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POLLUTANT REDUCTION PLAN RADNOR TOWNSHIP, DELAWARE COUNTY, PA

Prepared for:
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Table of Contents

I	Purpo	se	1
II	Backg	round	1
	A. Imp	paired Streams	1
	B. Per	mit Requirements	3
Ш	Summ	nary of Findings	4
IV	PRP E	lements	5
	A. Pub	lic Participation	5
	B. Ma	ps	5
	1.	Cobbs Creek Watershed	5
	2.	Plymouth Creek – Schuylkill River Watershed	9
	3.	Darby Creek Watershed	13
	C. Pol	utants of Concern	19
	D. Det	ermine Existing Loading for Pollutants of Concern	19
	1.	Pollutant Load Analysis	19
	2.	Parsed Watershed Areas and Impervious and Pervious Areas	19
	3.	Loading Rate	21
	4.	Existing Pollutant Loading	21
	5.	Adjust Estimated Pollutant Loading for Existing (Previously Implemented) BMPs	23
	E. Sele	ect BMPs to Achieve the Minimum Required Reductions in Pollutant Loading	25
	1.	Cobbs Creek Watershed	27
	2.	Plymouth Creek – Schuylkill River Watershed	31
	4.	Darby Creek Watershed	61
	F. Ide	ntify Funding Mechanisms	131
	G.Ide	ntify Responsible Parties for BMP Operations and Maintenance (O&M) of BMPs	132
V	Concl	usion	138
VI	Apper	ndices	139
	Apper	ndix A. Public Notice, Record of Public Comment/Reponses, and Record of Consideration	141
	Apper	ndix B. PaDEP Developed Land Loading Rates for PA Counties	143
	Apper	ndix C. PaDEP BMP Effectiveness Values	145
	Apper	ndix D. Supporting Calculations	147
	Apper	ndix E. Supporting BMP Documentation	157

I Purpose

The Township of Radnor, Delaware County has prepared this Pollutant Reduction Plan (PRP) for Municipal Separate Storm Sewer System (MS4) discharges to Cobbs Creek (HUC 12 Code: 020402020504), Plymouth Creek – Schuylkill River (HUC 12 Code: 020402031007), and Darby Creek (HUC 12 Code: 020402020505) in compliance with the current application requirements of PAG-13, National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems. The Pennsylvania Department of Environmental Projection (PaDEP) administers the stormwater requirements of the Clean Water Act through the Municipal Separate Storm Sewer (MS4) program. As required under PAG-13, this PRP provides an estimate of the current pollutant load of sediment discharged to impaired streams from Radnor Township MS4 areas, and provides a plan to reduce this load by at least 10% within the next five years through the implementation of Best Management Practices (BMPs). BMPs identified within this plan include existing detention basin retrofits, streambank restoration, and implementation of porous pavement, bioretention, and/or subsurface infiltration to manage impervious and pervious areas.

Radnor Township has been proactive in stormwater management activities, including the development of a Township-wide Geographic Information System that includes storm sewer and outfall information, the implementation of a Stormwater Fee, the formation of a Stormwater Management Advisory Committee (SWMAC), the implementation of strategic stormwater management projects to reduce flooding and/or improve water quality, and the development of several stormwater management studies. These earlier stormwater management efforts help to inform the analysis and findings of this PRP, including project-specific BMPs.

II Background

A. Impaired Streams

Radnor Township, located in Delaware County, Pennsylvania, covers 13.78 square miles. There are twenty-two impaired watersheds, as listed in the 2014 Pennsylvania Integrated Water Quality Monitoring and Assessment Report (Integrated Report), that are located all or in part within the boundaries of Radnor Township. These watersheds are listed below in Table 1. Many of these watersheds are impaired for sedimentation and one is impaired for nutrients. These watersheds fall under three Hydrologic Unit Codes (HUC) for larger watersheds, as also indicated in Table 1.

The streams and watersheds within Radnor Township are shown in Figure 1. The cross-hatched area represents Radnor Township. Watershed boundaries appear in dark green outline and light green fill. Impaired streams are shown in red, while unimpaired streams are shown in blue. A total of 254 mapped outfalls discharge to impaired stream segments within Radnor Township.

Table 1: Municipal MS4 Requirement Table, modified from PaDEP (PaDEP 2014 Integrated Report)

HUC 12	Impaired Waters	Requirements	Causes of Impairment
Cobbs Creek	Cobbs Creek	Appendix B-Pathogens (5)	Cause Unknown (5)
HUC: 020402020504		Appendix C-PCB (5)	Other Habitat Alterations
		Appendix E-Siltation (5)	Water/Flow Variability (4c)
Plymouth Creek –	Gulph Creek	Appendix E-Siltation (5)	Water/Flow Variability (4c)
Schuylkill River	Mill Creek	Appendix E-Nutrients	Water/Flow Variability (4c)
HUC: 020402031007		Siltation (5)	
Darby Creek	Saw Mill Run	Appendix C-PCB (5)	Cause Unknown (5)
HUC: 020402020505			Water/Flow Variability (4c)
	Browns Run	Appendix C-PCB (5)	Cause Unknown (5)
		Appendix E-Siltation (5)	Other Habitat Alterations
			Water/Flow Variability (4c)
	Abrahams Run	Appendix C - PCB (5)	Cause Unknown (5)
			Water/Flow Variability (4c)
	Miles Run	Appendix C - PCB (5)	Cause Unknown (5)
			Water/Flow Variability (4c)
	Glennbrook*		
	Kirks Run	Appendix C-PCB (5)	Cause Unknown (5)
		Appendix E-Siltation (5)	Other Habitat Alterations
	Marrie Install Des	A	Water/Flow Variability (4c)
	Meadowbrook Run	Appendix C-PCB (5)	Cause Unknown (5)
		Appendix E-Siltation (5)	Other Habitat Alterations Water/Flow Variability (4c)
	Little Darby Creek	Appendix C-PCB (5)	Cause Unknown (5)
	Little Darby Creek	Appendix C-FCB (3)	Water/Flow Variability (4c)
	Van Lear's Run*		water/110w variability (4c)
	Darby Creek	Appendix C-PCB (5)	Cause Unknown (5)
	Daiby creek	Appendix E-Siltation (5)	Other Habitat Alterations
		ripperiant 2 entation (e)	Water/Flow Variability (4c)
	Valley Run	Appendix C-PCB (5)	Cause Unknown (5)
	'	Appendix E-Siltation (5)	Other Habitat Alterations
			Water/Flow Variability (4c)
	Ithan Creek	Appendix C-PCB (5)	Cause Unknown (5)
		Appendix E-Siltation (5)	Other Habitat Alterations
			Water/Flow Variability (4c)
	Hardings Run	Appendix C-PCB (5)	Cause Unknown (5)
		Appendix E-Siltation (5)	Other Habitat Alterations
			Water/Flow Variability (4c)
	Foxes Run	Appendix C-PCB (5)	Cause Unknown (5)
		Appendix E-Siltation (5)	Other Habitat Alterations
	Comman Down	Annandia C. DCD (5)	Water/Flow Variability (4c)
	Camp Run	Appendix C - PCB (5)	Cause Unknown (5)
	Finn Run	Appendix C-PCB	Water/Flow Variability (4c) Cause Unknown (5)
	I IIIII NUII	Appendix E-Siltation (5)	Other Habitat Alterations
		Appendix L-Siltation (5)	Water/Flow Variability (4c)
	Doom Run	Appendix C-PCB (5)	Cause Unknown (5)
	Doom Nun	Appendix E-Siltation (5)	Other Habitat Alterations
		Appendix E Situation (5)	Water/Flow Variability (4c)
	Wigwam Run*		1.460,7.7611 141.4611117, (10)
	Julip Run*		
*Not included in Depth		ant Table had an account from the	United to UUC 13 hos!:-
"Not included in PaDEP's	s iviunicipai iVIS4 Requirem	ent Table, but appear as impaired	waters to HUC 12 basin.

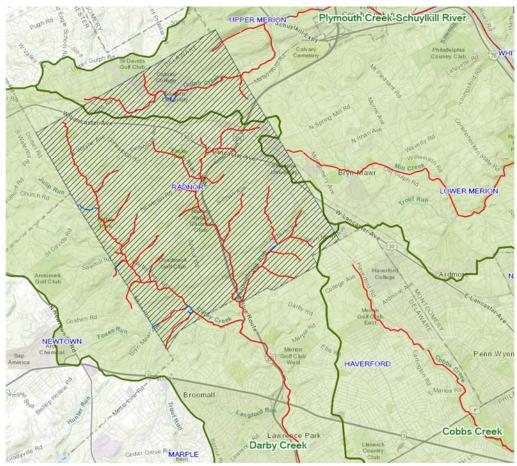


Figure 1: Streams and Watersheds of Radnor Township

B. Permit Requirements

The PaDEP administers all MS4 program stormwater requirements issued by the federal Clean Water Act. In December 2002, PaDEP issued PAG-13, a general permit for use by all small MS4s in Pennsylvania. The current 2013 PAG-13 will be reissued as the 2018 PAG-13.

Radnor Township currently operates under NPDES General Permit No. PAG130102, and is required to submit a Notice of Intent (NOI) for permit coverage under the 2018 PAG-13 General Permit. The 2018 PAG-13 also requires development and implementation of a Pollutant Reduction Plan (PRP) for discharges to local waters that are impaired by sediment and/or nutrients. The NOI and PRP must both be submitted to PaDEP by September 16, 2017.

The MS4 General Permit requires that the PRP provide a strategy to reduce sediment loading by at least 10% over the next five years, phosphorus loading by 5%, and nitrogen loading by 3% for all impaired streams within the municipality. As indicated in Table 1, the Pollutants of Concern are sediment and nutrients. Per PaDEP's presumptive approach, this PRP assumes that if sediment loading is reduced by 10%, then the nutrient reduction requirements for phosphorus and nitrogen are also met.

III Summary of Findings

The analysis performed within this PRP and implementation of proposed BMPs, Radnor Township will the required 10% sediment reduction from MS4 outfalls to impaired waters within 5 years of PaDEP's approval under the 2018 PAG-13 General Permit. The sediment reductions are anticipated to provide benefits to stream quality. Information shown in Table 2 summarize the existing sediment loads, required sediment reductions, and proposed reductions through BMP implementation. A detailed description of all required elements of the PRP and analyses performed follows this summary of findings.

Table 2: Summary of existing loads, required reductions, and proposed reductions

HUC 12	Waterway	Total Load (lbs/yr)	Existing BMP (Ibs/yr)	Required Reduction (lbs/yr)	BMP Load Reduction (lbs/yr)	Reduction %	HUC 12 Reduction %
Cobbs Creek (HUC: 020402020504)	Cobbs Creek	26,591	0	2659.1	8,948	34	34
Plymouth Creek – Schuylkill River	Gulph Creek	475,860	147	47571.3	68,563	14	12
(HUC: 020402031007)	Mill Creek	95,439	0	9543.9	0	0	
Darby Creek (HUC: 020402020505)	Saw Mill Run	9,614	0	961.4	0	0	14
	Browns Run	119,971	0	11997.1	0	0	
	Abrahams Run	23,305	0	2330.5	0	0	
	Miles Run	30,126	326	2980	0	0	
	Glennbrook	29,533	0	2953.3	0	0	
	Kirks Run	144,532	7,576	13695.6	10,500	7	
	Meadowbro ok Run	198,593	11,525	18706.8	23,824	12	
	Little Darby Creek	328,356	4,464	32389.2	92,447	28	
	Van Lear's Run	31,704	0	3170.4	0	0	
	Darby Creek	134,760	0	13476	0	0	
	Valley Run	214,796	0	21479.6	0	0	
	Ithan Creek	890,912	20,617	87029.5	188,385	21	
	Hardings Run	251,917	0	25191.7	40,182	16	
	Foxes Run	53,300	0	5330	0	0	
	Camp Run	10,665	0	1066.5	0	0	
	Finn Run	37,423	0	3742.3	0	0	
	Doom Run	1,590	0	159	0	0	
	Wigwam Run	7,948	0	794.8	0	0	
Total		3,116,935	44,655	307,280	432,849	14	

IV PRP Elements

A. Public Participation

The Township of Radnor made this Pollutant Reduction Plan (PRP) available for public review on August 2, 2017. The PRP was featured in a newspaper of general circulation more than 45 days before the submission of this report to PaDEP. A public meeting was held on August 10, 2017, where all comments were welcome. A copy of the public notice, record of public comment and responses, and record consideration can be found in Appendix A.

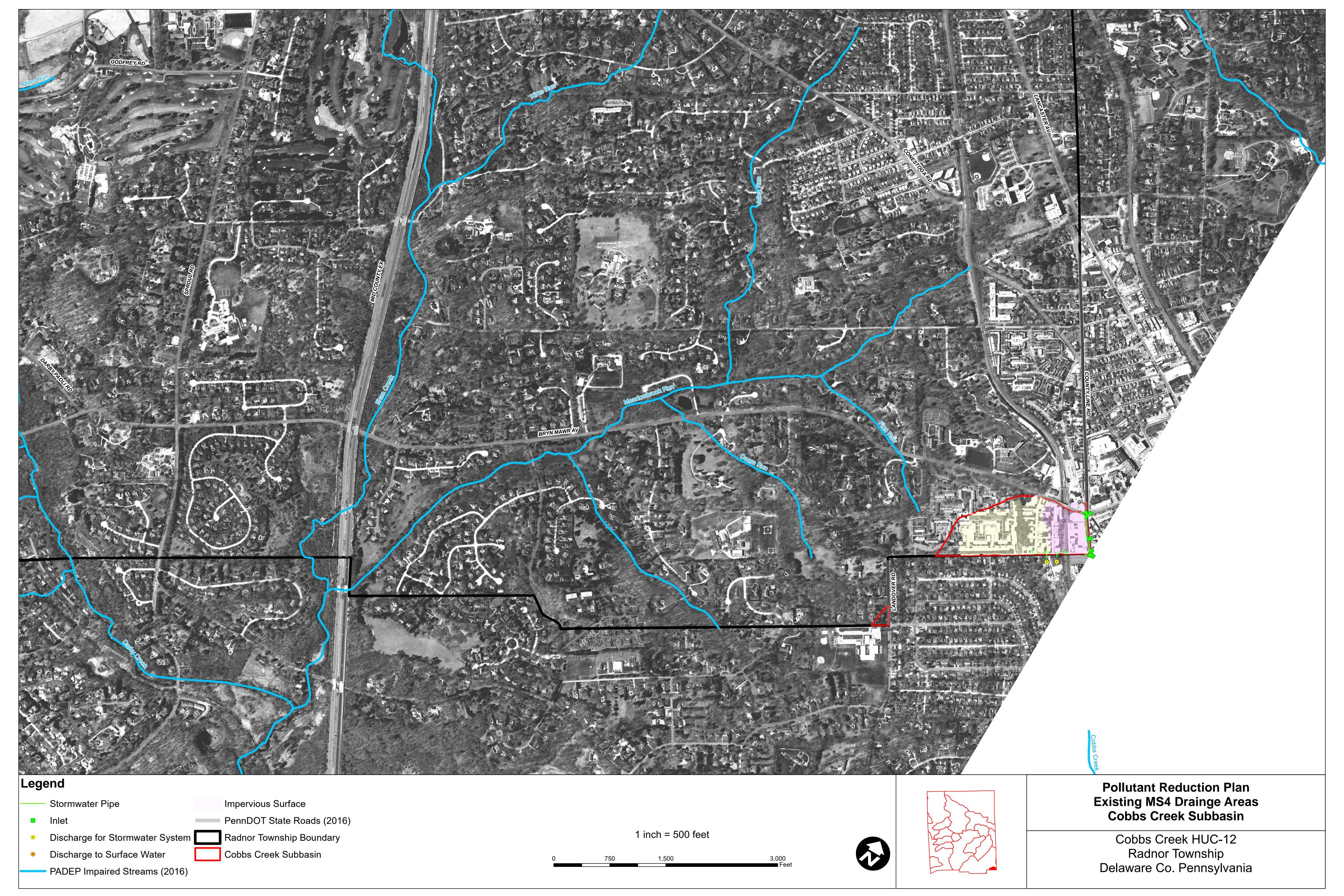
B. Maps

1. Cobbs Creek Watershed

There is one impaired stream that drains to Cobbs Creek Basin (HUC 12 Code: 020402020504), which is Cobbs Creek itself. A map is included for each waterway in Cobbs Creek that identifies the impervious/pervious surfaces associated with each MS4 outfall that discharges to the impaired surface water.

Cobbs Creek

A small portion of the southeast corner of Radnor Township drains to Cobbs Creek. Cobbs Creek is located within the Cobbs Creek Basin (HUC 12) and eventually drains to the Lower Delaware River. Cobbs Creek is impaired for pathogens, PCBs, and siltation.



2. Plymouth Creek – Schuylkill River Watershed

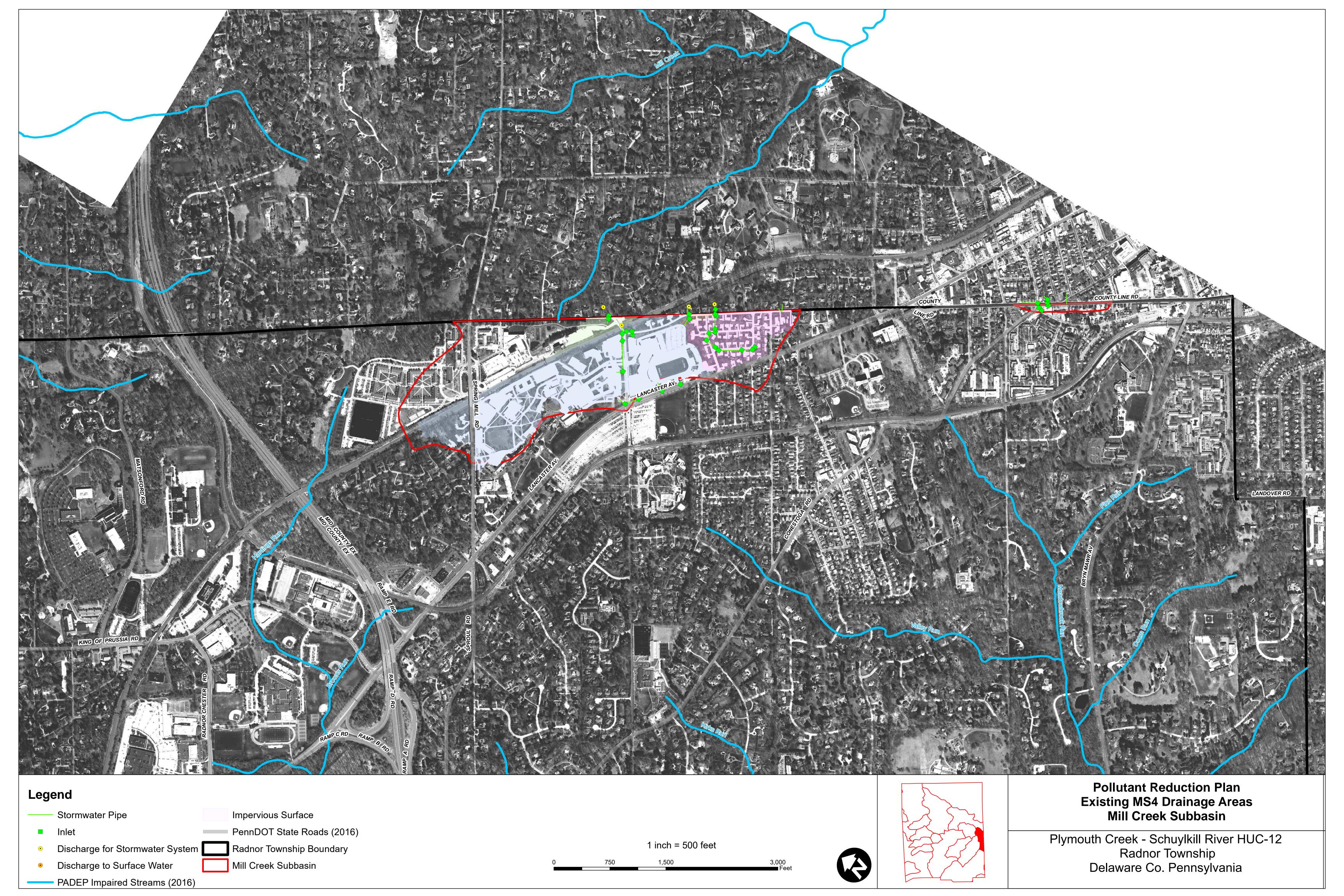
There are two impaired streams that drains to Plymouth Creek – Schuylkill River Basin (HUC 12 Code: 020402031007), which are Gulph Creek and Mill Creek. A map is included for each waterway in Cobbs Creek that identifies the impervious/pervious surfaces associated with each MS4 outfall that discharges to the impaired surface water.

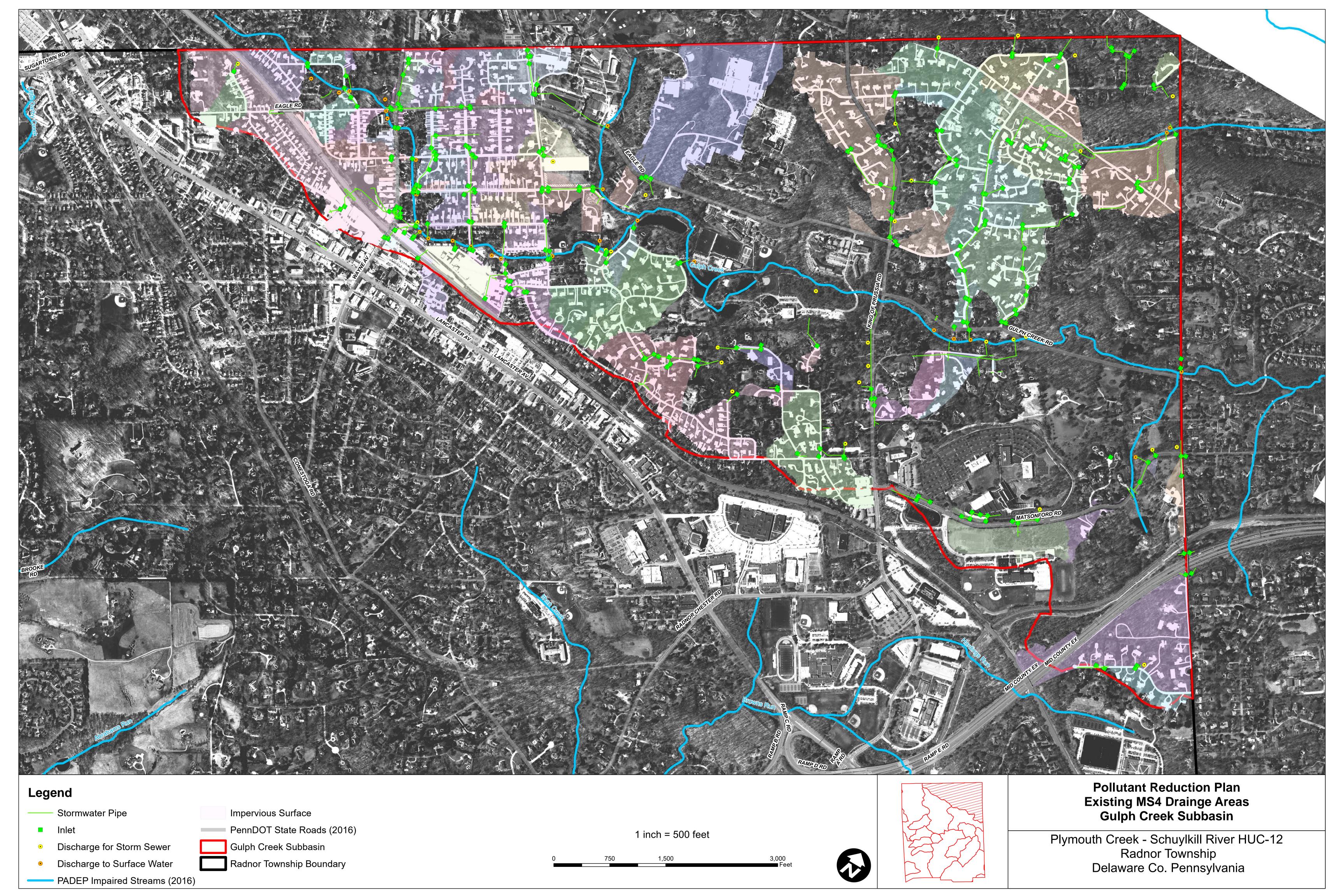
Gulph Creek

Gulph Creek runs along the northeast portion of Radnor Township. Gulph Creek is located within the Plymouth Creek-Schuylkill River Watershed (HUC 12) and eventually drains to the Schuylkill River. Gulph Creek is impaired for siltation. See map after this section.

Mill Creek

Portions of Radnor Township drain to Mill Creek, which is located west of Radnor Township. Mill Creek is located within the Plymouth Creek-Schuylkill River Watershed (HUC 12) and eventually drains to the Schuylkill River. Mill Creek is impaired for nutrients and siltation. See map after this section.





3. Darby Creek Watershed

There are several impaired streams that drains to Darby Creek Basin (HUC 12 Code: 020402020505), which are described in more detail below. Descriptions of each waterway appear below. Maps follow the descriptions for waterways in Cobbs Creek that identify the impervious/pervious surfaces associated with each MS4 outfall that discharges to the impaired surface water. Some waterways are tributary to other waterways, and are therefore combined on the maps as noted.

Saw Mill Run

Saw Mill Run is located in western Radnor Township and drains to Darby Creek. Saw Mill Run is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. Saw Mill Run is impaired for PCBs. Note that Saw Mill is included within the map for Darby Creek. See map following this section.

