TOTAL MAXIMUM DAILY LOAD PLAN

For

Unnamed Tributary to Sucker Run
and
West Branch of the Brandywine Creek
in the
Christina River Basin

Prepared for:

East Fallowfield Township
Chester County, PA

April 2022

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1.0 Executive Summary

East Fallowfield Township (EFT) has been operating under a Municipal Separate Storm Sewer System (MS4) permit issued by the Pennsylvania Department of Environmental Protection (PADEP) since 2003. The permit needs to be renewed in 2022 and the proposed application requires the Township to prepare a plan that will address the reduction of the Total Maximum Daily Load (TMDL) for sediment and nutrients in the streams within the Christina River Basin.

The long-term load reduction requirements for the Township were established by the EPA in "Total Maximum Daily Loads for Bacteria and Sediment in the Christina River Basin, Pennsylvania, Delaware, and Maryland" September 2006. The estimated pollutant loads assigned to East Fallowfield Township are 426.42 tons/yr. (924,840 lbs./yr.) of sediment, 75.74 tons/yr. of Nitrogen, and 15.345 tons/yr. of Phosphorus. This TMDL plan is committed to using the "presumptive method" and assumes that reduction of sediment requirements will achieve nutrient reduction requirements as well. The load reductions required for East Fallowfield Township are to be 46.91% for Sediment, 31.48% for Nitrogen, and 31.37% for Phosphorus (Nutrients). These values are based on modeling completed in the mid 1990's by PADEP and EPA.

The EFT TDML Plan includes specific requirements outlined in "PADEP TMDL Plan Instructions" (3800-PM-BCW0200d 1/2017) Existing load calculations follow guidance found in "Key Outcomes of CCWRA/PADEP Communications Regarding Christiana Basin TMDL & PRP Calculations Process" (Key Outcomes).

The EFT existing base load calculations are based on historic land use (1995) (**2,123,359 lbs./yr.).** The required reduction of 46.91% of the baseline load equals **996,068 lbs./yr**. EFT can take credit for additional load reduction based on the change in land use (1995 to 2012). The calculated load based on 2012 land use equals **1,671,554 lbs./yr**. therefore the land conversion reduction equals **451,806 lbs./yr**. That value is taken from the required reduction of 996,068 to reveal the remaining load reduction requirement which equals **544,262 lbs./yr**. This is the Long-term Reduction TMDL Objective.

EFT may be able to claim credit for constructed structural BMPs that were put in place during 1995–2012-time frame to claim further reduction of sediment load requirements. Documentation is required to assure existing BMPs continued to be maintained and are functioning as designed. At the time of this plan draft and permit application, the required BMP information is not complete. This draft plan does not take credit for existing BMPs.

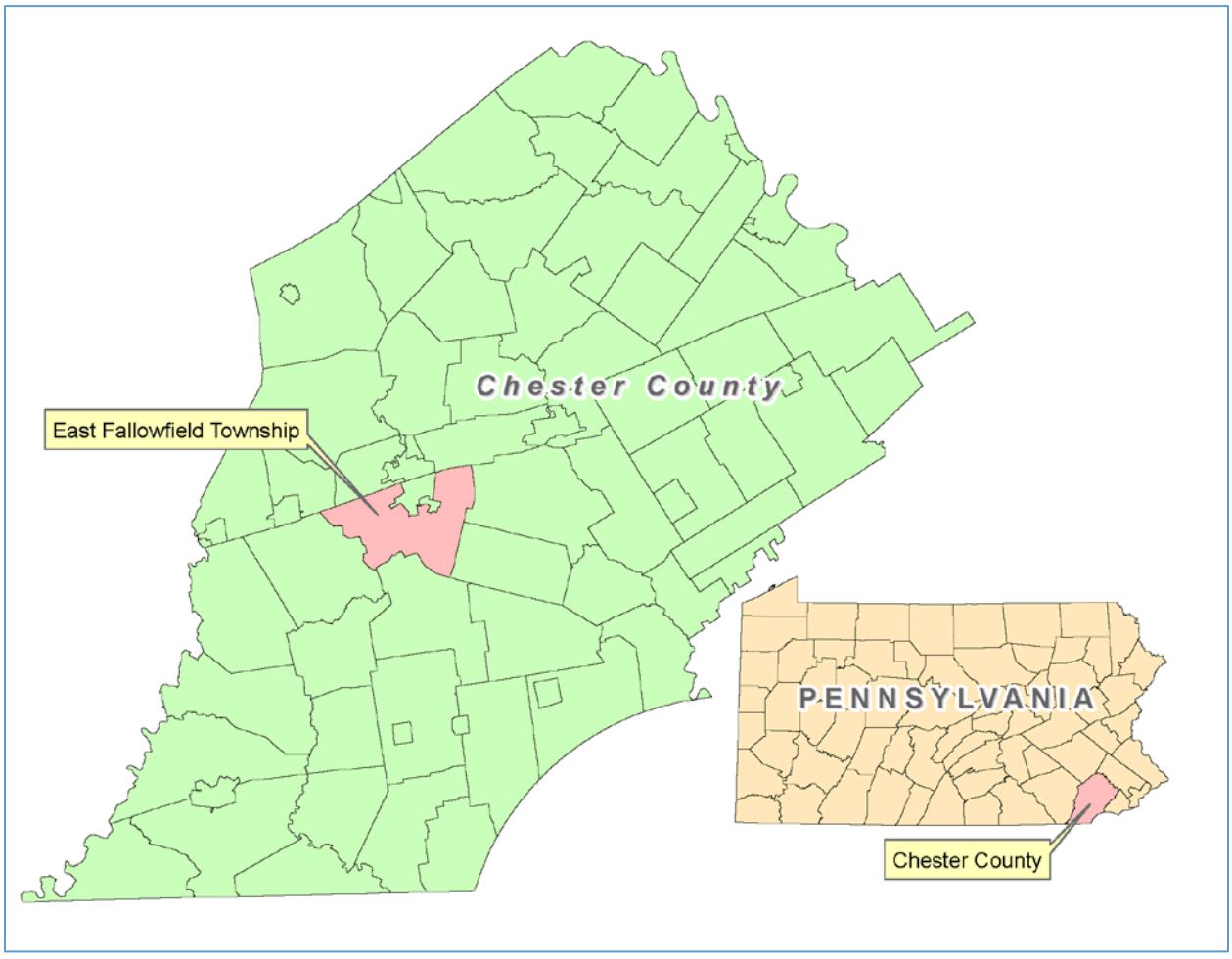
If EFT can achieve the Long-Term TMDL Objective through the construction of new BMPs within the first 5-year permit period, the Township will have met the MS4 TMDL obligation. If it is not possible to achieve that goal in the first permit period, then there is a Short-term Reduction option which equals 10% of the existing load. This is the value calculated based on 2012 land use data (1,671,554 lbs./yr.), 10% of which equals **167,154 lbs./yr.**

To accomplish the required reduction, several cost effective BMPs have been chosen to reduce the stormwater sediment loads. BMP facilities proposed include riparian buffers, rain gardens, detention basin improvements (infiltration basins, infiltration trenches, and extended detention basins), and roadside swales (open vegetated channels). The estimated cost for the proposed BMPs is **$428,627** or **$2.47/lb.** of sediment removed. Several grant opportunities are included in the Funding Section.

2.0 Purpose and Scope

East Fallowfield Township is currently covered under a Pennsylvania Department of Environmental Protection (PADEP), National Pollutant Discharge Elimination System (NPDES) Permit. This type of permit is required by both PADEP and the US Environmental Protection Agency (EPA) to comply with the Federal Clean Water Act and Pennsylvania's Clean Streams Law. As part of this permit, the Township is responsible for developing and implementing a Total Maximum Daily Load (TMDL) Plan for all stormwater discharges to local surface waters covered under Municipal Separate Storm Sewer System (MS4) within the Brandywine Creek/Christina River Watershed. Figure 1 shows the location of East Fallowfield Township in Chester County, Pennsylvania.

Figure 1 – East Fallowfield Township Location Map



According to the PADEP TMDL Plan Instructions (3800-PM-BCW0200d 1/2017), The TDML plan objectives include two key elements; a long-term reduction, and a short-term reduction of pollutant loads to achieve the Waste Load Allocations (WLAs) in the PADEP TDML. The focus of this plan is for the land area referred to as the 2010 Urbanized Area. This focus is further limited to just those lands that

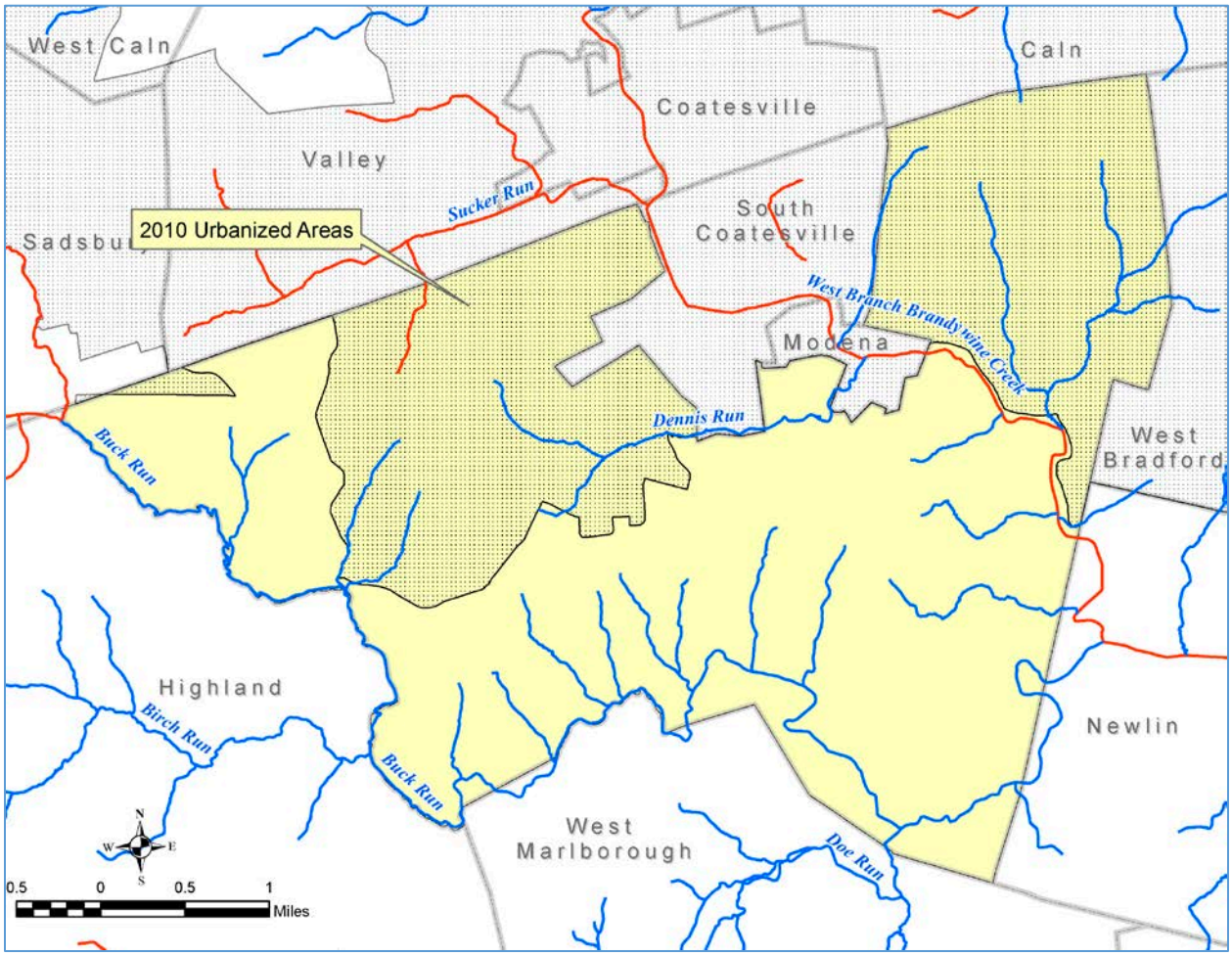
drain stormwater, then discharge to impaired streams, or are within 5 miles of impaired streams through conveyance by stormsewer system infrastructure, or local road drainage pathways. The Urbanized Area is based on population density from the 2010 US Census. Figure 2 presents the Urbanized Area as a dot pattern located in the northern part of the Township. The impaired streams are shown in red. Those discharges to impaired streams are primarily to the Unnamed Tributary to the Sucker Run in the northwest corner of the Township, as well as the Unnamed Tributaries to the West Branch of Brandywine Creek. Sucker Run and its tributaries are noted to be locally impaired due to Water/Flow Variability in the "Municipal MS4 Requirements Table" (6/26/17). Table 1 presents impairments and corresponding streams described in the "2014 Pennsylvania Integrated Water Quality Monitoring and Assessment Report, rev. 6/26/17).

Table 1 – MS4 Requirements Table.

MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)	Other Cause(s) of Impairment
East Fallowfield Township, Chester County	PAI130512	Yes	TMDL Plan, SP, IP	Christina River Basin Sediment	TMDL Plan-Siltation, Suspended Solids (4a)	
				West Branch Brandywine Creek	Appendix c-PCB(4a)	Water/Flow Variability (4c)
				East Branch Brandywine Creek		Cause Unknown (4a), Other Habitat Alterations, Water/Flow Variability (4c)
				Christina River Basin Nutrients	TMDL Plan-Nutrients, Organic Enrichment/ Low D.O. (4a)	
				Beaver Creek		Cause Unknown (4a), Other Habitat Alterations, Water/Flow Variability (4c)
				Sucker Run		Water/Flow Variability (4c)

The West Branch Brandywine Creek as it flows through a section of the Township in the eastern side along Mortonville Road and the railroad is noted to be impaired due to PCBs, and Water/Flow Variability. No other streams within the Township have been identified as being impaired. The land area that discharges stormwater to Dennis Run and the unnamed tributaries to the West Branch Brandywine Creek are included in this Plan, as they are within five miles of impaired section of the West Branch Brandywine Creek.

Figure 2 – Urbanized Area and impaired streams identified in East Fallowfield Township.



East Fallowfield Township is in the Christina River Basin, which is noted to be impaired for Siltation (sediment) and nutrients, therefore, a TMDL plan must be filed to address the removal of the required portion of those pollutants in the designated impaired streams, as assigned by the EPA and as part of the 2018 National Pollutant Discharge Elimination System (NPDES) MS4 Individual Permit application to the Pennsylvania Department of Environmental Protection (PA DEP). The required short-term objective will be based on the existing load calculations for the reduction of sediment load and will use the presumptive approach for nutrient reduction under the assumption that the achievement of TMDL Plan objectives for sediment will also achieve the objectives for nutrients. The land that drains to the unnamed tributaries to Buck Run are included in this TMDL Plan since they are included in the Christina River Basin TMDL Plan and have a WLA assigned. PADEP has stipulated that PCBs are not required to be addressed at this time. This plan has been prepared using the most current guidelines available by PADEP. All relevant definitions of regulatory terminology can be referenced in Section 6.0 of this report.

3.0 Permit Requirements

East Fallowfield Township is required by the PADEP and Environmental Protection Agency (EPA) to address the pollutants being discharged to the impaired stream by developing a plan to reduce the Total Maximum Daily Loads (TMDLs). The long-term load reduction requirements for the Township were established by the EPA in "Total Maximum Daily Loads for Bacteria and Sediment in the Christina River Basin, Pennsylvania, Delaware, and Maryland" September 2006. The estimated pollutant loads assigned to East Fallowfield Township are 426.42 tons/yr. of sediment, 75.74 tons/yr. of Nitrogen, and 15.345 tons/yr. of Phosphorus. The load reductions required for East Fallowfield Township are to be 46.91% for Sediment, 31.48% for Nitrogen, and 31.37% for Phosphorus (Nutrients). Table 2 presents a summary of loads and % reduction required. These loads have been calculated using the Christina Basin MapSheds Model Program and associated supporting tools developed by the Chester County Water Resources Authority (CCWRA) in conjunction with Dr. Barry Evans from Penn State and Mr. Bill Brown from PADEP for this Permit. These are considered the "baseline loads" for this TDML.

