Pine Creek Watershed TMDL

Berks and Chester Counties, Pennsylvania

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Executive Summary

The Pine Creek Watershed begins in Berks County and confluences with French Creek in Chester County, south eastern Pennsylvania. A Total Maximum Daily Load (TMDL) for nonpoint sediment loads was developed to address impairments noted in Pennsylvania's 2018 Section 303(d) and Pennsylvania Integrated Water Quality Monitoring and Assessment Report (Integrated Report). The impairments were documented during biological surveys of the aquatic life present in the watershed in 2016. Excessive siltation resulting from agricultural activities has been identified as the cause of these impairments in the basin. Because Pennsylvania does not currently have water quality criteria for sediment, a TMDL endpoint for sediment was identified using a reference watershed approach. The existing sediment loading in the Pine Creek Watershed is 1,038,750 pounds per year, 2,846 pounds per day. Based on a comparison with a similar, unimpaired watershed, Hay Creek, the maximum sediment loading that should allow water quality objectives to be met in the Pine Creek Watershed is 593,566 pounds per year, 1,626 pounds per day. Allocation of the sediment TMDL is summarized in Table 1.

Table 1. Summary of TMDL for Pine Creek Watershed in lbs./yr. & lbs./day

Summary of TMDL for the Pine Creek Watershed, lbs/yr:						
Pollutant	TMDL	MOS	WLA	LA	LNR	ALA
Sediment	593,566	59,357	5,936	528,274	19,055	509,219
Summary of TMDL for the Pine Creek Watershed, lbs/day:						
Pollutant	TMDL	MOS	WLA	LA	LNR	ALA
Sediment	1,626	163	16	1,447	52	1,395

Ten percent of the TMDL value was reserved explicitly as a margin of safety (MOS). The waste load allocation (WLA) is that portion of the total load assigned to National Pollutant Discharge Elimination System (NPDES) permitted point source discharges plus one percent of the TMDL value reserved for a bulk reserve WLA. There are no permitted facilities within the Pine Creek Watershed. The load allocation (LA) is the remaining portion of the TMDL after the MOS and WLA are removed. The LA is assigned to nonpoint sources; all sources other than the NPDES permitted point sources in the WLA. The LA is divided into loads not reduced (LNR) and the adjusted load allocation (ALA). LNR equal the sum of the wooded areas, wetland, open land and low, medium and high-density mixed development loads. The LNR is not targeted for reductions. The ALA equals the sum of hay/pasture lands, croplands and streambank loads. These source sectors are targeted for reductions as they produce the pollutants of concern. The TMDL established a 50% reduction to the targeted loads that make up the ALA. Ecological health in the watershed should be restored when a 43% reduction of the pollutants of concern is managed throughout the watershed.

Introduction

The Pine Creek Watershed is currently designated as Exception Value waters (EV). The designations of High Quality and Exceptional Value Waters fall under Special Protection providing additional Antidegradation Requirements found in Pennsylvania Code, Title 25., Environmental Protection, Chapter 93.4c. Of significance to this watershed, Chapter 93.4c (b) (2) *Nonpoint source control.* The Department will assure that cost-effective and reasonable best management practices for nonpoint source control are achieved. And Chapter 93.4a (d) *Protection of Exceptional Value Waters* – The water quality of Exceptional Value Waters shall be maintained and protected. Pine Creek is also designated as Migratory Fishes (MF) which provides the passage, maintenance and propagation of anadromous and catadromous fishes and other fishes that move to or from flowing waters to complete their life cycle in other waters.

This Total Maximum Daily Load (TMDL) calculation has been prepared for all segments in the Pine Creek Watershed, Attachment D. The watershed or drainage area of Pine Creek including its tributaries begins in Berks County and ends in Chester County at French Creek. The Pine Creek Watershed makes up approximately 6 square miles to its confluence with French Creek. Stream segments within the watershed are listed as impaired for siltation from agriculture. Land use in this watershed is composed of wooded areas 69.8%, wetlands 5.7%, mixed development 6.8%, open land 0.9% and agriculture including croplands 11.6% and hay/pasture 5.2%. Agriculture is a significant land use at 16.8% of the watershed basin.