Browns Run

Browns Run drains into Ithan Creek in central Radnor Township. Browns Run is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. Browns Run is impaired for PCBs and siltation. See map following this section.

Abrahams Run

Abrahams Run is located in western Radnor Township and drains into Little Darby Creek. Abrahams Run is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. Abrahams Run is impaired for PCBs. See map following this section.

Miles Run

Miles Run is located in western Radnor Township and drains into Darby Creek. Miles Run is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. Miles Run is impaired for PCBs. See map following this section.

Glennbrook

Glennbrook is a tributary to Meadowbrook Run, located in southeastern Radnor Township. Glenbrook is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. Note that Glenbrook is included within the map for Meadowbrook Run. See map following this section.

Kirks Run

Kirks Run drains into Ithan Creek in central Radnor Township. Kirks Run is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. Kirks Run is impaired for PCBs and siltation. See map following this section.

Meadowbrook Run

Meadowbrook Run drains into Ithan Creek in southern Radnor Township. Meadowbrook Run is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. Meadowbrook Run is impaired for PCBs and siltation. See map following this section.

Little Darby Creek

Little Darby Creek runs along the western portion of Radnor Township and drains into Darby Creek. Little Darby Creek is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. Little Darby Creek is impaired for PCBs. See map following this section.

Van Lear's Run

Van Lear's Run is a tributary to Ithan Creek in central Radnor Township. Ithan Creek is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. Note that Van Lear's Run is included within the map for Ithan Creek (upper). See map following this section.

Darby Creek

Darby Creek is located at the southwestern portion of Radnor Township. Darby Creek is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. Darby Creek is impaired for PCBs and siltation. See map following this section.

Valley Run

Valley Run drains into Meadowbrook Run at the southeast of Radnor Township. Valley Run is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. Valley Run is impaired for PCBs and siltation. See map following this section.

Ithan Creek

Ithan Creek runs through the center of Radnor Township. Ithan Creek is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. Ithan Creek is impaired for PCBs and siltation. See map following this section.

Hardings Run

Hardings Run is located east of central Radnor Township and drains to Browns Run. Hardings Run is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. Hardings Run is impaired for PCBs and siltation. See map following this section.

Foxes Run

Foxes Run is located at the southwest of Radnor Township and drains into Darby Creek. Foxes Run is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. Foxes Run is impaired for PCBs and siltation. Note that Foxes Run is included within the map for Darby Creek. See map following this section.

Camp Run

Camp Run drains to Little Darby Creek in western Radnor Township. Camp Run is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. Camp Run is impaired for PCBs. See map following this section.

Finn Run

Runn Run is located at the southeast of Radnor Township and drains Into Meadowbrook Run. Finn Run is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. Finn Run is impaired for PCBs and Siltation. Note that Finn Run is included within the map for Meadowbrook Run. See map following this section.

Doom Run

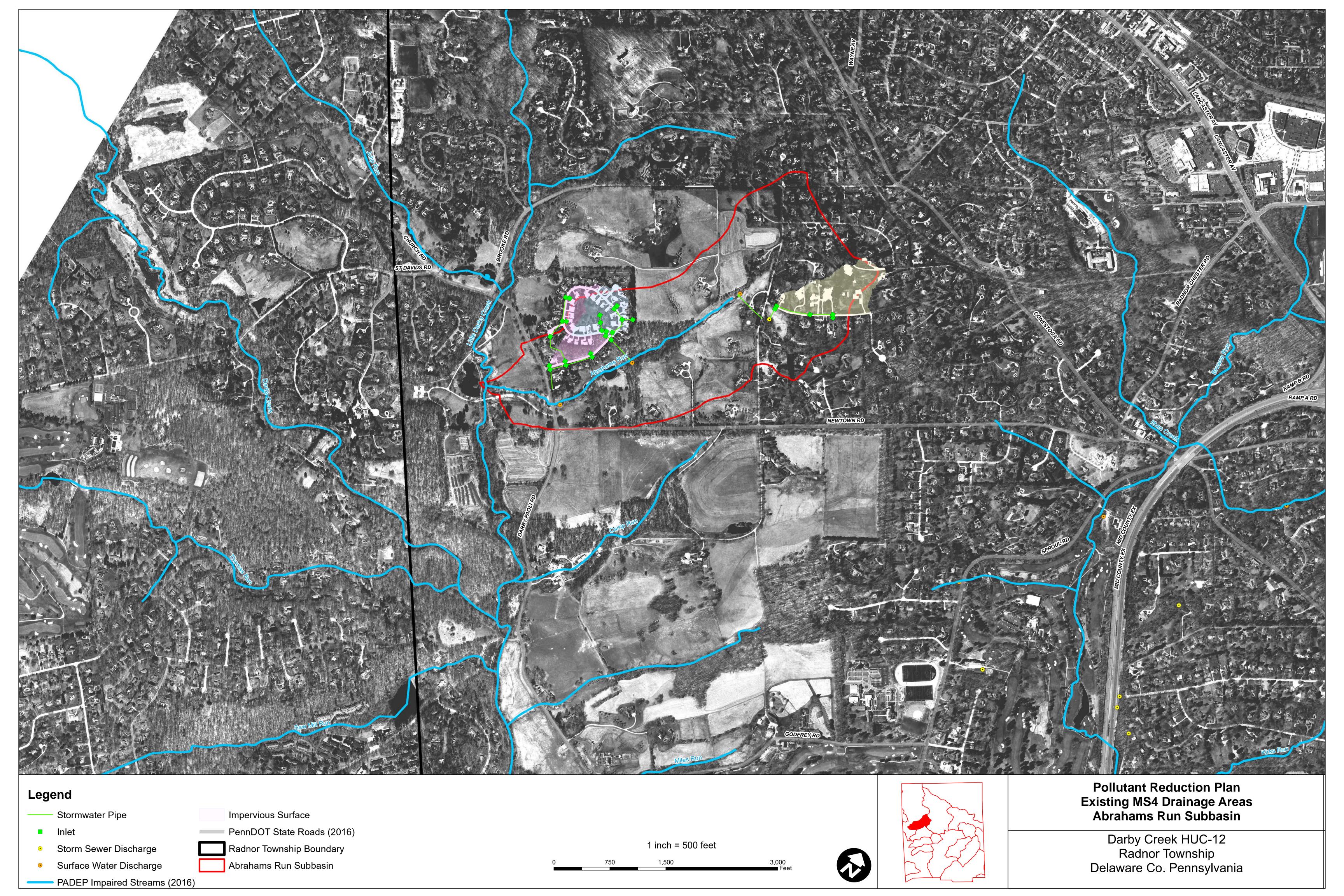
Doom Run is located in southern Radnor Township and drains into Meadowbrook Run. Doom Run is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. Doom Run is impaired for PCBs and siltation. Note that Doom Run is included within the map for Meadowbrook Run. See map following this section.

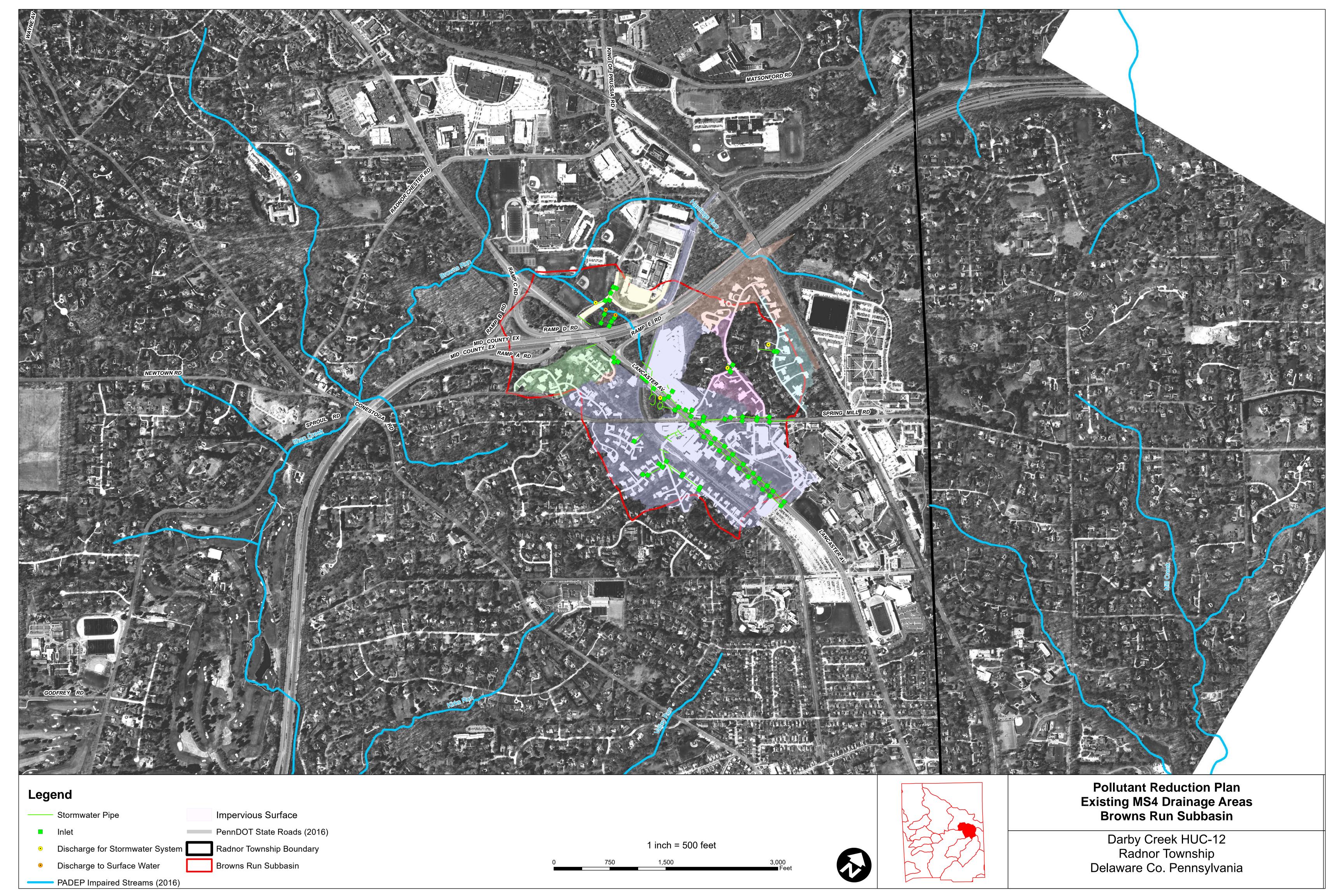
Wigwam Run

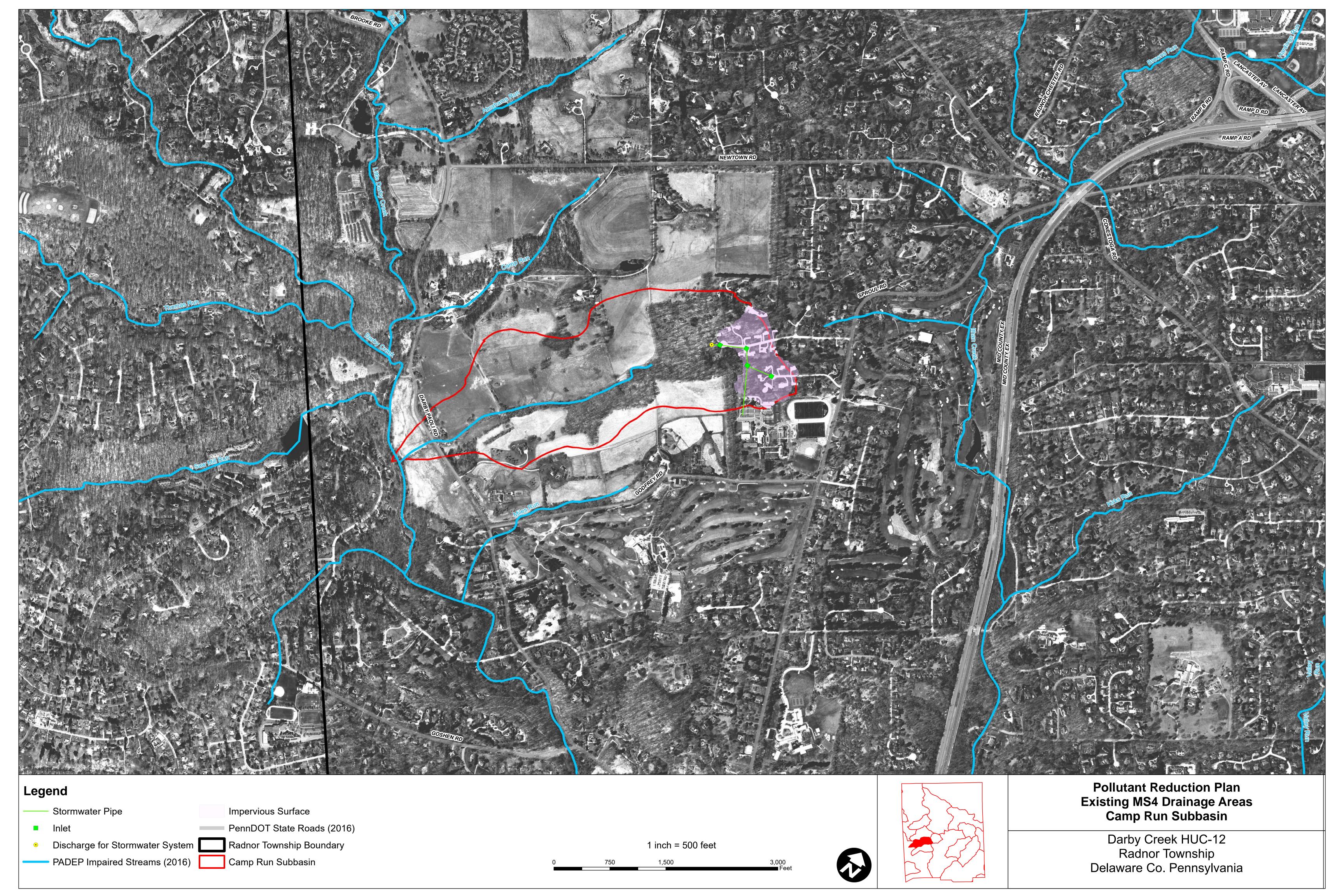
Wigwam Run is located in southwest Radnor Township and drains into Darby Creek. Wigwam Run is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. See map following this section.

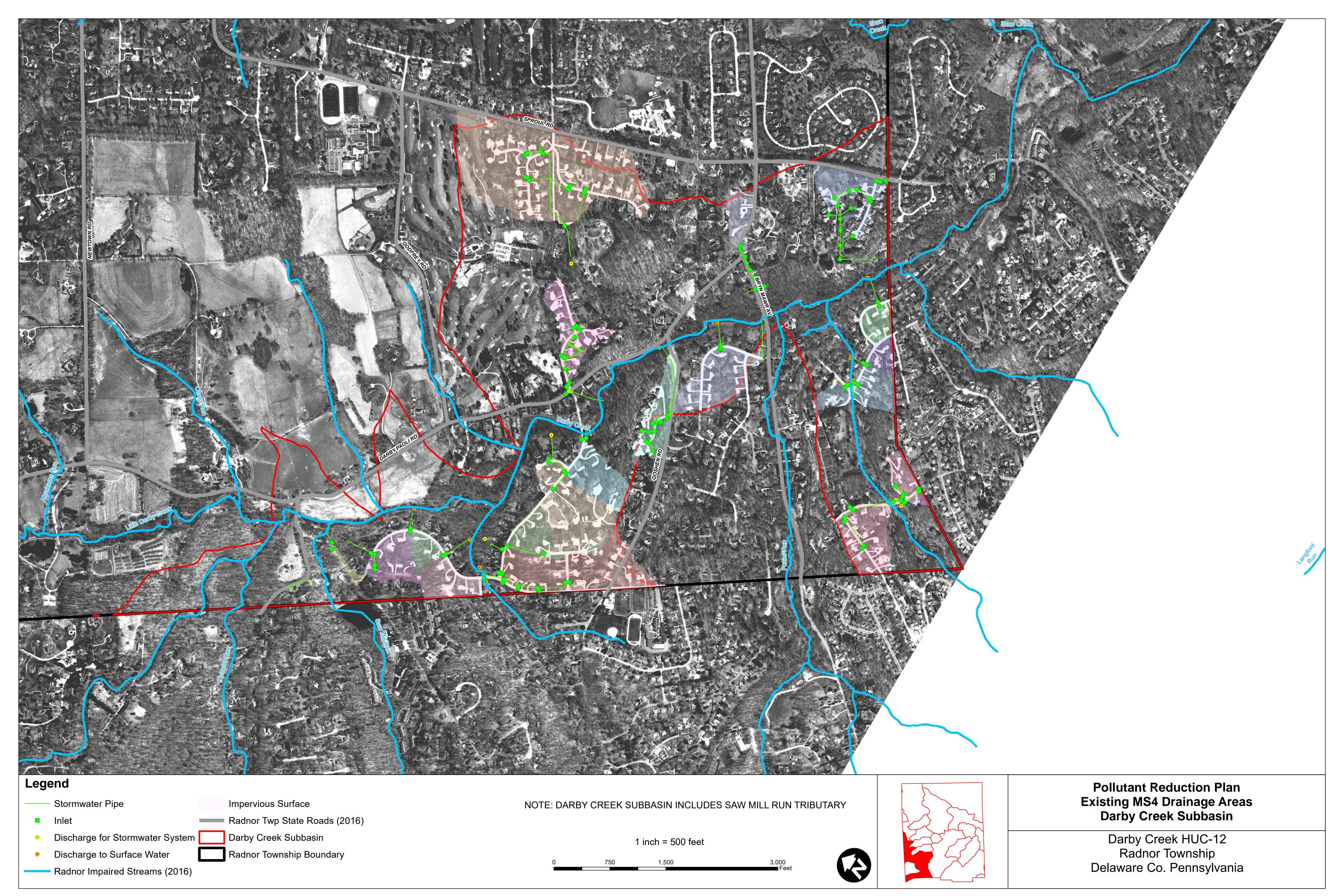
Julip Run

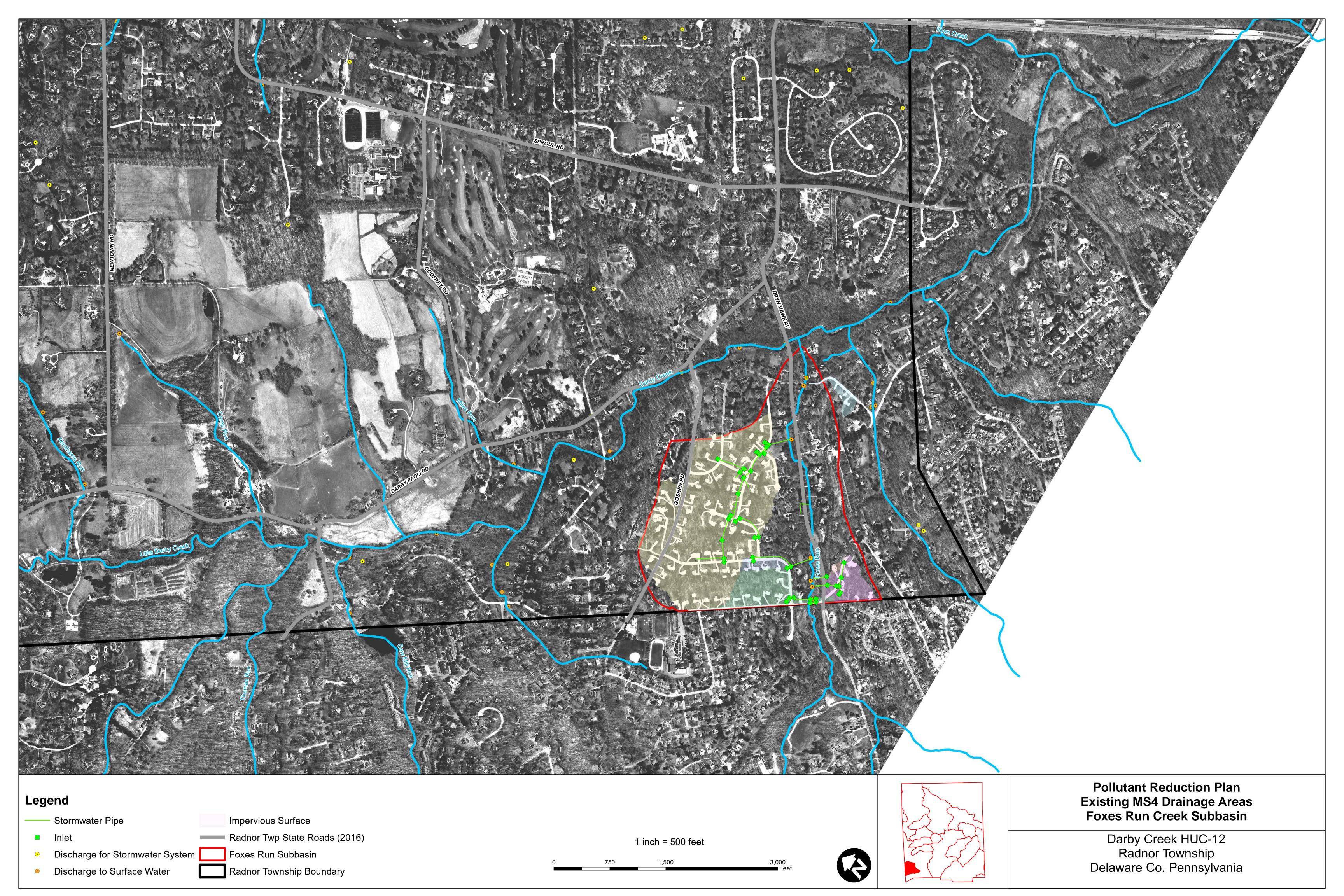
Julip Run is located in western Radnor Township and drains into Little Darby Creek. Julip Run is located within the Darby Creek Watershed (HUC 12) and eventually drains to the Lower Delaware River. See map following this section.