Table 2 - MS4 Baseline Load and % Reduction Requirements

MUNICIPALITIES LISTED IN TMDL REPORTS Brandywine Creek Watershed	Sediment (tons/year)				Total Nitrogen (kg/day)				Total Phosphorus (kg/day)			
	Baseline MS4 Load[1b.]	MS4 Load Allocation[1b.]	MS4 Load Reduction[1e.]	% Reduction[1b.]	MS4 Baseline Load[2g.]	MS4 Allocation[2a.]	MS4 Load Reduction[2m.]	% Reduction[2m.]	MS4 Baseline Load[2j.]	MS4 Allocation[2d.]	MS4 Load Reduction[2m.]	% Reduction[2m.]
BIRMINGHAM TWP	310.81	130.35	180.46	58.06%								
COATESVILLE CITY	231.29	79.76	151.53	65.52%	16.08	10.86	5.22	32.46%	3.015	2.031	0.984	32.64%
EAST BRADFORD TWP	1185.00	467.17	717.83	60.58%								
EAST BRANDYWINE TWP					54.19	44.44	9.75	17.99%	0.826	0.677	0.149	18.04%
EAST FALLOWFIELD TWP	803.23	426.42	376.81	46.91%	110.54	75.74	34.80	31.48%	22.365	15.348	7.017	31.37%
EAST MARLBOROUGH TWP	366.70	139.44	227.26	61.98%								
HIGHLAND TWP	384.80	238.86	145.94	37.93%								
HONEY BROOK BORO	20.58	13.23	7.35	35.70%	9.61	5.76	3.85	40.06%	0.184	0.11	0.074	40.22%
HONEY BROOK TWP	813.84	558.76	255.08	31.34%	421.64	279.02	142.62	33.83%	7.599	4.956	2.643	34.78%
KENNETT TWP			0.00		2.38	2.22	0.16	6.72%	0.213	0.198	0.015	7.04%
MODENA BORO	27.96	12.46	15.50	55.43%	4.80	3.25	1.55	32.29%	0.966	0.656	0.31	32.09%
NEWLIN TWP	144.18	59.59	84.59	58.67%	6.53	4.57	1.96	30.02%	1.337	0.936	0.401	29.99%
PARKESBURG BORO	52.11	32.35	19.76	37.93%								
PENNSBURY TWP	113.98	43.48	70.50	61.85%	47.00	43.71	3.29	7.00%	4.206	3.911	0.295	7.01%
POCOPSON TWP	821.21	320.79	500.42	60.94%								
SADSBURY TWP	289.73	172.13	117.60	40.59%	3.05	2.26	0.79	25.90%	0.329	0.205	0.124	37.69%
THORNBURY TWP	82.17	34.46	47.71	58.06%								
UPPER UWCHLAN TWP			0.00		10.92	8.96	1.96	17.95%	0.166	0.137	0.029	17.47%
VALLEY TWP	485.14	164.64	320.50	66.06%	57.57	43.75	13.82	24.01%	6.941	4.726	2.215	31.91%
WALLACE TWP	21.74	17.41	4.33	19.92%	126.53	103.76	22.77	18.00%	1.929	1.582	0.347	17.99%
WEST BRADFORD TWP	283.22	121.6	161.62	57.07%	17.25	12.08	5.17	29.97%	3.532	2.473	1.059	29.98%
WEST BRANDYWINE TWP			0.00		136.01	104.78	31.23	22.96%	9.63	8.344	1.286	13.35%
WEST CALN TWP	68.28	43.07	25.21	36.92%	183.72	149.26	34.46	18.76%	9.95	8.649	1.301	13.08%
WEST GOSHEN TWP	461.32	180.51	280.81	60.87%								

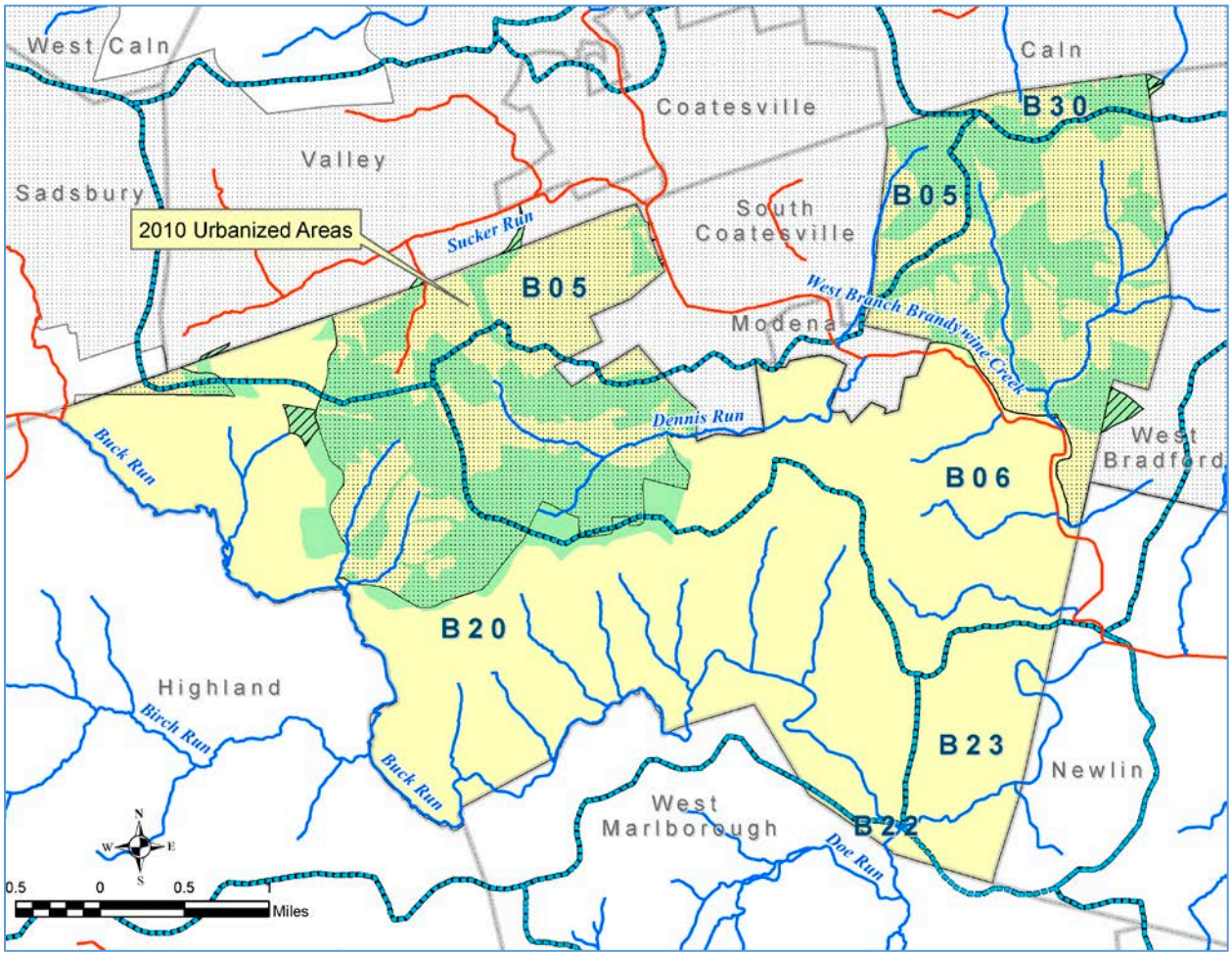
Red Clay Creek Watershed	Sediment (tons/year)				Total Nitrogen (kg/day)				Total Phosphorus (kg/day)			
	Baseline MS4 Load[1c.]	MS4 Load Allocation[1c.]	MS4 Load Reduction[1e.]	% Reduction[1c.]	MS4 Baseline Load[2h.]	MS4 Allocation[2b.]	MS4 Load Reduction[2m.]	% Reduction[2m.]	MS4 Baseline Load[2k.]	MS4 Allocation[2e.]	MS4 Load Reduction[2m.]	% Reduction[2m.]
EAST MARLBOROUGH TWP	8791.41	4,193.24	4598.17	52.30%	137.13	68.56	68.57	50.00%	2.742	1.372	1.37	49.96%
KENNETT SQUARE BORO	840.10	405.41	434.69	51.74%	13.26	6.63	6.63	50.00%	0.452	0.151	0.301	66.59%
KENNETT TWP	6751.63	3,312.06	3439.57	50.94%	157.97	97.83	60.14	38.07%	21.517	3.731	17.786	82.66%
NEW GARDEN TWP	4709.65	2,118.72	2590.93	55.01%	77.03	38.52	38.51	49.99%	27.708	2.87	24.838	89.64%
PENNSBURY TWP					4.32	4.32	0.00	0.00%	0.082	0.082	0.00	0.00%

White Clay Creek Watershed	Sediment (tons/year)				Total Nitrogen (kg/day)				Total Phosphorus (kg/day)			
	Baseline MS4 Load[1d.]	MS4 Load Allocation[1d.]	MS4 Load Reduction[1e.]	% Reduction[1d.]	MS4 Baseline Load[2i.]	MS4 Allocation[2c.]	MS4 Load Reduction[2m.]	% Reduction[2m.]	MS4 Baseline Load[2l.]	MS4 Allocation[2f.]	MS4 Load Reduction[2m.]	% Reduction[2m.]
AVONDALE BORO	463.65	140.02	323.63	69.80%	9.16	4.58	4.58	50.00%	0.322	0.135	0.187	58.07%
FRANKLIN TWP	4220.43	2,305.87	1914.56	45.36%	122.01	61.01	61	50.00%	15.219	5.557	9.662	63.49%
KENNETT TWP					2.17	2.17	0.00	0.00%	0.055	0.055	0	0.00%
LONDON BRITAIN TWP	2634.66	1,620.44	1014.22	38.50%	96.47	49.9	46.57	48.27%	15.732	7.333	8.399	53.39%
LONDON GROVE TWP	13616.33	4,842.81	8773.52	64.43%	262.76	128.47	134.29	51.11%	25.875	7.965	17.91	69.22%
NEW GARDEN TWP	6746.50	2,986.66	3759.84	55.73%	167.06	83.83	83.23	49.82%	41.916	13.374	28.542	68.09%
NEW LONDON TWP	1913.97	1,008.60	905.37	47.30%	53.56	26.61	26.95	50.32%	0.65	0.292	0.358	55.08%
PENN TWP	3584.76	1,410.29	2174.47	60.66%	71.23	33.36	37.87	53.17%	0.798	0.359	0.439	55.01%
WEST GROVE BORO	562.29	192.63	369.66	65.74%	9.24	4.36	4.88	52.81%	0.112	0.05	0.062	55.36%

4.0 TMDL Plan

This TMDL Plan will be limited to the Urbanized Areas within those watershed subbasins which have Waste Load Allocations (WLA) assigned by EPA to the TMDL Subbasins (B05, B06, and B20). Figure 3 presents the EPA TMDL Subbasins (blue dashed boundary lines, with blue labels), and EFT TMDL Planning Area (green shaded areas). The TMDL Planning Area includes all those lands which drain (through storm sewersheds) to MS4 Regulated Outfalls on impaired streams or outfalls that are located with five (5) miles of an impaired stream.

Figure 3 - TMDL Subbasins and Planning Area



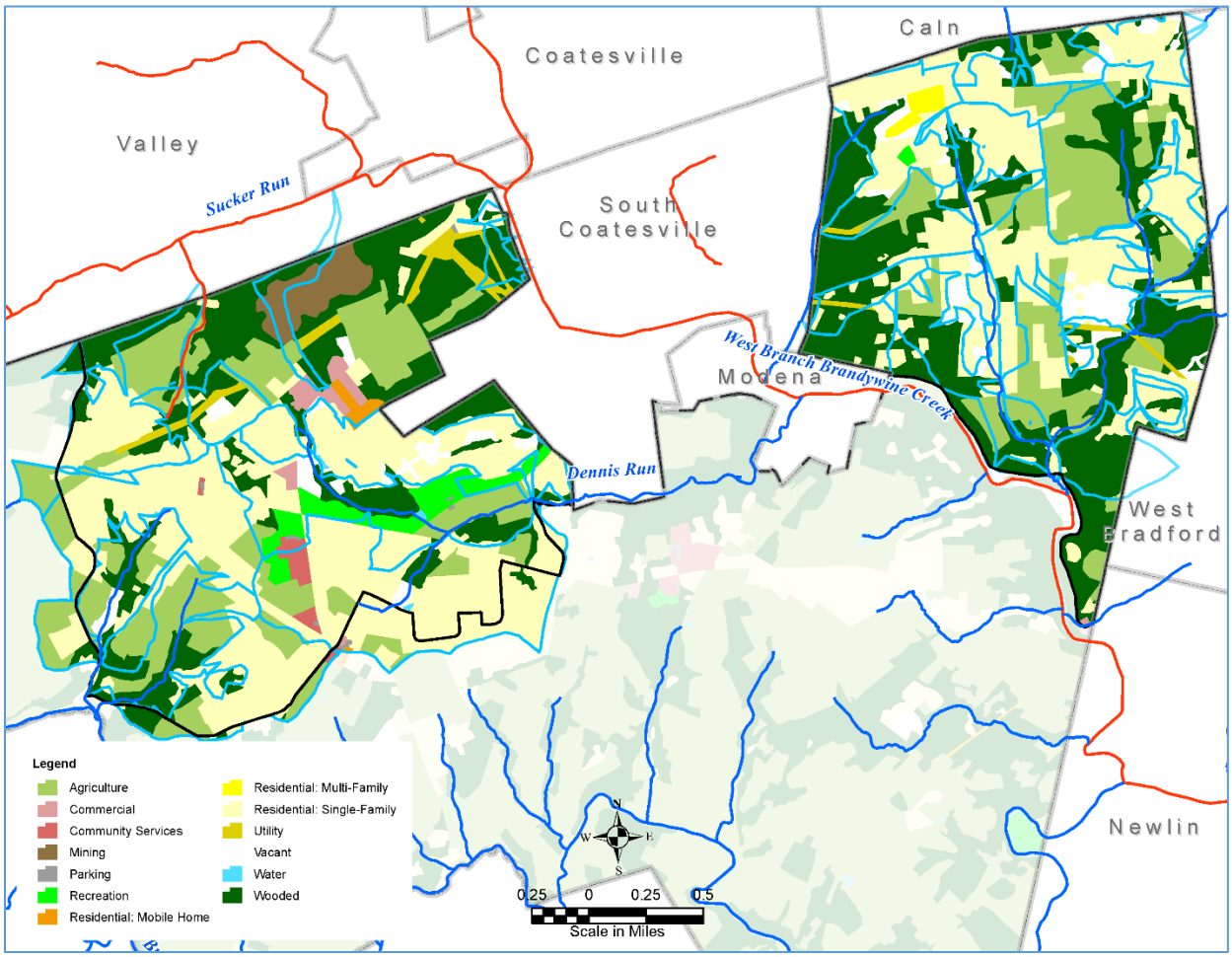
The 2010 Urbanized Area (dot pattern) includes approximately 4,094 acres. The EFT TMDL Planning Area (shown in green) includes a total of approximately 2,211 acres. The TDLM Plan includes sections specified in "PADEP TMDL Plan Instructions" (3800-PM-BCW0200d 1/2017). The following sections are considered by PADEP to be key elements which must be included in the plan.

A. **Public Participation** - East Fallowfield Township shall make this TMDL Plan available to the public for review and comment for thirty (30) days following preliminary approval from PADEP. This will be initiated by publishing a notice in the Daily Local News, a daily paper of general distribution upon

approval by East Fallowfield Township Board of Supervisor. A copy of the public notice will be included in Appendix A. Public Comments will be accepted at a regularly scheduled Board of Supervisors meeting. East Fallowfield Township shall consider and make a record of the consideration of each timely comment received from the public during the public comment period concerning the plan, identifying any changes made to the plan in response to the comment. A Public Comment Report will be included in Appendix A.

B. **TMDL Map** - A map (Figure 4) is included here that identifies land use within the TMDL Planning Area. The storm sewershed boundaries are outlined in blue. The storm sewershed drainage area is approximately 2,211 acres.

Figure 4 – Land Use (2012) within the TDML Planning Area.



The Urbanized area/TMDL Planning area are outlined in black and light blue respectively. All other areas outside the Planning Area are screened back to emphasize the land use within the planning/Urbanized area. Full sized detailed maps are included in Appendix B and Appendix C.

C. **Pollutants of Concern** - East Fallowfield Township is responsible for both sediment reduction and nutrient reduction. To meet the requirements, a minimum of ten (10) percent sediment reduction is covered in this plan. Per the "PADEP TMDL Plan Instructions" (3800-PM-BCW0200d 1/2017), as well as

the "Key Outcomes Report" issued by the CCWRA (5/5/17), "TMDLs may use a presumptive approach in which it is assumed that a 10% sediment reduction will also accomplish a 5% TP reduction." Therefore, this plan covers both the sediment and nutrient reduction requirement. Sediment loading calculations can be found in Appendix C.

D. **Existing Load for Pollutant of Concern** – In order to determine the existing load for this TMDL plan there are two options. Either use the Baseline Load assigned by the EPA in the Christina River TMDL Report or calculate a Revised Baseline Load using an approved land use analysis of the TMDL Planning Area. The Christina TMDL Baseline Load assigned by EPA is 426.42 tons/yr. or **852,840 lbs./yr.** of sediment.

The approved land use analysis used here is from "Key Outcomes of CCWRA/PADEP Communications Regarding Christiana Basin TMDL & PRP Calculations Process" (Key Outcomes). This option applies the Christina Basin MapShed (CMS) model results including 1995 watershed specific land use loading rates to calculate a Revised 1995 TMDL Baseline Load. The analysis will follow the 12-step approach provided in the Key Outcomes document.

Step 1 - Calculate the Revised (1995) TMDL Baseline Load. CMS 1995 land use loading rates are provided in the "1995 Land Use Loading Rates Look-Up Tables" (found in the workbook CORRECTEDBrandywineWatershed1995 LoadRates5.12.17.xlsx). The revised (1995) TMDL Baseline Load can be used to REPLACE the baseline load from the Christina TMDL Report. Table 3 present the 1995 land use areas within the TMDL Planning Area.

Table 3 - 1995 Land Use Baseline Load Calculations.

