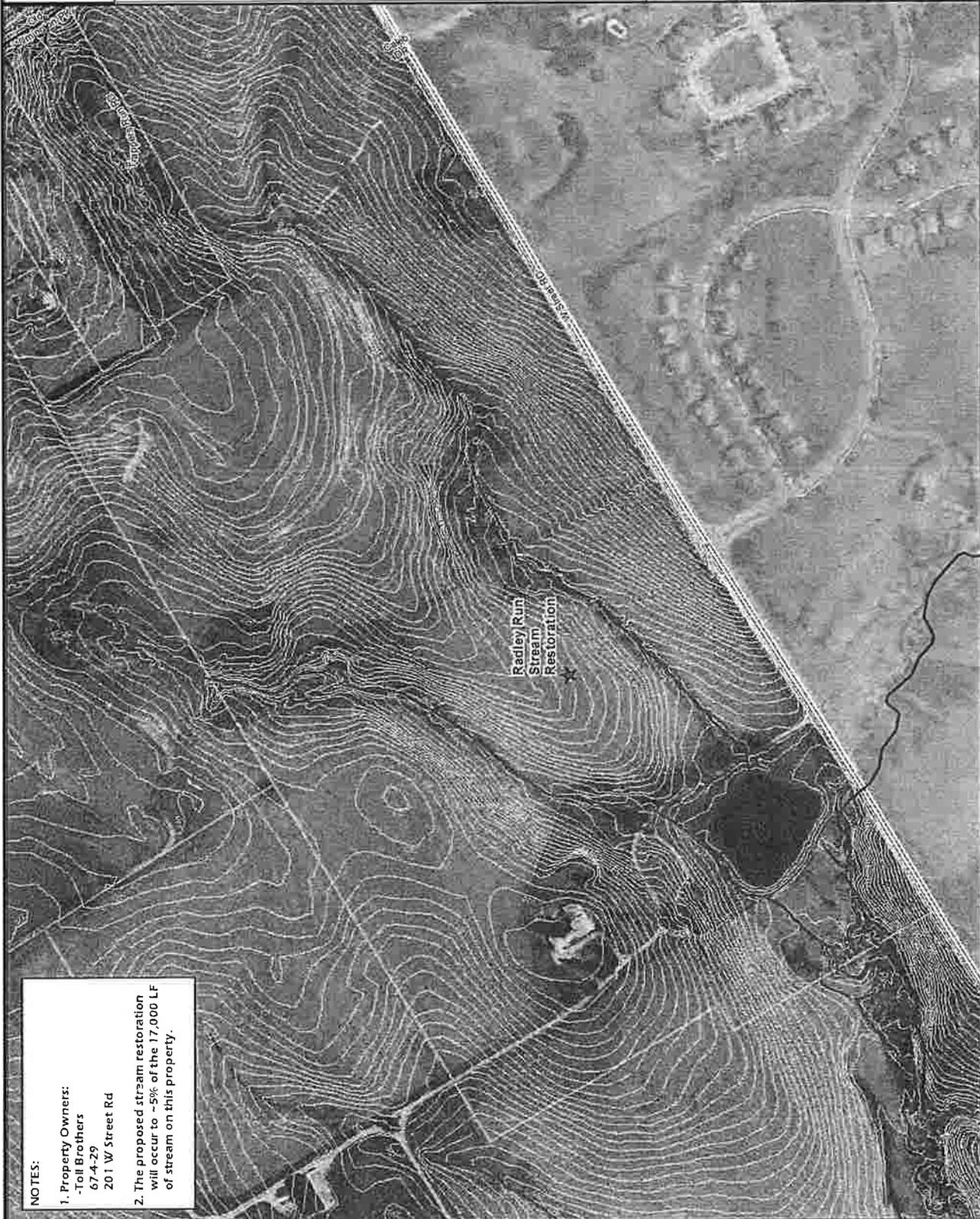
**DISCLAIMER:**  
This product is for informational purposes and may not have been prepared for, or be suitable for, legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.