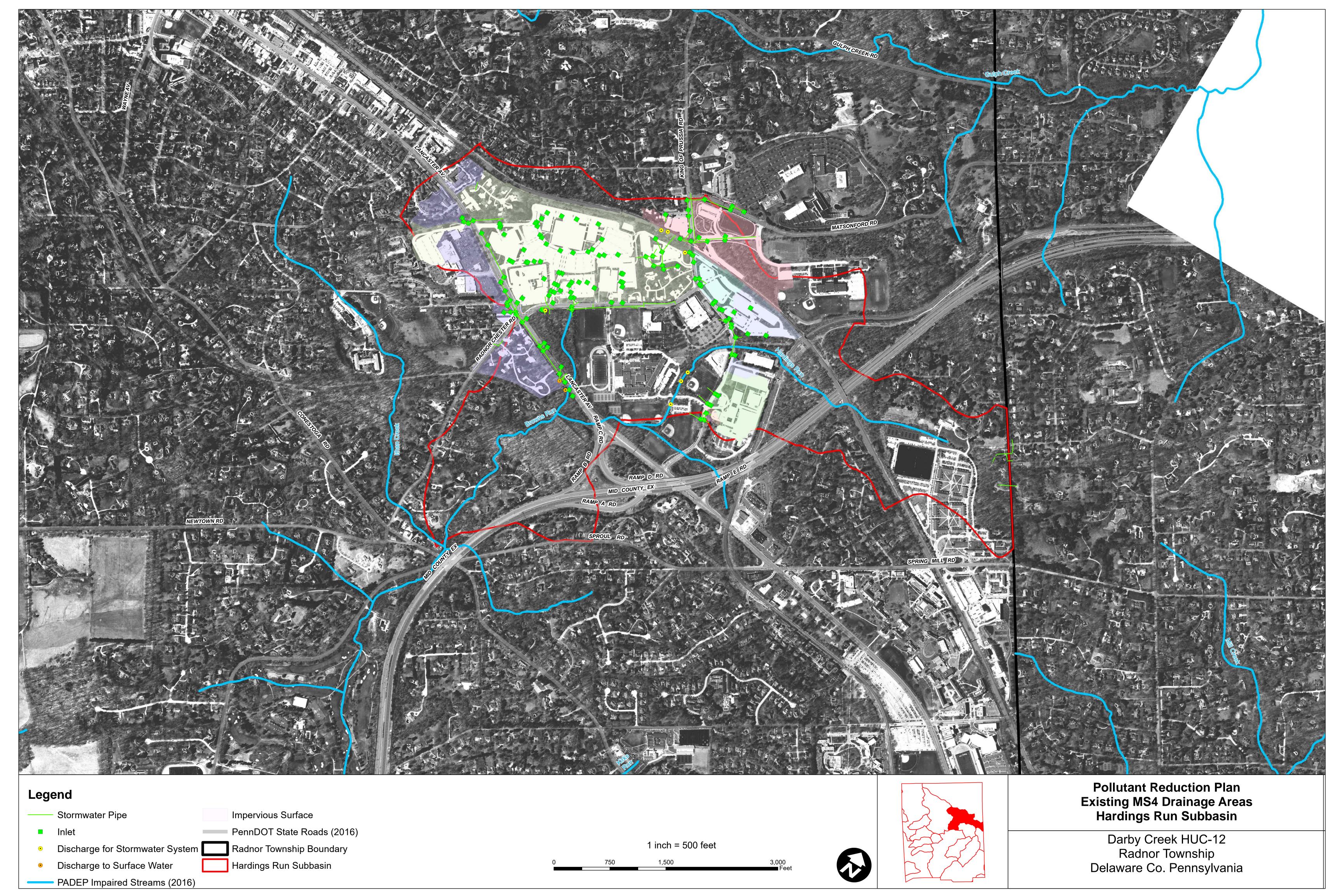


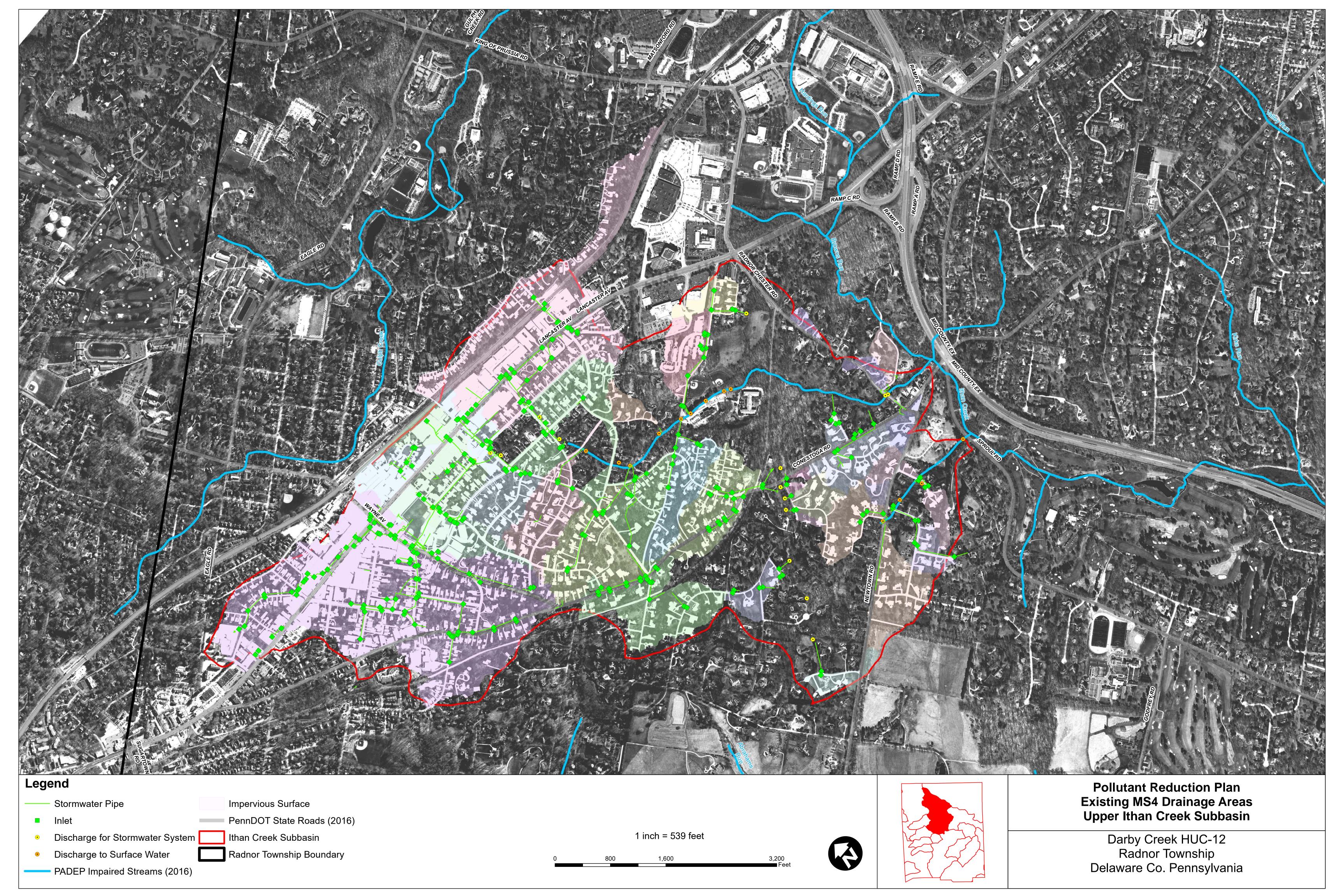


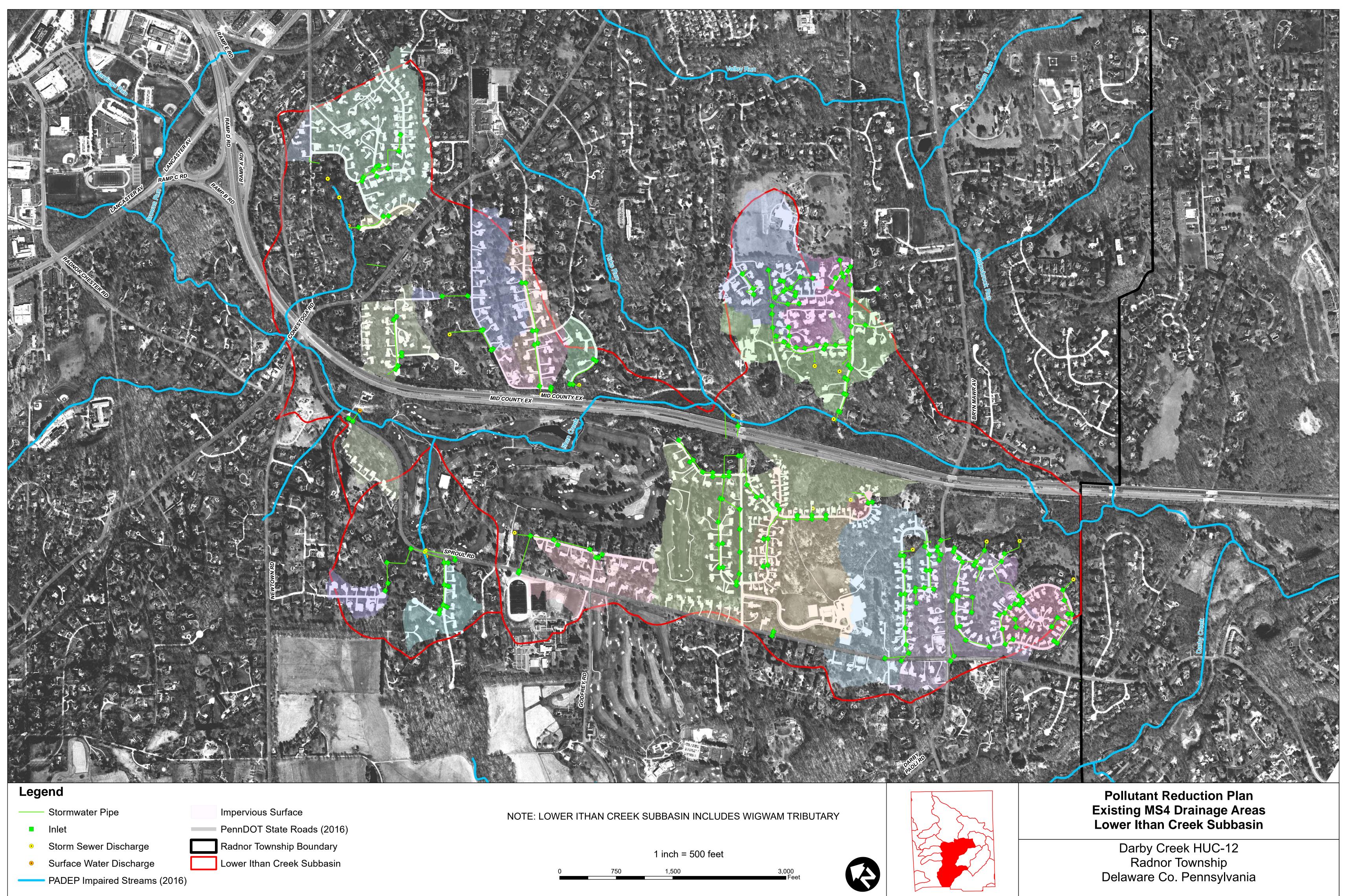


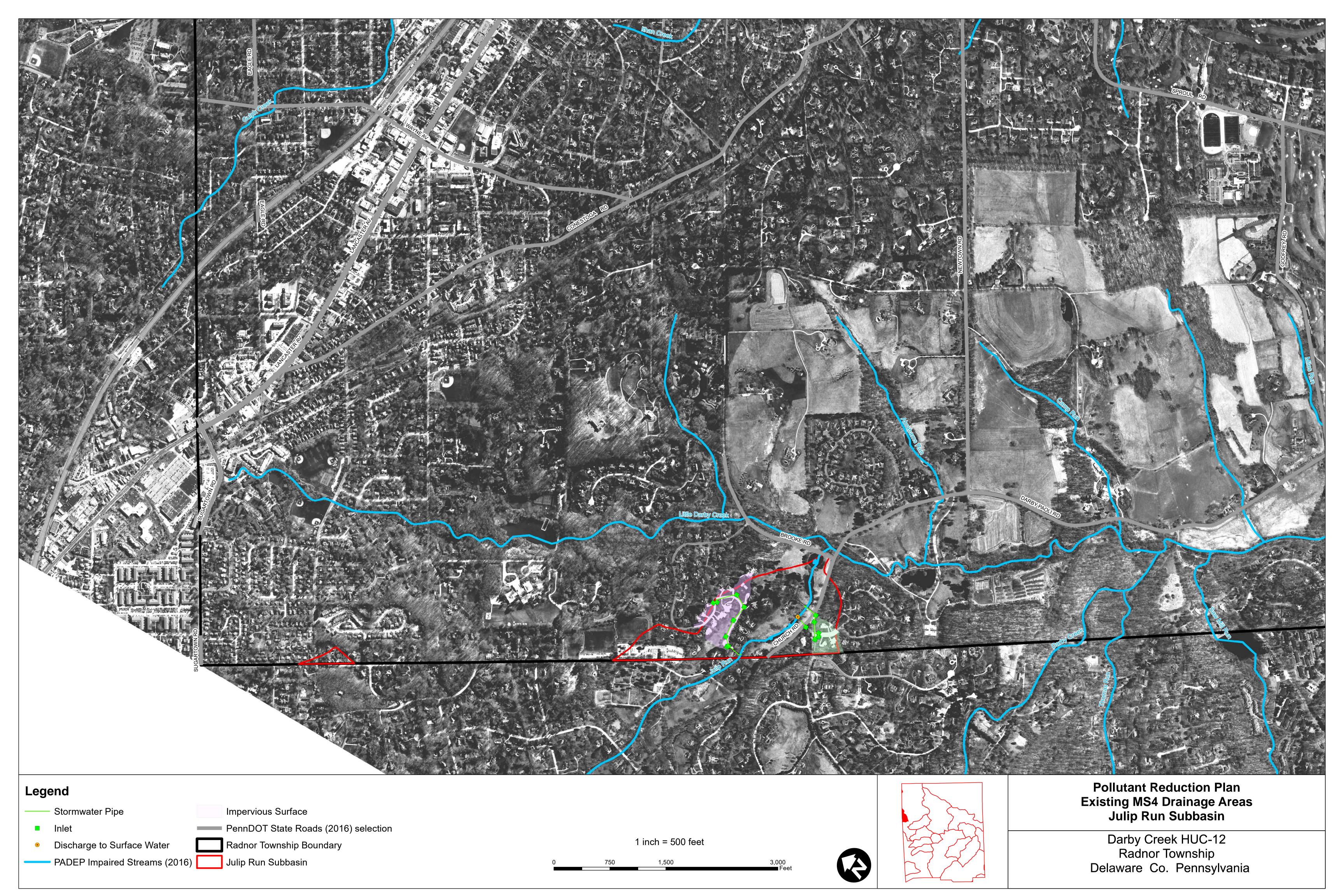


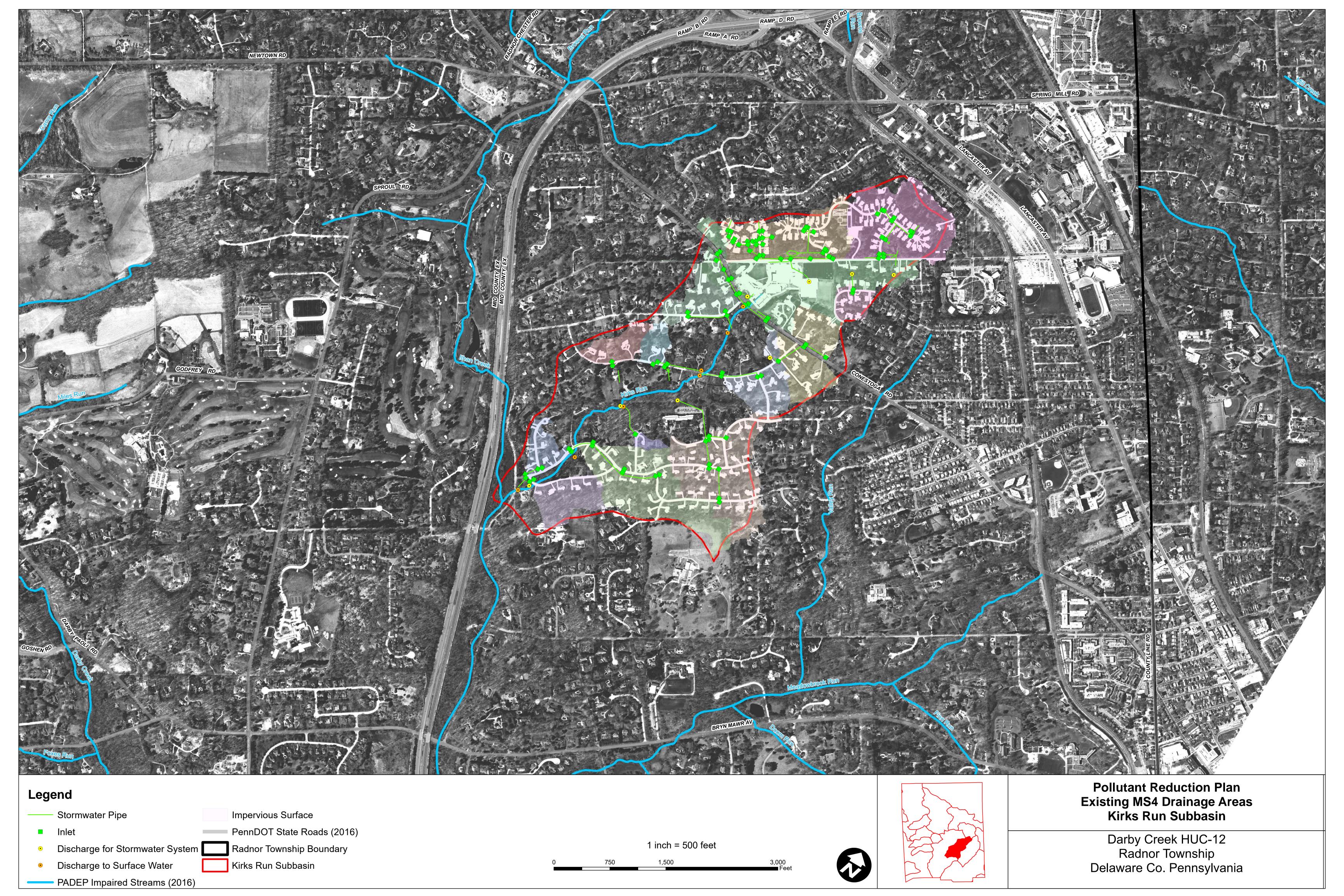


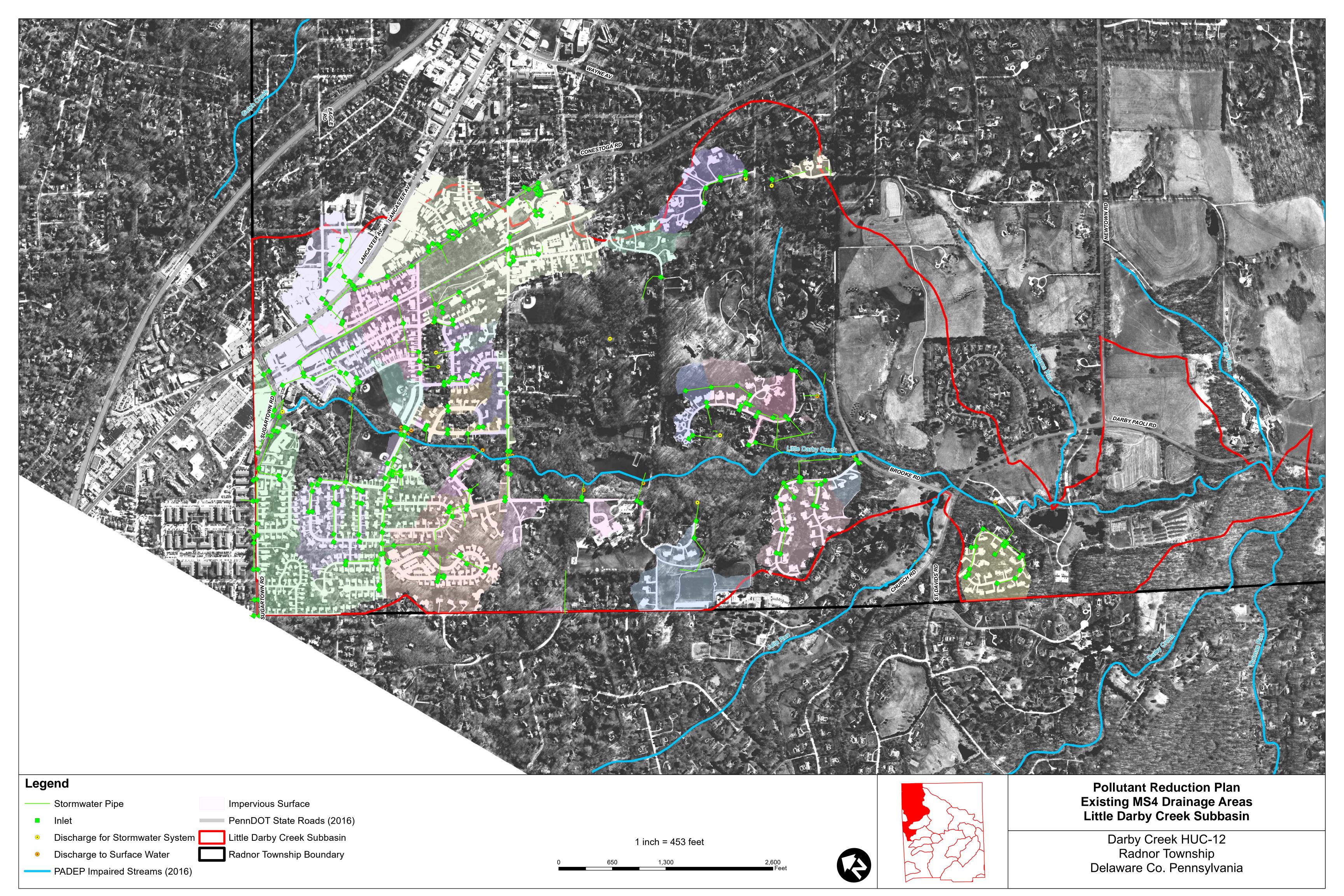


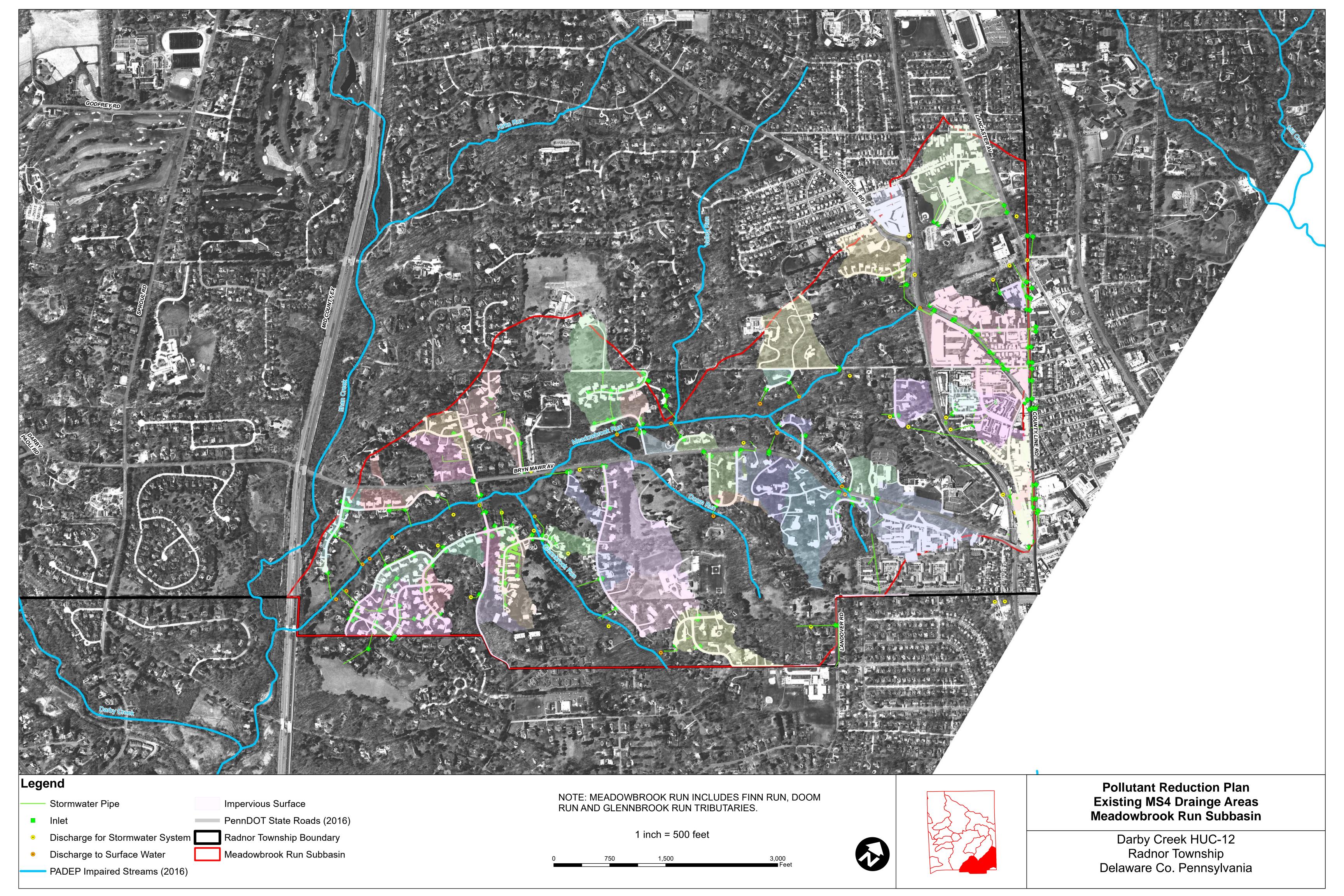


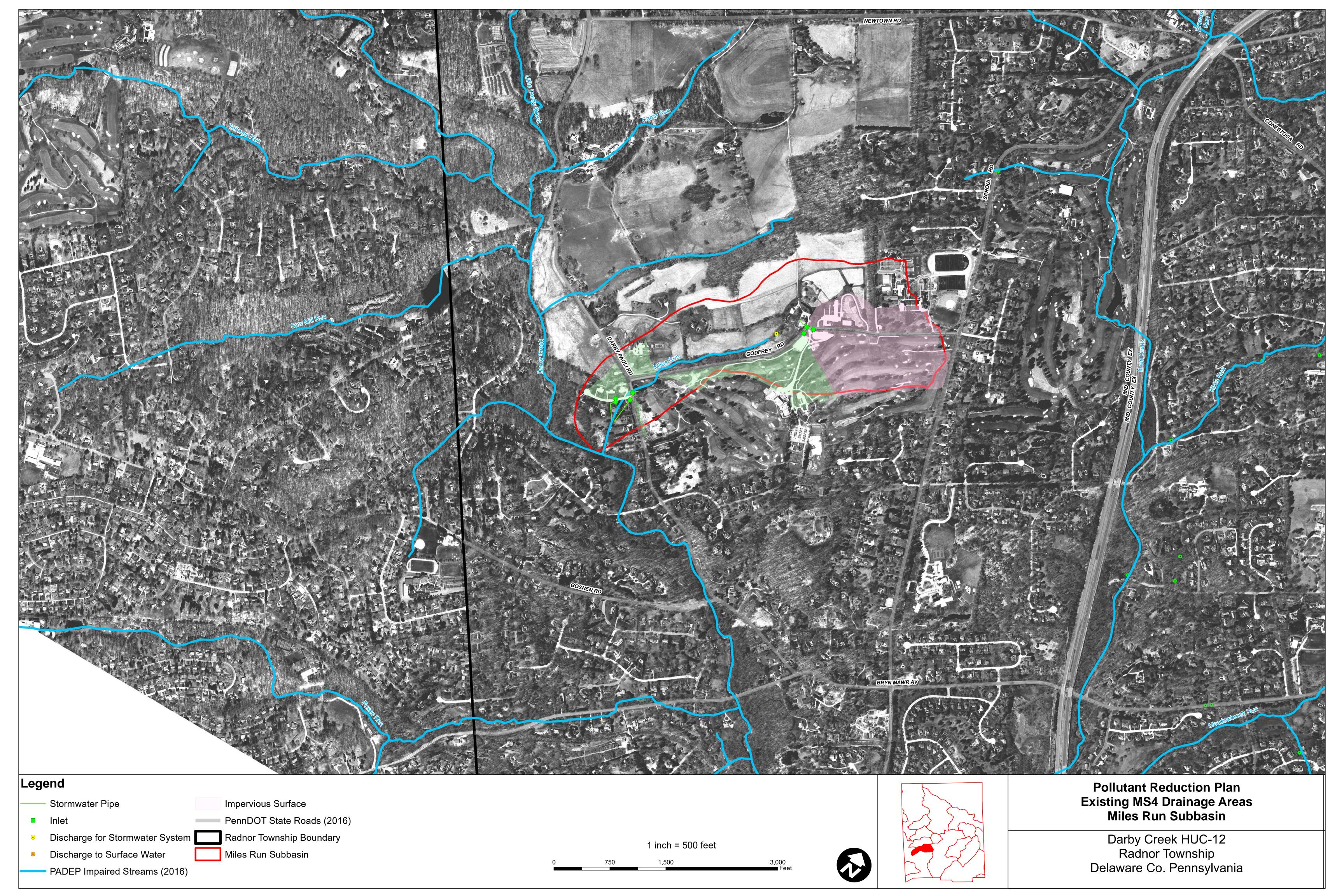


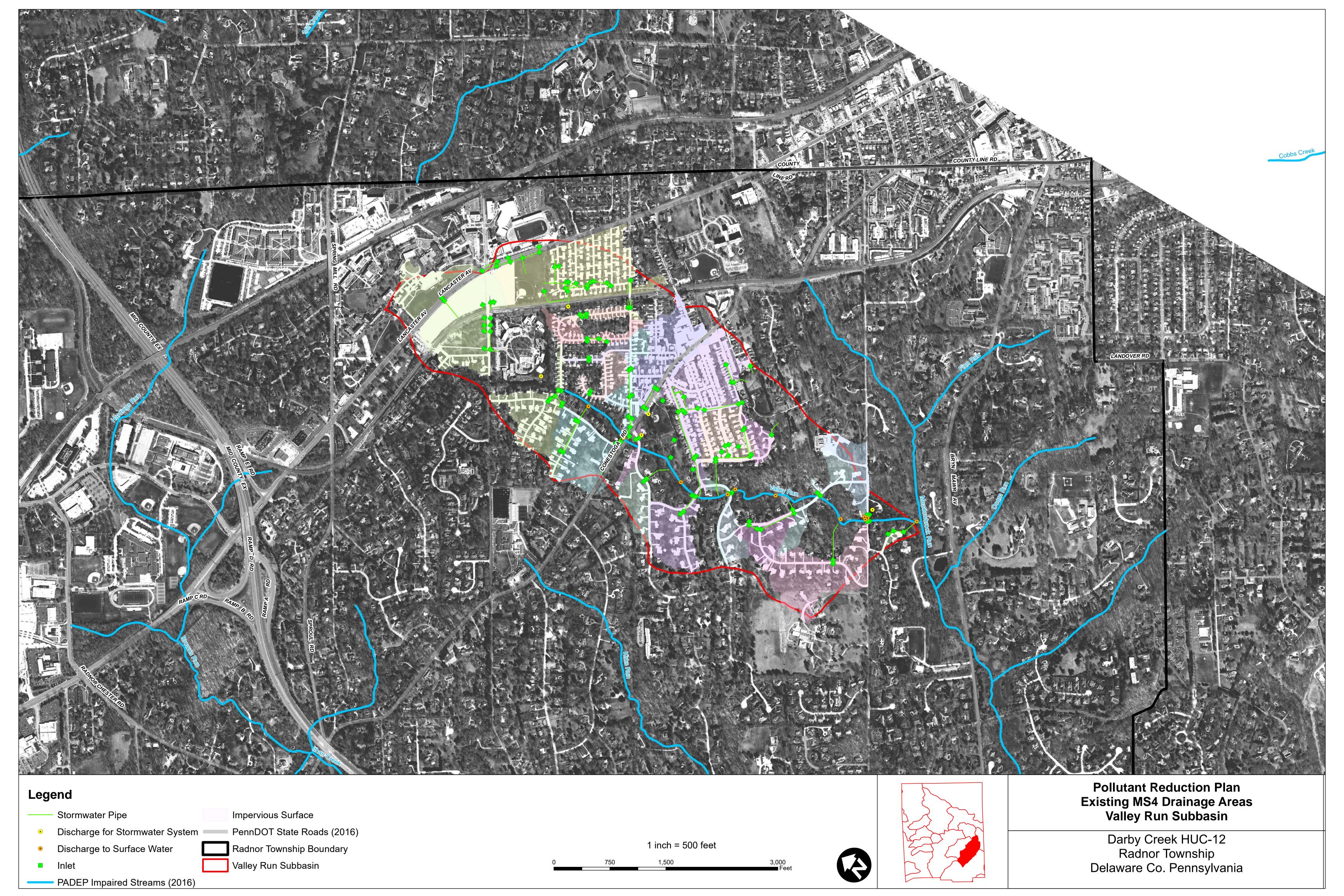


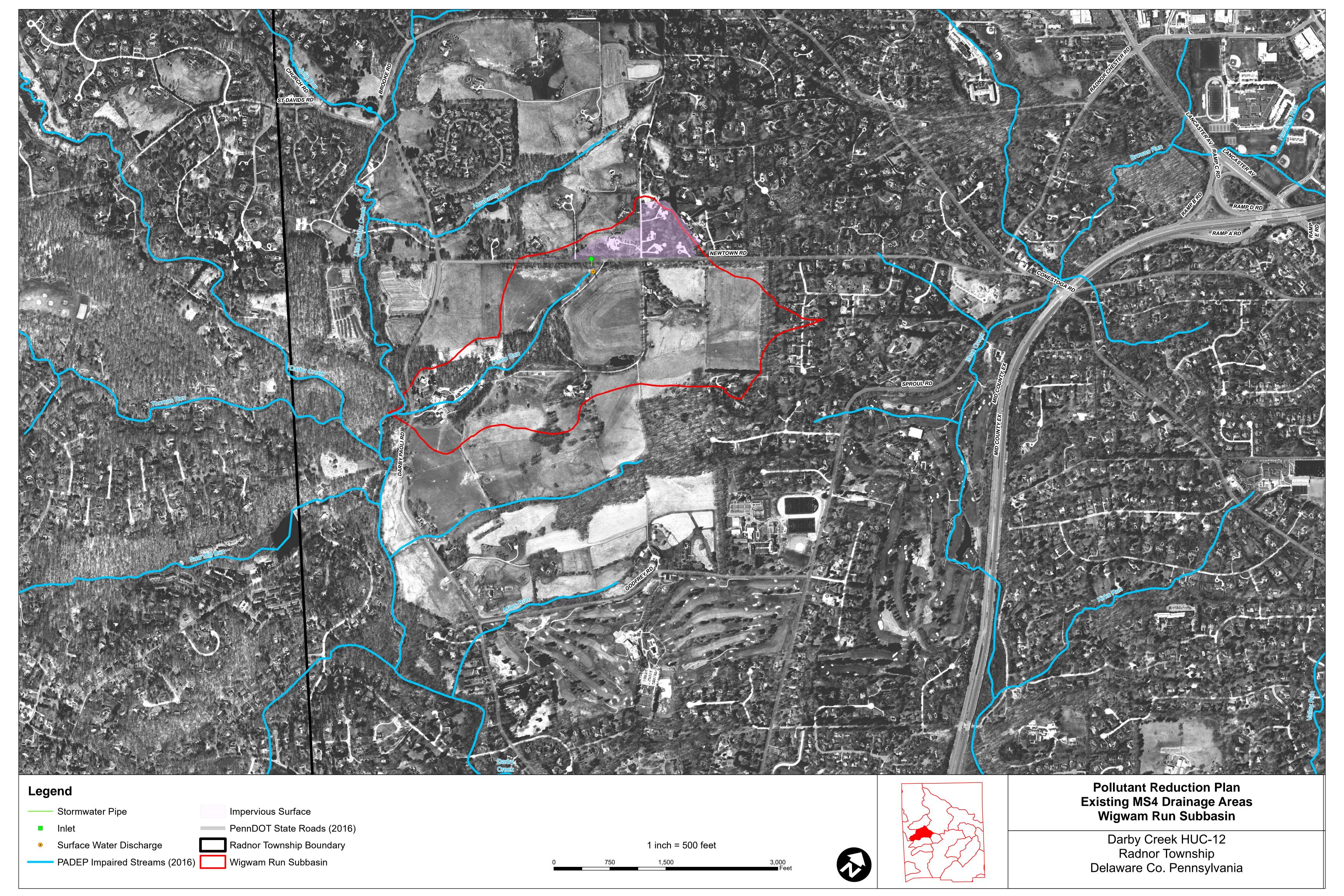












C. Pollutants of Concern

For PRPs developed for waters impaired by siltation only, a minimum of 10% sediment reduction is required. For PRPs developed for waters impaired by both siltation and nutrients, a 10% sediment reduction and a 5% Total Phosphorous (TP) reduction is required. According to the PRP Instructions document, PRPs may use a presumptive approach in which it is assumed that a 10% sediment reduction will also accomplish a 5% TP reduction.

Based on this information, Radnor is required to implement Best Management Practices (BMPs) that reduce sediment pollution from stormwater discharges (i.e. MS4 outfalls) to impaired waters by 10% within 5 years of PaDEP's approval of coverage under the 2018 PAG-13 General Permit.

D. Determine Existing Loading for Pollutants of Concern

1. Pollutant Load Analysis

The Radnor Township storm sewershed boundaries and land use within each watershed were delineated based on the existing Township Geographic Information System (GIS) as described below. To quantify baseline sediment loading within each watershed, the simplified method was used and an analysis of the existing land cover was developed based on impervious and pervious areas. Estimates of sediment loading rates were developed using the PaDEP MS4 Requirements Table (March 28, 2017) of 1,839 pounds/acre/year for impervious areas and 264.96 pounds/acre/year for pervious areas within the Urbanized Area. All of Radnor Township is located within the Urbanized Area.

Consistent with the PaDEP PRP Instructions (3800-PM-BCW010k Rev 3/2017), Radnor Township elected to parse areas that do not drain to the MS4, and to parse land areas associated with PennDOT roadways and right-of-ways. Subsequently, in the selection of BMPs that will meet the permit pollutant reduction requirements and be implementable within the five-year permit term, several BMP projects were identified that were either outside of the MS4 area or received drainage from areas outside of the MS4 area. Consistent with the guidance of the PRP Instructions, including Attachment A, the MS4 area was revised to include all drainage areas to the BMPs. The delineated areas are applied to both the pollutant load calculations and the proposed BMP pollutant reduction calculations.

2. Parsed Watershed Areas and Impervious and Pervious Areas

With the simplified method, it was necessary to determine the amount of impervious and pervious surfaces within each MS4 outfall of Radnor Township. To do this, the following methodology was followed. The Delaware Valley Regional Planning Commission (DVRPC) 2015 LiDAR Digital Elevation Model (DEM) were used for analyses. DEM tiles of Radnor Township were downloaded and combined into a single DEM. This DEM information was coupled with inlet information provided by Radnor Township. The DEM was processed within ArcGIS to delineate drainage areas to each inlet point. The inlet drainage areas were overlaid by 2' interval contours and aerial imagery to correct for modeling

inaccuracy including curbed roads, stream interception, and mapping inconsistencies. As described in Attachment A of the PRP Instructions, land areas in which stormwater does not enter MS4 and land areas associated with PennDOT right-of-way were parsed, or removed, to eliminate areas within the storm sewershed that do not drain to the MS4 and areas that area already covered by NPDES permit for the control of stormwater. Individual inlet drainage areas were then combined to outfall drainage areas using the pipe network provided by Radnor GIS data for each outfall. Finally, each outfall drainage area for each drainage basin (stream) were overlaid with the DVRPC 2015 impervious surface layer. The drainage areas to individual outfalls are indicated on the watershed maps in within Section IV(B), which includes a map for each watershed. Information on watershed areas, parsed areas, and adjusted watershed areas is provided in Table 3 below.

Table 3: Total and Adjusted Areas

HUC 12	Waterway	Total Area (ac)	Parsed Area (ac)	Adjusted Watershed Area (ac)
Cobbs Creek Basin HUC: 020402020504	Cobbs Creek	29.06	3.28	25.78
Plymouth Creek –	Gulph Creek	1,514.92	829.09	685.83
Schuylkill River Basin HUC: 020402031007	Mill Creek	143.60	44.86	98.74
Darby Creek Basin	Browns Run	216.06	84.14	131.92
HUC: 020402020505	Abrahams Run	202.63	173.79	28.84
	Julip Run	54.10	43.41	10.69
	Miles Run	148.91	84.58	64.33
	Kirks Run	313.80	94.95	218.85
	Meadowbrook Run (includes Glenbrook, Finn Run, Doom Run)	917.41	554.50	362.91
	Little Darby Creek	1,073.76	703.93	369.83
	Darby Creek (includes Saw Mill Run)	747.33	543.34	203.98
	Valley Run	383.33	148.66	234.67
	Ithan Creek -Upper (includes Van Lear's Run)	950.61	332.45	618.16
	Ithan Creek -Lower	997.92	502.66	495.26
	Wigwam Run	207.66	191.48	16.18
	Hardings Run	510.52	294.44	216.08
	Foxes Run	159.58	64.01	95.57
	Camp Run	165.77	149.68	16.09

3. Loading Rate

Developed land loading rates applied to this analysis were defined by Attachment B of the PRP Instructions document. This list is also provided in Appendix B of this report. Radnor Township is located within Delaware County, which does not appear on the list. Therefore, loading rates from the final entry comprising of "All Other Counties" was used in this analysis. The loading rates used to determine existing load are shown in Table 4.

Table 4: Developed land loading rates

County	Category	Acres	TN	TP	TSS
			(lbs/acre/year)	(lbs/acre/yr)	(lbs/acre/yr)
All Other	Impervious developed	-	23.06	2.28	1,839
Counties	Pervious developed	-	20.72	0.84	264.96

4. Existing Pollutant Loading

Using the simplified method, the existing pollutant load is calculated using both the land cover and the associated loading rate, which have been previously described. The existing pollutant loading is calculated by the following equation:

Impervious Area * Impervious Loading Rate + Pervious Area * Pervious Loading Rate

Since sediment is the pollutant of concern, all calculations are based on sediment load. Table 5 summarizes the sediment load for each watershed, broken down into impervious load, pervious load, and total load.

Table 5: Summary of Estimated Pollutant Loads

HUC 12	Waterway	Impervious (ac)	Pervious (ac)	Total Area (ac)	Impervious Sediment Load (lbs/yr)	Pervious Sediment Load (lbs/yr)	Total Load (lbs/yr)
Cobbs Creek Basin 020402020504	Cobbs Creek	12.8	11.5	24.3	23,546	3,045	26,591
Plymouth Creek –	Gulph Creek	186.1	504.0	690.2	342,307	133,553	475,860
Schuylkill River Basin 020402031007	Mill Creek	45.3	45.7	91.0	83,319	12,120	95,439
Darby Creek	Saw Mill Run	3.9	8.9	12.9	7,243	2,370	9,614
Basin	Browns Run	50.1	105.0	155.1	92,145	27,826	119,971
020402020505	Abrahams Run	9.2	23.9	33.2	16,966	6,339	23,305
	Miles Run	7.2	63.4	70.7	13,318	16,808	30,126
	Glennbrook	14.2	13.0	27.2	26,098	3,435	29,533
	Kirks Run	55.0	163.6	218.6	101,187	43,345	144,532
	Meadowbrook Run	80.7	189.3	270.0	148,437	50,155	198,593
	Little Darby Creek	147.2	217.6	364.8	270,706	57,650	328,356
	Van Lear's Run	11.7	38.6	50.3	21,482	10,222	31,704
	Darby Creek	47.6	178.3	225.9	87,509	47,251	134,760