The watershed is located within Hydrologic Unit Code (HUC) 02040203-Schuylkill. The TMDL was completed to address the impairments noted on the 2018 Pennsylvania 303(d) and Integrated Report, required under the Clean Water Act, and covers the listed segments shown in Table 2 and Attachment D. Siltation from agricultural activities has been listed as causing the impairment. The TMDL addresses siltation from streambanks, hay/pasture lands, and croplands.

Table 2. Integrated Water Quality Monitoring and Assessment Report Listed Segments

HUC: 02040203 – Schuylkill				
Watershed – Pine Creek, Berks County				
Source	EPA 305(b) Cause Code	Miles	Designated Use	Use Designation
Agriculture	Siltation	3.1	EV, MF	Aquatic Life

HUC= Hydrologic Unit Code
EV= Exceptional Value
MF= Migratory Fishes
See Attachments D & E, for more information on the listings and listing process.

Clean Water Act Requirements

Section 303(d) of the 1972 Clean Water Act requires states, territories, and authorized tribes to establish water quality standards. The water quality standards identify the uses for each waterbody and the scientific criteria needed to support that use. Uses can include designations for drinking water supply, contact recreation (swimming), and aquatic life support. Minimum goals set by the Clean Water Act require that all waters be "fishable" and "swimmable."

Additionally, the federal Clean Water Act and the United States Environmental Protection Agency's (EPA) implementing regulations (40 CFR 130) require:

- States to develop lists of impaired waters for which current pollution controls are not stringent enough to meet water quality standards (the list is used to determine which streams need TMDLs);
- States to establish priority rankings for waters on the lists based on severity of pollution and the designated use of the waterbody; states must also identify those waters for which TMDLs will be developed and a schedule for development;
- States to submit the list of waters to EPA every two years (April 1 of the even numbered years);
- States to develop TMDLs, specifying a pollutant budget that meets state water quality standards and allocate pollutant loads among pollution sources in a watershed, e.g., point and nonpoint sources; and
- EPA to approve or disapprove state lists and TMDLs within 30 days of final submission.

Pennsylvania Clean Streams Law Requirements and Agricultural Operations

All Pennsylvania farms are required by law to operate within regulatory compliance by implementing the requirements outlined in the Pennsylvania Clean Streams Law, Title 25 Environmental Protection, Part I Department of Environmental Protection, Subpart C Protection of Natural Resources, Article II Water Resources, Chapters: § 91.36 Pollution control and prevention at agricultural operations, § 92a.29 CAFO and § 102.4 Erosion and sediment control requirements. Water quality regulations can be found in Attachment G of this document and at the following website: http://www.pacode.com/secure/data/025/025toc.html

Agricultural regulations are designed to reduce the amount of sediment and nutrients reaching the streams and ground water in a watershed.

Integrated Water Quality Monitoring and Assessment Report, List 5, 303(d), Listing Process

Prior to developing TMDLs for specific waterbodies, there must be sufficient data available to assess which streams are impaired and should be listed on the Integrated Water Quality Monitoring and Assessment Report. Prior to 2004 the impaired waters were found on the 303(d) List; from 2004 to present, the 303(d) List was incorporated into the Integrated Water Quality Monitoring and Assessment Report and found on List 5. Please see Table 3 below for a breakdown of the changes to listing documents and assessment methods through time.

With guidance from EPA, the states have developed methods for assessing the waters within their respective jurisdictions. From 1996-2006, the primary method adopted by the Pennsylvania Department of Environmental Protection for evaluating waters found on the 303(d) lists (1998-2002) or in the Integrated Water Quality Monitoring and Assessment Report (2004-2006) was the Statewide Surface Waters Assessment Protocol (SSWAP). SSWAP was a modification of the EPA Rapid Bioassessment Protocol II (RPB-II) and provided a more consistent approach to assessing Pennsylvania's streams.

The assessment method required selecting representative stream segments based on factors such as surrounding land uses, stream characteristics, surface geology, and point source discharge locations. The biologist selected as many sites as necessary to establish an accurate assessment for a stream segment; the length of the stream segment could vary between sites. All the biological surveys included kick-screen sampling of benthic macroinvertebrates, habitat surveys, and measurements of pH, temperature, conductivity, dissolved oxygen, and alkalinity. Benthic macroinvertebrates were identified to the family level in the field.