1995 LOAD CALCULATION							
SOURCE	**AREA**	**TOTAL SEDIMENT LOADING RATE**	**TOTAL SEDIMENT**	**TOTAL NITROGEN LOADING RATE**	**TOTAL NITROGEN**	**TOTAL PHOSPHORUS LOADING RATE**	**TOTAL PHOSPHORUS**
UNITS	ACRES	LBS/ACRE	LBS	LBS/ACRE	LBS	LBS/ACRE	LBS
Hay/Past		153.18		1.52		0.38	
Cropland	773.04	1,727.47	1,335,403.41	6.98	5,395.82	1.81	1,399.20
Forest	387.92	136.22	52,842.46	0.15	58.19	0.03	11.64
Wetland	0.49	121.42	59.13	0.30	0.15	0.03	0.01
Disturbed	16.67	164.73	2,746.05	0.19	3.17	0.07	1.17
Turfgrass							
Open_Land	63.14	296.97	18,750.69	1.15	72.61	0.16	10.10
Bare_Rock							
Sandy_Areas							
Unpaved_Road							
Ld_Mixed							
Md_Mixed	13.18	1,741.77	22,948.90	6.20	81.69	0.87	11.46
Hd_Mixed	6.04	2,492.67	15,055.73	6.81	41.13	1.02	6.16
Ld_Residential	915.42	730.55	668,760.08	1.69	1,547.06	0.27	247.16
Md_Residential	2.05	1,741.36	3,574.89	6.16	12.65	0.87	1.79
Hd_Residential	1.29	2,495.94	3,217.90	6.61	8.52	1.01	1.30
TOTAL	**2179.23**		**2,123,359.23**		**7,220.98**		**1,690.00**

The **Revised (1995) TMDL Baseline Load** is **2,123,359 lbs./yr.**

Step 2 - Calculate the TMDL Load Reduction Required. The required reduction according to the EPA Christina River TMDL is **46.91%**, therefore, the **TMDL Load Reduction Required** is **996,068 lbs./yr**. of sediment. (Revised Baseline Load X TMDL % Reduction Assigned = 2,123,359 X 46.91% = 996,068 lbs.

Step 3 – Calculate the 2012 Load using a similar method used above the calculate the Revised (1995) TMDL load using 2012 MapShed land use area data and loading rates. The 2012 Load is the total load calculated using CMS 2012 (without state compiled BMPs) land use loading rates. CMS 2012 land use loading rates are provided in the 2012 Land Use Loading Rates Look-Up Tables (found in the workbook CORRECTEDBrandywineWatershed2012 LoadRates5.12.17.xlsx). Table 4 present the CMS 2012 land use areas used to calculate the 2012 Load.

Table 4 - 2012 Land Use Load Calculations.

2012 LOAD CALCULATION							
SOURCE	**AREA**	**TOTAL SEDIMENT LOADING RATE**	**TOTAL SEDIMENT**	**TOTAL NITROGEN LOADING RATE**	**TOTAL NITROGEN**	**TOTAL PHOSPHORUS LOADING RATE**	**TOTAL PHOSPHORUS**
UNITS	ACRES	LBS/ACRE	LBS	LBS/ACRE	LBS	LBS/ACRE	LBS
Hay/Past		185.06	-	1.70	-	0.42	-
Cropland	310.13	1,818.62	564,008.67	7.27	2,254.65	1.91	592.35
Forest	352.24	174.45	61,449.09	0.17	59.88	0.05	17.61
Wetland	3.61	158.47	571.61	0.32	1.15	0.04	0.14
Disturbed	122.79	228.93	28,110.78	0.26	31.93	0.10	12.28
Turfgrass	24.05	202.10	4,860.55	0.78	18.76	0.43	10.34
Open_Land		220.20	-	0.92	-	0.09	-
Bare_Rock		-	-	-	-	-	-
Sandy_Areas		-	-	-	-	-	-
Unpaved_Road		-	-	-	-	-	-
Ld_Mixed		680.65	-	1.62	-	0.25	-
Md_Mixed	15.79	1,548.50	24,448.91	7.42	117.15	0.95	15.00
Hd_Mixed	26.71	2,184.96	58,360.38	7.87	210.21	1.09	29.11
Ld_Residential	1,301.39	686.92	893,954.12	1.66	2,160.31	0.26	338.36
Md_Residential	21.06	1,547.69	32,594.45	7.40	155.84	0.95	20.01
Hd_Residential	1.46	2,182.85	3,195.11	7.69	11.26	1.07	1.57
TOTAL	**2,179.23**		**1,671,553.68**		**5,021.13**		**1,036.77**

The **2012 Load** is **1,671,554 lbs./yr.** of sediment.

Step 4 – Calculate the Land Conversion Load Reduction which is the Revised (1995) TMDL Baseline Load minus the 2012 Load (2,123,359 **-** 1,671,554 = 451,805). The **Land Conversion Load Reduction** is **451,805** In other words, 451,805 lbs. of load reductions have occurred to date based on land conversion. The calculated sediment load dropped a fair amount between 1995 and 2012, mainly due to a loss of cropland and an increase in residential development during that period.

Step 5 – Calculate the Existing BMP Reduction. East Fallowfield Township can calculate reductions for any existing functioning BMPs (with required documentation) installed prior to 2012 that they wish to use to further reduce their 2012 Load. The required documentation that must be included in this TMDL Plan includes the following information:

- A detailed description of the BMP.
- Latitude and longitude coordinates for the BMP.
- Location of the BMP on the storm sewershed map.
- The permit number, if any, that authorized installation of the BMP.
- Calculations demonstrating the pollutant reductions achieved by the BMP.
- The date the BMP was installed and a statement that the BMP continues to serve the function(s) it was designed for.
- The operation and maintenance (O&M) activities of the BMP, O&M frequencies, and party or parties who are responsible for O&M.

The required documentation for existing BMPs is incomplete at the time of this TMDL draft plan. However, the Township reserves the right to modify this plan to include possible reductions as soon as the documentation is complete. Table 5 lists the existing BMPs within the planning area including latitude and longitude. Figure 5 presents the location and type of existing BMP within the TMDL Planning area. See Appendix B for more detailed maps showing existing BMP locations.

Table 5 – Existing BMP Type and Location Coordinates

EXISTING BMP TYPE AND LOACTION								
FACILITY_ID	TYPE	Latitude	Longitude		FACILITY_ID	TYPE	Latitude	Longitude
EFT_BMP_1	Detention	39° 58' 9.831" N	75° 47' 9.165" W		EFT_BMP_31	Inflitration - Dry	39° 58' 27.728" N	75° 47' 35.593" W
EFT_BMP_2	Detention	39° 58' 4.179" N	75° 47' 13.271" W		EFT_BMP_32	Inflitration - Dry	39° 58' 41.291" N	75° 47' 18.112" W
EFT_BMP_3	Detention	39° 57' 50.593" N	75° 47' 8.759" W		EFT_BMP_33	Inflitration - Dry	39° 58' 50.198" N	75° 46' 59.037" W
EFT_BMP_4	Detention	39° 57' 58.291" N	75° 46' 42.570" W		EFT_BMP_34	Infiltration - Wet	39° 58' 31.338" N	75° 46' 56.414" W
EFT_BMP_5	Detention	39° 57' 56.578" N	75° 46' 28.374" W		EFT_BMP_35	Inflitration - Dry	39° 57' 3.223" N	75° 49' 26.934" W
EFT_BMP_6	Detention	39° 58' 2.260" N	75° 46' 42.719" W		EFT_BMP_37	Inflitration - Dry	39° 57' 0.324" N	75° 49' 43.099" W
EFT_BMP_7	Detention	39° 58' 13.500" N	75° 46' 4.664" W		EFT_BMP_38	Detention	39° 58' 50.191" N	75° 47' 22.107" W
EFT_BMP_8	Detention	39° 59' 5.693" N	75° 46' 8.013" W		EFT_BMP_39	Detention	39° 58' 49.599" N	75° 47' 25.775" W
EFT_BMP_9	Inflitration - Dry	39° 57' 59.569" N	75° 47' 9.849" W		EFT_BMP_40	Detention	39° 58' 42.517" N	75° 47' 36.242" W
EFT_BMP_10	Inflitration - Dry	39° 58' 3.378" N	75° 46' 27.557" W		EFT_BMP_41	Detention	39° 58' 27.555" N	75° 47' 39.709" W
EFT_BMP_11	Inflitration - Dry	39° 58' 37.036" N	75° 46' 12.166" W		EFT_BMP_42	Detention	39° 58' 35.045" N	75° 47' 18.261" W
EFT_BMP_12	Inflitration - Dry	39° 58' 29.590" N	75° 46' 7.284" W		EFT_BMP_43	Infiltration - Wet	39° 58' 54.132" N	75° 46' 59.460" W
EFT_BMP_13	Inflitration - Dry	39° 58' 17.232" N	75° 46' 1.815" W		EFT_BMP_44	Detention	39° 58' 30.241" N	75° 47' 7.343" W
EFT_BMP_14	Detention	39° 58' 17.106" N	75° 46' 0.351" W		EFT_BMP_45	Detention	39° 57' 58.690" N	75° 47' 18.015" W
EFT_BMP_15	Detention	39° 59' 4.081" N	75° 46' 16.234" W		EFT_BMP_46	Inflitration - Dry	39° 58' 31.850" N	75° 47' 1.455" W
EFT_BMP_16	Inflitration - Dry	39° 57' 32.653" N	75° 49' 23.435" W		EFT_BMP_47	Wet Pond	39° 57' 38.808" N	75° 51' 10.036" W
EFT_BMP_17	Inflitration - Dry	39° 57' 27.161" N	75° 50' 0.282" W		EFT_BMP_48	Wet Pond	39° 57' 35.124" N	75° 51' 6.921" W
EFT_BMP_19	Inflitration - Dry	39° 57' 20.978" N	75° 49' 12.421" W		EFT_BMP_49	Rain Garden	39° 57' 2.607" N	75° 50' 57.433" W
EFT_BMP_20	Inflitration - Dry	39° 57' 25.088" N	75° 50' 5.960" W		EFT_BMP_50	Detention Basin	39° 57' 13.572" N	75° 51' 17.566" W
EFT_BMP_21	Infiltration - Wet	39° 57' 24.959" N	75° 49' 27.132" W		EFT_BMP_51	Wet Pond	39° 57' 51.282" N	75° 51' 30.285" W
EFT_BMP_22	Detention	39° 57' 33.895" N	75° 49' 34.462" W		EFT_BMP_52	Wet Pond	39° 57' 28.883" N	75° 50' 24.655" W
EFT_BMP_23	Detention	39° 57' 24.825" N	75° 49' 20.891" W		EFT_BMP_53	Wet Pond	39° 57' 17.909" N	75° 51' 14.228" W
EFT_BMP_25	Inflitration - Dry	39° 57' 2.094" N	75° 50' 24.054" W		EFT_BMP_54	Wet Pond	39° 56' 55.405" N	75° 50' 0.058" W
EFT_BMP_29	Detention	39° 57' 10.789" N	75° 50' 16.317" W		EFT_BMP_55	Wet Pond	39° 58' 40.660" N	75° 47' 10.995" W
EFT_BMP_30	Infiltration - Wet	39° 56' 52.141" N	75° 50' 6.309" W		EFT_BMP_56	Wet Pond	39° 58' 7.109" N	75° 46' 44.073" W

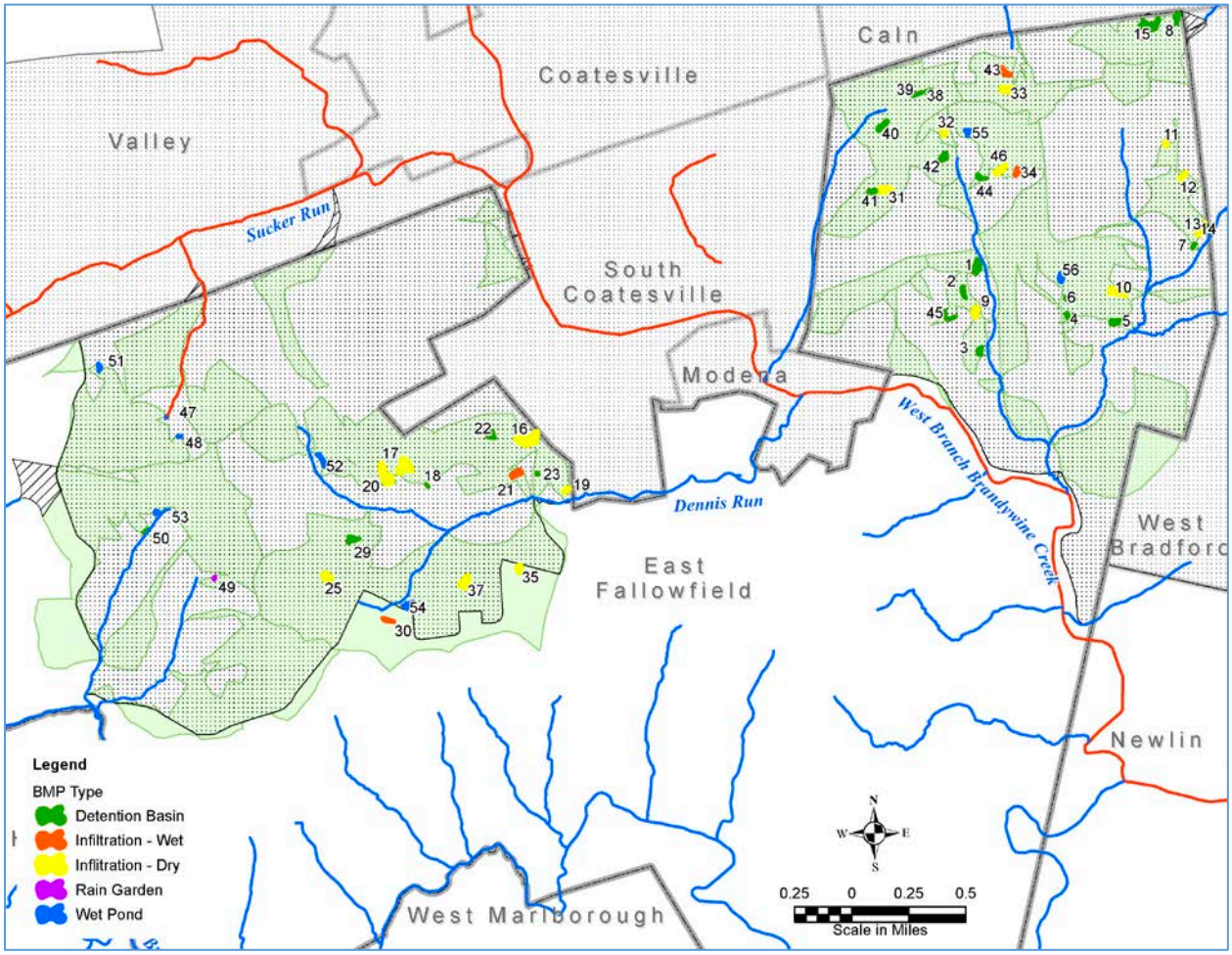
CMS 2012 land use areas, CMS 2012 land use loading rates, and NPDES Stormwater Discharges from Small MS4s BMP Effectiveness Values (3800-PM-BCW0100m, 5/2016, BMP Effectiveness Values) were used to calculate potential BMP load reductions. Existing BMPs load reduction potential values were calculated using a similar approach to planning area load calculations. Land Use area within drainage areas, which contribute flow to each BMP, were aggregated by each existing BMP. The area between the existing BMP outlets and ultimate discharge to stream were not included. Table 6 presents the BMP load reduction calculations for existing BMPs within the TDML planning area.

Table 6 – Existing BMP Load Reduction Calculations.