	Valley Run	95.7	146.2	242.0	176,050	38,746	214,796
	Ithan Creek	367.2	813.6	1,180.8	675,350	215,562	890,912
	Hardings Run	127.4	66.8	194.2	234,216	17,701	251,917
	Foxes Run	18.6	71.9	90.5	34,258	19,042	53,300
	Camp Run	3.76	14.12	17.89	6,923	3,742	10,665
	Finn Run	14.67	39.43	54.10	26,975	10,447	37,423
	Doom Run	0.69	1.24	1.92	1,263	327	1,590
	Wigwam Run	2.3	14.2	16.4	4,195	3,753	7,948
	TOTAL						3,116,935

5. Adjust Estimated Pollutant Loading for Existing (Previously Implemented) BMPs

The MS4 may claim credit in the form of reduced existing load for BMPs implemented prior to development of the PRP that continue to be operated and maintained. Effectiveness rates are based on the PaDEP Effectiveness Values table, found in Appendix C of this report. BMPs with contributing drainage areas from multiple soil groups, the effectiveness rate for each soil group was used for the respective drainage area. Existing BMPs and their associated reduction are presented in Table 6. A summary of pollutant loads considering BMP reduction credits is presented in Table 7.

Table 6: Summary of Existing BMP Reduction Credit

HUC 12	Waterway	BMP Name	Location	BMP Type	Coordinates	Drainage	Reduction
					(lat/lon)	Area (ac)	Credit (lb/yr)
		217 East	217 East	Dry	40.010173 /	21,142	89
Gulph		Lancaster	Lancaster	detention	-75.295223		
Creek	Gulph Creek	Ave.	Ave.				
Creek		711 County	711 County	Dry	40.047904 /	13,648	58
		Line Rd.	Line Rd.	Detention	-75.346483		
		Applegate	Applegate	Subsurface	40.01678543 /	3.87	6,018
			Lane	stone bed	-75.35119233		
		Ithan Woods	Ithan Wood	Subsurface	40.0323252 /	2.31	1,583
			Lane	bed	-75.36910001		
		Radnor	Louella	Infiltration	40.04256632 /	9.50	12,405
	Ithan Creek	Middle	Avenue	beds	-75.38755274		
	Terrair Creek	School					
		Villanova	791 -797 East	Dry	40.03665289 /	2.45	451
		Center	Lancaster	detention	-75.35193071		
			Avenue	_			
		Bryn Mawr	330 East	Dry	40.04311754 /	0.87	160
		Bank	Lancaster	detention	-75.37872584		
Darby		Agnos Imagin	Avenue 275 S. Ithan	Dotontion	40.02749024./	5.24	7.576
Creek	Kirks Run	Agnes Irwin	Avenue	Retention,	40.02748934 / -75.35144443	5.24	7,576
Basin		Harvard	Harvard Lane	pavers Wetland	40.013781 /	1.88	2,079
		пагуаги	narvaru Lane	wetiand	-75.341106	1.88	2,079
	Meadowbrook	Rosemont	919	Porous	40.025491 /	6.04	9,446
	Wicadowbrook	Business	Conestoga	Paving	-75.336432	0.04	3,440
		Campus	Road	Taving	75.550452		
		Copper	Sugartown	Rain Garden	40.04543107 /	1.01	890
		Kettle	Road and	l mani Garaen	-75.40607943	1.01	
Little Da			Morris Road				
	Little Darby	Brookfarm	127	Dry	40.03148356 /	20.43	3,574
			Brookfarm	detention	-75.39845432		
			Road				
	Miles D	Academy of	560 Sproul	Dry	40.01602832 /	1.77	326
	Miles Run	Notre Dame	Road	detention	-75.37030256		
TOTAL							44,655

Table 7: Summary of Adjusted Pollutant Loads and Required Reduction

HUC 12	Waterway	Impervious (ac)	Pervious (ac)	Total Area (ac)	Impervious Sediment Load (lbs/yr)	Pervious Sediment Load (lbs/yr)	Total Load (lbs/yr)	Existing BMP (lbs/yr)	Net Load (lbs/yr)	Required 10% Reduction (lbs/yr)
Cobbs Creek Basin	Cobbs Creek	12.8	11.5	24.3	23,546	3,045	26,591	0	26,591	
020402020504										2659.1
Plymouth Creek –	Gulph Creek	186.1	504.0	690.2	342,307	133,553	475,860	147	475,713	47571.3
Schuylkill River Basin	Mill Creek	45.3	45.7	91.0	83,319	12,120	95,439	0	95,439	
020402031007										9543.9
Darby Creek	Saw Mill Run	3.9	8.9	12.9	7,243	2,370	9,614	0	9,614	961.4
Basin	Browns Run	50.1	105.0	155.1	92,145	27,826	119,971	0	119,971	11997.1
020402020505	Abrahams Run	9.2	23.9	33.2	16,966	6,339	23,305	0	23,305	2330.5
	Miles Run	7.2	63.4	70.7	13,318	16,808	30,126	326	29,800	2980
	Glennbrook	14.2	13.0	27.2	26,098	3,435	29,533	0	29,533	2953.3
	Kirks Run	55.0	163.6	218.6	101,187	43,345	144,532	7,576	136,956	13695.6
	Meadowbrook Run	80.7	189.3	270.0	148,437	50,155	198,593	11,525	187,068	18706.8
	Little Darby Creek	147.2	217.6	364.8	270,706	57,650	328,356	4,464	323,892	32389.2
	Van Lear's Run	11.7	38.6	50.3	21,482	10,222	31,704	0	31,704	3170.4
	Darby Creek	47.6	178.3	225.9	87,509	47,251	134,760	0	134,760	13476
	Valley Run	95.7	146.2	242.0	176,050	38,746	214,796	0	214,796	21479.6
	Ithan Creek	367.2	813.6	1,180.8	675,350	215,562	890,912	20,617	870,295	87029.5
	Hardings Run	127.4	66.8	194.2	234,216	17,701	251,917	0	251,917	25191.7
	Foxes Run	18.6	71.9	90.5	34,258	19,042	53,300	0	53,300	5330
	Camp Run	3.76	14.12	17.89	6,923	3,742	10,665	0	10,665	1066.5
	Finn Run	14.67	39.43	54.10	26,975	10,447	37,423	0	37,423	3742.3
	Doom Run	0.69	1.24	1.92	1,263	327	1,590	0	1,590	159
	Wigwam Run	2.3	14.2	16.4	4,195	3,753	7,948	0	7,948	794.8
	TOTAL						3,116,935	44,655	3,072,280	307,228

E. Select BMPs to Achieve the Minimum Required Reductions in Pollutant Loading

Multiple BMPs are proposed to achieve the reductions in pollutant loading required under the 2018 PAG-13. In selecting specific BMP project, preferential consideration was given to BMP projects that met any of the criteria listed below, as these criteria provide a greater likelihood of successful implementation within the five-year permit period:

- Proposed BMP is located on municipal property
- Proposed BMP was identified in previous Township stormwater studies
- The existing storm sewer network is conducive to collecting a large drainage area to a BMP (i.e., existing detention basins)
- The proposed BMP would address a large impervious area such as a large parking lot

A total of 25 BMPs are proposed, and include 11 detention basin retrofits, 3 sections of streambank restoration totaling 3,078 linear feet, 1 wetland, 4 subsurface infiltration systems, and 6 retrofits of existing parking lots with bioretention areas or porous pavement.

The BMP pollutant load reduction is estimated based upon the PaDEP BMP effectiveness factor, which is included in Appendix C of this report. A summary of the anticipated pollutant reduction from the proposed BMPs is provided in Table 8, Table 9, and Table 10. A detailed description for each BMP is included in the following sections. Each section contains a summary of proposed BMPs for each of the three HUC basins (Cobbs Creek Watershed, Plymouth Creek — Schuylkill River Watershed, and Darby Creek Watershed) followed by a brief description of each proposed BMP. Additional calculations, including the BMP effectiveness values, are presented in Appendix D of this report.

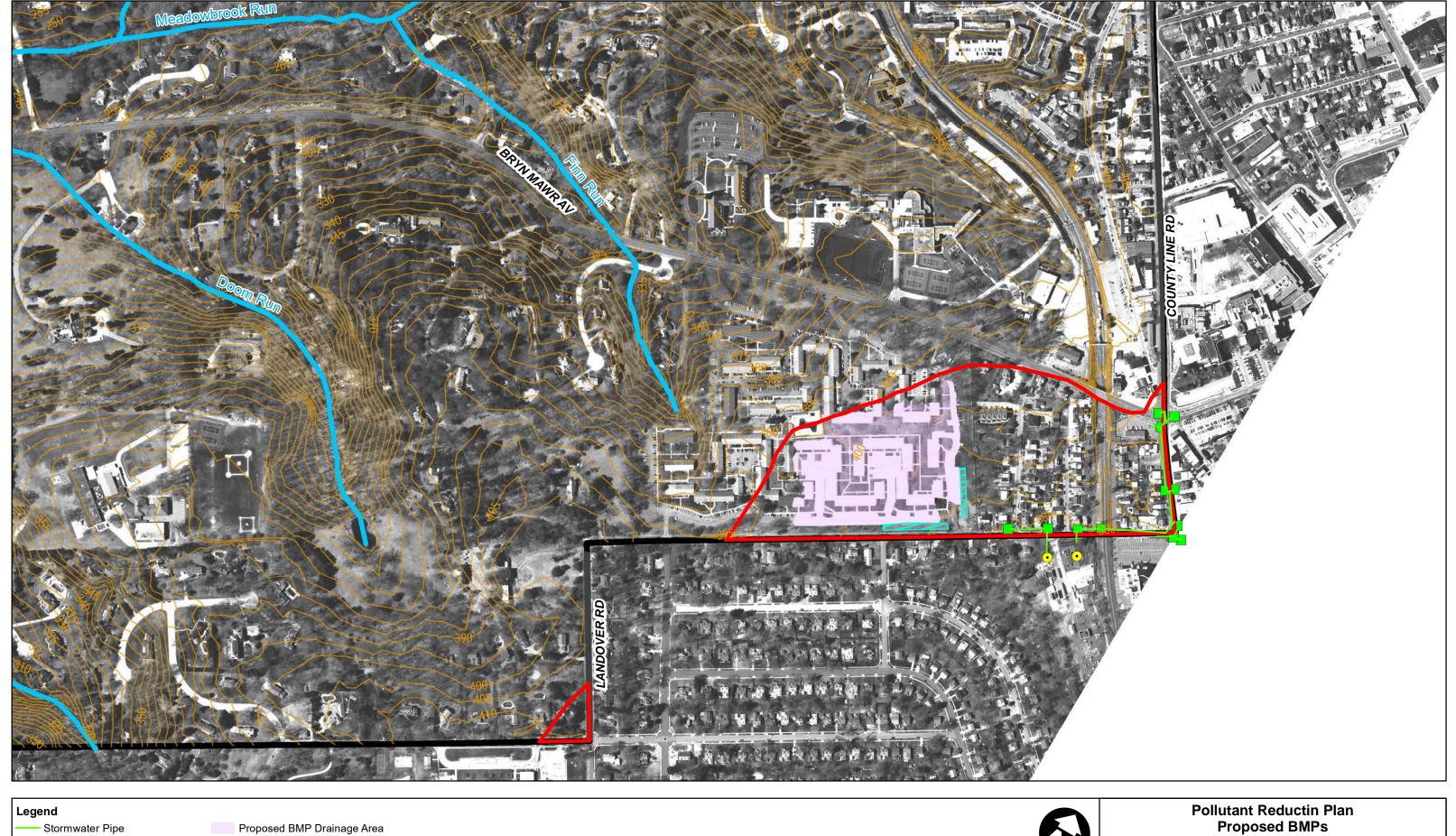
1. Cobbs Creek Watershed

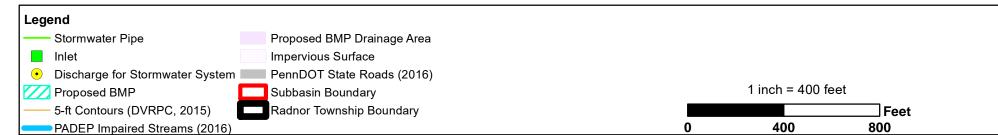
Table 8: Summary of Proposed BMPs for Cobbs Creek Basin

BMP Name	Location	ВМР Туре	Drainage Area (ac)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Radwyn Apartments	275 S. Bryn	Raingarden/	9.09	56	8,948
Raingarden /	Mawr Ave.	Bioretention			
Bioretention					
TOTAL					8,948

Radwyn Apartments Raingarden / Bioretention

A bioretention area is proposed at the Radwyn Apartments. The site is located in the southeast corner of Radnor Township and drains to Cobbs Creek, within the Cobbs Creek Basin. The site is a privately-owned apartment complex, consisting of several apartment buildings with associated parking and amenity space. A majority of the on-site area is underlain by B soils, suggesting favorable conditions for an infiltration BMP. An above ground planted bioretention area with infiltration is proposed and will consist of a shallow excavated surface depression planted with native vegetation which will capture and treat the contributing drainage area. The contributing drainage area to the BMP is 9.09 acres and the BMP will achieve a sediment reduction of 8,948 lb/yr.