The listings found in the Integrated Water Quality Monitoring and Assessment Reports from 2008 to present were derived based on the Instream Comprehensive Evaluation protocol (ICE). Like the superseded SSWAP protocol, the ICE protocol requires selecting representative segments based on factors such as surrounding land uses, stream characteristics, surface geology, and point source discharge locations. The biologist selects as many sites as necessary to establish an accurate assessment for a stream segment; the length of the stream segment could vary between sites. All the biological surveys include D-frame kicknet sampling of benthic macroinvertebrates, habitat surveys, and measurements of pH, temperature, conductivity, dissolved oxygen, and alkalinity. Collected samples are returned to the laboratory where the samples are then subsampled to obtain a benthic macroinvertebrate sample of 200 ± 20% (N = 160-240). The benthic macroinvertebrates in this

subsample are then identified to the generic level. The ICE protocol is a modification of the EPA Rapid Bioassessment Protocol III (RPB-III) and provides a more rigorous and consistent approach to assessing Pennsylvania's streams than the SSWAP.

After these surveys (SSWAP, 1998-2006 lists or ICE, 2008-present lists) were completed, the biologist determined the status of the stream segment. The decision was based on the performance of the segment using a series of biological metrics. If the stream segment was classified as impaired, it was then listed on the state's 303(d) List or presently the Integrated Water Quality Monitoring and Assessment Report with the source and cause documented.

Once a stream segment is listed as impaired, a TMDL must be developed for it. A TMDL addresses only one pollutant. If a stream segment is impaired by multiple pollutants, all of those pollutants receive separate and specific TMDLs within that stream segment. In order for the TMDL process to be most effective, adjoining stream segments with the same source and cause listing are addressed collectively on a watershed basis.

Table 3. Impairment Documentation and Assessment Chronology

Listing Date:	Listing Document:	Assessment Method:
1998	303(d) List	SSWAP
2002	303(d) List	SSWAP
2004	Integrated Report	SSWAP
2006	Integrated Report	SSWAP
2008-Present	Integrated Report	ICE

Integrated Report = Integrated Water Quality Monitoring and Assessment Report

SSWAP= Statewide Surface Waters Assessment Protocol

ICE= Instream Comprehensive Evaluation Protocol

Basic Steps for Determining a TMDL

Although all watersheds must be handled on a case-by-case basis when developing TMDLs, there are basic processes or steps that apply to all cases. They include:

1. Collection and summarization of pre-existing data (watershed characterization, inventory contaminant sources, determination of pollutant loads, etc.);

2. Calculate TMDL for the waterbody using EPA approved methods and computer models;
3. Allocate pollutant loads to various sources;
4. Determine critical and seasonal conditions;
5. Submit a draft report for public review and comments; and
6. EPA approval of the TMDL.

TMDL Elements: MOS + WLA + LA

A TMDL equation consists of a margin of safety (MOS), wasteload allocation (WLA) and load allocation (LA). The MOS is applied to account for uncertainties in the computational process. The MOS may be expressed implicitly by documenting conservative processes in the computations or explicitly by setting aside a portion of the allowable load. The WLA is the portion of the load assigned to a bulk reserve permitting allocation and to point sources that have National Pollutant Discharge Elimination System (NPDES) permitted discharges. The LA is the portion of the load assigned to nonpoint sources, all sources other than those within the WLA.

TMDL Approach

The TMDL developed for the Pine Creek Watershed addresses sediment. Because neither Pennsylvania nor EPA has water quality criteria for sediment, a method was developed to determine water quality objectives for this pollutant that should result in the impaired stream segments attaining their designated uses. The method employed for this TMDL is termed the Reference Watershed Approach.

Selection of the Reference Watershed

The reference watershed approach was used to estimate the appropriate sediment loading reduction necessary to restore healthy aquatic communities to the impaired watershed, Pine Creek. This approach is based on selecting a non-impaired, reference, watershed and estimating its current loading rates for the pollutants of concern. The objective of the process is to reduce loading rates of those pollutants to a level equivalent to or lower than the loading rates in the reference watershed. Achieving the

appropriate load reductions should allow the return of a healthy biological community to affected stream segments.

First, there are three factors that should be considered when selecting a suitable reference watershed: impairment status, similarity of physical properties, climate, terrain and size of the watershed. A watershed that the Department has assessed and determined to be attaining water quality standards shall be used as the reference. Second, a watershed that closely resembles the impaired watershed in physical properties such as land use/land cover, rainfall, runoff and soils should be chosen. Finally, the size of the reference watershed should be within ±30% of the impaired watershed area.