EXISTING BMP LOAD REDUCTION CALCULATION															
FACILITY_ID	TYPE	BMP Drainage Area ID	BMP Effectiveness	Crop	Disturb.	Forest	HD Mixed Res.	MD Mixed Res.	HD Res.	MD Res.	LD Res.	Turf Golf	Water	Sediment Load	Load Reduction
EFT_BMP_1	Detention	EFT_RD_114	10%	1.38	2.23688	2.88					8.108		0.1628	9,123.81	912.38
EFT_BMP_2	Detention	EFT_RD_117a	10%		4.66						2.01			2,450.18	245.02
EFT_BMP_3	Detention	EFT_RD_118	10%		2.42						8.36		0.20	6,326.94	632.69
EFT_BMP_4	Detention	EFT_RD_142	10%	0.06	3.81						0.45			1,283.81	128.38
EFT_BMP_5	Detention	EFT_RD_144	10%		8.84		0.02				0.07		0.26	2,169.16	216.92
EFT_BMP_6	Detention	EFT_RD_141	10%	0.07	2.82						2.40			2,419.58	241.96
EFT_BMP_7	Detention	EFT_RD_155	10%			0.00					5.75			3,952.71	395.27
EFT_BMP_8	Detention	EFT_RD_93	10%		1.98	1.29					4.20			3,568.23	356.82
EFT_BMP_9	Inflitration - Dry	EFT_RD_117b	95%		1.20						1.65			1,409.93	1,339.43
EFT_BMP_10	Inflitration - Dry	EFT_RD_145	95%		9.63						0.55			2,583.59	2,454.41
EFT_BMP_11	Inflitration - Dry	EFT_RD_159	95%								2.06			1,416.13	1,345.33
EFT_BMP_12	Inflitration - Dry	EFT_RD_157	95%								5.98			4,106.37	3,901.05
EFT_BMP_13	Inflitration - Dry	EFT_RD_156	95%			0.08					4.47			3,081.67	2,927.59
EFT_BMP_14	Detention	EFT_RD_156	10%			0.08					4.47			3,081.67	308.17
EFT_BMP_15	Detention	EFT_RD_95	10%		2.59	0.53					15.37			11,241.88	1,124.19
EFT_BMP_16	Inflitration - Dry	EFT_RD_59b	95%		3.33	3.37					23.58	2.38		18,031.16	17,129.60
EFT_BMP_17	Inflitration - Dry	EFT_RD_57	95%		7.39	0.22			0.46		35.59			27,187.14	25,827.79
EFT_BMP_19	Inflitration - Dry	EFT_RD_61	95%			0.03					5.41			3,723.89	3,537.70
EFT_BMP_20	Inflitration - Dry	EFT_RD_55	95%		1.76	0.07					18.47			13,100.80	12,445.76
EFT_BMP_21	Infiltration - Wet	EFT_RD_58	95%	0.51							1.64	9.59		3,989.44	3,789.97
EFT_BMP_22	Detention	EFT_RD_59a	10%		6.32	2.98					18.60			14,743.34	1,474.33
EFT_BMP_23	Detention	EFT_RD_60	10%			0.01					5.26	0.00		3,617.68	361.77
EFT_BMP_25	Inflitration - Dry	EFT_RD_2d	95%	22.97				11.34			20.22	6.86		74,606.25	70,875.94
EFT_BMP_29	Detention	EFT_RD_3	10%								29.11	0.65		20,130.24	2,013.02
EFT_BMP_30	Infiltration - Wet	EFT_RD_2c	95%	10.86			1.84	2.42	0.55		45.68			60,079.04	57,075.09
EFT_BMP_31	Inflitration - Dry	EFT_RD_170b	95%	1.20	1.09	0.06					5.90	0.03	0.12	6,527.47	6,201.10
EFT_BMP_32	Inflitration - Dry	EFT_RD_78	95%			0.26				0.01	6.81			4,734.13	4,497.43
EFT_BMP_33	Inflitration - Dry	EFT_RD_88a	95%								12.68			8,706.97	8,271.62
EFT_BMP_34	Infiltration - Wet	EFT_RD_82	95%	0.03	1.41	1.87					11.87			8,848.98	8,406.53
EFT_BMP_35	Inflitration - Dry	EFT_RD_1	95%			2.88					47.29			32,985.31	31,336.04
EFT_BMP_37	Inflitration - Dry	EFT_RD_2a	95%								43.57			29,927.61	28,431.23
EFT_BMP_38	Detention	EFT_RD_77a	10%		0.11					10.32	12.12			24,318.02	2,431.80
EFT_BMP_39	Detention	EFT_RD_77a	10%		0.11					10.32	12.12			24,318.02	2,431.80
EFT_BMP_40	Detention	EFT_RD_77b	10%			0.52				8.64	17.95	1.89		26,171.44	2,617.14
EFT_BMP_41	Detention	EFT_RD_170a	10%		0.76	0.01					4.57		0.16	3,338.84	333.88
EFT_BMP_42	Detention	EFT_RD_79	10%	0.44		0.04					10.74	0.96	0.28	8,414.31	841.43
EFT_BMP_43	Infiltration - Wet	EFT_RD_88b	95%		1.05	1.22					10.58		0.29	7,765.15	7,376.89
EFT_BMP_44	Detention	EFT_RD_84	10%								4.74			3,259.12	325.91
EFT_BMP_45	Detention	EFT_RD_111	10%		1.99						1.25			1,315.16	131.52
EFT_BMP_46	Inflitration - Dry	EFT_RD_83	95%		1.11	1.57					10.69			7,875.14	7,481.38
EFT_BMP_47	Wet Pond	EFT_RD_35	60%	0.04		0.41					14.99			10,448.25	6,268.95
EFT_BMP_48	Wet Pond	EFT_RD_36	60%			0.94					6.10			4,351.87	2,611.12
EFT_BMP_49	Rain Garden	EFT_RD_24	90%	0.44							3.76			3,386.13	3,047.51
EFT_BMP_50	Detention Basin	EFT_RD_27	10%	0.26		0.44					11.46			8,415.01	841.50
EFT_BMP_51	Wet Pond	EFT_RD_42	60%	0.24		0.19					19.38			13,787.16	8,272.30
EFT_BMP_52	Wet Pond	EFT_RD_54	60%		2.09	0.47	0.02				19.39		0.71	14,045.59	8,427.35
EFT_BMP_53	Wet Pond	EFT_RD_26	60%			0.00	0.46	0.85			72.29		0.18	52,016.95	31,210.17
EFT_BMP_54	Wet Pond	EFT_RD_2b	60%	5.21	4.08	0.04					42.91		0.63	39,988.19	23,992.92
EFT_BMP_55	Wet Pond	EFT_RD_86	60%		0.55	1.13					23.99			16,805.20	10,083.12
EFT_BMP_56	Wet Pond	EFT_RD_139	60%	15.50	1.29	0.00					19.62		0.60	42,059.09	25,235.46
														Total	**442,166.69**

When the existing BMP documentation is complete, and all BMPs listed above comply with the requirements, the sediment load reduction could potentially be reduced by 442,167 lbs./yr.

Figure 5 – Existing BMP Locations



Step 6 - Calculate the Revised 2012 Load. This is done by taking the 2012 Load and subtracting the Existing BMP Reduction. As previously mentioned, documentation of existing BMPs is not complete, therefore a **Revised 2012 Load** will not be calculated until the required BMP documentation is complete.

Step 7 – Calculate the Existing Load which equals is the Revised 2012 Load (or 2012 Load). Calculation of the existing load is important for use by the MS4 and PADEP in measuring progress over life of the permit. The existing load is the 2012 Load if BMP reduction is not used to calculate a Revised 2012 Load. Therefore, the **Existing Load** is **1,671,554 lbs./yr.**

Step 8 – Calculate the Remaining TMDL Reduction Required after Land Conversion. This is accomplished by taking the Load Reduction Required (step 2) minus the Land Conversion Load Reduction (Step 4)- Existing BMP Reduction (Step 5 – none taken) equals the remaining load reduction required. The Remaining TMDL Reduction Required after land use conversion and credit for Existing BMP Load Reductions is calculated as follows:

- TMDL Load Reduction Required (996,067) – Load Reduction from Land Conversion (451,806) – Existing BMP Reduction (0.0) = **Remaining TMDL Load Reduction Required** still to be achieved = **544,262 lbs./yr.**

Table 7 present the remaining TMDL reduction required after land use conversion.

Table 7 – Revised Required Load Reduction Calculation

Revised Load Reduction Calculation					
Revised (1995) Baseline Load	Required Reduction	TMDL Load Reduction Required	Existing Load	Land Conversion Reduction	TMDL Reduction Required after Land Conversion
lbs./yr.	Percent	lbs./yr.	lbs./yr.	lbs./yr.	lbs./yr.
2,123,359.23	46.91%	996,067.81	1,671,553.68	451,805.55	**544,262.26**

Step 9 - Calculate the TMDL Load Reduction Required this Permit Period. There are two options to derive this value, as follows:

- Achieve 100% reduction of Remaining TMDL Reduction Required (544,262 lbs.)
- Or the following reductions from the **Existing Load** (2012 Load) are required
    1. 10% reduction for sediment.
    2. 5% reduction for phosphorus.
    3. 1062*0.03% reduction for nitrogen.

The presumptive approach can be applied, which allows for the 5% phosphorus and 3% nitrogen reductions to be presumed to be achieved if the 10% sediment reduction is achieved.

To achieve 100% of the remaining TMDL reduction **544,262 lbs./yr**. of sediment would need to be removed by proposed BMPs constructed over the five-year permit cycle. If that is not possible, then 10% of the Existing Load (1,671,534 lbs./yr.) or **167,154 lbs./yr**. of sediment would need to be removed by proposed BMPs constructed over the five-year permit cycle. According to values found in Table 4 above, the Existing Total Nitrogen (TN) Load is 5,021 lbs./yr. and the Existing Total Phosphorous (TP) Load is 1,037 lbs./yr. The required reduction for TN is 150.6 lbs./yr. and 51.84 lbs./yr. for TP over the 5-year permit cycle. Both approaches are less than the load assigned in the Christina TMDL Report (852,840 lbs./yr.)

Step 10 – Remaining Long-term Reduction Required to be Achieved. TMDL Reduction Required after Land Conversion minus the sediment reduction to be achieved in first 5-year permit period, equals the reduction achieved in future permit terms. (544,262 - 167,153 = 377,109 lbs./yr.)

Step 11 – Proposed Urban BMP Load Reduction Calculations: (See Section G. below)

Step 12 Summary of Calculations –

A. Revised 1995 Baseline Load = 2,123,359 lbs./yr. sediment
B. TMDL Load Reduction Required = 996,068 lbs./yr.
C. Existing Load = 1,671,554 lbs./yr.
D. Remaining TMDL Load Reduction Required = 544,262 lbs./yr.

E. TMDL Reduction Required this 5-year period = 544,262 lbs./yr.
Or, if that cannot be achieved, then 10% of the existing load = 167,154 lbs./yr. sediment

E. **Waste Load Allocation (WLA).** As mentioned above (Table 2), the Christina Basin TMDL MS4 Waste Load Allocation assigned to East Fallowfield Township is **426.42 tons/yr.** of sediment. East Fallowfield Township has elected to use the "presumptive approach, so this analysis is limited to sediment WLA. The load percent reduction required for East Fallowfield Township has been establish by DEP to be 46.91% for Sediment. These numbers are based on a PADEP/EPA Baseline MS4 Load of 803.23 tons/yr. as an average annual sediment allocation for East Fallowfield which is in the Brandywine Creek Watershed.

F. Analysis of TMDL Objectives.

1. Long-Term Reduction – According to the analysis above the long-term reduction requirement equals **544,262 lbs./yr**. That is not possible to achieve in the first 5-year permit cycle.

2. Short-Term Reduction – East Fallowfield Township has determined that 544,262 lbs./yr. of sediment cannot be reduced during the next permit period, so it elects to pursue BMPs for the reduction of 167,153 lbs./yr. as its short term TMDL Objective. The required reduction, 10% of the Existing Load (1,671,534 lbs./yr.) or **167,153 lbs./yr**. of sediment, would need to be removed by proposed BMPs constructed over the five-year permit cycle.

G. Select BMPs To Achieve the Minimum Required Reductions in Pollutant Load.

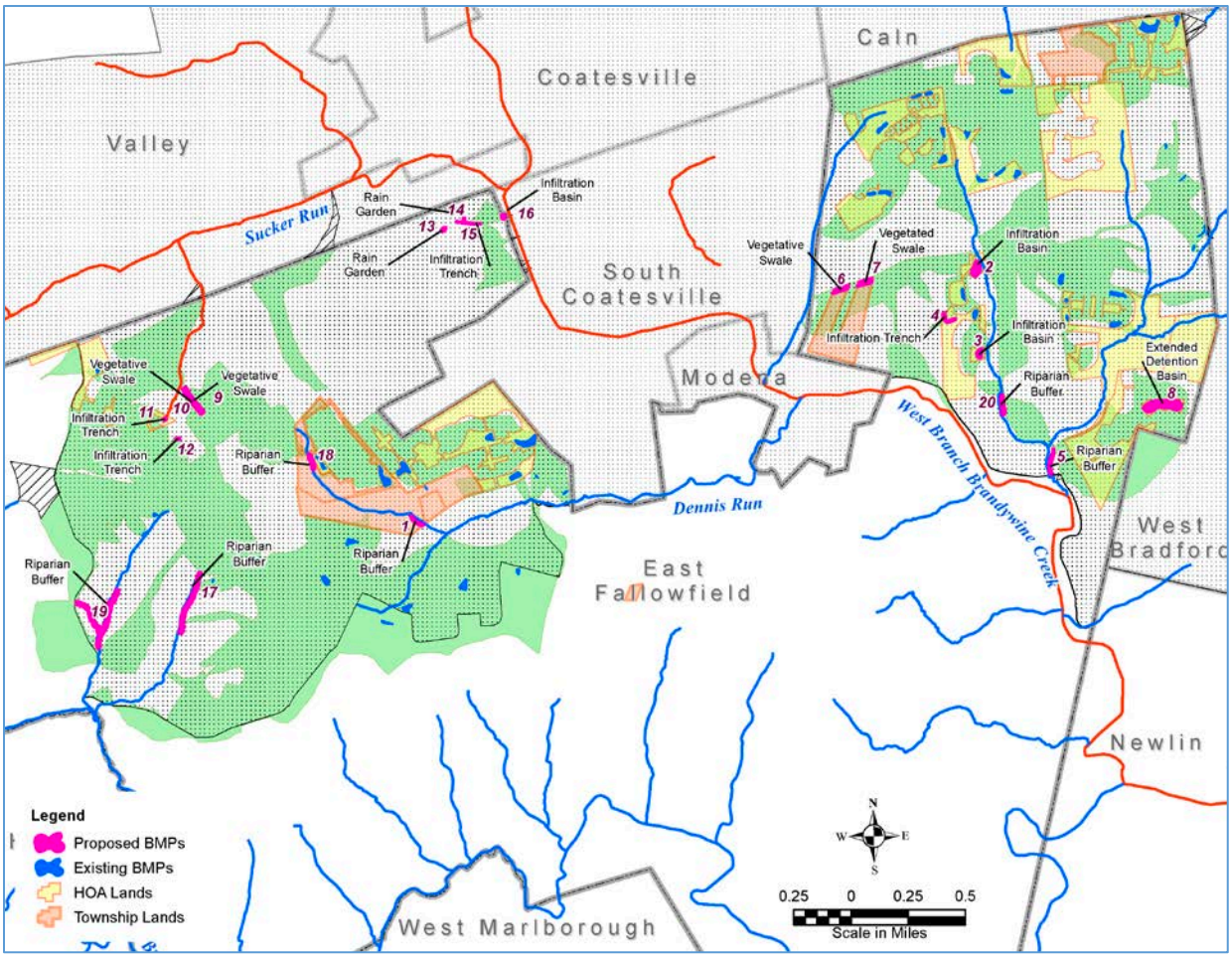
Several opportunities for new BMP construction and improvements to existing facilities have been identified. Where available, land ownership was considered first. Township owned lands provide the most control and ease of construction and permitting process. Homeowner Association (HOA) lands may be desirable especially if maintenance programs have not been adequate. Private ownership may pose the most resistance unless the benefits of equitable agreements are met. Table 8 presents the landowner's name and location of the proposed BMPs. Township owned opportunities are shaded light grey, HOA land are darker grey, and private lands are light green. Figure 6 presents the location and type of proposed BMP.

Table 8 – Proposed BMPs, Owners, and Locations

FACILITY_ID	TYPE	OWNER	LOCATION
pBMP-1	Riparian Buffer	East Fallowfield Township	NW COR STRASBURG RD
pBMP-2	Infiltration Basin	Stone Creek HOA	SE COR OF GOOSETOWN RD
pBMP-3	Infiltration Basin	Stone Creek HOA	ES & REAR OF EAGLE GLEN DR
pBMP-4	Infiltration Trench	Stone Creek HOA	WS GLEN EAGLE DR
pBMP-5	Riparian Buffer	Dennis Fallon	NW COR S CALN RD & MORTONV
pBMP-6	Vegetated Swale	East Fallowfield Township	SS GOOSETOWN ROAD
pBMP-7	Vegetated Swale	East Fallowfield Township	SS GOOSETOWN ROAD
pBMP-8	Extended Detention	Wellington Hunt HOA	NS OF SAW MILL RD
pBMP-9	Vegetated Swale	Township Road ROW	ES OF PARK AVENUE
pBMP-10	Vegetated Swale	Township Road ROW	WS OF PARK AVENUE
pBMP-11	Infiltration Trench	Strasburg Hunt HOA	SS WINDY HILL RD

pBMP-12	Vegetated Swale	David Lacour	NS WILLOW ROCK WAY CLDSC
pBMP-13	Rain Garden	Craig Reynolds	WS RT 82 - Newlinville Village
pBMP-14	Rain Garden	East Fallowfield Township	NS NEWLINVILLE RD
pBMP-15	Infiltration Trench	Township Road ROW	SS NEWLINVILLE RD
pBMP-16	Infiltration Basin	ISG Plate Inc.	WS S COATES BORO LN
pBMP-17	Riparian Buffer	Matthew and Mary Lamar	ES PARK AVE
pBMP-18	Riparian Buffer	East Fallowfield Township	NS & SS OF CROSSING BLVD
pBMP-19	Riparian Buffer	Michael Price & Mary Lamar	ES MOUNT CARMEL RD
pBMP-20	Riparian Buffer	Robert Hoadley	WS MORTONVILLE RD

Figure 6 – Proposed BMP Locations.



BMP facilities proposed include riparian buffers, rain gardens, detention basin improvements (infiltration basins and infiltration trenches, and extended detention basins), and roadside swales (open vegetated channels). Table 9 summarizes load reduction estimates for the proposed BMPs. This list will provide facilities for short term and a portion of the long-term reduction requirements for EFT. Rows shaded green would achieve short-term objectives.

Table 9 – Proposed BMP Estimated Load Reduction.