Radwyn Apartments Raingarden

Cobbs Creek HUC-12 Radnor Township Delaware Co. Pennsylvania

2. Plymouth Creek – Schuylkill River Watershed

Table 9: Summary of Proposed BMPs for Plymouth Creek – Schuylkill River Basin

BMP Name	Location	ВМР Туре	Drainage Area (ac)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Eastern University West Campus Lot Raingarden	Radnor Rd.	Raingarden/ Bioretention	17.27	40	13,125
Township Parking	259 Willow Ave.	Porous paving / Infiltration	4.83	33	3,223
Woods Lane Subdivision Basin 1 Retrofit	Woods Ln.	Basin Retrofit	12.99	27	5,390
Woods Lane Subdivision Basin 2 Retrofit	Woods Ln.	Basin Retrofit	8.09	28	3,444
North Wayne Field Basin Retrofit	North Wayne Ave.	Basin Retrofit	43.44	25	17,258
Valley Forge Military Academy	Eagle Rd.	Porous Paving / Infiltration	13.39	35	9,338
Cowan Park Stream Restoration	Radnor Street Rd.	Stream Restoration	NA – 374 ft	NA	16,785
TOTAL					68,593

Eastern University West Campus Lot Raingarden

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Eastern University	Radnor Rd.	Raingarden/	17.27	40	13,125
West Campus Lot		Bioretention			
Raingarden					

A bioretention area is proposed on the West Campus Lot of Eastern University, located along Radnor Road in northern Radnor Township. The site drains to Gulph Creek in the Plymouth Creek – Schuylkill River Basin. The site for the proposed BMP currently consists of a large, privately-owned impervious parking lot. A majority of the on-site area is underlain by B soils, suggesting favorable conditions for an infiltration BMP. The bioretention area will consist of a shallow excavated surface depression planted with native vegetation which will capture and treat the contributing drainage area. The above ground planted bioretention area with infiltration is proposed to capture a drainage area of approximately 17.27 acres and the BMP will achieve a sediment reduction of 13,125 lbs/yr.







Eastern University West Campus Lot Raingarden

Plymouth - Schuylkill River HUC-12 Radnor Township Delaware Co. Pennsylvania

Township Parking

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Township Parking	259 Willow Ave.	Porous paving / Infiltration	4.83	33	3,223

A publicly-owned parking lot located at Willow Ave and Radnor Road across from Cowan Park is proposed to be retrofitted with porous paving. The site drains to Gulph Creek in the Plymouth Creek — Schuylkill River Basin. The site is underlain by C soils, and infiltration is likely to be feasible. Porous paving consists of a permeable surface course underlaid by a stone bed on an un-compacted subsurface, which provides temporary storage and infiltration to occur. The contributing drainage area to the porous paving is 4.83 acres and the BMP will achieve a sediment reduction of 3,223 lbs/yr.





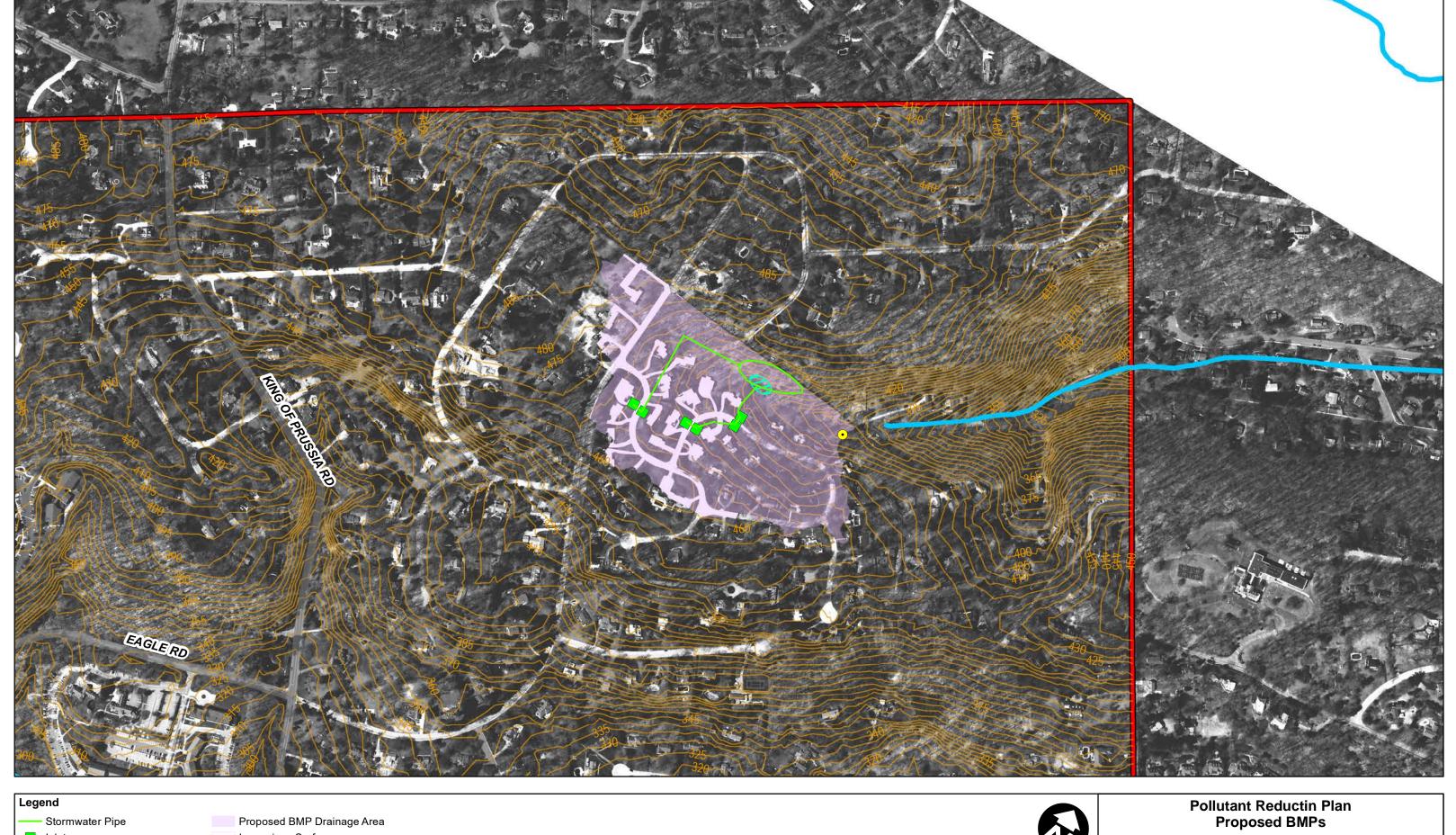
Cowen Park Township Lot Porous Paving/Infiltration

Plymouth - Schuylkill River HUC-12 Radnor Township Delaware Co. Pennsylvania

Woods Lane Subdivision Basin 1 Retrofit

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Woods Lane Subdivision Basin 1	Woods Ln.	Basin Retrofit	12.99	27	5,390
Retrofit		Recroite			

A retrofit of an existing detention basin on Woods Lane is proposed. This site is privately owned by an HOA. The site drains to Gulph Creek in the Plymouth Creek – Schuylkill River Basin. The proposed retrofit intends to convert a detention basin to a dry extended detention basin. By extending he duration of detention, the treatment effectiveness is increased. The contributing drainage area is 12.99 acres and the BMP will achieve a sediment reduction of 5,390 lbs/yr.





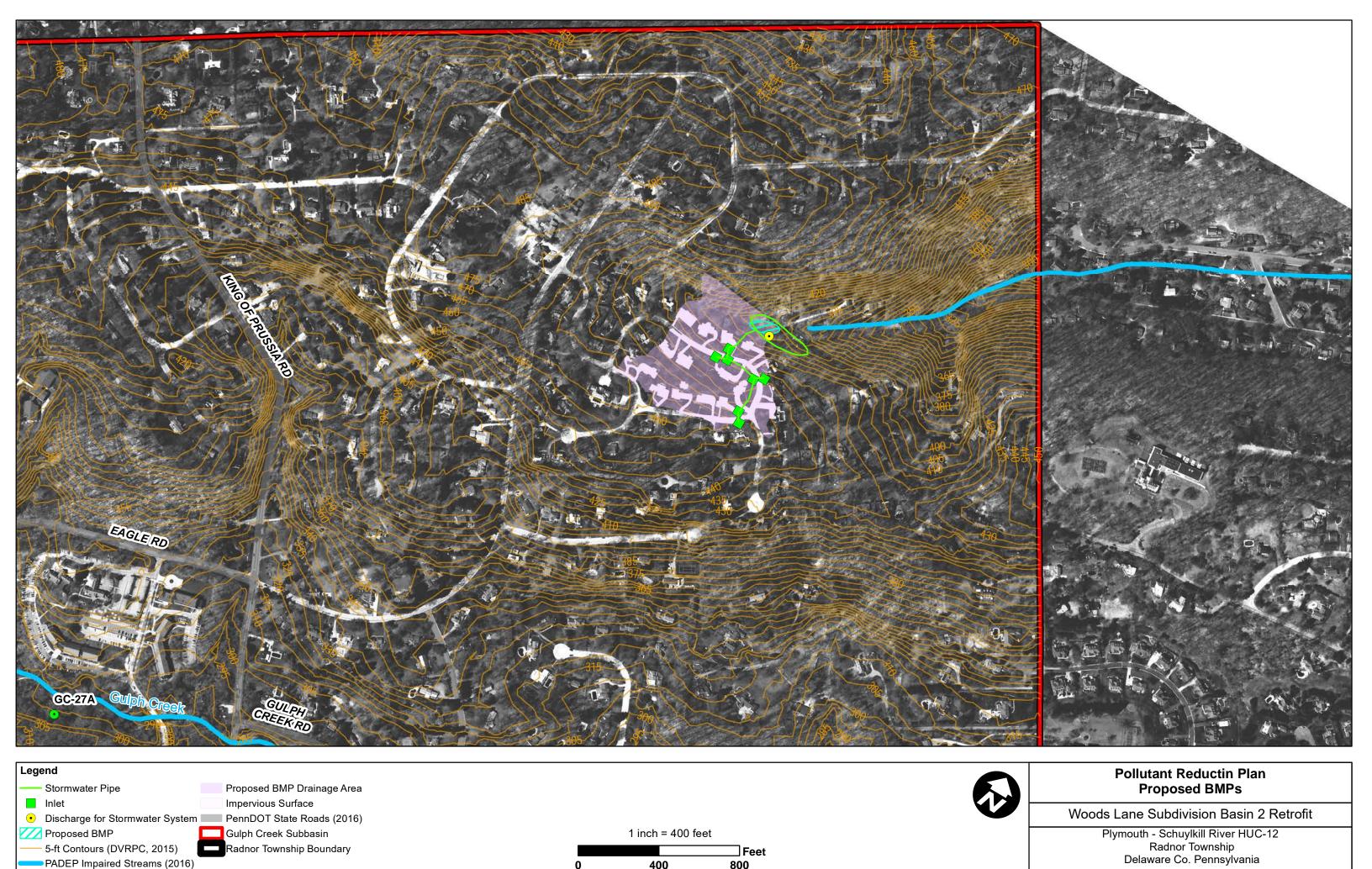
Woods Lane Subdivision Basin 1 Retrofit

Plymouth - Schuylkill River HUC-12 Radnor Township Delaware Co. Pennsylvania

Woods Lane Subdivision Basin 2 Retrofit

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Woods Lane	Woods Ln.	Basin	8.09	28	3,444
Subdivision Basin 2		Retrofit			
Retrofit					

A retrofit of a second existing detention basin on Woods Lane is proposed. This site is privately owned by an HOA. The site drains to Gulph Creek in the Plymouth Creek – Schuylkill River Basin. The proposed retrofit intends to convert a detention basin to a dry extended detention basin. By extending he duration of detention, the treatment effectiveness is increased. The contributing drainage area is 8.09 acres and the BMP will achieve a sediment reduction of 3,444 lbs/yr.

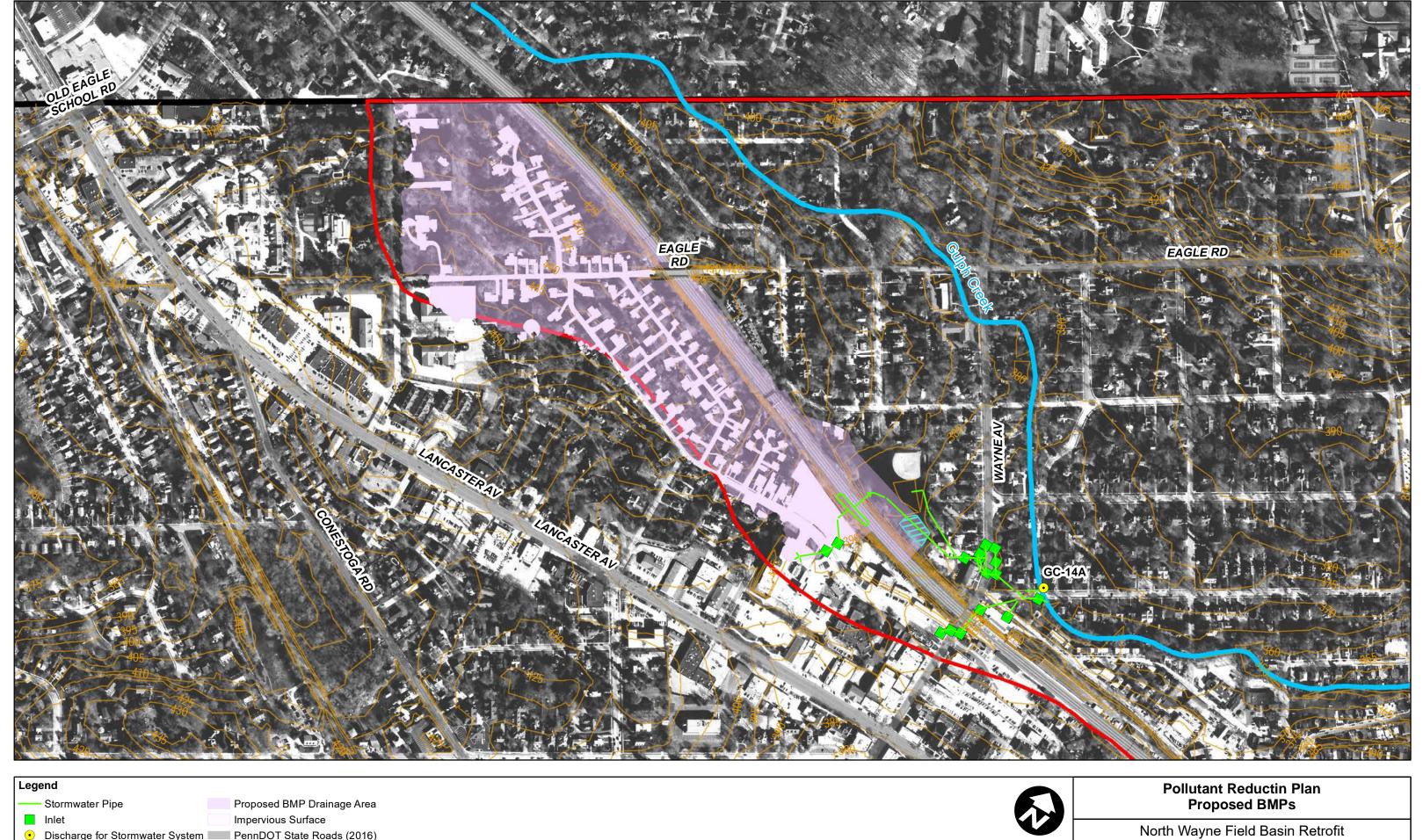


PADEP Impaired Streams (2016)

North Wayne Field Basin Retrofit

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
North Wayne Field	North	Basin	43.44	25	17,258
Basin Retrofit	Wayne Ave.	Retrofit			

A retrofit of an existing basin at North Wayne Park is proposed. This site is publicly-owned and the primary use is recreation. The site drains to Gulph Creek in the Plymouth Creek – Schuylkill River Basin. The proposed retrofit intends to convert a detention basin to a dry extended detention basin. By extending he duration of detention, the treatment effectiveness is increased. The contributing drainage area is 43.44 acres and the BMP will achieve a sediment reduction of 17,258 lbs/yr.





Plymouth - Schuylkill River HUC-12 Radnor Township Delaware Co. Pennsylvania

Valley Forge Military Academy

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Valley Forge Military Academy	Eagle Rd.	Porous Paving / Infiltration	13.39	35	9,338

Valley Forge Military Academy is a privately-owned educational institution. This site is proposed to be retrofitted with porous paving. The site drains to Gulph Creek in the Plymouth Creek – Schuylkill River Basin. The site is underlain by B and C soils, and infiltration is likely to be feasible. Porous paving consists of a permeable surface course underlaid by a stone bed on an un-compacted subsurface, which provides temporary storage and infiltration to occur. The contributing drainage area to the porous paving is 13.39 acres and the BMP will achieve a sediment reduction of 9,338 lbs/yr.





Valley Forge Military Academy Subsurface Infiltration

Plymouth - Schuylkill River HUC-12 Radnor Township Delaware Co. Pennsylvania

Cowan Park Stream Restoration

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Cowan Park	Radnor	Stream	NA – 374 ft	NA	16,785
Stream	Street Rd.	Restoration			
Restoration					

Cowan Park is a publicly-owned park at the northeast corner of Willow Avenue and Radnor Road. The existing site contains recreational fields including a baseball diamond and a basketball court. Gulph Creek runs along the east and southeast of Cowan Park, and Gulph Creek drains to the Plymouth Creek – Schuylkill River Basin. Stream restoration is proposed along 374 feet of Gulph Creek abutting the public park. Stream restoration involves stabilization to prevent channel and bank erosion that would otherwise be delivered downstream. The Cowan Park stream restoration will achieve a sediment reduction of 16,785 lbs/yr.





Cowen Park Stream Restoration

Schuylkill River HUC-12 Radnor Township Delaware Co. Pennsylvania

4. Darby Creek Watershed

Table 10: Summary Proposed BMPs for Darby Creek Basin

BMP Name	Location	BMP Type	Drainage Area	Percent	TSS Reduction
			(acres)	Impervious (%)	(lbs/year)
Portledge Subdivision	Portledge Dr.	Basin Retrofit	5.52	26	2,223
Basin Retrofit					
Haymarket Subdivision	Haymarket	Basin Retrofit	8.15	30	3,603
Basin Retrofit	Ln.				
Cornerstone and Hills	Cornerstone	Basin Retrofit	108.39	18	36,212
of Bryn Mawr Basin	Dr.				
Retrofit					
Haviland Subdivision	Haviland Dr.	Basin Retrofit	15.08	27	6,263
Basin Retrofit					
Veterans Memorial	406 E.	Subsurface	70.35	35	31,561
Park Subsurface	Lancaster	Storage			
Infiltration	Ave.	Module			
Ithan Valley Park	S. Ithan Ave.	Stream	NA – 2000 ft	NA	89,760
Stream Restoration		Restoration			
Warren Filipone	S. Devon Ave.	Subsurface	25.44	70	20,381
Memorial Park		Storage			
Subsurface Infiltration		Module			
Warren Filipone	S. Devon Ave.	Stream	NA – 704 ft	NA	31,596
Memorial Park Stream		Restoration			
Restoration		_			
Devon Square	Eaton Dr.	Basin Retrofit	19.22	36	9,650
Subdivision Basin					
Retrofit					22.425
West Wayne Preserve	Conestoga	Wetland	37.70	48	23,135
Wetland	Rd.	C 1	45.74	20	7.605
Bo Connor Park	S. Devon Ave.	Subsurface	15.74	39	7,685
Subsurface Infiltration		Storage			
Montrose	Montrose	Module Basin Retrofit	7.95	64	6,092
Condominiums Basin	Ave.	מפטווו הפנוטוונ	7.33	U 4	0,032
Retrofit	AVE.				
Radnor House	E. Lancaster	Bioretention	23.97	38	17,732
Bioretention	Ave.	Diorecention	23.37		17,732
Villanova Campus	Lancaster	Infiltration	20.78	69	18,763
Improvements	Ave.				
Lincoln Financial	Radnor	Porous Paving	49.91	61	33,549
Porous Parking Retrofit	Chester Rd.	/ Infiltration			
KTM&C, LLP Basin	King of	Basin Retrofit	12.90	37	6,633
Retrofit	Prussia Rd.				-,
Trianon Subdivision	Trianon Lane	Basin Retrofit	22.87	32	10,500
Basin Retrofit					
TOTAL					355,338

Portledge Subdivision Basin Retrofit

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Portledge	Portledge	Basin	5.52	26	2,223
Subdivision Basin	Dr.	Retrofit			
Retrofit					

A retrofit of an existing detention basin on Portledge Drive is proposed. This site is privately owned by an HOA. The site drains to Ithan Creek in the Darby Creek Basin. The proposed retrofit intends to convert a detention basin to a dry extended detention basin. By extending the duration of detention, the treatment effectiveness is increased. The contributing drainage area is 5.52 acres and the BMP will achieve a sediment reduction of 2,223 lbs/yr.