The search for a reference watershed that would satisfy the above characteristics was done by means of a desktop screening using several GIS shapefiles, including a watershed layer, soils layer, Landsat-derived land cover/use grid, and the stream assessment information found on the Department's GIS-based websites. The suitability of the chosen watershed was confirmed through discussions with Department staff as well as through field verification of conditions.

Based on the above criteria, a headwaters subwatershed of the Hay Creek Watershed was selected as the reference watershed for developing the Pine Creek Watershed TMDL. This portion of Hay Creek flows through the Historic Joanna Furnace in eastern Berks County, Pennsylvania and is attaining its anti-degradation designated use of High Quality - Cold Water Fishes as well as Migratory Fishes. Since Hay Creek is protected under anti-degradation standards like Pine Creek, it is a suitable reference. The attainment of designated uses is based on biological sampling done by the Department. There are no point sources in the Hay Creek Watershed. Table 4 compares the characteristics of the two watersheds.

Table 4. Comparison of the Pine Creek & Hay Creek Watersheds		
	Pine Creek Watershed	Hay Creek Watershed
Area, ac	3,737	2,872
Land Use Distribution	17% Agriculture 70% Forest 13% Other	9% Agriculture 76% Forest 15% Other
Soils	A - High Infiltration 38% B - Moderate Infiltration 40% B/D - Medium/Very Slow Infiltration 1% C - Slow Infiltration 7% C/D - Medium/Very Slow Infiltration 3% D - Very Slow Infiltration 12%	B - Moderate Infiltration 90% C - Slow Infiltration 2% C/D - Medium/Very Slow Infiltration 2% D - Very Slow Infiltration 6%
Average Rainfall, inches	44.7	44.2
Average Elevation, feet	655.8	671.3
Average Slope	7.9%	10.0%

The analysis of value counts for each pixel of the Multi-Resolution Land Characterization (MRLC) grid revealed that land cover/use distributions in both watersheds are similar. Agriculture and forest are significant land use categories in both the Pine Creek and Hay Creek Watersheds.

Hydrologic / Water Quality Modeling

The TMDL for this watershed was calculated using the “Model My Watershed” application (MMW), which is part of the WikiWatershed web toolkit, developed through an initiative of the Stroud Water Research Center. MMW is a replacement for the Mapshed desktop modelling application that has been used to derive approved sediment TMDLs in Pennsylvania. Both programs calculate sediment and nutrient fluxes using the “Generalized Watershed Loading Function Enhanced” (GWLF-E) model. However, MapShed was built using a MapWindow GIS package that is no longer supported, whereas

MMW operates with GeoTrellis, an open-source geographic data processing engine and framework. The MMW application is freely available for use at https://wikiwatershed.org/model/. In addition to the changes to the GIS framework, the MMW application continues to be updated and improved relative to its predecessor.

MMW provides the ability to simulate runoff and sediment load from a watershed given variable-size source areas (i.e., agricultural, forested, and developed land). The model used in MMW, GWLF-E, is a continuous simulation model that uses daily time steps for weather data and water balance calculations. Monthly calculations are made for sediment loads based on the daily water balance accumulated to monthly values.

GWLF-E is a combined distributed/lumped parameter watershed model that simulates 30-years of daily water, nitrogen, phosphorus and sediment fluxes. For surface loading, it is distributed in the sense that it allows multiple land use/cover scenarios, but each area is assumed to be homogenous with regard to various attributes considered by the model. Additionally, the model does not spatially distribute the source areas, but simply aggregates the loads from each source area into a watershed total; in other words, there is no spatial routing. For sub-surface loading, the model acts as a lumped parameter model using a water balance approach. No distinctly separate areas are considered for sub-surface flow contributions. Daily water balances are computed for an unsaturated zone as well as a saturated sub-surface zone, where infiltration is simply computed as the difference between precipitation and snowmelt minus surface runoff plus evapotranspiration.

With respect to the major processes simulated, GWLF-E models surface runoff using the Soil Conservation Service Curve Number (SCS-CN) approach with daily weather inputs of temperature and precipitation. Erosion and sediment yield are estimated using monthly erosion calculations based on the Universal Soil Loss Equation (USLE) algorithm with monthly rainfall-runoff coefficients and a monthly composite of KLSCP values for each source area (i.e., land cover/soil type combination). The KLSCP factors are variables used in the calculations to depict changes in soil loss erosion (K), the length slope factor (LS), the vegetation cover factor (C), and the conservation practices factor (P). A sediment delivery ratio based on watershed size and transport capacity, which is based on average daily runoff, is then applied to the calculated erosion to determine sediment yield for each source sector. Evapotranspiration is determined using daily weather data and a cover factor dependent upon land use/cover type. Finally, a water balance is performed daily using supplied or computed precipitation, snowmelt, initial unsaturated zone storage, maximum available zone storage, and evapotranspiration values.