PROPOSED BMP LOAD REDUCTION CALCULATION													
FACILITY _ID	TYPE	Soil Hydro. Group	BMP Drainage Area ID	BMP Effective.	Crop	Disturb.	Forest	HD Mixed Res.	LD Res.	Turf Golf	Water	Sediment Load	Load Reduction
pBMP-1	Riparian Buffer	C/D	15	50%	0.004		0.126		0.015	3.773	0	802.09	401.04
pBMP-2	Infiltration Basin	B	4	95%	1.382	2.237			8.108		0.163	8,620.84	8,189.80
pBMP-3	Infiltration Basin	B	2	95%		2.422			8.358		0.197	6,326.98	6,010.63
pBMP-4	Infiltration Trench	B	3	95%		1.987			1.252			1,314.90	1,249.16
pBMP-5	Riparian Buffer	B/D, B	20	50%			4.384		2.818			2,700.55	1,350.27
pBMP-6	Vegetated Swale	B	6	70%			4.117	1.171	0.326			3,500.75	2,450.52
pBMP-7	Vegetated Swale	B	5	70%			3.99		1.212			1,528.61	1,070.03
pBMP-8	Extended Detention	B, C/D	7	60%			4.652		21.59			15,642.21	9,385.33
pBMP-9	Vegetated Swale	B	12	70%	0.028	3.312	2.23	1.542	7.824			9,941.85	6,959.30
pBMP-10	Vegetated Swale	B	13	70%	0.379		3.059	1.498	4.262			7,423.65	5,196.55
pBMP-11	Infiltration Trench	B	10	95%	0.042		0.41		14.994			10,447.62	9,925.24
pBMP-12	Vegetated Swale	C/D	11	70%			0.942		6.096			4,351.81	3,046.27
pBMP-13	Rain Garden	B	16	90%			3.207	0.112	2.711			2,666.43	2,399.79
pBMP-14	Rain Garden	B	18	90%		0.306	0.801		0.752			726.35	653.72
pBMP-15	Infiltration Trench	B	17	95%			3.426	1.17	1.992			4,522.43	4,296.31
pBMP-16	Infiltration Basin	B	19	95%		1.095	2.492		0.482			1,016.51	965.68
pBMP-17	Riparian Buffer	B, C/D	8	50%	48.028		0.416		24.326			104,127.34	52,063.67
pBMP-18	Riparian Buffer	C/D	14	50%		3.862	0.234	0.713	1.752		0	3,686.30	1,843.15
pBMP-19	Riparian Buffer	B, C/D	9	50%	87.502	8.297	12.112		22.123			178,342.06	89,171.03
pBMP-20	Riparian Buffer	B	1	50%	5.527		1.091		1.26			11,107.36	5,553.68
												Total	**212,181.17**

Proposed BMP Descriptions (Source: Pennsylvania Stormwater BMP Manual)

Riparian Buffer

A riparian buffer is a permanent area of trees and shrubs located adjacent to streams, lakes, ponds, and wetlands. Riparian forests are the most beneficial type of buffer for they provide ecological and water quality benefits. Restoration of this ecologically sensitive habitat is a responsive action to past activities that may have eliminated any vegetation.

The USDA Forest Service estimates that over one-third of the rivers and streams in Pennsylvania have had their riparian areas degraded or altered. This fact is sobering when one considers the important stormwater functions that riparian buffers provide. The non-structural BMP, Riparian Forest Buffer Protection, addresses the importance of protecting the three-zone system of existing riparian buffers.

Riparian buffers are scientifically proven to provide several economic and environmental values. Buffers are characterized by high species density, high species diversity, and high bio-productivity as a transition between aquatic and upland environments. Project designers should consider the benefits or services provided by the buffer and apply these to their project goals. Priorities for riparian buffer use should be established early in the planning stages.

Rain Gardens/Bioretention

Bioretention is a method of treating stormwater by pooling water on the surface and allowing filtering and settling of suspended solids and sediment at the mulch layer, prior to entering the plant/soil/microbe complex media for infiltration and pollutant removal. Bioretention techniques are used to accomplish water quality improvement and water quantity reduction.

Bioretention can be integrated into a site with a high degree of flexibility and can balance nicely with other structural management systems, including porous asphalt parking lots, infiltration trenches, as well as non-structural stormwater BMPs.

The vegetation serves to filter (water quality) and transpire (water quantity) runoff, and the root systems can enhance infiltration. The plants take up pollutants; the soil medium filters out pollutants and allows storage and infiltration of stormwater runoff; and the bed provides additional volume control. Properly designed bioretention techniques mimic natural ecosystems through species diversity, density and distribution of vegetation, and the use of native species, resulting in a system that is resistant to insects, disease, pollution, and climatic stresses.

Infiltration Basin

Infiltration Basins are shallow, impounded areas designed to temporarily store and infiltrate stormwater runoff. The size and shape can vary from one large basin to multiple, smaller basins throughout a site. Ideally, the basin should avoid disturbance of existing vegetation. If disturbance is unavoidable, replanting and landscaping may be necessary and should integrate the existing landscape as subtly as possible and compaction of the soil must be prevented (see Infiltration Guidelines). Infiltration Basins use the existing soil mantle to reduce the volume of stormwater runoff by infiltration and evapotranspiration. The quality of the runoff is also improved by the natural cleansing processes of the existing soil mantle and by the vegetation planted in the basins. The key to promoting infiltration is to provide enough surface area for the volume of runoff to be absorbed to meet the criteria in Chapter 3. An engineered overflow structure should be provided for the larger storms.

Infiltration Trenches

An Infiltration Trench is a linear stormwater BMP consisting of a continuously perforated pipe at a minimum slope in a stone-filled trench. Usually, an Infiltration Trench is part of a conveyance system and is designed so that large storm events are conveyed through the pipe with some runoff volume reduction. During small storm events, volume reduction may be significant and there may be little or no discharge. All Infiltration Trenches are designed with a positive overflow.

An Infiltration Trench differs from an Infiltration Bed in that it may be constructed without heavy equipment entering the trench. It is also intended to convey some portion of runoff in many storm events.

Extended detention Basin

Dry extended detention basins are surface stormwater structures which provide for the temporary storage of stormwater runoff to prevent downstream flooding impacts. Water quality benefits may be achieved with extended detention of the runoff volume from the water quality design storm. • The primary purpose of the detention basin is the attenuation of stormwater runoff peaks.

- Detention basins should be designed to control runoff peak flow rates of discharge for the 1 year through 100-year events.

- Inflow and discharge hydrographs should be calculated for each selected design storm. Hydrographs should be based on the 24-hour rainfall event.

- Basins should be designed to provide water quality treatment storage to capture the computed runoff volume of the water quality design storm.

- Detention basins should have a sediment forebay or equivalent upstream pretreatment. The forebay should consist of a separate cell that is offline (so as to not resuspend sediment, formed by an acceptable barrier and will need periodic sediment removal.

- A micro pool storage area should be designed where feasible for the extended detention of runoff volume from the water quality design storm.

- Flow paths from inflow points to outlets should be maximized.

Vegetated Swales

Vegetated swales are broad, shallow channels designed to slow runoff, promote infiltration, and filter pollutants and sediments in the process of conveying runoff. Vegetated Swales provide an environmentally superior alternative to conventional curb and gutter conveyance systems, while providing partially treated (pretreatment) and partially distributed stormwater flows to subsequent BMPs. Swales are often heavily vegetated with a dense and diverse selection of native, close-growing, water-resistant plants with high pollutant removal potential. The various pollutant removal mechanisms of a swale include sedimentary filtering by the swale vegetation (both on side slopes and on bottom), filtering through a subsoil matrix, and/or infiltration into the underlying soils with the full array of infiltration-oriented pollutant removal mechanisms.

A Vegetated Swale typically consists of a band of dense vegetation, underlain by at least 24 inches of permeable soil. Swales constructed with an underlying 12-to-24-inch aggregate layer provide significant volume reduction and reduce the stormwater conveyance rate. The permeable soil media should have a minimum infiltration rate of 0.5 inches per hour and contain a high level of organic material to enhance pollutant removal. A nonwoven geotextile should completely wrap the aggregate trench (See BMP 6.4.4 Infiltration Trench for further design guidelines).

Short-Term Reductions for this Permit Term - It is being recommended that the Township endorses an initial plan to remove sediments from being discharged to the impaired tributary to the Sucker Run. That includes the installation of infiltration trench and vegetated swale (pBMPs-11 & 12) and roadside vegetated swales (E & WS Park Ave., pBMPs-9 & 10). The infiltration trenches and vegetated swale will provide a sediment load reduction of over 25,127 lbs./yr.

The recently drafted Newlinville Village Master Plan included recommendations for stormwater management opportunities to mitigate flooding conditions in the Village. One recommendation included road widening which could incorporate an infiltration bed beneath the new width (pBMP-15). In addition, rain gardens could be constructed to mitigate roof top and road runoff (pBMP-14, & pBMP-13). A new infiltration basin (pBMP-16) could be constructed at the eastern end of Newlinville Road.

Riparian Buffer opportunities could begin with a pilot project at the East Fallowfield Community Park (pBMPs-1 & 18). Lessons learned could be brought to private landowners where projects (pBMPs-17 & 19) could be run during the same planting season to allow for bulk tree purchase to take advantage of quantity discounts.

If all the above proposed BMPs mention in this section, the load reduction is estimated to be 176,922 and which satisfies the short-term reduction objectives.

Long-term reductions to meet the WLA – The long-term reduction requirement equals **544,262 lbs./yr**. If the short-term reduction is achieved there will remain 367,340 lbs./yr. to be achieved in subsequent permit periods. The list of proposed BMPs presented in Table 9 includes several options which could be implemented over subsequent permit cycles: five (5), ten (10), and fifteen (15) years out. East Fallowfield will continue to look for opportunities and grant funding through future special projects to piggyback MS4 benefits with community improvements. Future development opportunities will be reviewed considering ongoing needs for pollution reduction with options available to include porous paving, rain gardens, bio retention berms and vegetative swales.

4.1 Funding Mechanisms

Cost estimate for the construction of proposed BMPs are taken from Chesapeake Bay Assessment Scenario Tool and Maryland Stormwater BMP Cost Worksheet. Cost estimates for each type of proposed BMP are included in Table 10.

Table 10 – Cost Estimates for Proposed BMP implementation.

Planning Level Unit Cost Development for Stormwater Best Management Practices (BMPs)[1]
PART 1: Initial Costs Per Impervious Acre Treated

BMP	Acres	Sediment Reduction	Impervious acres treated	Pre-Construction Costs[2]	Construction Costs[3]	Total Unit Costs	Land Costs[4]	Total Costs Including Land	Annualized Initial Costs[5]	Cost per pound of sediment removed
Riparian Buffers[6]	7.39	143,478.90	8.81	$406	$4,062	$33,023	$36,950	$69,973	$4,703	$0.49
Vegetated Swales	1.2	12,155.85	3.49	$4,000	$20,000	$83,760	$6,000	$89,760	$6,033	$7.38
Rain Gardens	0.21	3,053.50	0.99	$9,375	$37,500	$46,406	$1,050	$47,456	$3,190	$15.54
Infiltration Trenches	0.27	14,221.60	3.08	$16,700	$41,750	$180,026	$1,350	$181,376	$12,191	$12.75
Infiltration Basin	0.18	965.70	0.67	$16,700	$41,750	$39,162	$900	$40,062	$2,693	$41.48
Totals		173,875.55						$428,627	$28,810	$2.47

[1] Most costs are expressed per acre of impervious area treated, not per acre of BMP. Initial costs are assumed to take place in year T=0; annual costs are incurred from year T= 1 through year T= 20.

[2] Includes cost of site discovery, surveying, design, planning, permitting, etc. which, for various BMPs tend to range from 10% to 40% of BMP construction costs.

[3] Includes capital, labor, material and overhead costs, but not land costs, and associated implementation.

[4] For all stormwater BMPs that require land it is assumed that an easement cost of $5000 per acre.

[5] Initial BMP costs, including preconstruction, construction, and land costs, are amortized over 20 years at 3% to arrive at annualized initial costs.

[6] Cost for Riparian Buffers is from Chesapeake Bay Assessment Scenario Tool - Pennsylvania BMP Cost and are based on BMP acres and not impervious area treated.

The total cost of the proposed BMP implementation is estimated to be $4228,Funding sources for the proposed BMPs for this 5-year permit cycle is expected to be obtained from a combination of the grant opportunities and the Township's general fund budget. Trees required for the Riparian Buffer BMPs will be sought through grant applications to the TreeVitalize and Keystone 10 Million Trees Partnership. The proposed BMPs in the Newlinville area will include grant applications Through the American Rescue Plan (ARP) Funds or Bipartisan Infrastructure Law (BIL), and or PennDOT since much of the flood hazard is associated with drainage from the State highway. Other grant opportunities may include PennVest and Commonwealth Financing Authority (CFA). CFA was established in 2004 as an independent agency of the Department of Community and Economic Development (DCED), and includes the PA Small Water and Sewer Program

4.2 Operations and Maintenance

All of the proposed BMPs will have Operations and Maintenance (O&M) plans and will be the responsibility of the Township to enact those plans. Anticipated costs for O&M are presented in Table 11.

Planning Level Unit Cost Development for Stormwater Best Management Practices (BMPs)
PART 2: Annual Maintenance Costs

Stormwater BMP	Routine and Intermittent Maintenance Costs			Average Annual Municipal Implementation Costs[3]	Maintenance, Intermittent Repair, and Implementation Costs[4]	
	Annual Routine Maintenance[1]	Average Annual Intermittent Maintenance[2]	Total Annual Maintenance Costs		Total (Over 20 Years)	Average Annual (Over 20 Years)
Riparian Buffers	$81	$600	$681	$10	$13,832	$692
Vegetated Swales	$400	$400	$800	$10	$16,207	$810
Rain Gardens	$750	$750	$1,500	$31	$30,620	$1,531
Infiltration Trenches	$418	$418	$835	$31	$17,320	$866
Infiltration Basin	$418	$418	$835	$31	$17,320	$866
Totals			**$4,651**		**$95,299**	**$4,765**

[1] Annual routine maintenance costs over 20 years; assumes a 3% discount rate, but also a 3% annual increase in maintenance cost which washes out the effect of discounting resulting in a constant present value annual cost throughout the 20 year period.

[2] Intermittent/corrective maintenance tasks are those that accrue every 3 to 5 years; these are averaged here over the 20 year period.

[3] Average annual municipal cost of inspecting and monitoring stormwater BMPs and enforcing construction and maintanance standards.

[4] Combined annual operating, implementation, and maintenance costs.

O&M requirements for specific BMP types are as follows:

Riparian Buffers

Maintenance measures that should be performed regularly:

- Plantings need deep regular watering during the first growing season, either natural watering via rainfall, or planned watering, via caretaker.
- Planting in the fall increases the likelihood of sufficient rain during planting establishment.
- Mulch will assist in moisture retention in the root zone of plantings, moderate soil temperature, provide some weed suppression, and retard evaporation
- Use coarse, organic mulch that is slow to decompose in order minimize repeat application
- Apply 2-4 inch layer, leaving air space around tree trunk to prevent fungus growth.
- Use combination of woodchips, leaves, and twigs that are stockpiled for six months to a year.
- Mulch will assist in moisture retention in the root zone of plantings, moderate soil temperature, provide some weed suppression, and retard evaporation
- Use coarse, organic mulch that is slow to decompose in order minimize repeat application
- Apply 2-4 inch layer, leaving air space around tree trunk to prevent fungus growth.
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- Mulch will assist in moisture retention in the root zone of plantings, moderate soil temperature, provide some weed suppression, and retard evaporation
- Use coarse, organic mulch that is slow to decompose in order minimize repeat application
- Apply 2-4 inch layer, leaving air space around tree trunk to prevent fungus growth.
- Use combination of woodchips, leaves, and twigs that are stockpiled for six months to a year.
- Repair broken stakes
- Tighten stake lines
- Straighten leaning tubes
- Clean debris from tube
- Remove netting as tree grows
- Remove when tree is approximately 2 inches wide
- Monitor restoration sight regularly for any signs of invasive plants.
- Appendix B contains common invasive plants found in Pennsylvania.
- Choice of control method is based on a variety of considerations, but falls into three general categories:
- Mechanical
- Mechanical with application of herbicide
- Herbicide

Special Maintenance Considerations

Riparian buffer restoration sites should be monitored to maximize wildlife habitat and water quality benefits, and to discover emerging threats to the project. During the first four years, the new buffer should be monitored four times annually (February, May, August, and November are recommended) and inspected after any severe storm. Repairs should be made as soon as possible.

Depending on restoration site size, the buffer area should be sampled to approximate survival rate. Data derived should consider survival of the planted material and natural regeneration to determine if in-fill planting should occur to supplement plant density.

Survival rates of at least 70% are deemed to be successful. Calculate percent survival by the following equation: (# of live plants / # of installed plants) 100 = % survival

Vegetated Swales –

Compared to other stormwater management measures, the required upkeep of vegetated swales is relatively low. In general, maintenance strategies for swales focus on sustaining the hydraulic and pollutant removal efficiency of the channel, as well as maintaining a dense vegetative cover. Experience has proven that proper maintenance activities ensure the functionality of vegetated swales for many years. Maintenance activities to be done annually and within 48 hours after every major storm event (> 1 inch rainfall depth):

- Inspect and correct erosion problems, damage to vegetation, and sediment and debris accumulation (address when > 3 inches at any spot or covering vegetation)
- Inspect vegetation on side slopes for erosion and formation of rills or gullies, correct as needed

- Inspect for pools of standing water; dewater and discharge to an approved location and restore to design grade
- Mow and trim vegetation to ensure safety, aesthetics, proper swale operation, or to suppress weeds and invasive vegetation; dispose of cuttings in a local composting facility; mow only when swale is dry to avoid rutting
- Inspect for litter; remove prior to mowing
- Inspect for uniformity in cross-section and longitudinal slope, correct as needed
- Inspect swale inlet (curb cuts, pipes, etc.) and outlet for signs of erosion or blockage, correct as needed

Rain Gardens -

- While vegetation is being established, pruning and weeding may be required.
- Detritus may also need to be removed every year. Perennial plantings may be cut down at the end of the growing season.
- Mulch should be re-spread when erosion is evident and be replenished as needed. Once every 2 to 3 years the entire area may require mulch replacement.
- Bioretention areas should be inspected at least two times per year for sediment buildup, erosion, vegetative conditions, etc.
- During periods of extended drought, Bioretention areas may require watering.
- Trees and shrubs should be inspected twice per year to evaluate health.