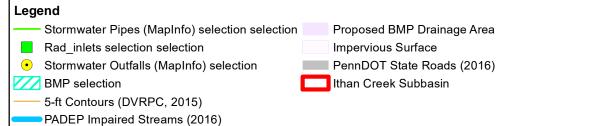


1 inch = 400 feet

400

Feet

800





Pollutant Reductin Plan Proposed BMPs

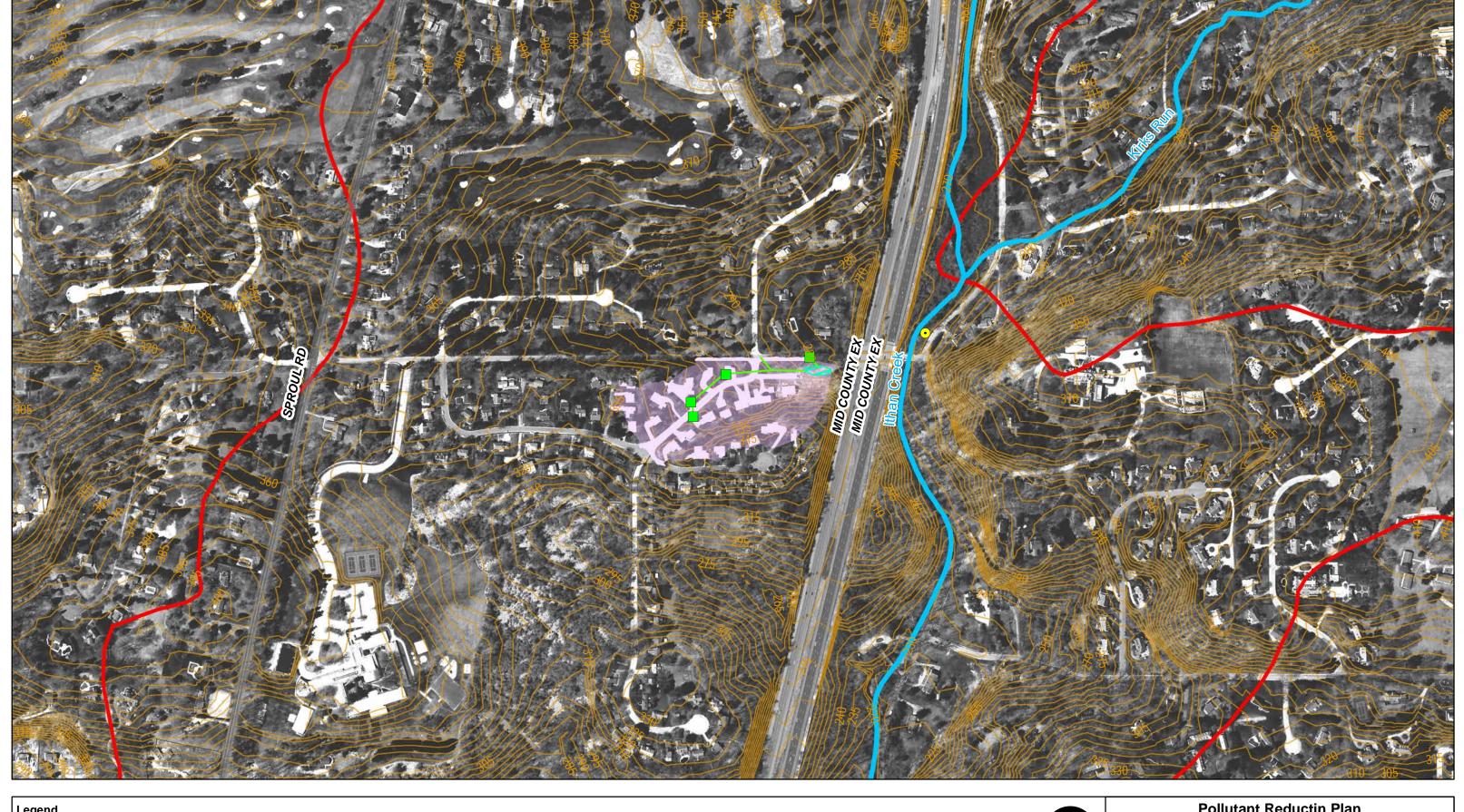
Portledge Subdivision Basin Retrofit

Darby Creek HUC-12 Radnor Township Delaware Co. Pennsylvania

Haymarket Subdivision Basin Retrofit

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Haymarket	Haymarket	Basin	8.15	30	3,603
Subdivision Basin	Ln.	Retrofit			
Retrofit					

A retrofit of an existing detention basin on Haymarket Lane is proposed. This site is privately owned by an HOA. The site drains to Ithan Creek in the Darby Creek Basin. The proposed retrofit intends to convert a detention basin to a dry extended detention basin. By extending the duration of detention, the treatment effectiveness is increased. The contributing drainage area is 8.15 acres and the BMP will achieve a sediment reduction of 3,603 lbs/yr.





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Pollutant Reductin Plan Proposed BMPs

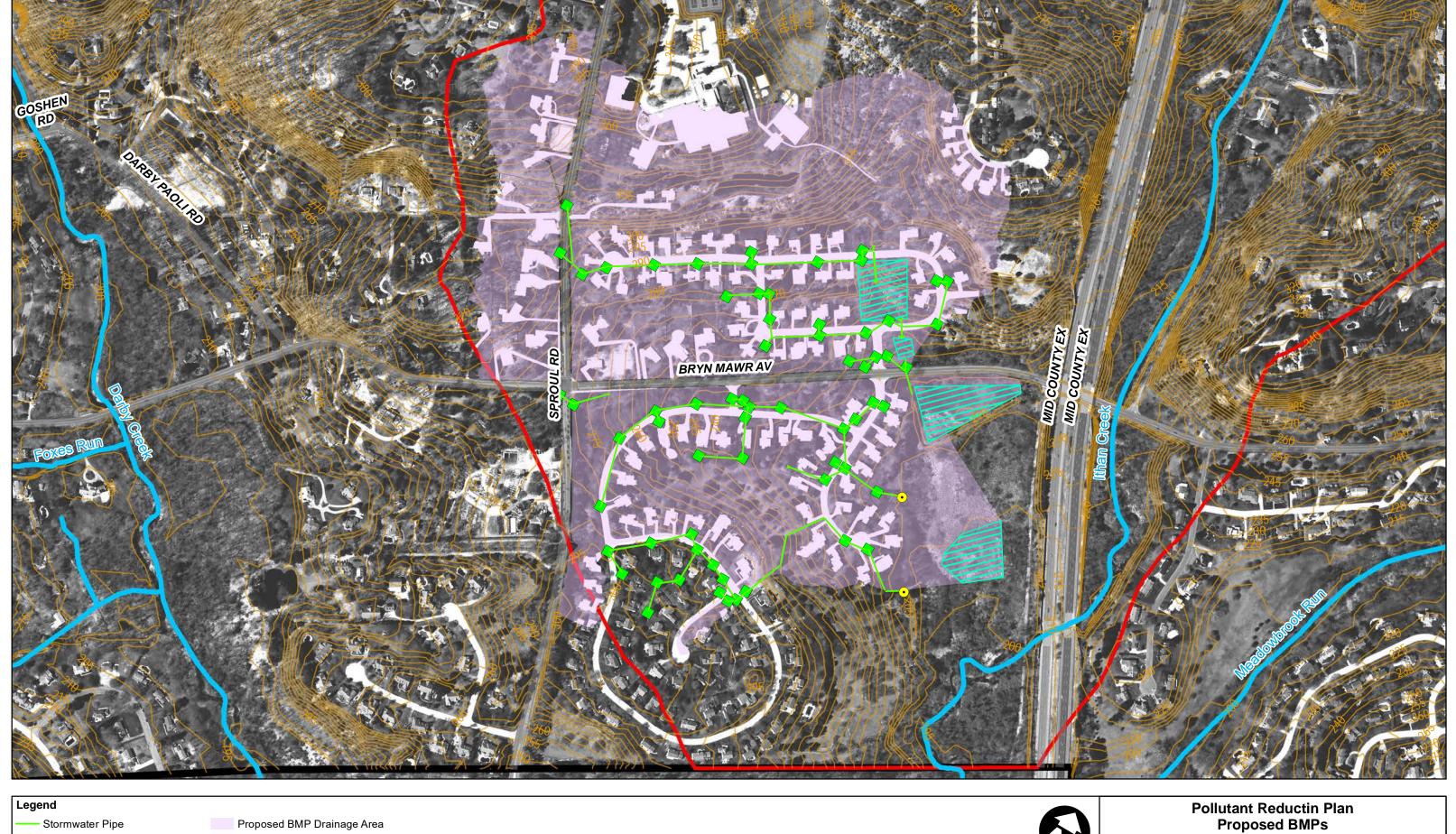
Haymarket Subdivisionl Basin Retrofit

Darby Creek HUC-12 Radnor Township Delaware Co. Pennsylvania

Cornerstone and Hills of Bryn Mawr Basin Retrofit

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Cornerstone and	Cornerstone	Basin	108.39	18	36,212
Hills of Bryn Mawr	Dr.	Retrofit			
Basin Retrofit					

A retrofit of an existing detention basin on Cornerstone Drive is proposed. This site is privately owned by an HOA. The site drains to Ithan Creek in the Darby Creek Basin. The proposed retrofit intends to convert a detention basin to a dry extended detention basin. By extending the duration of detention, the treatment effectiveness is increased. The contributing drainage area is 108.39 acres and the BMP will achieve a sediment reduction of 36,212 lbs/yr.







Cornerstone and Hills of Bryn Mar Basin Retrofit

Darby Creek HUC-12 Radnor Township Delaware Co. Pennsylvania

Haviland Subdivision Basin Retrofit

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Haviland	Haviland Dr.	Basin	15.08	27	6,263
Subdivision Basin		Retrofit			
Retrofit					

A retrofit of an existing detention basin on Haviland Drive is proposed. This site is privately owned by an HOA. The site drains to Ithan Creek in the Darby Creek Basin. The proposed retrofit intends to convert a detention basin to a dry extended detention basin. By extending the duration of detention, the treatment effectiveness is increased. The contributing drainage area is 15.08 acres and the BMP will achieve a sediment reduction of 6,263 lbs/yr.







Pollutant Reductin Plan Proposed BMPs

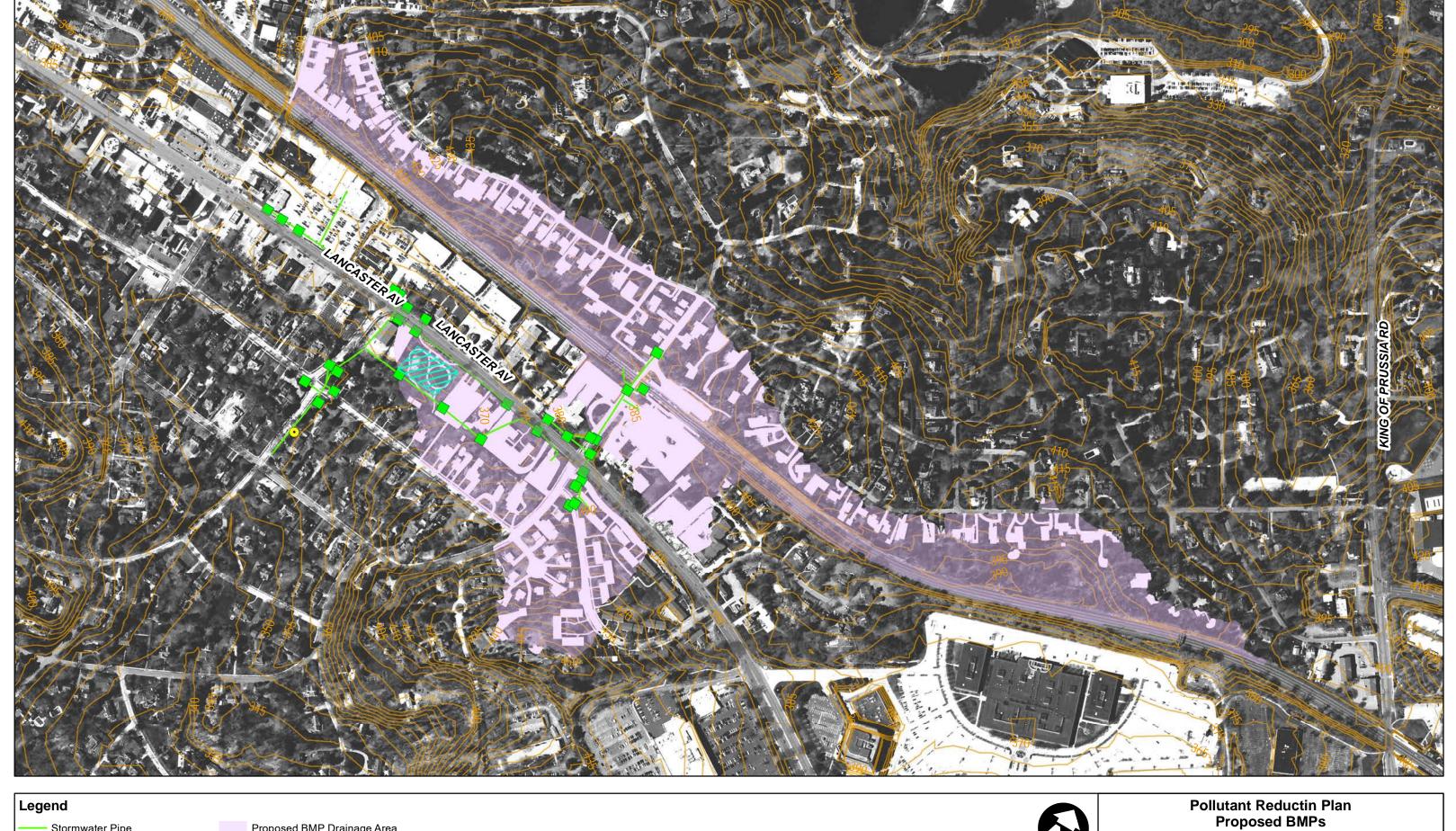
Havelin Subdivision Basin Retrofit

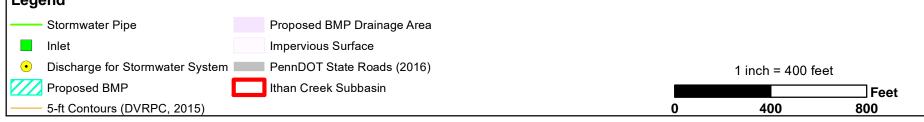
Darby Creek HUC-12 Radnor Township Delaware Co. Pennsylvania

Veterans Memorial Park Subsurface Infiltration

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Veterans	406 E.	Subsurface	70.35	35	31,561
Memorial Park	Lancaster	Storage			
Subsurface	Ave.	Module			
Infiltration					

Veterans Memorial Park, formerly named St. Davids Community Park, is a publicly-owned park located at 406 Lancaster Avenue in Radnor Township. The site drains to Ithan Creek in the Darby Creek Basin. The proposed BMP consists of a subsurface module system that allow for storage and infiltration. The subsurface feature will ensure that this site maintains the current land use. The site is entirely underlain by C soils, which indicates that infiltration is likely feasible in this area. A conveyance network will pipe the runoff from the contributing drainage area to the underground storage/infiltration modules. The contributing drainage area is 70.35 acres and the BMP will achieve a sediment reduction of 31,561 lbs/yr.





Veterans Memorial Park Subsurface Infiltration

Ithan Valley Park Stream Restoration

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Ithan Valley Park	S. Ithan Ave.	Stream	NA – 2000 ft	NA	89,760
Stream		Restoration			
Restoration					

Ithan Valley Park is a publicly-owned park that lies between S. Ithan Ave and Interstate 476 near the intersection of S. Ithan Avenue and S. Roberts Road. Ithan Creek runs through the park, and Ithan Creek drains to the Darby Creek Basin. Stream restoration is proposed along 2000 feet of the Ithan Creek abutting the public park. Stream restoration involves stabilization to prevent channel and bank erosion that would otherwise be delivered downstream. The Ithan Valley Park stream restoration will achieve a sediment reduction of 89,760 lbs/year.



1 inch = 400 feet

400

☐ Feet

800

• Discharge for Stormwater System

5-ft Contours (DVRPC, 2015)

PADEP Impaired Streams (2016)

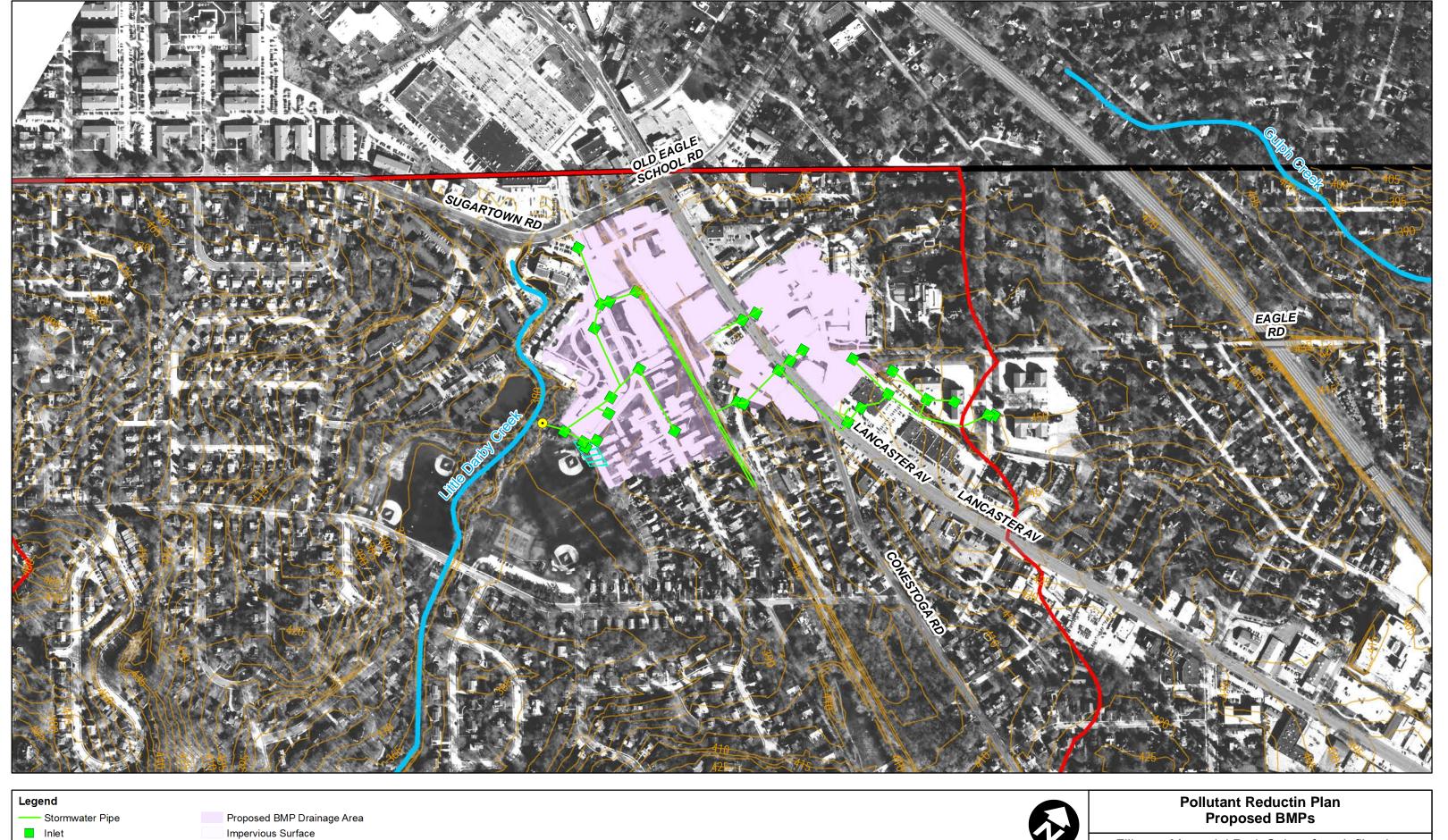
■ ■ Stream Restoration



Ithan Valley Park Stream Restoration

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Warren Filipone	S. Devon	Subsurface	25.44	70	20,381
Memorial Park	Ave.	Storage			
Subsurface		Module			
Infiltration					

Warren Filipone Memorial Park is a publicly-owned park located at 400 South Devon Avenue. Radnor Township uses Warren Filipone Memorial Park for many recreational activities This site drains to Little Darby Creek, which runs through the park, and lies within the Darby Creek Basin. The site currently has several baseball diamonds, several tennis courts, a basketball court, a playground, a parking area, and open field space. Three BMPs are proposed to improve the park area, and the second BMP is discussed here. Please see the preceding and following sections for additional BMP projects at this site. Runoff from the contributing drainage area will be directed to proposed subsurface storage/infiltration modules. The nature of subsurface modules allows for the continued use of the park consistent with the current use. The contributing drainage area is 25.44 acres and the BMP will achieve a sediment reduction of 20,381 lbs/yr.





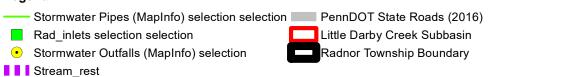
Filipone Memorial Park Subsurface Infiltration

Warren Filipone Memorial Park Stream Restoration

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Warren Filipone Memorial Park	S. Devon Ave.	Stream Restoration	NA – 704 ft	NA	31,596
Stream Restoration					

Warren Filipone Memorial Park is a publicly-owned park located at 400 South Devon Avenue. Radnor Township uses Warren Filipone Memorial Park for many recreational activities. This site drains to Little Darby Creek, which runs through the park, and lies within the Darby Creek Basin. The site currently has several baseball diamonds, several tennis courts, a basketball court, a playground, a parking area, and open field space. Three BMPs are proposed to improve the park area, and the third BMP is discussed here. Please see the two preceding sections for additional BMP projects at this site. Stream restoration is proposed along 704 feet of Little Darby Creek abutting the public park. Stream restoration involves stabilization to prevent channel and bank erosion that would otherwise be delivered downstream. The Warren Filipone Memorial Park stream restoration will achieve a sediment reduction of 31,596 lbs/year.





5-ft Contours (DVRPC, 2015)

PADEP Impaired Streams (2016)

1 inch = 400 feet Feet 800 400

Filipone Memorial Park Stream Restoration

Devon Square Subdivision Basin Retrofit

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Devon Square Subdivision Basin Retrofit	Eaton Dr.	Basin Retrofit	19.22	36	9,650

A retrofit of an existing detention basin on Eaton Drive is proposed. This site is privately owned by an HOA. The site drains to Little Darby Creek in the Darby Creek Basin. The proposed retrofit intends to convert a detention basin to a dry extended detention basin. By extending the duration of detention, the treatment effectiveness is increased. The contributing drainage area is 19.22 acres and the BMP will achieve a sediment reduction of 9,650 lbs/yr.



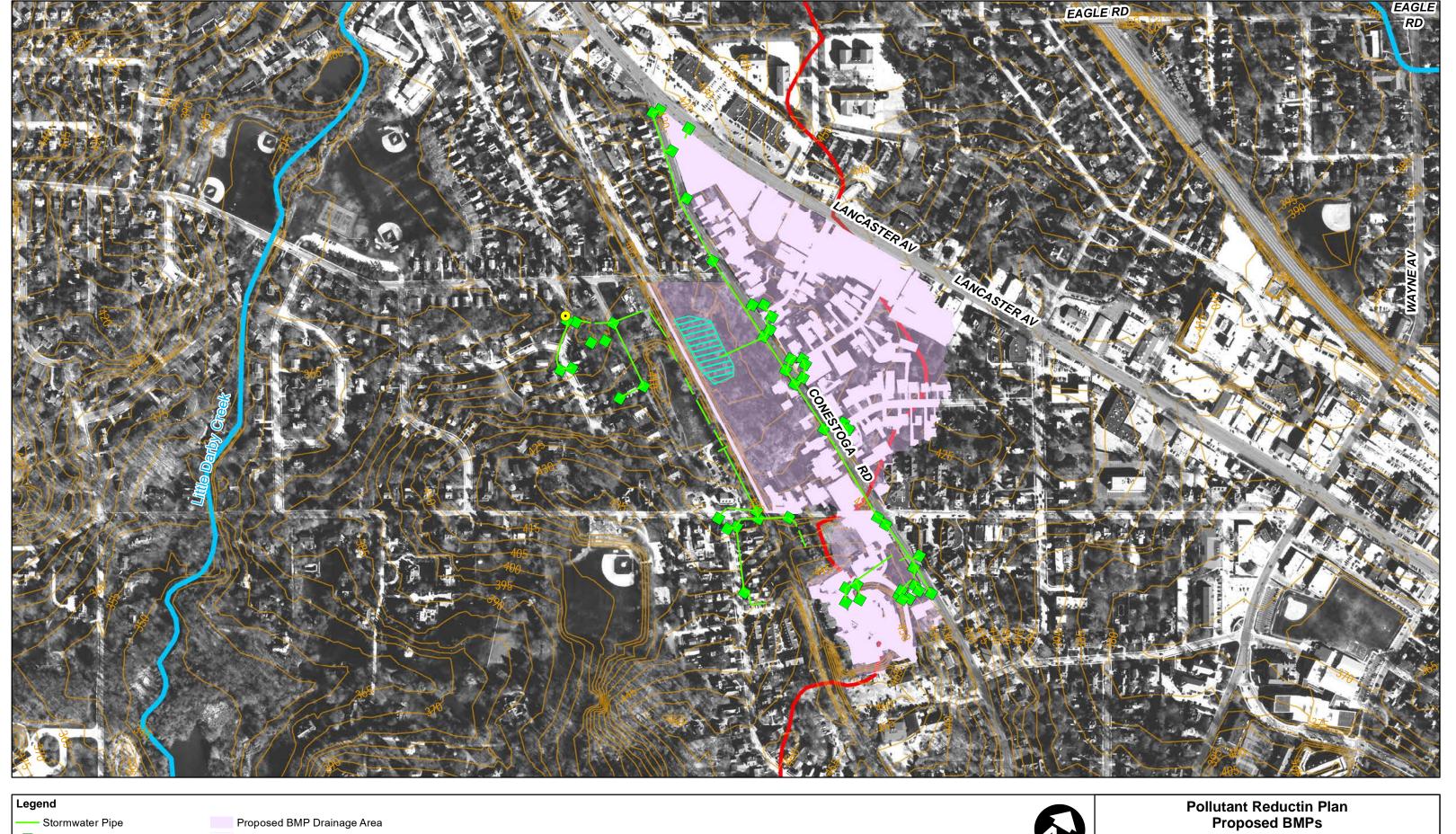


Devon Square Subdivision Basin Retrofit

West Wayne Preserve Wetland

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
West Wayne Preserve Wetland	Conestoga Rd.	Wetland	37.70	48	23,135

A wetland is proposed at West Wayne Preserve, which is located along Conestoga Road near the intersection of Conestoga Road and S. Devon Avenue. The site drains to Little Darby Creek in the Darby Creek Basin. A wetland is a water impoundment that retains a permanent pool, allowing sufficient time to allow settlement of sediments intercepted in stormwater runoff. The contributing drainage area is 37.70 acres and the BMP will achieve a sediment reduction of 23,135 lbs/yr.







West Wayne Preserve Wetland

Bo Connor Park Subsurface Infiltration

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Bo Connor Park	S. Devon	Subsurface	15.74	39	7,685
Subsurface	Ave.	Storage			
Infiltration		Module			

Bo Connor Park is a publicly-owned park at the northwest corner of Radnor Township, near the intersection of S. Devon Avenue and Arbordale Road. The site is currently used for recreational purposes. The site drains to Little Darby Creek in the Darby Creek Basin. The proposed BMP is subsurface infiltration modules, which will allow for storage of contributing runoff and subsequent infiltration. The subsurface feature will ensure that the site maintains the current land use. A conveyance network will pipe the runoff from the contributing drainage area to the underground storage/infiltration modules. The contributing drainage area is 15.74 acres and the BMP will achieve a sediment reduction of 7,685 lbs/yr.