For a detailed discussion of this modelling program, including a description of the data input sources, see https://wikiwatershed.org/documentation/mmw-tech/.

Watershed Assessment and Modeling

The Model My Watershed model was used to establish existing loading conditions for the Pine Creek and Hay Creek Watersheds. Modeling data and outputs have been attached to this TMDL as Attachment C. Department staff visited the Pine Creek and Hay Creek Watersheds to get a better understanding of existing conditions that might influence the model. For general observations, see pages 14-17. The individual watershed characteristics included:

Pine Creek Watershed (impaired)

- limited or absent riparian buffers in the agricultural areas
- sloping croplands lacking BMPs
- livestock in the stream

Hay Creek Watershed (reference)

- established and protected riparian forest buffers
- rain garden and storm water management at public historic site
- vegetated filter strips and buffers in croplands
- livestock exclusion fencing, buffers and rotational grazing
- manure and stormwater BMPs present

Based on field observations adjustments may be made to specific parameters used in the model. Any adjustments were as follows:

Pine Creek Watershed

- No changes to the model were necessary for the Pine Creek Watershed.

Hay Creek Watershed

- No changes to the model were necessary for the Hay Creek Watershed.

Figure 1. Agricultural stream segments lacking riparian buffers in the Pine Creek Watershed

Figure 2. Cattle with free access to the stream in the Pine Creek Watershed

Figure 3. Mature riparian forest buffer in the Hay Creek Watershed

Figure 4. Educational rain garden at the Historic Joanna Furnace in the Hay Creek Watershed

The model produced area information and sediment loading based on land use

(Tables 5 and 6).

Table 5. Existing Loading Values for Pine Creek, impaired			
Source	Area, ac	Sediment, lbs/yr	Unit Area Load, lbs/ac/yr
Hay/Past	195	19,692	101
Cropland	432	863,965	1,999
Wooded Areas	2,610	11,829	5
Wetland	215	844	4
Open Land	35	3,354	96
Low Intensity Mixed Development	249	2,672	11
Medium Intensity Mixed Development	2	355	144
Stream Bank		136,037	
Total	3,739	1,038,750	278

Table 6. Existing Loading Values for Hay Creek, reference			
Source	Area, ac	Sediment, lbs/yr	Unit Area Load, lbs/ac/yr
Hay/Pasture	153	17,538	115
Cropland	106	263,381	2,481
Wooded Areas	2,185	11,820	5
Wetland	15	58	4
Open Land	7	784	106
Low Intensity Mixed and Open Development	393	4,302	11
Medium Intensity Mixed Development	10	643	65
High Intensity Mixed Development	2	100	40
Streambank		157,278	
Total	2,872	455,904	159

For Tables 6 and 7, the streambank sediment loads are calculated by a streambank routine built into the model. This routine uses linear streambank miles rather than area.

Development of Sediment TMDL

The target TMDL value for the Pine Creek Watershed was established based on current loading rates for sediment in the Hay Creek reference watershed. Hay Creek is currently designated as anti-degradation, High Quality - Cold Water Fishes (HQ-CWF) and Migratory Fishes (MF). Previous biological assessments have determined that the watershed is attaining its designated uses. Reducing the loading rates of sediment in the Pine Creek Watershed to levels equal to or less than the reference watershed should allow for the reversal of current use impairments.

As described in the previous section, sediment loading rates were computed for the Hay Creek Watershed using the model. The target TMDL value for sediment was determined by multiplying the unit area loading rates for the Hay Creek Watershed by the total watershed area of the Pine Creek Watershed, Table 7. TMDL values are commonly expressed as annual loads in this document. To find the daily loads, divide the annual loads by 365 days of the year.