Infiltration Trenches –

- Catch Basins and Inlets should be inspected and cleaned at least 2 times per year.
- The vegetation along the surface of the Infiltration Trench should be maintained in good condition, and any bare spots revegetated as soon as possible.
- Vehicles should not be parked or driven on a vegetated Infiltration Trench, and care should be taken to avoid excessive compaction by mowers.
- Infiltration Basin - Catch Basins and Inlets (upgradient of infiltration basin) should be inspected and cleaned at least two times per year and after runoff events. The vegetation along the surface of the Infiltration basin should be maintained in good condition, and any bare spots revegetated as soon as possible.
- Vehicles should not be parked or driven on an Infiltration Basin, and care should be taken to avoid excessive compaction by mowers.
- Inspect the basin after runoff events and make sure that runoff drains down within 72 hours. Mosquitos should not be a problem if the water drains in 72 hours. Mosquitos require a considerably long breeding period with relatively static water levels.
- Also inspect for accumulation of sediment, damage to outlet control structures, erosion control measures, signs of water contamination/spills, and slope stability in the berms.
- Mow only as appropriate for vegetative cover species.
    - Remove accumulated sediment from basin as required. Restore original cross section and infiltration rate. Properly dispose of sediment.

Infiltration Basins –

- Catch Basins and Inlets (upgradient of infiltration basin) should be inspected and cleaned at least two times per year and after runoff events.
- The vegetation along the surface of the Infiltration basin should be maintained in good condition, and any bare spots revegetated as soon as possible.
- Vehicles should not be parked or driven on an Infiltration Basin, and care should be taken to avoid excessive compaction by mowers.
- Inspect the basin after runoff events and make sure that runoff drains down within 72 hours. Mosquito's should not be a problem if the water drains in 72 hours. Mosquitoes require a considerably long breeding period with relatively static water levels.
- Also inspect for accumulation of sediment, damage to outlet control structures, erosion control measures, signs of water contamination/spills, and slope stability in the berms.
- Mow only as appropriate for vegetative cover species.
- Remove accumulated sediment from basin as required. Restore original cross section and infiltration rate. Properly dispose of sediment.

5.0 Conclusion

Based upon the analysis of the sediment loads being generated from the sewersheds to the designated MS4 outfalls, it has been determined that the required 10% sediment reduction will be achieved through the implementation of the proposed BMPs.

6.0 Definitions

Best Management Practices (BMPs) *means schedules of activities, prohibitions of practices, maintenance procedures and other management practices to prevent or reduce pollutant loading to surface waters of this Commonwealth. The term includes treatment requirements, operating procedures and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. The term includes activities, facilities, measures, planning or procedures used to minimize accelerated erosion and sedimentation and manage stormwater to protect, maintain, reclaim and restore the quality of waters and the existing and designated uses of waters within this Commonwealth before, during and after earth disturbance activities. (25 Pa. Code § 92a.2)*

Clean Water Act (CWA) *means the Federal Water Pollution Control Act, as amended, 33 U.S.C.A. §§ 1251 - 1387.*

Cleaning Agent *means any product, substance, or chemical other than water that is used to clean the exterior surface of vehicles.*

Designated Uses *are those uses specified in 25 Pa. Code §§ 93.4(a) and 93.9a – 93.9z for each water body or segment whether they are being attained. (25 Pa. Code § 93.1)*

Dry Weather *means a condition in which there are no precipitation, snowmelt, drainage, or other events producing a stormwater discharge for more than 48 consecutive hours.*

Existing Permittee *means any entity that has been designated as a regulated small MS4 and has previously obtained permit coverage under the PAG-13 General Permit or obtained an Individual NPDES MS4 Permit.*

Existing Uses *are those uses attained in the water body on or after November 28, 1975, whether they are included in the water quality standards. (25 Pa. Code § 93.1)*

Illicit Connection *means any physical connection to a municipal separate storm sewer system that can convey illicit discharges into the system and/or is not authorized or permitted by the permittee.*

Illicit Discharge *means any discharge to a municipal separate storm sewer that is not composed entirely of stormwater, except non-stormwater discharges as described in the "Discharges Authorized by this General Permit" section of this General Permit. Examples of illicit discharges include dumping of motor vehicle fluids, household hazardous wastes, grass clippings, leaf litter, animal wastes, or unauthorized discharges of sewage, industrial waste, restaurant wastes, or any other non-stormwater waste into a municipal separate storm sewer system. Illicit discharges can be accidental or intentional.* ***3800-PM-BCW0100d 5/2016 Permit***

Impaired Waters *means surface waters that fail to attain one or more of its designated uses under 25 Pa. Code Chapter 93 and as listed in Categories 4 and 5 of Pennsylvania's Integrated Water Quality Monitoring and Assessment Report.*

Integrated Water Quality Monitoring and Assessment Report *means the report published every other year by DEP to report on the conditions of Pennsylvania's surface waters to satisfy sections 305(b) and 303(d) of the CWA.*

Intermittent Stream *means a body of water flowing in a channel or bed composed primarily of substrates associated with flowing water, which, during periods of the year, is below the local water table and obtains its flow from both surface runoff and groundwater discharges. (25 Pa. Code § 92a.2)*

Load Allocation *means the portion of a surface water's loading capacity that is assigned or allocated to existing and future nonpoint sources and natural quality. (25 Pa. Code § 96.1)*

Low Impact Development (LID*) means site design approaches and small-scale stormwater management practices that promote the use of natural systems for infiltration, evapotranspiration, and reuse of rainwater. LID can be applied to new development, urban retrofits, and revitalization projects. LID utilizes design techniques that infiltrate, filter, evaporate, and store runoff close to its source. Rather than rely on costly large-scale conveyance and treatment systems, LID addresses stormwater through a variety of small, cost-effective landscape features located on-site.*

MS4 Requirements Table *is a compilation of information regarding Pennsylvania MS4s, surface waters that receive stormwater discharges from MS4s, surface water impairments and TMDLs that is posted to DEP's website, www.dep.pa.gov/MS4. The MS4 Requirements Table has been assembled by DEP to assist MS4 permittees in determining applicable requirements for the development of plans and implementation of BMPs, as well as eligibility for the PAG-13 General Permit. In general, the MS4 Requirements Table will be updated prior to each renewal of this General Permit based on DEP's latest published Integrated Water Quality Monitoring and Assessment Report.*

Municipal separate storm sewer *means a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains): (i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the CWA that discharges to surface waters; (ii) Designed or used for collecting or conveying stormwater; (iii) Which is not a combined sewer; and (iv) Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2. (25 Pa. Code § 92a.32(a) and 40 CFR § 122.26(b)(8))*

Municipal Separate Storm Sewer System (MS4) *means all separate storm sewers that are defined as "large" or "medium" or "small" municipal separate storm sewer systems pursuant to 40 CFR §§ 122.26(b)(4), (b)(7), and (b)(16), respectively, or designated under 40 CFR § 122.26(a)(1)(v). (25 Pa. Code § 92a.32(a) and 40 CFR § 122.26(b)(18))*

Municipality *means a city, town, borough, county, township, school district, institution, authority or other public body created by or pursuant to State law and having jurisdiction over disposal of sewage, industrial wastes or other wastes. (25 Pa. Code § 92a.2)*

New Permittee *means any entity that has been designated as a regulated small MS4 and has not previously obtained permit coverage under the PAG-13 General Permit or obtained an Individual NPDES MS4 Permit.*

NOI *means the Notice of Intent for coverage under the NPDES General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems.*

Non-Municipal Permittee *means a regulated small MS4 that is not a municipality, e.g., military bases, large hospital or prison complexes, and highways and other thoroughfares.* ***3800-PM-BCW0100d 5/2016 Permit***

Non-Structural BMPs *means actions that involve management and source controls such as: (1) policies and ordinances that provide requirements and standards to direct growth to identified areas, promote redevelopment, protect areas such as wetlands and riparian areas, maintain and/or increase open space, provide buffers along water bodies, minimize impervious surfaces, and minimize disturbance of soils and vegetation; (2) education programs for developers and the public about minimizing water quality impacts; (3) measures such as minimizing the percentage of impervious area after development, use of measures to minimize directly connected impervious areas, street sweeping, and source control measures such as good housekeeping, maintenance, and spill prevention; and other BMPs as referenced in Chapter 5 of the Pennsylvania Stormwater BMP Manual (363-0300-002).*

Ordinance *means a law enacted by the government of a municipality.*

Outfall means a point source as defined by 40 CFR § 122.2 at the point where a municipal separate storm sewer discharges to surface waters and does not include open conveyances connecting two municipal separate storm sewers, or pipes, tunnels or other conveyances which connect segments of the same

stream or other surface waters and are used to convey surface waters. (25 Pa. Code § 92a.32(a) and 40 CFR § 122.26(b)(9))

Owner or Operator *means the owner or operator of any "facility" or "activity" subject to regulation under the NPDES program. (25 Pa. Code § 92a.3(b)(1) and 40 CFR § 122.2)*

Permittee *means the owner or operator of a regulated small MS4 authorized to discharge under the terms of this General Permit.*

Point Source *means a discernible, confined, and discrete conveyance, including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, Concentrated Aquatic Animal Production Facility (CAAP), Concentrated Animal Feeding Operation (CAFO), landfill leachate collection system, or vessel or other floating craft from which pollutants are or may be discharged. (25 Pa. Code § 92a.2)*

Pollutant *means any contaminant or other alteration of the physical, chemical, biological, or radiological integrity of surface water which causes or has the potential to cause pollution as defined in section 1 of the Pennsylvania Clean Streams Law, 35 P.S. § 691.1. (25 Pa. Code § 92a.2)*

Qualifying *Development or Redevelopment Project means an earth disturbance activity that requires an NPDES permit for stormwater discharges associated with construction activity per 25 Pa. Code Chapter 102.*

Regulated Small MS4 *means any small MS4 that is covered by the federal Phase II stormwater program, either through automatic nationwide designation under 40 CFR § 122.32(a)(1) (via the Urbanized Area criteria) or by designation on a case-by-case basis by DEP pursuant to 40 CFR § 122.32(a)(2). "Regulated small MS4s" are a subset of "small MS4s" as defined in this section.*

Riparian Forest Buffer *means an area of permanent vegetation consisting of native trees, shrubs, forbs and grasses along surface water that is maintained in a natural state or sustainably managed to protect and enhance water quality, stabilize stream channels and banks, and buffer land use activities from surface waters.*

Small Municipal Separate Storm Sewer System (Small MS4) *means an MS4, as defined in this section, that is not a large or medium MS4 pursuant to 40 CFR §§ 122.26(b)(4) and 122.26(b)(7). The term small MS4 includes systems like separate storm sewer systems in municipalities, such as systems at military bases, large hospital or prison complexes, and highways and other thoroughfares. The term does not include separate storm sewers in very discrete areas, such as individual buildings. (25 Pa. Code § 92a.32(a) and 40 CFR § 122.26(b)(16))*

Standard Operating Procedure (SOP) *means a policy or set of procedures that are enacted by a non-municipal permittee to implement a stormwater management program.*

Storm Sewershed *means the land area that drains to an individual MS4 outfall from within the jurisdiction of the MS4 permittee. The term "combined storm sewershed" means the drainage areas of all MS4 outfalls that discharge to a specific surface water or to waters within the Chesapeake Bay watershed.* ***3800-PM-BCW0100d 5/2016 Permit***

Stormwater *means runoff from precipitation, snow melt runoff and surface runoff and drainage. "Stormwater" has the same meaning as "storm water." (25 Pa. Code § 92a.2)*

Structural BMPs *means stormwater storage and management practices including, but not limited to, wet ponds and extended detention outlet structures; filtration practices such as grassed swales, sand filters and filter strips; infiltration practices such as infiltration basins and infiltration trenches; and other BMPs as referenced in Chapter 6 of the Pennsylvania Stormwater BMP Manual (363-0300-002).*

Surface Waters *means perennial and intermittent streams, rivers, lakes, reservoirs, ponds, wetlands, springs, natural seeps, and estuaries, excluding water at facilities approved for wastewater treatment such as wastewater treatment impoundments, cooling water ponds and constructed wetlands used as part of a wastewater treatment process. (25 Pa. Code § 92a.2)*

Total Maximum Daily Load (TMDL) *means the sum of individual waste load allocations for point sources, load allocations for nonpoint sources and natural quality and a margin of safety expressed in terms of mass per time, toxicity, or other appropriate measures. (25 Pa. Code § 96.1)*

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

Waste Load Allocation (WLA) *means the portion of a surface water's loading capacity that is allocated to existing and future point source discharges. (25 Pa. Code § 96.1)*

Water Quality Criteria *means numeric concentrations, levels or surface water conditions that need to be maintained or attained to protect existing and designated uses. (25 Pa. Code § 93.1)*

Water Quality *Standards means the combination of water uses to be protected and the water quality criteria necessary to protect those uses. (25 Pa. Code § 92a.2)*

Appendix A: Published Notice, Public Comments, and Responses

Appendix B: Storm Sewershed/Planning Area Map

Appendix C: Land Use Map

Appendix D: Supporting Calculations

Appendix D: Supporting Calculations

1995 LOAD CALCULATION							
SOURCE	**AREA**	**TOTAL SEDIMENT LOADING RATE**	**TOTAL SEDIMENT**	**TOTAL NITROGEN LOADING RATE**	**TOTAL NITROGEN**	**TOTAL PHOSPHORUS LOADING RATE**	**TOTAL PHOSPHORUS**
UNITS	ACRES	LBS/ACRE	LBS	LBS/ACRE	LBS	LBS/ACRE	LBS
Hay/Past		153.18		1.52		0.38	
Cropland	773.04	1,727.47	1,335,403.41	6.98	5,395.82	1.81	1,399.20
Forest	387.92	136.22	52,842.46	0.15	58.19	0.03	11.64
Wetland	0.49	121.42	59.13	0.30	0.15	0.03	0.01
Disturbed	16.67	164.73	2,746.05	0.19	3.17	0.07	1.17
Turfgrass							
Open_Land	63.14	296.97	18,750.69	1.15	72.61	0.16	10.10
Bare_Rock							
Sandy_Areas							
Unpaved_Road							
Ld_Mixed							
Md_Mixed	13.18	1,741.77	22,948.90	6.20	81.69	0.87	11.46
Hd_Mixed	6.04	2,492.67	15,055.73	6.81	41.13	1.02	6.16
Ld_Residential	915.42	730.55	668,760.08	1.69	1,547.06	0.27	247.16
Md_Residential	2.05	1,741.36	3,574.89	6.16	12.65	0.87	1.79
Hd_Residential	1.29	2,495.94	3,217.90	6.61	8.52	1.01	1.30
TOTAL	**2179.23**		**2,123,359.23**		**7,220.98**		**1,690.00**

2012 LOAD CALCULATION							
SOURCE	**AREA**	**TOTAL SEDIMENT LOADING RATE**	**TOTAL SEDIMENT**	**TOTAL NITROGEN LOADING RATE**	**TOTAL NITROGEN**	**TOTAL PHOSPHORUS LOADING RATE**	**TOTAL PHOSPHORUS**
UNITS	ACRES	LBS/ACRE	LBS	LBS/ACRE	LBS	LBS/ACRE	LBS
Hay/Past		185.06	-	1.70	-	0.42	-
Cropland	310.13	1,818.62	564,008.67	7.27	2,254.65	1.91	592.35
Forest	352.24	174.45	61,449.09	0.17	59.88	0.05	17.61
Wetland	3.61	158.47	571.61	0.32	1.15	0.04	0.14
Disturbed	122.79	228.93	28,110.78	0.26	31.93	0.10	12.28
Turfgrass	24.05	202.10	4,860.55	0.78	18.76	0.43	10.34
Open_Land		220.20	-	0.92	-	0.09	-
Bare_Rock		-	-	-	-	-	-
Sandy_Areas		-	-	-	-	-	-
Unpaved_Road		-	-	-	-	-	-
Ld_Mixed		680.65	-	1.62	-	0.25	-
Md_Mixed	15.79	1,548.50	24,448.91	7.42	117.15	0.95	15.00
Hd_Mixed	26.71	2,184.96	58,360.38	7.87	210.21	1.09	29.11
Ld_Residential	1,301.39	686.92	893,954.12	1.66	2,160.31	0.26	338.36
Md_Residential	21.06	1,547.69	32,594.45	7.40	155.84	0.95	20.01
Hd_Residential	1.46	2,182.85	3,195.11	7.69	11.26	1.07	1.57
TOTAL	**2,179.23**		**1,671,553.68**		**5,021.13**		**1,036.77**