Feet

800

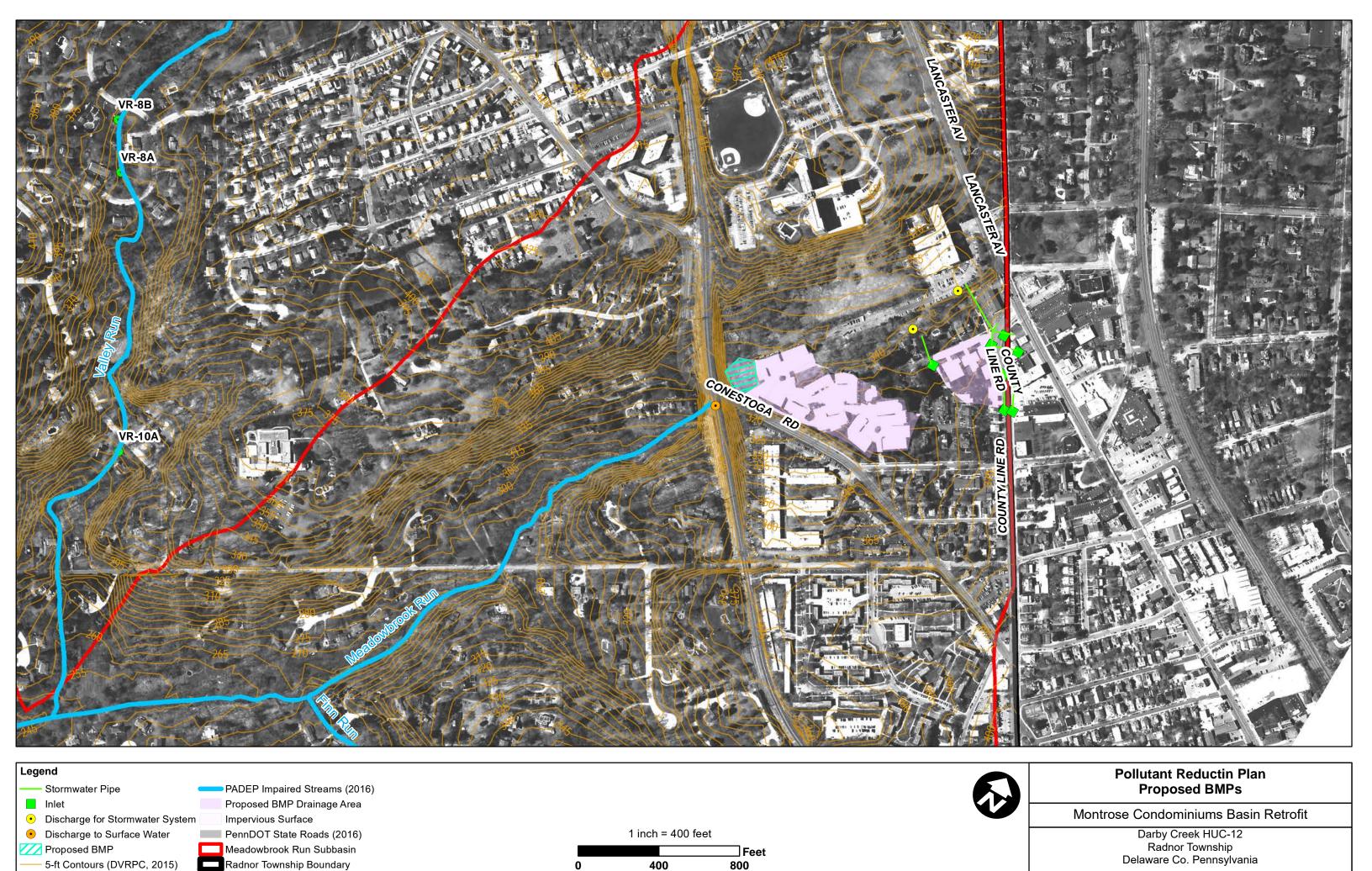




Montrose Condominiums Basin Retrofit

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Montrose	Montrose	Basin	7.95	64	6,092
Condominiums	Ave.	Retrofit			
Basin Retrofit					

A retrofit of an existing detention basin on Montrose Avenue. This site is privately owned by an HOA. The site drains to Meadowbrook Run in the Darby Creek Basin. The proposed retrofit intends to convert a detention basin to a dry extended detention basin. By extending the duration of detention, the treatment effectiveness is increased. The contributing drainage area is 7.95 acres and the BMP will achieve a sediment reduction of 6,092 lbs/yr.



Radnor House Bioretention

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Radnor House Bioretention	E. Lancaster Ave.	Bioretention	23.97	38	17,732

A bioretention area is proposed at the Radnor House Condominiums, located at 1030 E. Lancaster Avenue. The site drains to Meadowbrook Run in the Darby Creek Basin. The site for the proposed BMP consists of a large, privately-owned condominium complex with associated parking and open green space. The bioretention area will consist of a shallow excavated surface depression planted with native vegetation which will capture and treat the contributing drainage area. Portions of the underlaying soils are B soils, suggesting infiltration is feasible. The above ground planted bioretention area with infiltration is proposed to capture a drainage area of approximately 23.97 acres and the BMP will achieve a sediment reduction of 17,732 lbs/yr.



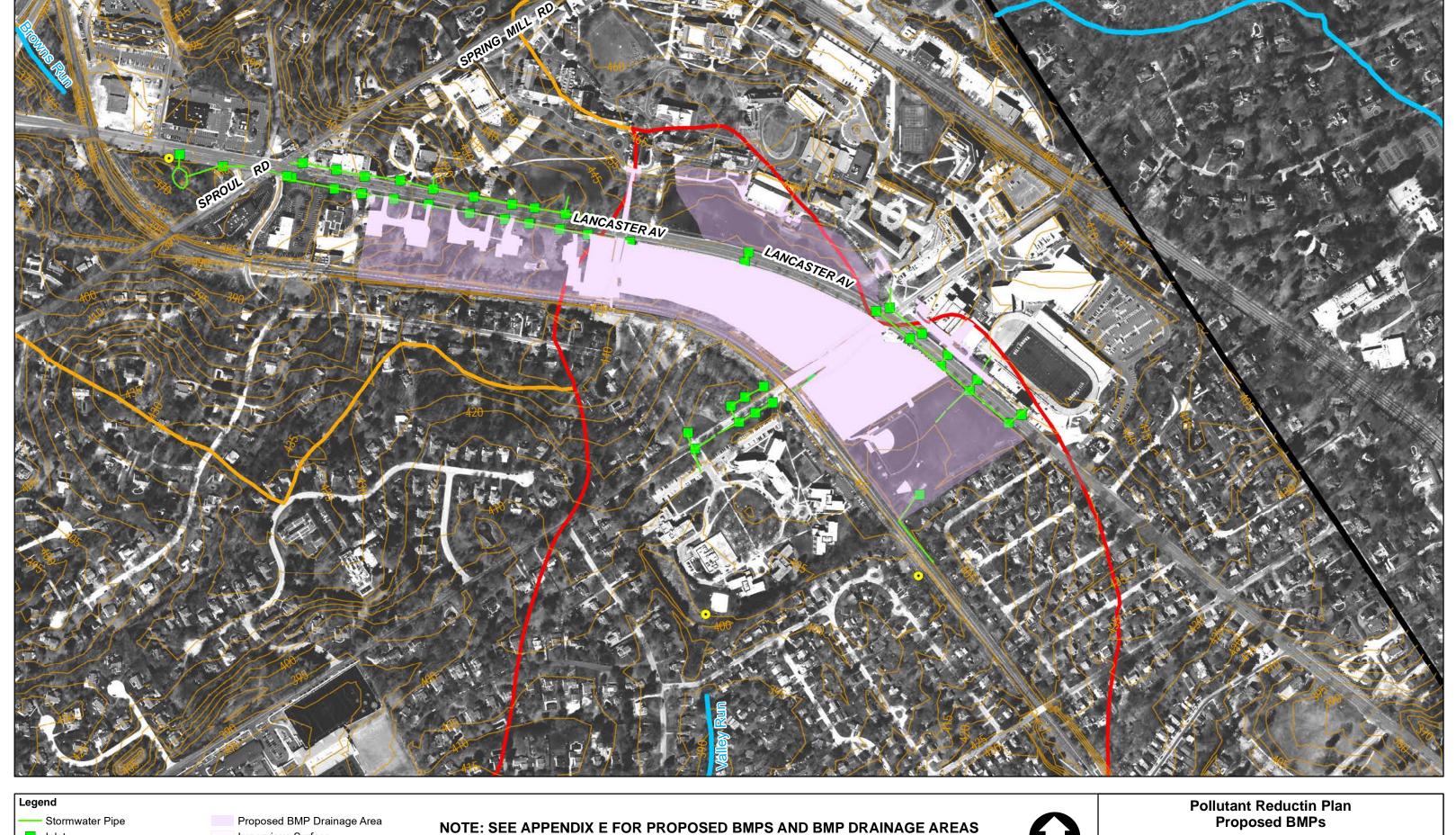


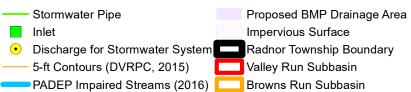
Radnor House Bioretention

Villanova Campus Improvements

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Villanova Campus Improvements	Lancaster Ave.	Infiltration	20.78	69	18,763

Villanova is located in eastern Radnor township, along Lancaster Avenue. Villanova is currently under construction for various campus improvements, including Lancaster Avenue Housing, West Lancaster Parking Garage, Pike Garage, and a Performing Arts Center. For the purposes of this pollutant reduction plan, these campus improvements with associated stormwater management are designated as proposed projects. Stormwater management includes many raingarden/bioretention areas, cisterns, and infiltration systems. Accompanying plans are provided to supplement this report. The proposed improvements capture a drainage area of approximately 20.78 acres and the BMP will achieve a sediment reduction of 18,763 lbs/yr.





PennDOT State Roads (2016)

1 inch = 400 feet

400

Feet

800

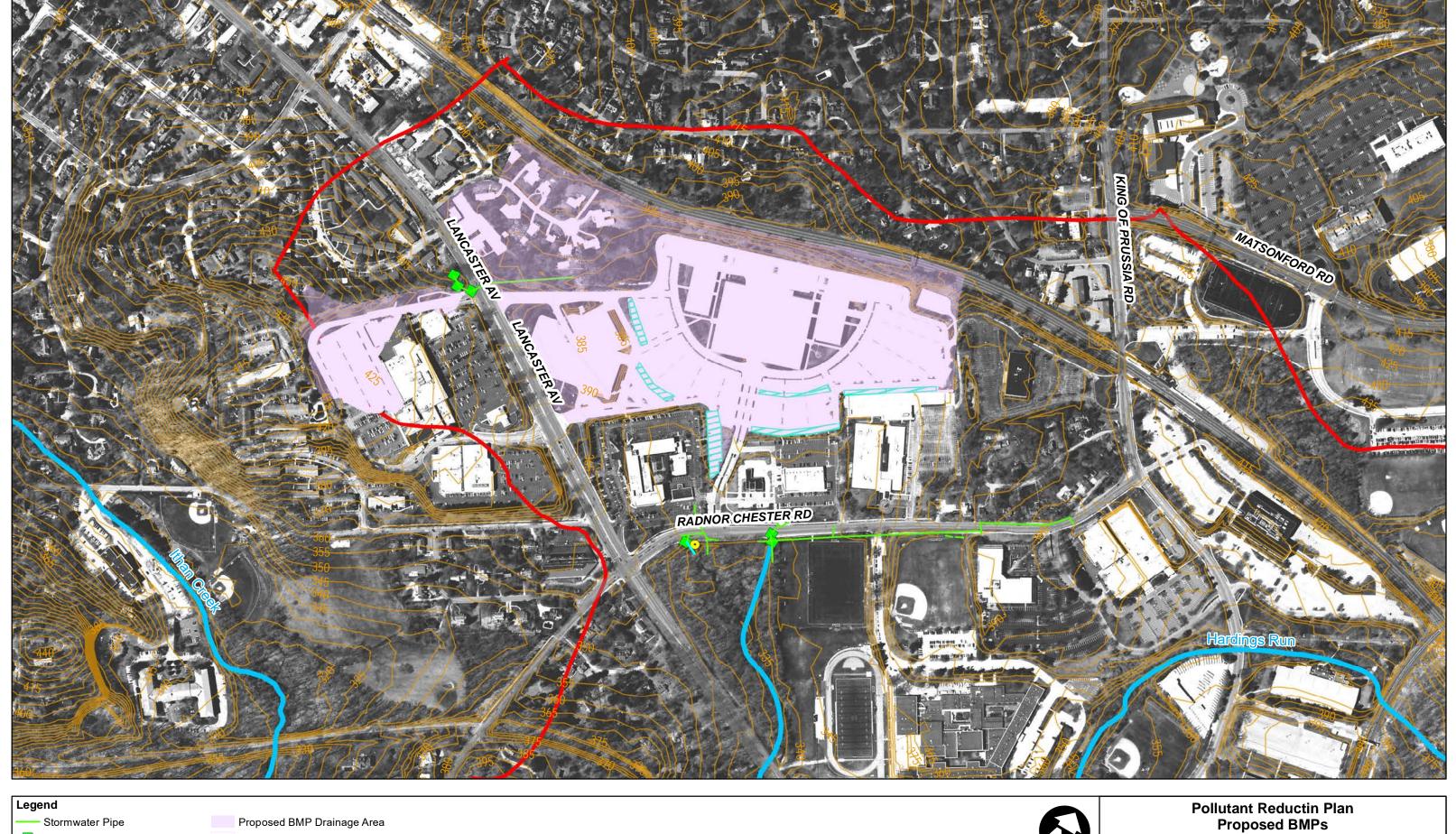


Villanova University Stormwater BMPs

Lincoln Financial Porous Parking Retrofit

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Lincoln Financial	Radnor	Porous	49.91	61	33,549
Porous Parking	Chester Rd.	Paving /			
Retrofit		Infiltration			

The Lincoln Financial is a privately-owned business complex located near the intersection of Radnor Chester Road and Lancaster Avenue in northern Radnor Township. The site drains to Hardings Run in the Darby Creek Basin. The large building footprint and large parking lot areas make this site a great candidate for BMP improvements. Preliminary information indicates that the site is underlain by C/D soils, and further infiltration testing will be required to confirm the ability of the soils to infiltrate. Porous paving and parking bay bioretention are proposed for this site. Porous paving consists of a permeable surface course underlaid by a stone bed on an un-compacted subsurface, which provides temporary storage and infiltration to occur. The bioretention areas will consist of a shallow excavated surface depression planted with native vegetation which will capture and treat the contributing drainage area. The total contributing drainage area to the proposed BMPs is 49.91 acres and the BMP will achieve a sediment reduction of 33,549 lbs/yr.



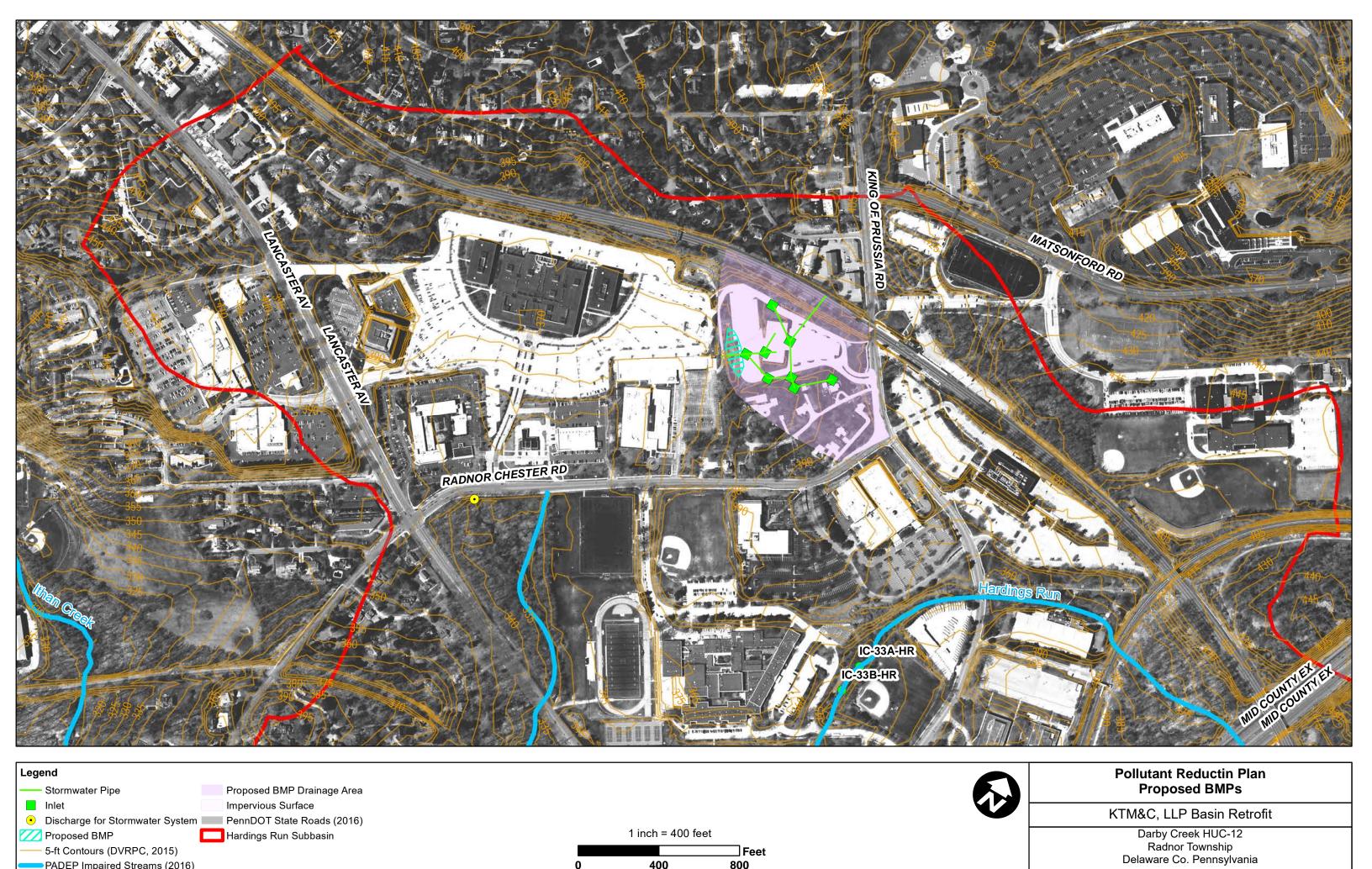


Lincoln Financial Porous Paving/Infiltration

KTM&C, LLP Basin Retrofit

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
KTM&C, LLP Basin	King of	Basin	12.90	37	6,633
Retrofit	Prussia Rd.	Retrofit			

A retrofit of an existing basin is proposed at a site near the intersection of King of Prussia Road and Radnor Chester Road. This site is privately owned and drains to Hardings Run in the Darby Creek Basin. The proposed retrofit intends to convert a detention basin to a dry extended detention basin. By extending the duration of detention, the treatment effectiveness is increased. The contributing drainage area is 12.90 acres and the BMP will achieve a sediment reduction of 6,633 lbs/yr.

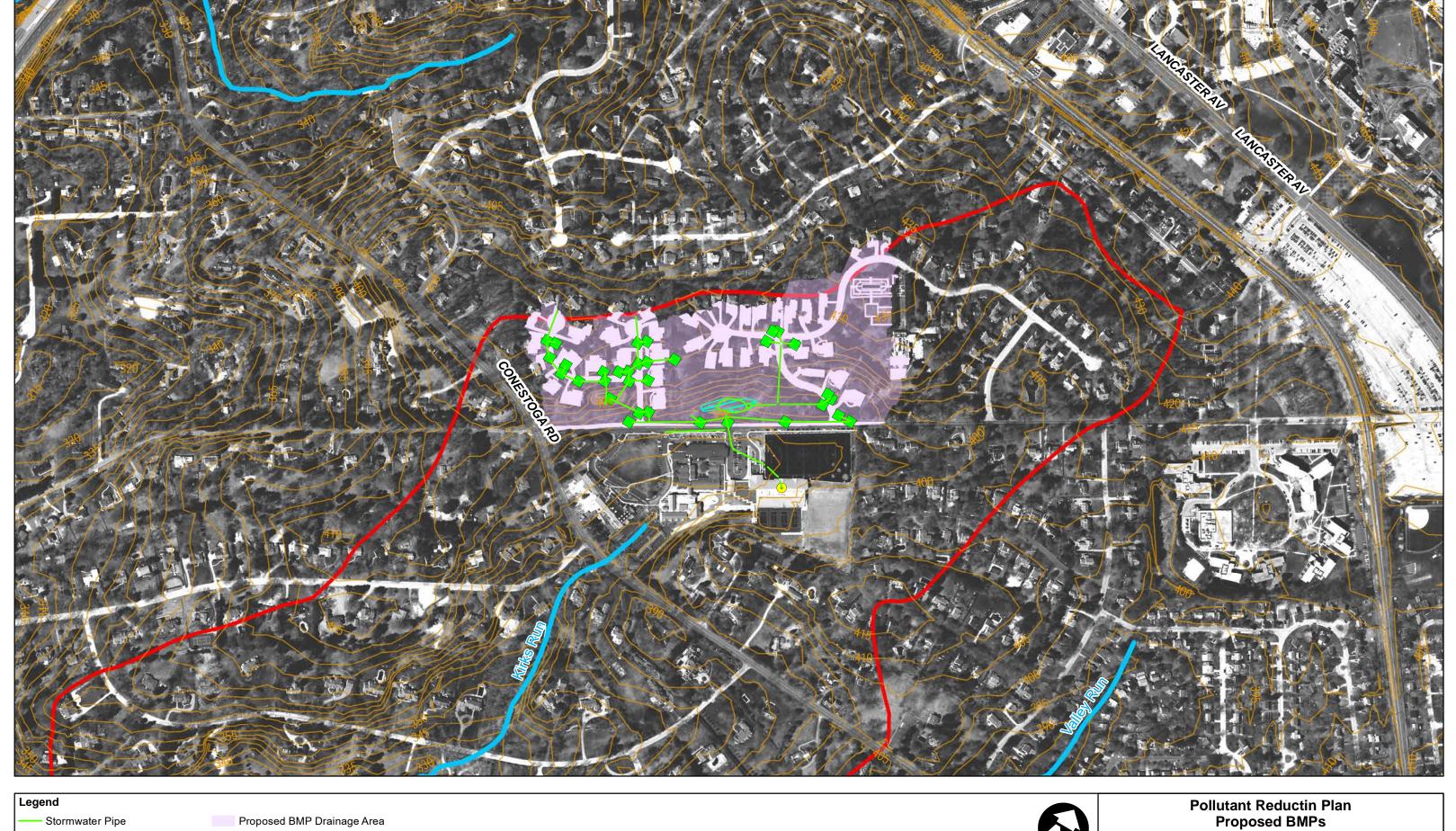


PADEP Impaired Streams (2016)

Trianon Subdivision Basin Retrofit

BMP Name	Location	ВМР Туре	Drainage Area (acres)	Percent Impervious (%)	TSS Reduction (lbs/yr)
Trianon	Trianon Lane	Basin	22.87	32	10,500
Subdivision Basin		Retrofit			
Retrofit					

A retrofit of an existing detention basin along S. Ithan Avenue near the intersection of S. Ithan Avenue and Chalous Lane. This site is privately owned by an HOA. The site drains to Kirks Run in the Darby Creek Basin. The proposed retrofit intends to convert a detention basin to a dry extended detention basin. By extending the duration of detention, the treatment effectiveness is increased. The contributing drainage area is 22.87 acres and the BMP will achieve a sediment reduction of 10,500 lbs/yr.







Trianon Subdivision Basin Retrofit

F. Identify Funding Mechanisms

The funding mechanisms for each proposed BMP will be the Radnor Township Stormwater Fee, which currently provides approximately \$1,000,000 in available funds each year.

G. Identify Responsible Parties for BMP Operations and Maintenance (O&M) of BMPs

In order to ensure long-term effectiveness and functionality of proposed BMPs, appropriate operation and maintenance is critical (O&M). Table 11 outlines the responsible parties, O&M activity, and frequency of each activity. The 2006 Pennsylvania Stormwater BMP Manual was used for guidance.