Table 7. TMDL Values for the Pine Creek Watershed

Pollutant	Loading Rate in Reference, lb/ac/yr	Total Area in impaired Watershed, ac	Target TMDL Value, lb/yr	Target TMDL Value, lb/day
Sediment	159	3,739	593,566	1,626

* takes into account rounding in previous calculations

The target TMDL value was then used as the basis for load allocations and reductions in the Pine Creek Watershed as follows:

TMDL = MOS + WLA + LA

LA = ALA + LNR

where:

TMDL = Total Maximum Daily Load

MOS = Margin of Safety

WLA = Waste Load Allocation (Point Sources)

LA = Load Allocation (Nonpoint Sources)

ALA = Adjusted Load Allocation

LNR = Loads Not Reduced

Margin of Safety

The margin of safety (MOS) is that portion of the pollutant loading that is reserved to account for any uncertainty in the data and computational methodology used for the analysis. For this analysis, the MOS is explicit. Ten percent of the targeted TMDL for sediment was reserved as the MOS. Using ten percent of the TMDL load is based on professional judgment and will provide an additional level of protection to the designated uses of Pine Creek.

593,566 lbs/yr TMDL * 0.1 = 59,357 lbs/yr MOS

Waste Load Allocation

The waste load allocation (WLA) portion of the TMDL equation is the sum of the pollutant loading assigned to permitted point sources and a bulk reserve. Each point source discharge in a watershed is assigned pollutant limits found in its accompanying National Pollutant Discharge Elimination System (NPDES) permit. These limits are used to calculate the sediment loadings included in the WLA. The bulk reserve is explicit and is calculated as one percent of the targeted TMDL. This bulk reserve enables the TMDL to account for the dynamic nature of permit activity. There are currently no NPDES permitted discharges in the Pine Creek Watershed. Therefore, only the bulk reserve is factored into the total WLA, Table 8.

593,566 lbs/yr TMDL * 0.01 = 5,936 lbs/yr bulk reserve = 5,936 lbs/yr WLA

Table 8. Waste Load Allocation for the Pine Creek Watershed

	Facility Name	Load, lb/yr	Load, lb/day
Bulk Reserve	NA	5,936	16

Load Allocation

The load allocation (LA) is the portion of the TMDL assigned to nonpoint sources, all sources other than permitted sources. The LA contains loads targeted for reduction and background loads that are not targeted for reduction. The LA for sediment was computed by subtracting the MOS and WLA values from the TMDL value.

593,566 lbs/yr TMDL – 59,357 lbs/yr MOS – 5,936 lbs/yr WLA = 528,274 lbs/yr LA

Loads Not Reduced and Adjusted Load Allocation

The Load Allocation (LA) is comprised of loads not reduced (LNR) and the adjusted load allocation (ALA). The LNR are the nonpoint source loads in the watershed that are not targeted for reduction. The ALA is made up of the nonpoint source loads targeted for reductions to attain the overall TMDL reduction goal. The ALA is the base TMDL element that all non-point source loads being reduced must collectively not exceed and is calculated as follows:

First, the sum of the LNR is calculated.

11,829 lbs/yr Wooded Areas + 2,672 lbs/yr Low Intensity Mixed Development + 355 lbs/yr Medium Intensity Mixed Development + 844 lbs/yr Wetland + 3,354 lbs/yr Open Land = 19,055 lbs/yr LNR

Next, the LNR is subtracted from the LA to find the ALA, Table 9.

Table 9. Load Allocations, Loads Not Reduced and Adjusted Load Allocations		
	Sediment, lbs/yr	Sediment, lbs/day
Load Allocation (LA)	528,274	1,447
Loads Not Reduced (LNR):	19,055	52
Wooded Areas	11,829	32
Low Intensity Mixed Development	2,672	7
Medium Intensity Mixed Development	355	1
Wetland	844	2
Open Land	3,354	9
Adjusted Load Allocation (ALA)	509,219	1,395

528,274 lbs/yr LA – 19,055 lbs/yr LNR = 509,219 lbs/yr ALA

The ALA is further analyzed using the Equal Marginal Percent Reduction (EMPR) allocation method described in Attachment B. The EMPR calculates the sediment load reductions per targeted sources to meet the TMDL. Although the Pine Creek Watershed TMDL was developed to address impairments caused by agricultural activities such as hay/pastureland and cropland, these sources were not the only sources considered for reductions. Streambanks are also significant contributors to the sediment load in the watershed. Thus, streambanks were included into the ALA and targeted for reduction.