**CEDARVILLE**  
Engineering Group, LLC

Westtown Township  
Chester County,  
Pennsylvania

MAP UPDATED: June 2017



**NOTES:**

- Property Owners:  
-Toll Brothers  
674-29  
201 W Street Rd
- The proposed stream restoration will occur to ~5% of the 17,000 LF of stream on this property.

# Appendix F

## Storm Sewershed/Planning Area Map





# Appendix G

## Land Cover Map







**Limerick Office**  
649 N. Lewis Road  
Limerick, PA 19468  
T 610.495.0303  
F 610.495.5855

**VIA ELECTRONIC MAIL**

June 19, 2017

Mr. Eugene C. Briggs, Jr., AICP  
Assistant Township Manager  
Easttown Township  
566 Beaumont Road  
Devon, PA 19333

RE: Rockhill Real Estate VI, LP New Car Dealership – 311 Lancaster Avenue  
Preliminary/Final Plan Application  
**Township Engineer Review**  
Township File No. CU 99; LD 112  
ARRO #10917.56

Dear Mr. Briggs:

ARRO has reviewed the following documents for the above-referenced project:

- a) Application for Preliminary/Final Land Development Plan.
- b) Application for Conditional Use.
- c) Cover letter prepared by Fox Rothschild LLP (the “Applicant’s Attorney”) dated June 14, 2017.
- d) Zoning Hearing Board Decision 556.
- e) Waiver request letter prepared by T&M Associates (the “Applicant’s Engineer”) dated June 14, 2017.
- f) Stormwater Management and Erosion and Sediment Control Narrative prepared by the Applicant’s Engineer dated June 14, 2017.
- g) Preliminary/Final Land Development Plans consisting of fourteen (14) sheets prepared by the Applicant’s Engineer dated June 14, 2017 (the “Plan”).

## **APPLICABLE DOCUMENTS**

The documents commonly applicable to subdivision and/or land development projects would appear to be as follows (the following list should not be considered a comprehensive list of all ordinances, plans or requirements that may apply, but rather a list of the ordinances, plans, and requirements that commonly apply to subdivision and/or land development projects):

- Easttown Township Zoning Ordinance, being Chapter 455 of the Easttown Township Code of Ordinances, as amended through Ordinance No. 427-16 (the “Zoning Ordinance”, or “ZO”).
- Easttown Township Natural Resources Protection Ordinance, being Chapter 247 of the Easttown Township Code of Ordinances, as amended through Ordinance No. 424-14 (the “NRPO”).
- Easttown Township Subdivision and Land Development Ordinance of 1973, being Chapter 400 of the Easttown Township Code of Ordinances, as amended through Ordinance No. 424-14 (the “SALDO”).
- Easttown Township Stormwater Management Ordinance, being Chapter 388 of the Easttown Township Code of Ordinances, as amended through Ordinance No. 425-15 (the “SWMO”).
- Public Sanitary Sewage System Ordinance of Easttown Township, being Chapter 345 of the Easttown Township Code of Ordinances, as amended through Ordinance No. 422-14 (the “Public Sanitary Sewer Ordinance”).
- Standard Specifications for Construction of Sanitary Sewers and Appurtenances bearing a revision date of February 10, 2015 adopted via Resolution No. 2015-03 of the Easttown Municipal Authority (the “Sewer Specs”).
- Standard Construction and Material Specifications for Public Improvements, being Chapter A490 of the Easttown Township Code of Ordinances, as amended through Ordinance No. 424-14 (the “Public Improvements Specifications”).