Table 11: Operation and Maintenance for Proposed BMPs

BMP Name	ВМР Туре	Responsible Party	O&M Activity and Frequency
Radwyn Apartments Raingarden/Bioretention	Raingarden/ Bioretention	Radnor Township	 Inspect for proper function, 2x annually Inspect plantings for health, 2x per year and replant as necessary Remove dead or decaying material, 1x annually Re-spread mulch, 1x every 2 years Prune, weed, and replant as necessary
Eastern University West Campus Lot Raingarden	Raingarden/ Bioretention	Radnor Township	 Inspect for proper function, 2x annually Inspect plantings for health, 2x per year and replant as necessary Remove dead or decaying material, 1x annually Re-spread mulch, 1x every 2 years Prune, weed, and replant as necessary
Township Parking	Porous Paving/ Infiltration	Radnor Township	 Inspect for proper function, 2x annually Remove sediment from inlet structures, 2x annually Maintain overlaying vegetation in good condition, if necessary Avoid excessive compaction of underlying soils, as necessary
Woods Lane Subdivision Basin 1 Retrofit	Basin Retrofit	Radnor Township	 Inspect basin and all associated structures for proper function, 4x annually Remove accumulated debris and sediment, 4x annually and after all storms greater than 1" Inspect vegetated area for erosion, 1x annually Prune, weed, mow, and replant as necessary

BMP Name	BMP Type	Responsible Party	O&M Activity and Frequency
Woods Lane Subdivision Basin 2 Retrofit	Basin Retrofit	Radnor Township	 Inspect basin and all associated structures for proper function, 4x annually Remove accumulated debris and sediment, 4x annually and after all storms greater than 1" Inspect vegetated area for erosion, 1x annually Prune, weed, mow, and replant as necessary
North Wayne Field Basin Retrofit	Basin Retrofit	Radnor Township	 Inspect basin and all associated structures for proper function, 4x annually Remove accumulated debris and sediment, 4x annually and after all storms greater than 1" Inspect vegetated area for erosion, 1x annually Prune, weed, mow, and replant as necessary
Valley Forge Military Academy	Porous Paving/ Infiltration	Radnor Township	 Inspect for proper function, 2x annually Remove sediment from inlet structures, 2x annually Maintain overlaying vegetation in good condition, if necessary Avoid excessive compaction of underlying soils, as necessary
Cowan Park Stream Restoration	Stream Restoration	Radnor Township	 Inspect for proper function, 2x annually Remove weeds and invasive species for first growing season, and 2x annually thereafter Inspect after large rain events, 4x annually for first 2 years after restoration Prune, weed, and replant as necessary

BMP Name	ВМР Туре	Responsible Party	O&M Activity and Frequency
Portledge Subdivision Basin Retrofit	Basin Retrofit	Radnor Township	 Inspect basin and all associated structures for proper function, 4x annually Remove accumulated debris and sediment, 4x annually and after all storms greater than 1" Inspect vegetated area for erosion, 1x annually Prune, weed, mow, and replant as necessary
Haymarket Subdivision Basin Retrofit	Basin Retrofit	Radnor Township	 Inspect basin and all associated structures for proper function, 4x annually Remove accumulated debris and sediment, 4x annually and after all storms greater than 1" Inspect vegetated area for erosion, 1x annually Prune, weed, mow, and replant as necessary
Cornerstone and Hills of Bryn Mawr Basin Retrofit	Basin Retrofit	Radnor Township	 Inspect basin and all associated structures for proper function, 4x annually Remove accumulated debris and sediment, 4x annually and after all storms greater than 1" Inspect vegetated area for erosion, 1x annually Prune, weed, mow, and replant as necessary
Haviland Subdivision Basin Retrofit	Basin Retrofit	Radnor Township	 Inspect basin and all associated structures for proper function, 4x annually Remove accumulated debris and sediment, 4x annually and after all storms greater than 1" Inspect vegetated area for erosion, 1x annually Prune, weed, mow, and replant as necessary

BMP Name	ВМР Туре	Responsible Party	O&M Activity and Frequency
Veterans Memorial Park Subsurface Infiltration	Infiltration / Subsurface Storage Module	Radnor Township	 Inspect for proper function, 2x annually Remove sediment from inlet structures, 2x annually Maintain overlaying vegetation in good condition, if necessary Avoid excessive compaction of underlying soils, as necessary
Ithan Valley Park Stream Restoration	Stream Restoration	Radnor Township	 Inspect for proper function, 2x annually Remove weeds and invasive species for first growing season, and 2x annually thereafter Inspect after large rain events, 4x annually for first 2 years after restoration Prune, weed, and replant as necessary
Warren Filipone Memorial Park Subsurface Infiltration	Infiltration / Subsurface Storage Module	Radnor Township	 Inspect for proper function, 2x annually Remove sediment from inlet structures, 2x annually Maintain overlaying vegetation in good condition, if necessary Avoid excessive compaction of underlying soils, as necessary
Warren Filipone Memorial Park Stream Restoration	Stream Restoration	Radnor Township	 Inspect for proper function, 2x annually Remove weeds and invasive species for first growing season, and 2x annually thereafter Inspect after large rain events, 4x annually for first 2 years after restoration Prune, weed, and replant as necessary
Devon Square Subdivision Basin Retrofit	Basin Retrofit	Radnor Township	 Inspect basin and all associated structures for proper function, 4x annually Remove accumulated debris and sediment, 4x annually and after all storms greater than 1" Inspect vegetated area for erosion, 1x annually Prune, weed, mow, and replant as necessary

BMP Name	ВМР Туре	Responsible Party	O&M Activity and Frequency
West Wayne Preserve Wetland	Wooded Wetland	Radnor Township	 Inspect for proper function, 2x annually Inspect vegetation, 2x weekly for first growing season after installation Inspect after large rain events, 4x annually for first 2 years after installation Prune, weed, and replant as necessary
Bo Connor Park Subsurface Infiltration	Infiltration / Subsurface Storage Module	Radnor Township	 Inspect for proper function, 2x annually Remove sediment from inlet structures, 2x annually Maintain overlaying vegetation in good condition, if necessary Avoid excessive compaction of underlying soils, as necessary
Montrose Condominium Basin Retrofit	Basin Retrofit	Radnor Township	 Inspect basin and all associated structures for proper function, 4x annually Remove accumulated debris and sediment, 4x annually and after all storms greater than 1" Inspect vegetated area for erosion, 1x annually Prune, weed, mow, and replant as necessary
Radnor House Bioretention	Bioretention	Radnor Township	 Inspect for proper function, 2x annually Inspect plantings for health, 2x per year and replant as necessary Remove dead or decaying material, 1x annually Re-spread mulch, 1x every 2 years Prune, weed, and replant as necessary
Villanova Campus Improvements	Infiltration	Villanova University	 Inspect for proper function, 2x annually Remove sediment from inlet structures, 2x annually Maintain overlaying vegetation in good condition, if necessary Avoid excessive compaction of underlying soils, as necessary

BMP Name	ВМР Туре	Responsible Party	O&M Activity and Frequency
Lincoln Financial Porous Parking Retrofit	Porous Paving/ Infiltration	Radnor Township	 Inspect for proper function, 2x annually Remove sediment from inlet structures, 2x annually Maintain overlaying vegetation in good condition, if necessary Avoid excessive compaction of underlying soils, as necessary
KTM&C, LLP Basin Retrofit	Basin Retrofit	Radnor Township	 Inspect basin and all associated structures for proper function, 4x annually Remove accumulated debris and sediment, 4x annually and after all storms greater than 1" Inspect vegetated area for erosion, 1x annually Prune, weed, mow, and replant as necessary
Trianon Subdivision Basin Retrofit	Basin Retrofit	Radnor Township	 Inspect basin and all associated structures for proper function, 4x annually Remove accumulated debris and sediment, 4x annually and after all storms greater than 1" Inspect vegetated area for erosion, 1x annually Prune, weed, mow, and replant as necessary

V Conclusion

With the implementation of the proposed Best Management Practices (BMPs), Radnor Township will achieve a reduction of 14%, exceeding the required 10% sediment reduction from stormwater discharges (i.e. MS4 outfalls) to impaired waters within 5 years of PaDEP's approval under the 2018 PAG-13 General Permit. The information in Table 12 confirms that Radnor Township will achieve the required reductions.

Table 12: Summary of Required Reductions

HUC 12	Waterway	Total Load (lbs/yr)	Existing BMP (lbs/yr)	Required Reduction (lbs/yr)	BMP Load Reduction (lbs/yr)	Reduction %	HUC 12 Reduction %
Cobbs Creek (HUC: 020402020504)	Cobbs Creek	26,591	0	2659.1	8,948	34	34
Plymouth Creek – Schuylkill River	Gulph Creek	475,860	147	47571.3	68,563	14	12
(HUC: 020402031007)	Mill Creek	95,439	0	9543.9	0	0	
Darby Creek (HUC: 020402020505)	Saw Mill Run	9,614	0	961.4	0	0	14
	Browns Run	119,971	0	11997.1	0	0	
	Abrahams Run	23,305	0	2330.5	0	0	
	Miles Run	30,126	326	2980	0	0	
	Glennbrook	29,533	0	2953.3	0	0	
	Kirks Run	144,532	7,576	13695.6	10,500	7	
	Meadowbro ok Run	198,593	11,525	18706.8	23,824	12	
	Little Darby Creek	328,356	4,464	32389.2	92,447	28	
	Van Lear's Run	31,704	0	3170.4	0	0	
	Darby Creek	134,760	0	13476	0	0	
	Valley Run	214,796	0	21479.6	0	0	
	Ithan Creek	890,912	20,617	87029.5	188,385	21	
	Hardings Run	251,917	0	25191.7	40,182	16	
	Foxes Run	53,300	0	5330	0	0	
	Camp Run	10,665	0	1066.5	0	0	
	Finn Run	37,423	0	3742.3	0	0	
	Doom Run	1,590	0	159	0	0	
	Wigwam Run	7,948	0	794.8	0	0	
Total		3,116,935	44,655	307,280	432,849	14	

VI Appendices

Appendix A. Public Notice, Record of Public Comment/Reponses, and Record of Consideration

Appendix B. PaDEP Developed Land Loading Rates for PA Counties

ATTACHMENT B

DEVELOPED LAND LOADING RATES FOR PA COUNTIES^{1,2,3}

County	Category	Acres	TN lbs/acre/yr	TP lbs/acre/yr	TSS (Sediment) lbs/acre/yr
A -l	impervious developed	10,373.2	33.43	2.1	1,398.77
Adams	pervious developed	44,028.6	22.99	0.8	207.67
5 16 1	impervious developed	9,815.2	19.42	1.9	2,034.34
Bedford	pervious developed	19,425	17.97	0.68	301.22
	impervious developed	1,292.4	36.81	2.26	1,925.79
Berks	pervious developed	5,178.8	34.02	0.98	264.29
	impervious developed	3,587.9	20.88	1.73	1,813.55
Blair	pervious developed	9,177.5	18.9	0.62	267.34
	impervious developed	10,423	14.82	2.37	1,880.87
Bradford	pervious developed	23,709.7	13.05	0.85	272.25
	impervious developed	3,237.9	20.91	2.9	2,155.29
Cambria	pervious developed	8,455.4	19.86	1.12	325.3
	impervious developed	1,743.2	18.46	2.98	2,574.49
Cameron	pervious developed	1,334.5	19.41	1.21	379.36
	impervious developed	25.1	28.61	3.97	2,177.04
Carbon	pervious developed	54.2	30.37	2.04	323.36
	impervious developed	7,828.2	19.21	2.32	1,771.63
Centre		· · · · · · · · · · · · · · · · · · ·	18.52		-
	pervious developed	15,037.1		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
Columbia	pervious developed	21,848.2	22.15	1.22	280.39
Cumberland	impervious developed	8,774.8	28.93	1.11	2,065.1
Gambonana	pervious developed	26,908.6	23.29	0.34	306.95
Dauphin	impervious developed	3,482.4	28.59	1.07	1,999.14
Бацріпії	pervious developed	9,405.8	21.24	0.34	299.62
Elks	impervious developed	1,317.7	18.91	2.91	1,556.93
LIKS	pervious developed	1,250.1	19.32	1.19	239.85
Franklin	impervious developed	13,832.3	31.6	2.72	1,944.85
FIANKIII	pervious developed	49,908.6	24.37	0.76	308.31
C. Italia	impervious developed	3,712.9	22.28	2.41	1,586.75
Fulton	pervious developed	4,462.3	18.75	0.91	236.54
11 (* 1	impervious developed	7,321.9	18.58	1.63	1,647.53
Huntington	pervious developed	11,375.4	17.8	0.61	260.15
	impervious developed	589	19.29	2.79	1,621.25
Indiana	pervious developed	972	20.1	1.16	220.68
	impervious developed	21.4	18.07	2.76	1,369.63
Jefferson	pervious developed	20.4	19.96	1.24	198.60
	impervious developed	3,770.2	22.58	1.69	1,903.96
Juniata	pervious developed	8,928.3	17.84	0.55	260.68
	impervious developed	2,969.7	19.89	2.84	1,305.05
Lackawana	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
		1,192.1	40.58	1.85	1,948.53
Lebanon	impervious developed				· · · · · · · · · · · · · · · · · · ·
	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

			TN	TP	TSS (Sediment)
County	Category	Acres	lbs/acre/yr	lbs/acre/yr	lbs/acre/yr
Makaan	impervious developed	38.7	20.93	3.21	1,843.27
McKean pervious developed		5.3	22.58	1.45	249.26
Mifflin	impervious developed	5,560.2	21.83	1.79	1,979.13
IVIIIIIIII	pervious developed	16,405.5	21.13	0.71	296.07
Montour	impervious developed	5,560.2	21.83	1.79	1,979.13
Wortou	pervious developed	16,405.5	21.13	0.71	296.07
Northumberland	impervious developed	8,687.3	25.73	1.54	2,197.08
Northumberiand	pervious developed	25,168.3	24.63	0.54	367.84
Down	impervious developed	5,041.1	26.77	1.32	2,314.7
Perry	pervious developed	9,977	23.94	0.51	343.16
Dattan	impervious developed	2,936.3	16.95	2.75	1,728.34
Potter	pervious developed	2,699.3	17.11	1.09	265.2
0 - 1 11-:11	impervious developed	5,638.7	30.49	1.56	1,921.08
Schuylkill	pervious developed	14,797.2	29.41	0.57	264.04
0	impervious developed	4,934.2	28.6	1.11	2,068.16
Snyder	pervious developed	14,718.1	24.35	0.4	301.5
0	impervious developed	1,013.6	25.13	2.79	1,845.7
Somerset	pervious developed	851.2	25.71	1.14	293.42
Sullivan	impervious developed	3,031.7	19.08	2.85	2,013.9
Sullivan	pervious developed	3,943.4	21.55	1.31	301.58
0	impervious developed	7,042.1	19.29	2.86	1,405.73
Susquehanna	pervious developed	14,749.7	20.77	1.21	203.85
T:	impervious developed	7,966.9	12.37	2.09	1,767.75
Tioga	pervious developed	18,090.3	12.22	0.76	261.94
11	impervious developed	4,382.6	22.98	2.04	2,393.55
Union	pervious developed	14,065.3	20.88	0.69	343.81
14/	impervious developed	320.5	18.69	2.89	1,002.58
Wayne	pervious developed	509	21.14	1.31	158.48
10/	impervious developed	3,634.4	16.03	2.53	2,022.32
Wyoming	pervious developed	10,792.9	13.75	0.7	238.26
Varile	impervious developed	10,330.7	29.69	1.18	1,614.15
York	pervious developed	40,374.8	18.73	0.29	220.4
All Other	impervious developed	· -	23.06	2.28	1,839
Counties	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 C. PaDEP BMP Effectiveness Values

3800-PM-BCW0100m 5/2016
BMP Effectiveness Values
pennsylvania
DEPARTMENT OF ENVIRONMENTAL

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION BUREAU OF CLEAN WATER

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

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

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

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

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

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

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

Appendix D. Supporting Calculations

Proposed BMP Sup	porting Calculation
BMP Name:	Radwyn Apartments Raingarden/Bioretention
BMP Type:	Raingarden/Bioretention
HUC 12:	Cobbs Creek (020402020504)
Impaired Waterway:	Cobbs Creek
Effectiveness:	0.85
Drainage Area (ac):	9.09
Impervious Area (ac):	5.15
Impervious (%)	56
Sediment Load (lb/year):	10,527
Reduction (lb/year)	8,948

Proposed BMP Supporting Calculation	
BMP Name:	Eastern University West Campus Lot Rain Garden
BMP Type:	Raingarden/Bioretention
HUC 12:	Plymouth Creek – Schuylkill River (020402031007)
Impaired Waterway:	Gulph Creek
Effectiveness:	0.85
Drainage Area (ac):	17.27
Impervious Area (ac):	6.87
Impervious (%)	40
Sediment Load (lb/year):	15,441
Reduction (lb/year)	13,125

Proposed BMP Supporting Calculation	
BMP Name:	Township Parking
BMP Type:	Porous/Infiltration
HUC 12:	Plymouth Creek – Schuylkill River (020402031007)
Impaired Waterway:	Gulph Creek
Effectiveness:	0.85
Drainage Area (ac):	4.82
Impervious Area (ac):	1.59
Impervious (%)	33
Sediment Load (lb/year):	3,792
Reduction (lb/year)	3,223

Proposed BMP Supporting Calculation	
BMP Name:	Woods Lane Subdivision Basin 1 Retrofit
BMP Type:	Basin Retrofit
HUC 12:	Plymouth Creek – Schuylkill River (020402031007)
Impaired Waterway:	Gulph Creek
Effectiveness:	0.60
Drainage Area (ac):	12.99
Impervious Area (ac):	3.49
Impervious (%)	27
Sediment Load (lb/year):	8,984
Reduction (lb/year)	5,390

Proposed BMP Supporting Calculation	
BMP Name:	Woods Lane Subdivision Basin 2 Retrofit
BMP Type:	Basin Retrofit
HUC 12:	Plymouth Creek – Schuylkill River (020402031007)
Impaired Waterway:	Gulph Creek
Effectiveness:	0.60
Drainage Area (ac):	8.09
Impervious Area (ac):	2.27
Impervious (%)	28
Sediment Load (lb/year):	5,739
Reduction (lb/year)	3,444

Proposed BMP Supporting Calculation	
BMP Name:	North Wayne Field Basin Retrofit
BMP Type:	Basin Retrofit
HUC 12:	Plymouth Creek – Schuylkill River (020402031007)
Impaired Waterway:	Gulph Creek
Effectiveness:	0.60
Drainage Area (ac):	43.44
Impervious Area (ac):	10.87
Impervious (%)	0.25
Sediment Load (lb/year):	28,763
Reduction (lb/year)	17,258

Proposed BMP Supporting Calculation	
BMP Name:	Valley Forge Military Academy
BMP Type:	Porous Paving / Infiltration
HUC 12:	Plymouth Creek – Schuylkill River (020402031007)
Impaired Waterway:	Gulph Creek
Effectiveness:	0.85
Drainage Area (ac):	13.39
Impervious Area (ac):	4.70
Impervious (%)	35
Sediment Load (lb/year):	10,986
Reduction (lb/year)	9,338

Proposed BMP Supporting Calculation	
BMP Name:	Cowan Park Stream Restoration
BMP Type:	Stream Restoration
HUC 12:	Plymouth Creek – Schuylkill River (020402031007)
Impaired Waterway:	Gulph Creek
Effectiveness:	44.88 lb/ft/yr for 374 Feet
Drainage Area (ac):	NA
Impervious Area (ac):	NA
Impervious (%)	NA
Sediment Load (lb/year):	NA
Reduction (lb/year)	16,785

Proposed BMP Supporting Calculation	
BMP Name:	Portledge Subdivision Basin Retrofit
BMP Type:	Retrofit
HUC 12:	Darby Creek (020402020505)
Impaired Waterway:	Ithan Creek
Effectiveness:	0.60
Drainage Area (ac):	5.52
Impervious Area (ac):	1.41
Impervious (%)	26
Sediment Load (lb/year):	3,705
Reduction (lb/year)	2,223

Proposed BMP Supporting Calculation	
BMP Name:	Haymarket Subdivision Retrofit
BMP Type:	Basin Retrofit
HUC 12:	Darby Creek (020402020505)
Impaired Waterway:	Ithan Creek
Effectiveness:	0.60
Drainage Area (ac):	8.15
Impervious Area (ac):	2.43
Impervious (%)	30
Sediment Load (lb/year):	6,005
Reduction (lb/year)	3,603

Proposed BMP Supporting Calculation	
BMP Name:	Cornerstone and Hills of Bryn Mawr Basin Retrofit
BMP Type:	Retrofit
HUC 12:	Darby Creek (020402020505)
Impaired Waterway:	Ithan Creek
Effectiveness:	0.60
Drainage Area (ac):	108.39
Impervious Area (ac):	19.84
Impervious (%)	18
Sediment Load (lb/year):	60,354
Reduction (lb/year)	36,212

Proposed BMP Supporting Calculation	
BMP Name:	Haviland Subdivision Basin Retrofit
BMP Type:	Retrofit
HUC 12:	Darby Creek (020402020505)
Impaired Waterway:	Ithan Creek
Effectiveness:	0.60
Drainage Area (ac):	15.08
Impervious Area (ac):	4.06
Impervious (%)	27
Sediment Load (lb/year):	10,439
Reduction (lb/year)	6,263

Proposed BMP Supporting Calculation	
BMP Name:	Veterans Memorial Park Subsurface Infiltration
BMP Type:	Subsurface Storage Module
HUC 12:	Darby Creek (020402020505)
Impaired Waterway:	Ithan Creek
Effectiveness:	0.55
Drainage Area (ac):	70.35
Impervious Area (ac):	24.48
Impervious (%)	35
Sediment Load (lb/year):	57,383
Reduction (lb/year)	31,561

Proposed BMP Supporting Calculation	
BMP Name:	Ithan Valley Park Stream Restoration
BMP Type:	Stream Restoration
HUC 12:	Darby Creek (020402020505)
Impaired Waterway:	Ithan Creek
Effectiveness:	44.88 lb/ft/yr for 2000 Feet
Drainage Area (ac):	NA
Impervious Area (ac):	NA
Impervious (%)	NA
Sediment Load (lb/year):	NA
Reduction (lb/year)	89,760

Proposed BMP Supporting Calculation	
BMP Name:	Warren Filipone Memorial Park Subsurface
	Infiltration
BMP Type:	Subsurface Storage Module
HUC 12:	Darby Creek (020402020505)
Impaired Waterway:	Little Darby Creek
Effectiveness:	0.55
Drainage Area (ac):	25.44
Impervious Area (ac):	17.76
Impervious (%)	70
Sediment Load (lb/year):	34,730
Reduction (lb/year)	20,381

Proposed BMP Supporting Calculation	
BMP Name:	Warren Filipone Memorial Park Stream Restoration
BMP Type:	Stream Restoration
HUC 12:	Darby Creek (020402020505)
Impaired Waterway:	Little Darby Creek
Effectiveness:	44.88 lb/ft/yr for 704 Feet
Drainage Area (ac):	NA
Impervious Area (ac):	NA
Impervious (%)	NA
Sediment Load (lb/year):	NA
Reduction (lb/year)	31,596

Proposed BMP Supporting Calculation	
BMP Name:	Devon Square Subdivision Basin Retrofit
BMP Type:	Basin Retrofit
HUC 12:	Darby Creek (020402020505)
Impaired Waterway:	Little Darby Creek
Effectiveness:	0.60
Drainage Area (ac):	19.22
Impervious Area (ac):	6.95
Impervious (%)	36
Sediment Load (lb/year):	16,083
Reduction (lb/year)	9,650

Proposed BMP Supporting Calculation	
BMP Name:	West Wayne Preserve Wetland
BMP Type:	Wetland
HUC 12:	Darby Creek (020402020505)
Impaired Waterway:	Little Darby Creek
Effectiveness:	0.60
Drainage Area (ac):	37.70
Impervious Area (ac):	18.09
Impervious (%)	48
Sediment Load (lb/year):	38,558
Reduction (lb/year)	23,135

Proposed BMP Supporting Calculation	
BMP Name:	Bo Connor Park Subsurface Infiltration
BMP Type:	Subsurface Storage Module
HUC 12:	Darby Creek (020402020505)
Impaired Waterway:	Little Darby Creek
Effectiveness:	0.55
Drainage Area (ac):	15.74
Impervious Area (ac):	6.20
Impervious (%)	39
Sediment Load (lb/year):	13,973
Reduction (lb/year)	7,685

Proposed BMP Supporting Calculation	
BMP Name:	Montrose Condominiums Basin Retrofit
BMP Type:	Basin Retrofit
HUC 12:	Darby Creek (020402020505)
Impaired Waterway:	Meadowbrook Run
Effectiveness:	0.60
Drainage Area (ac):	7.95
Impervious Area (ac):	5.10
Impervious (%)	64
Sediment Load (lb/year):	9,387
Reduction (lb/year)	6,092

Proposed BMP Supporting Calculation	
BMP Name:	Radnor House Bioretention
BMP Type:	Bioretention
HUC 12:	Darby Creek (020402020505)
Impaired Waterway:	Meadowbrook Run
Effectiveness:	0.85
Drainage Area (ac):	23.97
Impervious Area (ac):	9.18
Impervious (%)	38
Sediment Load (lb/year):	20,861
Reduction (lb/year)	17,732

Proposed BMP Supporting Calculation	
BMP Name:	Villanova Campus Improvements
BMP Type:	Infiltration Practices
HUC 12:	Darby Creek (020402020505)
Impaired Waterway:	Ithan Creek
Effectiveness:	0.55 & 0.85
Drainage Area (ac):	20.78
Impervious Area (ac):	14.30
Impervious (%)	69
Sediment Load (lb/year):	28,384
Reduction (lb/year)	18,763

Proposed BMP Supporting Calculation	
BMP Name:	Lincoln Financial Porous Paving Retrofit
BMP Type:	Porous Paving / Infiltration
HUC 12:	Darby Creek (020402020505)
Impaired Waterway:	Hardings Run
Effectiveness:	0.55
Drainage Area (ac):	49.91
Impervious Area (ac):	30.30
Impervious (%)	61
Sediment Load (lb/year):	60,998
Reduction (lb/year)	33,549

Proposed BMP Supporting Calculation	
BMP Name:	KTM&C, LLP Basin Retrofit
BMP Type:	Basin Retrofit
HUC 12:	Darby Creek (020402020505)
Impaired Waterway:	Hardings Run
Effectiveness:	0.60
Drainage Area (ac):	12.90
Impervious Area (ac):	4.83
Impervious (%)	37
Sediment Load (lb/year):	11,055
Reduction (lb/year)	6,633

Proposed BMP Supporting Calculation	
BMP Name:	Trianon Subdivision Basin Retrofit
BMP Type:	Basin Retrofit
HUC 12:	Darby Creek (020402020505)
Impaired Waterway:	Kirks Run
Effectiveness:	0.6
Drainage Area (ac):	22.87
Impervious Area (ac):	7.22
Impervious (%)	32
Sediment Load (lb/year):	17,500
Reduction (lb/year)	10,500

Appendix E. Supporting BMP Documentation