Calculation of Sediment Load Reductions

The adjusted load allocation (ALA) established in the previous section represents the sediment load that is available for allocation between Hay/Pasture, Cropland and Streambanks in the Pine Creek Watershed. Data needed for load reduction analyses, including land use distribution, were obtained by GIS analysis. The Equal Marginal Percent Reduction (EMPR) allocation method, Attachment B, was used to distribute the ALA between the three land use types and streambanks. The process is summarized below:

1. Each land use/source load is compared with the total allocable load to determine if any contributor would exceed the allocable load by itself. The evaluation is carried out as if each source is the only contributor to the pollutant load to the receiving waterbody. If the contributor exceeds the allocable load, that contributor would be reduced to the allocable

load. This is the baseline portion of EMPR. For this evaluation cropland exceeded the allocable load.

2. After any necessary reductions have been made in the baseline, the multiple analyses are run. The multiple analyses will sum the baseline loads and compare them to the total allocable load. If the allocable load is exceeded, an equal percent reduction will be made to all contributors' baseline values. After any necessary reductions in the multiple analyses, the final reduction percentage for each contributor can be computed. For this evaluation the allocable load was exceeded. The equal percent reduction, i.e., the ALA divided by the summation of the baselines, worked out to a 23% reduction for the targeted land uses/sources except cropland which received a 55% reduction. The aggregated load reduction from the source sectors targeted under the ALA is 50%. Ecological health should be attained when a 43% reduction of the pollutants of concern is managed throughout the watershed.

Tables 10 and 11 contain the results of the EMPR for Hay/Pasture, Cropland and Streambanks in the Pine Creek Watershed. The load allocation for each land use is shown along with the percent reduction of current loads necessary to reach the targeted ALA.

Table 10. Sediment Load Allocations for Source Sectors in the Pine Creek Watershed, Annual Values

		Allowable Loading	Load Allocation	Current Loading	Current Load	Percent Reduction
Land Use	Acres	lbs/acre/yr	lbs./yr	lbs/acre/yr	lbs/yr	
Cropland	432	902	389,961	1,999	863,965	55%
Hay/Pasture	195	77	15,080	101	19,692	23%
Streambanks			104,178		136,037	23%
AGGREGATE			509,219		1,019,695	50%

Table 11. Sediment Load Allocations for Source Sectors in the Pine Creek Watershed, Daily Values						
		Allowable Loading	Load Allocation	Current Loading	Current Load	Percent Reduction
Land Use	Acres	lbs/acre/day	lbs/day	lbs./acre/day	lbs/day	
Cropland	432	2.5	1,068.4	5.5	2,367.0	55%
Hay/Pasture	195	0.2	41.3	0.3	54.0	23%
Streambanks	-		285.4		372.7	23%
AGGREGATE		ALA	1,395.1		2,793.7	50%

TMDL Summary

The sediment TMDL established for the Pine Creek Watershed consists of a Waste Load Allocation (WLA), Margin of Safety (MOS) and Load Allocation (LA). The LA is broken into Loads Not Reduced (LNR) and Adjusted Load Allocation (ALA) for further analysis. The individual components of the Pine Creek Watershed TMDL are summarized in Table 12.

Table 12. TMDL Components for the Pine Creek Watershed		
Component	Sediment (lbs./yr.)	Sediment (lbs./day)
TMDL (Total Maximum Daily Load):	593,566	1,626
WLA (Waste Load Allocation)	5,936	16
MOS (Margin of Safety)	59,357	163
LA (Load Allocation)	528,274	1,447
LA:		
LNR (Loads Not Reduced)	19,055	52
ALA (Adjusted Load Allocation)	509,219	1,395

TMDL = WLA + MOS + LA

LA = ALA + LNR

Consideration of Critical Conditions

The model is a continuous simulation model that uses daily time steps for weather data and water balance calculations. Monthly calculations are made for sediment loads based on daily water balance accumulated in monthly values. Therefore, all flow conditions are taken into account for loading calculations. Because there is generally a significant lag between the introduction of sediment to a waterbody and the resulting impact on beneficial uses, establishing this TMDL using average annual conditions is protective of the waterbody.

Consideration of Seasonal Variations

The continuous simulation model used for this analysis considers seasonal variation through a number of mechanisms. Daily time steps are used for weather data and water balance calculations. The model accounts for growing season and hours of daylight for each month. The model also considers the months of the year when manure is applied to the land. The combination of these actions by the model accounts for seasonal variability.