EXISTING BMP LOAD REDUCTION CALCULATION

FACILITY_ID	TYPE	BMP Drainage Area ID	BMP Effectiveness	Crop	Disturb.	Forest	HD Mixed Res.	MD Mixed Res.	HD Res.	MD Res.	LD Res.	Turf Golf	Water	Sediment Load	Load Reduction
EFT_BMP_1	Detention	EFT_RD_114	10%	1.38	2.23688	2.88					8.108		0.1628	9,123.81	912.38
EFT_BMP_2	Detention	EFT_RD_117a	10%		4.66						2.01			2,450.18	245.02
EFT_BMP_3	Detention	EFT_RD_118	10%		2.42						8.36		0.20	6,326.94	632.69
EFT_BMP_4	Detention	EFT_RD_142	10%	0.06	3.81						0.45			1,283.81	128.38
EFT_BMP_5	Detention	EFT_RD_144	10%		8.84		0.02				0.07		0.26	2,169.16	216.92
EFT_BMP_6	Detention	EFT_RD_141	10%	0.07	2.82						2.40			2,419.58	241.96
EFT_BMP_7	Detention	EFT_RD_155	10%			0.00					5.75			3,952.71	395.27
EFT_BMP_8	Detention	EFT_RD_93	10%		1.98	1.29					4.20			3,568.23	356.82
EFT_BMP_9	Inflitration - Dry	EFT_RD_117b	95%		1.20						1.65			1,409.93	1,339.43
EFT_BMP_10	Inflitration - Dry	EFT_RD_145	95%		9.63						0.55			2,583.59	2,454.41
EFT_BMP_11	Inflitration - Dry	EFT_RD_159	95%								2.06			1,416.13	1,345.33
EFT_BMP_12	Inflitration - Dry	EFT_RD_157	95%								5.98			4,106.37	3,901.05
EFT_BMP_13	Inflitration - Dry	EFT_RD_156	95%			0.08					4.47			3,081.67	2,927.59
EFT_BMP_14	Detention	EFT_RD_156	10%			0.08					4.47			3,081.67	308.17
EFT_BMP_15	Detention	EFT_RD_95	10%		2.59	0.53					15.37			11,241.88	1,124.19
EFT_BMP_16	Inflitration - Dry	EFT_RD_59b	95%		3.33	3.37					23.58	2.38		18,031.16	17,129.60
EFT_BMP_17	Inflitration - Dry	EFT_RD_57	95%		7.39	0.22			0.46		35.59			27,187.14	25,827.79
EFT_BMP_19	Inflitration - Dry	EFT_RD_61	95%			0.03					5.41			3,723.89	3,537.70
EFT_BMP_20	Inflitration - Dry	EFT_RD_55	95%		1.76	0.07					18.47			13,100.80	12,445.76
EFT_BMP_21	Infiltration - Wet	EFT_RD_58	95%	0.51							1.64	9.59		3,989.44	3,789.97
EFT_BMP_22	Detention	EFT_RD_59a	10%		6.32	2.98					18.60			14,743.34	1,474.33
EFT_BMP_23	Detention	EFT_RD_60	10%			0.01					5.26	0.00		3,617.68	361.77
EFT_BMP_25	Inflitration - Dry	EFT_RD_2d	95%	22.97				11.34			20.22	6.86		74,606.25	70,875.94
EFT_BMP_29	Detention	EFT_RD_3	10%								29.11	0.65		20,130.24	2,013.02
EFT_BMP_30	Infiltration - Wet	EFT_RD_2c	95%	10.86			1.84	2.42	0.55		45.68			60,079.04	57,075.09
EFT_BMP_31	Inflitration - Dry	EFT_RD_170b	95%	1.20	1.09	0.06					5.90	0.03	0.12	6,527.47	6,201.10
EFT_BMP_32	Inflitration - Dry	EFT_RD_78	95%			0.26				0.01	6.81			4,734.13	4,497.43
EFT_BMP_33	Inflitration - Dry	EFT_RD_88a	95%								12.68			8,706.97	8,271.62
EFT_BMP_34	Infiltration - Wet	EFT_RD_82	95%	0.03	1.41	1.87					11.87			8,848.98	8,406.53
EFT_BMP_35	Inflitration - Dry	EFT_RD_1	95%			2.88					47.29			32,985.31	31,336.04
EFT_BMP_37	Inflitration - Dry	EFT_RD_2a	95%								43.57			29,927.61	28,431.23
EFT_BMP_38	Detention	EFT_RD_77a	10%		0.11					10.32	12.12			24,318.02	2,431.80
EFT_BMP_39	Detention	EFT_RD_77a	10%		0.11					10.32	12.12			24,318.02	2,431.80
EFT_BMP_40	Detention	EFT_RD_77b	10%			0.52				8.64	17.95	1.89		26,171.44	2,617.14
EFT_BMP_41	Detention	EFT_RD_170a	10%		0.76	0.01					4.57		0.16	3,338.84	333.88
EFT_BMP_42	Detention	EFT_RD_79	10%	0.44		0.04					10.74	0.96	0.28	8,414.31	841.43
EFT_BMP_43	Infiltration - Wet	EFT_RD_88b	95%		1.05	1.22					10.58		0.29	7,765.15	7,376.89
EFT_BMP_44	Detention	EFT_RD_84	10%								4.74			3,259.12	325.91
EFT_BMP_45	Detention	EFT_RD_111	10%		1.99						1.25			1,315.16	131.52
EFT_BMP_46	Inflitration - Dry	EFT_RD_83	95%		1.11	1.57					10.69			7,875.14	7,481.38
EFT_BMP_47	Wet Pond	EFT_RD_35	60%	0.04		0.41					14.99			10,448.25	6,268.95
EFT_BMP_48	Wet Pond	EFT_RD_36	60%			0.94					6.10			4,351.87	2,611.12
EFT_BMP_49	Rain Garden	EFT_RD_24	90%	0.44							3.76			3,386.13	3,047.51
EFT_BMP_50	Detention Basin	EFT_RD_27	10%	0.26		0.44					11.46			8,415.01	841.50
EFT_BMP_51	Wet Pond	EFT_RD_42	60%	0.24		0.19					19.38			13,787.16	8,272.30
EFT_BMP_52	Wet Pond	EFT_RD_54	60%		2.09	0.47	0.02				19.39		0.71	14,045.59	8,427.35
EFT_BMP_53	Wet Pond	EFT_RD_26	60%			0.00	0.46	0.85			72.29		0.18	52,016.95	31,210.17
EFT_BMP_54	Wet Pond	EFT_RD_2b	60%	5.21	4.08	0.04					42.91		0.63	39,988.19	23,992.92
EFT_BMP_55	Wet Pond	EFT_RD_86	60%		0.55	1.13					23.99			16,805.20	10,083.12
EFT_BMP_56	Wet Pond	EFT_RD_139	60%	15.50	1.29	0.00					19.62		0.60	42,059.09	25,235.46
														Total	**442,166.69**

PROPOSED BMP LOAD REDUCTION CALCULATION

FACILITY_ID	TYPE	Soil Hydro. Group	BMP Drainage Area ID	BMP Effective.	Crop	Disturb.	Forest	HD Mixed Res.	LD Res.	Turf Golf	Water	Sediment Load	Load Reduction
pBMP-1	Riparian Buffer	C/D	15	50%	0.004		0.126		0.015	3.773	0	802.09	401.04
pBMP-2	Infiltration Basin	B	4	95%	1.382	2.237			8.108		0.163	8,620.84	8,189.80
pBMP-3	Infiltration Basin	B	2	95%		2.422			8.358		0.197	6,326.98	6,010.63
pBMP-4	Infiltration Trench	B	3	95%		1.987			1.252			1,314.90	1,249.16
pBMP-5	Riparian Buffer	B/D, B	20	50%			4.384		2.818			2,700.55	1,350.27
pBMP-6	Vegetated Swale	B	6	70%			4.117	1.171	0.326			3,500.75	2,450.52
pBMP-7	Vegetated Swale	B	5	70%			3.99		1.212			1,528.61	1,070.03
pBMP-8	Extended Detention	B, C/D	7	60%			4.652		21.59			15,642.21	9,385.33
pBMP-9	Vegetated Swale	B	12	70%	0.028	3.312	2.23	1.542	7.824			9,941.85	6,959.30
pBMP-10	Vegetated Swale	B	13	70%	0.379		3.059	1.498	4.262			7,423.65	5,196.55
pBMP-11	Infiltration Trench	B	10	95%	0.042		0.41		14.994			10,447.62	9,925.24
pBMP-12	Vegetated Swale	C/D	11	70%			0.942		6.096			4,351.81	3,046.27
pBMP-13	Rain Garden	B	16	90%			3.207	0.112	2.711			2,666.43	2,399.79
pBMP-14	Rain Garden	B	18	90%		0.306	0.801		0.752			726.35	653.72
pBMP-15	Infiltration Trench	B	17	95%			3.426	1.17	1.992			4,522.43	4,296.31
pBMP-16	Infiltration Basin	B	19	95%		1.095	2.492		0.482			1,016.51	965.68
pBMP-17	Riparian Buffer	B, C/D	8	50%	48.028		0.416		24.326			104,127.34	52,063.67
pBMP-18	Riparian Buffer	C/D	14	50%		3.862	0.234	0.713	1.752		0	3,686.30	1,843.15
pBMP-19	Riparian Buffer	B, C/D	9	50%	87.502	8.297	12.112		22.123			178,342.06	89,171.03
pBMP-20	Riparian Buffer	B	1	50%	5.527		1.091		1.26			11,107.36	5,553.68
												Total	**212,181.17**

Planning Level Unit Cost Development for Stormwater Best Management Practices (BMPs) [1]
PART 1: Initial Costs Per Impervious Acre Treated

BMP	Acres	Sediment Reduction	Impervious acres treated	Pre-Construction Costs[2]	Construction Costs[3]	Total Unit Costs	Land Costs[4]	Total Costs Including Land	Annualized Initial Costs[5]	Cost per pound of sediment removed
Riparian Buffers[6]	7.39	143,478.90	8.81	$406	$4,062	$33,023	$36,950	$69,973	$4,703	$0.49
Vegetated Swales	1.2	12,155.85	3.49	$4,000	$20,000	$83,760	$6,000	$89,760	$6,033	$7.38
Rain Gardens	0.21	3,053.50	0.99	$9,375	$37,500	$46,406	$1,050	$47,456	$3,190	$15.54
Infiltration Trenches	0.27	14,221.60	3.08	$16,700	$41,750	$180,026	$1,350	$181,376	$12,191	$12.75
Infiltration Basin	0.18	965.70	0.67	$16,700	$41,750	$39,162	$900	$40,062	$2,693	$41.48
Totals		**173,875.55**						**$428,627**	**$28,810**	**$2.47**

[1] Most costs are expressed per acre of impervious area treated, not per acre of BMP. Initial costs are assumed to take place in year T=0; annual costs are incurred from year T= 1 through year T= 20.

[2] Includes cost of site discovery, surveying, design, planning, permitting, etc. which, for various BMPs tend to range from 10% to 40% of BMP construction costs.

[3] Includes capital, labor, material and overhead costs, but not land costs, and associated implementation.

[4] For all stormwater BMPs that require land it is assumed that an easement cost of $5000 per acre.

[5] Initial BMP costs, including preconstruction, construction, and land costs, are amortized over 20 years at 3% to arrive at annualized initial costs.

[6] Cost for Riparian Buffers is from Chesapeake Bay Assessment Scenario Tool - Pennsylvania BMP Cost and are based on BMP acres and not impervious area treated.

Planning Level Unit Cost Development for Stormwater Best Management Practices (BMPs)
PART 2: Annual Maintenance Costs

Stormwater BMP	Routine and Intermittent Maintenance Costs			Average Annual Municipal Implementation Costs[3]	Maintenance, Intermittent Repair, and Implementation Costs[4]	
	Annual Routine Maintenance[1]	Average Annual Intermittent Maintenance[2]	Total Annual Maintenance Costs		Total (Over 20 Years)	Average Annual (Over 20 Years)
Riparian Buffers	$81	$600	$681	$10	$13,832	$692
Vegetated Swales	$400	$400	$800	$10	$16,207	$810
Rain Gardens	$750	$750	$1,500	$31	$30,620	$1,531
Infiltration Trenches	$418	$418	$835	$31	$17,320	$866
Infiltration Basin	$418	$418	$835	$31	$17,320	$866
Totals			**$4,651**		**$95,299**	**$4,765**

[1] Annual routine maintenance costs over 20 years; assumes a 3% discount rate, but also a 3% annual increase in maintenance cost which washes out the effect of discounting resulting in a constant present value annual cost throughout the 20 year period.

[2] Intermittent/corrective maintenance tasks are those that accrue every 3 to 5 years; these are averaged here over the 20 year period.

[3] Average annual municipal cost of inspecting and monitoring stormwater BMPs and enforcing construction and maintanance standards.

[4] Combined annual operating, implementation, and maintenance costs.

PARSING CALCULATIONS FOR EAST FALLOWFIELD TOWNSHIP TMDL PLAN

Land Area Approach 1 (land area served by MS4 = planning area plus remainder of UA)

A. Determine the total land area of the municipality within the TMDL watershed (EFT = 9994.9 acres).

B. Determine the total land area served by the MS4 within the municipality and within the TMDL watershed (EFT planning area and /or UA = 4356.1 acres).

C. Calculate the ratio of land areas by dividing the land area determined in Step B to the land area determined in Step A (EFT = 4356.1 / 9994.9) and apply it to both the existing MS4 pollutant load(s) and the WLA(s) that are assigned to the MS4 in the TMDL. The required percent (%) reduction of pollutant load should not change.

Inputs: Existing pollutant load = 803.23 tons/yr., WLA = 426.42 tons/yr., % reduction = **46.91%**

- Step A: 9994.9 acres
- Step B: 4356.1 acres
- Step C: Ratio = 4356.1 / 9994.9 = 0.44

Outputs

- Parsed existing load = 0.44 x 803.23 tons/yr. = 353.42 lbs./yr.
- Parsed WLA = 0.44 * 426.42 tons/yr. = 187.62 tons/yr.
- New % reduction [(352.42 – 187.62)/352.42] x 100 = **46.76%**

Land Area Approach 2 (land area served by MS4 = planning area)

A. Determine the total land area of the municipality within the TMDL watershed (EFT = 9994.9 acres).

B. Determine the total land area served by the MS4 within the municipality and within the TMDL watershed (EFT planning area = 2179.2 acres).

C. Calculate the ratio of land areas by dividing the land area determined in Step B to the land area determined in Step A (EFT = 2179.2 / 9994.9) and apply it to both the existing MS4 pollutant load(s) and the WLA(s) that are assigned to the MS4 in the TMDL. The required percent (%) reduction of pollutant load should not change.

Inputs: Existing pollutant load = 803.23 tons/yr., WLA = 426.42 tons/yr., % reduction = 46.91%

- Step A: 9994.9 acres
- Step B: 2179.2 acres
- Step C: Ratio = 2179.2 / 9994.9 = 0.22

Outputs

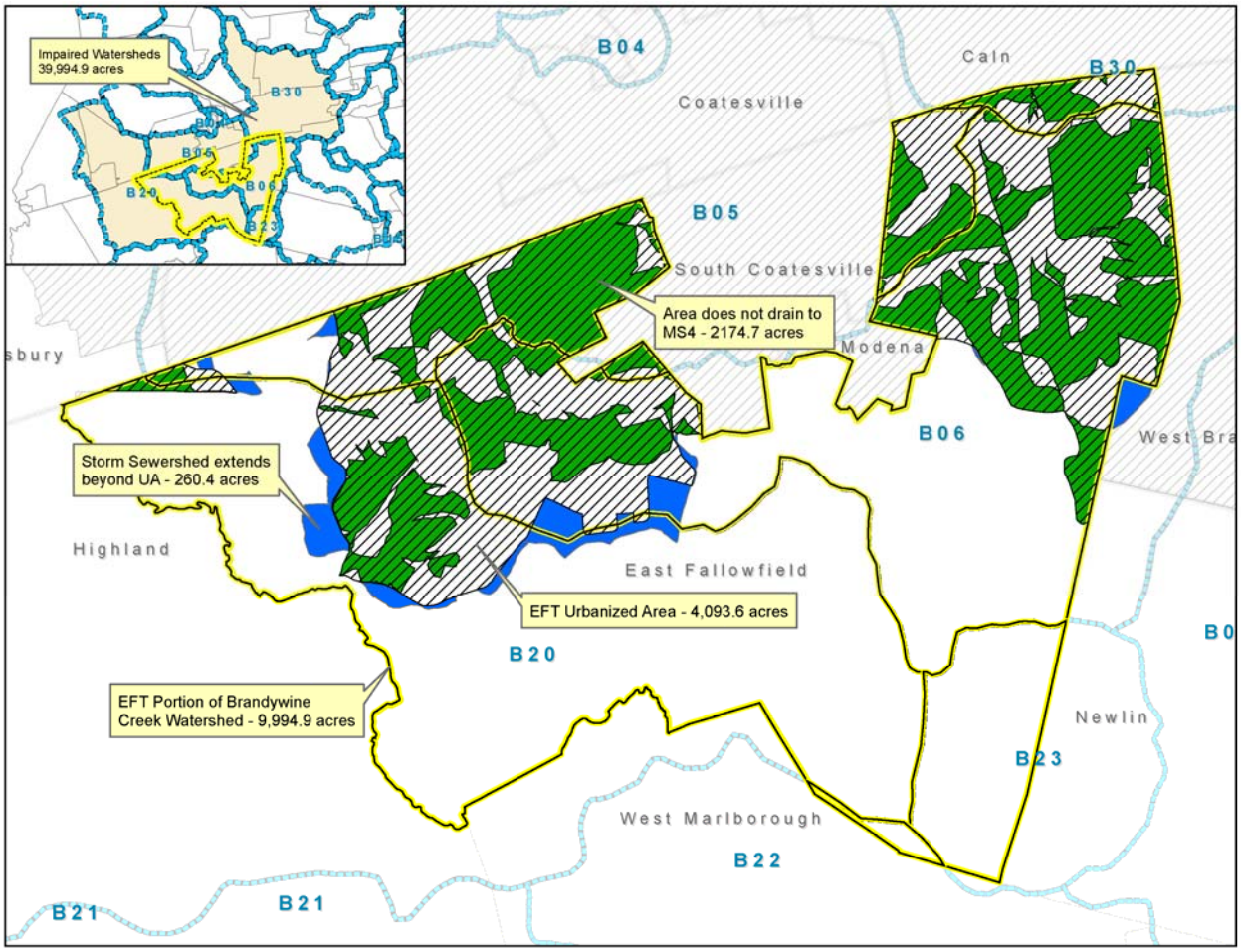
- Parsed existing load = 0.22 x 803.23 tons/yr. = 176.71 lbs./yr.
- Parsed WLA = 0.22 * 426.42 tons/yr. = 93.81 tons/yr.
- New % reduction [(176.71 – 93.81)/176.71] x 100 = **46.91%**

2. Weighted Land Use Approach

A. Determine the TMDL Planning Area.

The impaired watersheds (B05, B06, B20, B23, and B30) is 39,994.9 acres total, including municipalities outside of East Fallowfield Township. Figure 1 presents geographic features used to determine the planning area. The yellow line represents the impaired watershed boundary within East Fallowfield Township (9,994.9 acres). The striped area is the UA within East Fallowfield Township (4093.6 acres), and the blue area represents land outside of the UA in East Fallowfield Township that drains into the MS4 (260.4 acres). The green area represents land within the UA that does not drain into the MS4 (2174.7 acres). The TMDL Planning Area is represented by the following formula: UA + Additional Land Draining to MS4 – Land within UA Not Draining to MS4. In East Fallowfield Township, the planning area (storm sewershed) is **2,179.3 acres** (4,093.6 acres + 260.4 acres – 2,174.7 acres).