The following comments are offered for your consideration:

## **ZONING ORDINANCE**

1. ARRO defers comment to the Township Zoning Officer regarding Zoning Ordinance compliance.

## **SALDO**

2. §400-14: The Applicant is requesting a partial waiver of this section to allow the Plan to be processed concurrently as a preliminary/final land development plan. We have no issue with requested waiver.
3. §400-22.A and §400-23.A: The Applicant is requesting a waiver of these sections to allow the Plan to be drawing at a scale of 1" = 20' rather than 1" = 50'. We have no issue with the requested waiver.
4. §400-22.B and §400-23.B: The Applicant is requesting a waiver of these sections to allow the Plan to be drawn on 24" x 36" sheets rather than the sizes specified in these sections. We have no issue with the requested waiver.
5. §400-22.C(10): The existing water service line and sanitary building sewer and lateral should be added to the Plan.
6. §400-22.D(1) and §400-23.D(1): The Applicant is requesting a waiver of these sections to allow the typical street cross section drawings to not be provided. As streets are not being proposed, it is our opinion that a waiver is not warranted; however, we suggest that a note be added to the plan stating that the street cross sections required by the subject sections have not been provided, as no streets are proposed.
7. §400-22.D(2) and §400-23.D(2): The Applicant is requesting a waiver of these sections to allow profiles and elevations at 50-foot intervals along proposed streets to not be provided. As streets are not being proposed, it is our opinion that a waiver is not warranted; however, we suggest that a note be added to the plan stating that the profiles and elevations required by the subject sections have not been provided, as no streets are proposed.
8. §400-22.D(4): The Applicant is requesting a waiver of this section to allow preliminary designs of bridges and culverts to not be provided. As bridges and culverts are not being proposed, it is our opinion that a waiver is not warranted; however, we suggest that a note be added to the plan stating that the preliminary bridge and culvert designs required by the subject section have not been provided, as bridges and culverts are not proposed.
9. §400-22.D(5): The Applicant is requesting a waiver of this section to allow submission of a subdivision sewerage disposal report to not be provided. As the Applicant proposes to not alter the prior use or intensity of the site, which is connected to the public sewer system and was previously allocated 2 EDUs, we have no issue with the requested waiver.

10. §400-22.D(6): The Applicant is requesting a partial waiver of this section to allow a conservation plan overlay to not be provided. Based on the Applicant Engineer's justification, we have no issue with the requested waiver.
11. §400-22.D(7): The Applicant is requesting a waiver of this section to allow a sewage facilities planning module to not be provided. We have no issue with the requested waiver, provided that the Applicant obtain sewage facilities planning module exemption from the Pennsylvania Department of Environmental Protection.
12. §400-24: The Applicant is requesting a partial waiver of this section to allow a conservation plan to not be provided. Based on the Applicant Engineer's justification, we have no issue with the requested waiver.
13. §400-25: The Applicant is requesting a waiver of this section to allow an environmental impact assessment to not be provided. Based on the Applicant Engineer's justification, we have no issue with the requested waiver.
14. §400-26.A: Prior to or as a condition of final plan approval, the Applicant should submit to our office for review and approval an improvements cost estimate, and after our office approves same, should post financial security as required by this section. Attached for the Applicant's use in preparing the improvements cost estimate is a document prepared by our office entitled, "Recommendations for Preparation of Improvements Cost Estimates for Easttown Township" dated 10/27/10 and last revised 02/08/11.
15. §400-26.A(1): As a condition of final plan approval, the Applicant should execute a subdivision and land development agreement and financial security agreement in a form and manner acceptable to the Township Solicitor.
16. §400-32 through §400-33 and §400-35 through §400-47: We defer to the Township Transportation Engineer as to compliance with these sections, as applicable.
17. §400-34.A: The right-of-way being offered on the east side of the property should be fully contained to the Applicant's property, and should be offered to either Easttown Township or the Pennsylvania Department of Transportation in perpetuity at no cost. A general note regarding dedication should be added to Sheet 2 of the Plan.
18. §400-49: We defer to the Township Zoning Officer as to compliance with this section regarding lot frontage.
19. §400-50: We defer to the Township Zoning Officer as to compliance with this section regarding building setback lines.

20. §400-52: We defer to the Township Zoning Officer as to compliance with this section regarding lot size.
21. §400-53.B: The Applicant should provide the Township with evidence of sewage facility planning module approval, or exemption therefrom, from the Pennsylvania Department of Environmental Protection.
22. §400-62 & §400-63: We defer to the Township Landscape Architect as to compliance with these sections regarding park, recreation and open space facilities, and dedication of open space and recreational facilities.
23. §400-68: Monuments should be set in accordance with the requirements of this section.
24. §400-69: We defer to the Township Landscape Architect as to compliance with this section regarding landscaping.