Figure 1 – Parsing Area Determination



B. Determine the land uses in the planning Area.

- Using a GIS-based analysis to recalculate the existing loads and WLAs using load rates from the TMDL. Recalculate the TMDL Existing load for the entire impaired stream watersheds.

Table 1. Existing sediment load for the entire watershed

Existing Load for the Entire Impaired Stream Watersheds			
Source	**Area (acres)**	**Sediment (lbs./yr.)**	**Unit Area Load (lbs./ac./yr.**
Hay/Pasture	3.83	586.37	153.18
Cropland	16,360.57	28,262,400.77	1727.47
Forest	11,934.66	1,625,738.70	136.22
Water	141.93	17,233.38	121.42
Disturbed	68.41	11,268.85	164.73
Open Land	1,703.18	505,792.47	296.97
Medium-Density Mixed Urban	967.58	1,700,783.10	1757.77
High-Density Mixed Urban	593.62	1,479,703.75	2492.67
Low-Density Residential	7,275.85	5,315,370.03	730.55
Medium-Density Residential	538.85	938,328.35	1741.36
High-Density Residential	406.22	1,013,900.75	2495.94
Totals	**39,991**	**40,871,107**	

- Calculate the TMDL existing load for the entire Township

Table 2. Existing Sediment Load in East Fallowfield Township.

Existing Load for Impaired Stream Watershed In East Fallowfield			
Source	**Area (acres)**	**Sediment (lbs./yr.)**	**Unit Area Load (lbs./ac./yr.**
Cropland	4,388.68	7,581,312.13	1727.47
Forest	3,280.35	446,848.94	136.22
Water	51.18	6,213.96	121.42
Disturbed	60.56	9,975.91	164.73
Open Land	263.79	78,336.54	296.97
Medium-Density Mixed Urban	75.78	133,211.83	1757.77
High-Density Mixed Urban	26.16	65,203.70	2492.67
Low-Density Residential	1,823.31	1,332,016.04	730.55
Medium-Density Residential	20.67	35,994.30	1741.36
High-Density Residential	4.44	11,090.38	2495.94
Totals	**9,995**	**9,700,204**	

- Calculate the "Allowable Load" using the Waste Load Allocation/Percent Reduction assigned to the East Fallowfield Township.

Table 3. Allowable Loading (WLA) for East Fallowfield Township.

Allowable Loading (WLA) for Impaired Stream Watershed In East Fallowfield				
Source	**Area (acres)**	**Sediment (lbs./yr.)**	**Unit Area Load (lbs./ac./yr.)**	**Reduction**
Cropland	4,388.68	3,556,393.52	810.36	53.09%
Forest	3,280.35	209,616.84	63.90	53.09%
Water	51.18	2,914.97	56.96	53.09%
Disturbed	60.56	4,679.70	77.27	53.09%
Open Land	263.79	36,747.67	139.31	53.09%
Medium-Density Mixed Urban	75.78	62,489.67	824.57	53.09%
High-Density Mixed Urban	26.16	30,587.05	1,169.31	53.09%
Low-Density Residential	1,823.31	624,848.72	342.70	53.09%
Medium-Density Residential	20.67	16,884.93	816.87	53.09%
High-Density Residential	4.44	5,202.50	1,170.85	53.09%
Totals	**9,995**	**4,550,366**	*	**

* WLA UAL = Table 2 UAL* 46.91%

** Reduction = 1 - WLA UAL/Table 2 UAL

- Calculate the revised MS4 existing load based on the planning area. There is no need to recalculate stream bank erosion because it is included in the approved land use loading rates found in: "Christina Basin Land Use Loading Rate Calculation Tool." Rev. May 12, 2017.

Table 4. MS4 Existing Load for East Fallowfield Township Planning Area

Existing Load in EFT Planning Area			
Source	**Area (acres)**	**Sediment (lbs./yr.)**	**Unit Area Load (lbs./ac./yr.**
Cropland	773.04	1,335,403.41	1727.47
Forest	387.92	52,842.46	136.22
Water	0.49	59.13	121.42
Disturbed	16.67	2,746.05	164.73
Open Land	63.14	18,750.69	296.97
Medium-Density Mixed Urban	13.18	23,159.71	1757.77
High-Density Mixed Urban	6.04	15,055.73	2492.67
Low-Density Residential	915.42	668,760.08	730.55
Medium-Density Residential	2.05	3,574.88	1741.36
High-Density Residential	1.29	3,217.90	2495.94
Totals	**2,179**	**2,123,570**	

- Calculate the revised Waste Load Allocation based on the planning area

Table 5. Allowable Loading (WLA) for East Fallowfield Township Planning Area.

Allowable Loading (WLA) in the EFT Planning Area				
Source	**Area (acres)**	**Sediment (lbs./yr.)**	**Unit Area Load (lbs./ac./yr.)**	**Reduction**
Cropland	773.04	626,437.74	810.36	53.09%
Forest	387.92	24,788.40	63.90	53.09%
Water	0.49	27.74	56.96	53.09%
Disturbed	16.67	1,288.17	77.27	53.09%
Open Land	63.14	8,795.95	139.31	53.09%
Medium-Density Mixed Urban	13.18	10,864.22	824.57	53.09%
High-Density Mixed Urban	6.04	7,062.64	1,169.31	53.09%
Low-Density Residential	915.42	313,715.35	342.70	53.09%
Medium-Density Residential	2.05	1,676.98	816.87	53.09%
High-Density Residential	1.29	1,509.52	1,170.85	53.09%
Totals	**2,179**	**996,167**	*	**

* WLA UAL = Table 4 UAL* 46.91%
** Reduction = 1 - WLA UAL/Table 4 UAL

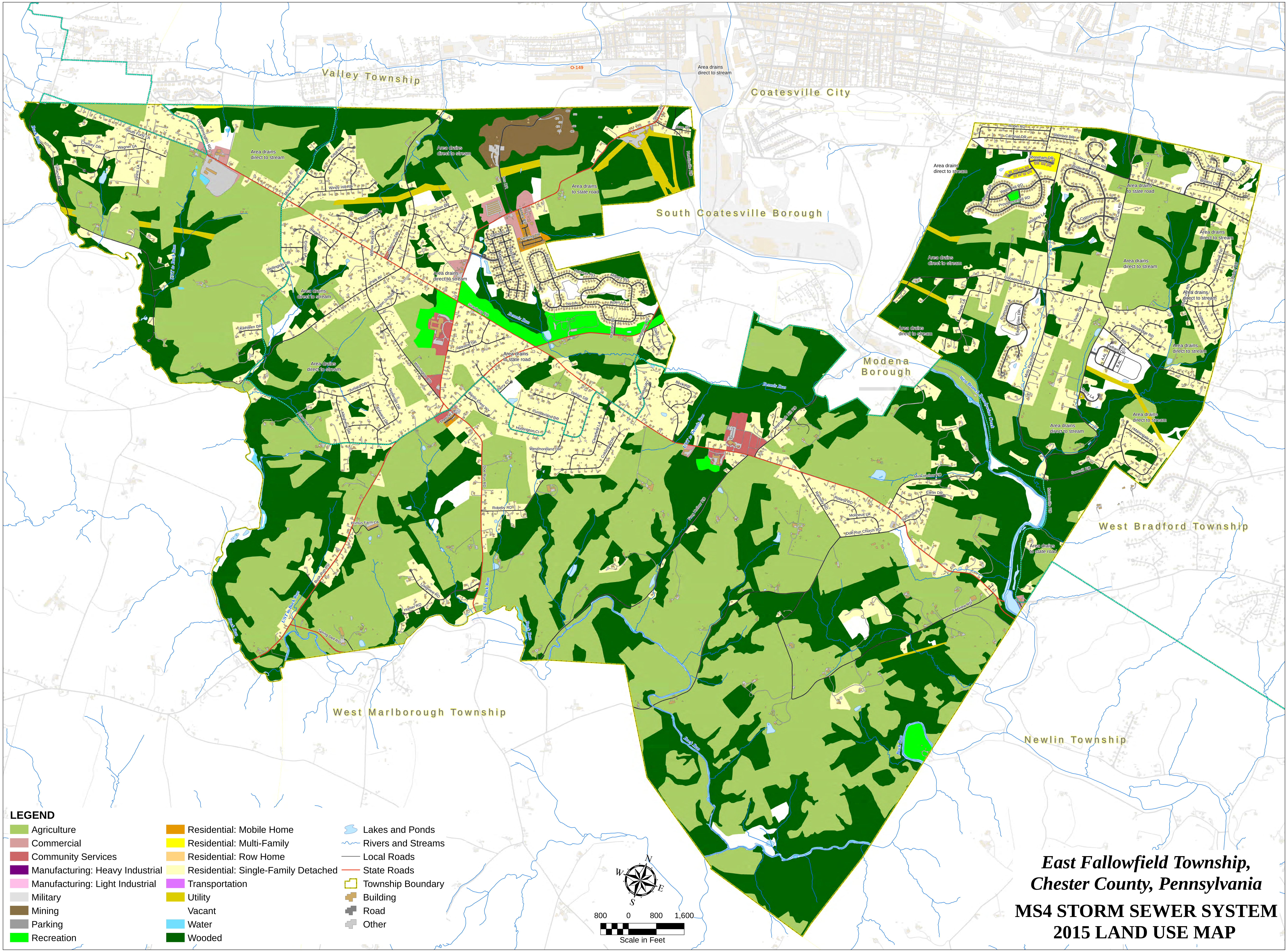
Summary

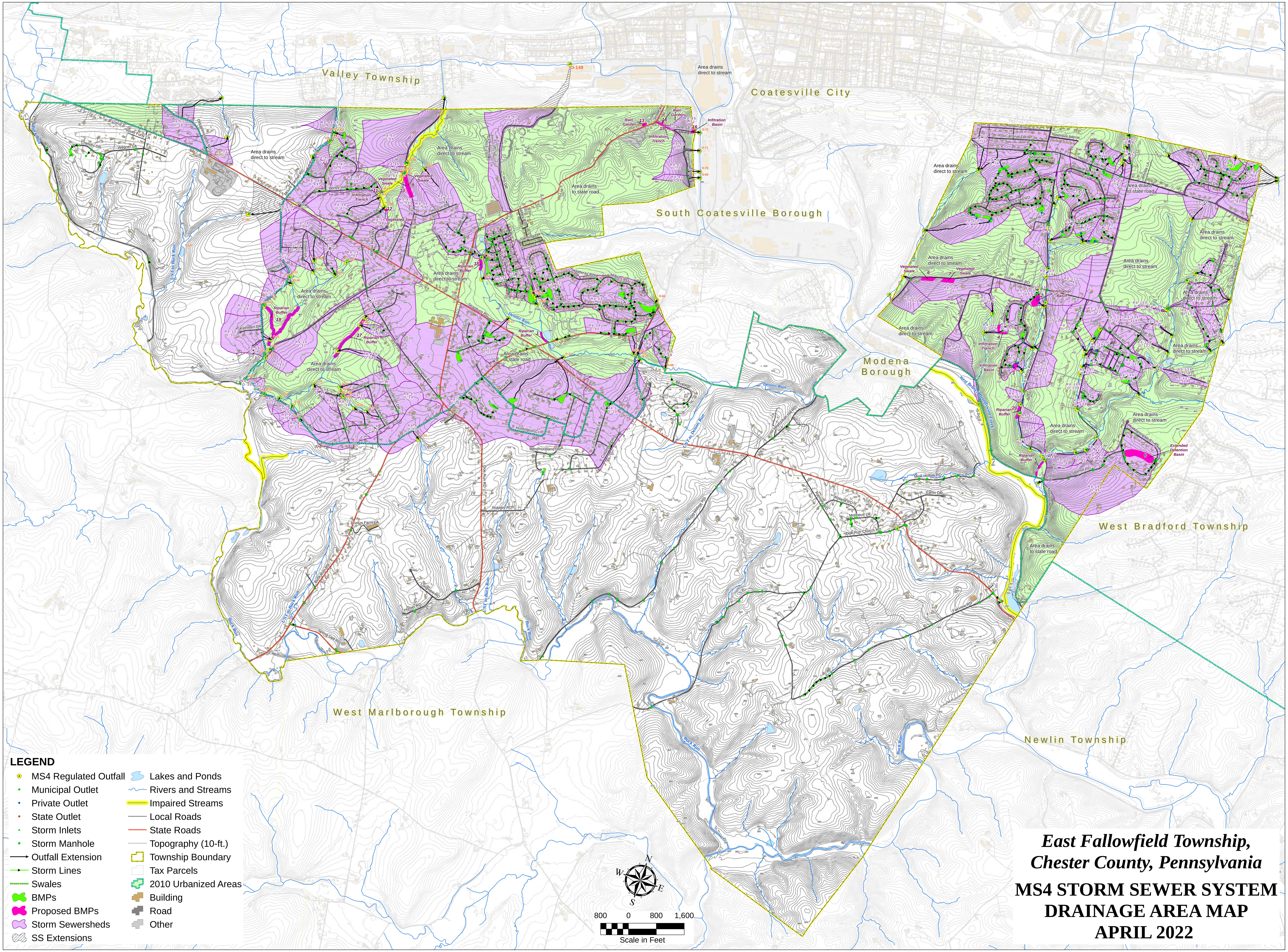
If parsing using the Weighted Land Use Approach the follow results would occur:

- The Christina River TMDL assigned sediment baseline load is 803.23 tons/yr. or 1,606,460 lbs./yr.
- The assigned Percent Reduction is 46.91% leaving a WLA of 426.42 tons/yr. or **852,840 lbs./yr.**
- Parsing results in a WLA of **996,167 lbs./yr.**

If parsing were to use the Land Area Approach above, the result would be as follows:

- The parsed Percent Reduction is 46.76% leaving a WLA of 427.64 tons/yr. or **855,280 lbs./yr.**


Valley Township
Coatesville City
South Coatesville Borough
Modena Borough
West Bradford Township
West Marlborough Township
Newlin Township
Area drains direct to stream
Area drains to state road
LEGEND
Agriculture
Commercial
Community Services
Manufacturing: Heavy Industrial
Manufacturing: Light Industrial
Military
Mining
Parking
Recreation
Residential: Mobile Home
Residential: Multi-Family
Residential: Row Home
Residential: Single-Family Detached
Transportation
Utility
Vacant
Water
Wooded
Lakes and Ponds
Rivers and Streams
Local Roads
State Roads
Township Boundary
Building
Road
Other
N
E
S
W
800 0 800 1,600
Scale in Feet
East Fallowfield Township,
Chester County, Pennsylvania
MS4 STORM SEWER SYSTEM
2015 LAND USE MAP


Valley Township
Coatesville City
South Coatesville Borough
Modena Borough
West Bradford Township
West Marlborough Township
Newlin Township
Area drains direct to stream
Area drains to state road
Vegetated Swale
Infiltration Trench
Infiltration Basin
Riparian Buffer
Rain Garden
Extended Detention Basin
LEGEND
MS4 Regulated Outfall
Municipal Outlet
Private Outlet
State Outlet
Storm Inlets
Storm Manhole
Outfall Extension
Storm Lines
Swales
BMPs
Proposed BMPs
Storm Sewersheds
SS Extensions
Lakes and Ponds
Rivers and Streams
Impaired Streams
Local Roads
State Roads
Topography (10-ft.)
Township Boundary
Tax Parcels
2010 Urbanized Areas
Building
Road
Other
N
E
S
W
800 0 800 1,600
Scale in Feet
East Fallowfield Township,
Chester County, Pennsylvania
MS4 STORM SEWER SYSTEM
DRAINAGE AREA MAP
APRIL 2022