#### **SWMO**

25. §388-10: The Applicant should submit an Application for Drainage Permit prior to the building permit application. A Drainage Permit must be issued by the Township prior to the commencement of any work associated with earth disturbance. A note to this effect should be added to the Plan.
26. §388-13.L: The following items should be addressed:
  - a. In the Section View on Sheet 10 of the Plan, the Crates & Geotextile detail reference should be changed from Sheet 14 of 17 to Sheet 13 of 14.
  - b. The stormwater management report should be signed and sealed by the Professional Engineer responsible for its preparation.
27. §388-18.I: It should be stated on the plans the person or firm conducting the infiltration testing, and the type of test performed.
28. §388-18.Q: Leaf guards must be provided for all roof drains. Invisiflow self-cleaning downspout filters or equivalent would be an acceptable alternative.
29. §388-18.T.(4): It should be clarified on the drawings that the geotextile for the infiltration trench will overlap at joints a minimum of twelve (12) inches.

30. §388-25.A(3): The statement required by this section should be added to the Plan and should be signed by the Applicant.
31. §388-35: The plan should include the following in the description of actions necessary to operate, inspect, and maintain the underground basin:  
*The underground basins shall be inspected 72 hours following all rain events exceeding 1" of rainfall. If standing water is visible at that time within any underground basin, the underground basin must be excavated and reconstructed to obtain an infiltration rate approved by Easttown Township.*
32. §388-35.B.(3): The operation and maintenance plan on Sheet 10 of the Plan should be expanded to describe how/when the maintenance valve is to be opened, and limitations regarding opening of same. Depending on the intended use, we may require that the invert elevation of the 8" pipe out of the proposed inlet be raised from 451.80 to 454.62 so as to guarantee that the volume of the infiltration pit is maximized.
33. §388-36: A Stormwater Best Management Practices (BMPs) and Conveyances Operation and Maintenance Agreement (the "BMP Agreement") shall be fully executed and recorded at the Chester County Recorder of Deeds. We defer to the Township Planning Commission Solicitor as to preparation of the BMP Agreement. The BMP Agreement should be processed either as part of the final land development application or building permit application, at the discretion of the Township Planning Commission Solicitor. Prior to commencement of any work associated with earth disturbance, Applicant shall obtain a Drainage Permit from the Township, and the Applicant shall submit a copy of the BMP Agreement recording receipt to the Township. The Township shall be provided with a copy of the fully recorded BMP Agreement before the Drainage Permit will be closed out, and the Drainage Permit must be closed out before any Certificate of Occupancy can be issued. The existence and applicability of the BMP Agreement should be identified on the Plan. Exhibit A to the BMP Agreement will be prepared and issued by either our office or the Township Planning Commission Solicitor as part of the final plan approval process.
34. §388-41.B.(3): The plans as presented make no provisions for connections of sump pumps or foundation drains to the stormwater management bed. It should be noted on the plans that currently there are no provisions for the connections of sump pumps and foundation drains to the infiltration bed and that any provisions for future connections of sump pumps and foundation drains to the infiltration bed will require a re-design of the system.
35. §388-45.A: The following should be added to the plan as a general note:  
*Permittee or Permittee's designee shall contact the Township at 610-687-3000 to arrange the pre-construction conference at the site with the Township Engineer. The pre-construction conference must be held prior to commencement of any work associated with the site. The Township Engineer's office hours in Easttown Township are Mondays and Wednesdays between 9:00 AM and noon.*

## **SEWER SPECS**

36. A note should be added to the Plan stating that should any sanitary sewer work be required, all sanitary sewer construction materials, means, methods, testing and procedures shall be in accordance with Easttown Municipal Authority's Standard Specifications for Construction of Sanitary Sewers and Appurtenances bearing a revision date of February 10, 2015.
37. §14.1.A: Note 3 on Sheet 4 of the Plan references "service". If any wastewater is generated anything other than a toilet or a bathroom or kitchen sink, a grease trap should be retrofit into the existing sewer system if not already present.
38. §14.1.B&C: If a grease trap is proposed for retrofit, either details and specifications should be provided on the Plan for the grease traps, or a note should be added to the Plan stating that such information shall be provided to the Authority Engineer for review and approval prior to installation.

## **PUBLIC IMPROVEMENTS SPECIFICATIONS**

39. A note should be added to the Plan stating that all construction materials, means, methods, testing and procedures shall be in accordance with Easttown Township's Standard Construction and Material Specifications for Public Improvements, being Chapter A490 of the Easttown Township Code of Ordinances, as amended through Ordinance No. 424-14.
40. §A490-26: A note should be added to the plan stating the acceptable working days and hours as identified in this section.

## **GENERAL COMMENTS**

41. A general note should be added to the Plan stating that the Developer shall submit Zoning and Drainage Permit applications to the Township for review and approval prior to submission of a Building Permit application.
42. The Waivers block on Sheet 1 of the Plan should be revised after the Board of Supervisors considers the waivers to list the waivers approved by the Board of Supervisors, including date of approval.
43. The right side of the General Notes column on Sheet 2 of the Plan is cut off, and should be included in full in the next submission.

Eugene C. Briggs, Jr., AICP  
Easttown Township  
January 19, 2017  
Page 8

44. We defer to the Township Transportation Engineer as to all issues related to a potential PennDOT Highway Occupancy Permit, as well as to all issues related to site access, crosswalks, street signs and markings, curb ramps and traffic and pedestrian circulation.
45. We defer to the Township Landscape Architect as to all issues related to landscaping and lighting, and as to recommendations on all waivers of the Natural Resources Protection Ordinance NRPO.
46. All signature blocks within the Plan should be signed as a condition of preliminary/final plan approval, and prior to recording. Eight (8) original full-size, fully executed, signed/sealed and full/complete Plan sets should be recorded, and three (3) recorded original Plan sets should be furnished to the Township after recording. It is our understanding that the County will retain four (4) recorded originals, and the Applicant should retain one (1) original.
47. All legal instruments, as determined necessary and appropriate by the Township Planning Commission Solicitor, should be submitted for review and approval by the Township Planning Commission Solicitor prior to or as a condition of final plan approval. For each legal instrument requiring a legal description (and accompanying plat, if determined necessary by the Township Planning Commission Solicitor), such legal description (and accompanying plat, if appropriate) should be provided to the Township Engineer for review and approval prior to or as a condition of final plan approval.
48. Additional comments may be forthcoming based upon review of revised plans.
49. All comments offered by the Township Zoning Officer, Township Solicitor, Township Planning Commission Solicitor, Township Landscape Architect and Township Transportation Engineer should be successfully addressed, as well as all comments offered by the Township Planning Commission and any other Township advisory body.

We trust that our comments will be of assistance to the Township. Please feel free to contact me via email at [brady.flaharty@thearrogroupp.com](mailto:brady.flaharty@thearrogroupp.com) or by mobile phone at 484-995-7137 with any questions.

Sincerely,



Eugene C. Briggs, Jr., AICP  
Easttown Township  
January 19, 2017  
Page 9

Brady L. Flaharty, P.E.  
ARRO Consulting, Inc. – Township Engineer

BLF: blf

Attachment

c: Jennifer L. Wunder, Esq., Applicant's Attorney – Fox Rothschild, LLP  
Keith A. Lieberman, P.E., Applicant's Engineer – T&M Associates  
Andrew D.H. Rau, Esq., Township BOS Solicitor - Unruh Turner Burke & Frees, P.C.  
Kristin S. Camp, Esq., Township PC Solicitor – Buckley, Brion, McGuire & Morris, LLP  
Lisa L. Thomas, RLA, AICP, LEED AP, Twp. Landscape Architect – Glackin Thomas Panzak, Inc.  
Christopher J. Williams, P.E., Township Transportation Engineer – McMahon Associates, Inc.