Consideration of Background Contributions

The model accounts for all landuses within the watershed and their respective contributions to the sediment load. The background sources of sediment within the watershed are from mixed development, forested and wetland areas. There are no additional upstream sources of sediment to this watershed as the entire Pine Creek Watershed including all headwaters was assessed and modeled. The landuses in this TMDL that are targeted for reductions are significant and anthropogenic sources of sediment to the watershed, thus will not be considered background. They include streambanks, hay/pasture and cropland.

Recommendations

Sediment reduction in the TMDL is allocated to nonpoint sources in the watershed including agricultural activities and streambanks. Implementation of best management practices (BMPs) in these affected areas is called for according to this TMDL document. The proper implementation of these BMPs should achieve the loading reduction goals established in the TMDL.

From an agricultural perspective, reductions in the amount of sediment reaching streams in the watershed can be made by implementing an Erosion and Sediment Control Plan or Conservation Plan and a Nutrient Management Plan. Implementation of these plans is required under the Pennsylvania Clean Streams Law, Title 25 Environmental Protection.

To attain the goals of the TMDL, further reductions to the pollutants of concern are made by implementing a targeted suite of BMPs. This could include things like the establishment of cover crops, strip cropping, vegetated filter strips, residue management, no till/conservation tillage, crop rotation, contour farming, terracing, stabilizing heavy use areas and proper management of storm water. Vegetated or riparian forest buffers are acceptable BMPs to intercept any runoff from farm fields and pastures. For the pasturing of farm animals and animal heavy use areas, acceptable BMPs may include critical area planting, waste water treatment strips, constructed wetlands, animal trails and walkways, diversions, roof runoff structures, manure storage, rotational grazing, livestock exclusion fencing and riparian forest buffers. Some of these BMPs were observed in the impaired watershed. However, they were more extensively used in the unimpaired reference watershed. Since both watersheds have similar agricultural activities, it is apparent that the greater use of BMPs in the reference watershed has contributed to its ability to maintain its attainment status and ecological health.

Fencing livestock out of the riparian area while reestablishing riparian forest buffers along the stream and wetland systems is important because wetlands and riparian forest buffers provide connectivity of land and water while protecting against erosive flows and freeze thaw erosion exacerbated in anthropogenic watersheds. The buffered streams and wetlands also provide nesting and nursery sites as well as shade, cover, food and stable temperatures that ensure viable habitat is available to maintain waters designated as high quality - cold water fishes.

Once reestablished, wetlands and riparian forest buffers act as nutrient and sediment sinks while the associated root structures and vegetative matter protect streambanks from the ravages of increasingly numerous and intense flooding events associated with anthropogenic land use change and climate change. Furthermore, the stable, diverse and concentrated biological communities maintained within functioning wetland and riparian systems assimilate and remove nutrients and sediment from the water column instead of allowing them to pass downstream unchecked. Thus, wetlands and riparian forest buffers work directly toward attaining the goals of the TMDL by reducing pollutant loads in the watershed and stabilizing streambanks.

Economic gains are attained as wetland and riparian forest buffer protection is attained. For example, as ecological conditions improve, dairy cattle become healthier resulting in their milk becoming more valuable. Improved property values are also linked to improved and stabilized ecological conditions.

Wetlands and riparian forest buffers also provide critical habitat to rare and sensitive aquatic, amphibious and terrestrial organisms including migratory species. Restoring and protecting this green infrastructure helps to provide connectivity to fractured ecosystems, a valuable ecological restoration technique.

Further ground truthing should be performed to assess the extent of existing BMPs and to determine the most cost effective and environmentally protective combination of BMPs required for meeting the sediment reduction goals outlined in this report. A combined effort involving key personnel from the Department, County Conservation District, appropriate River Basin Commission and other state and local agencies and/or watershed groups would be the most effective in accomplishing any ground truthing exercises. Development of a more detailed watershed implementation plan (WIP) is recommended.

Public Participation

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* on June 27, 2020 to foster public comment on the allowable loads calculated.

Literature Cited

Stroud Water Research Center. (2018). Model My Watershed [Software]. Version 1.24.0 Available from https://wikiwatershed.org/

Stroud Water Research Center. (2018). Model My Watershed Technical Documentation. https://wikiwatershed.org/documentation/mmw-tech/

Attachment A

Maps of Impaired and Reference Watersheds

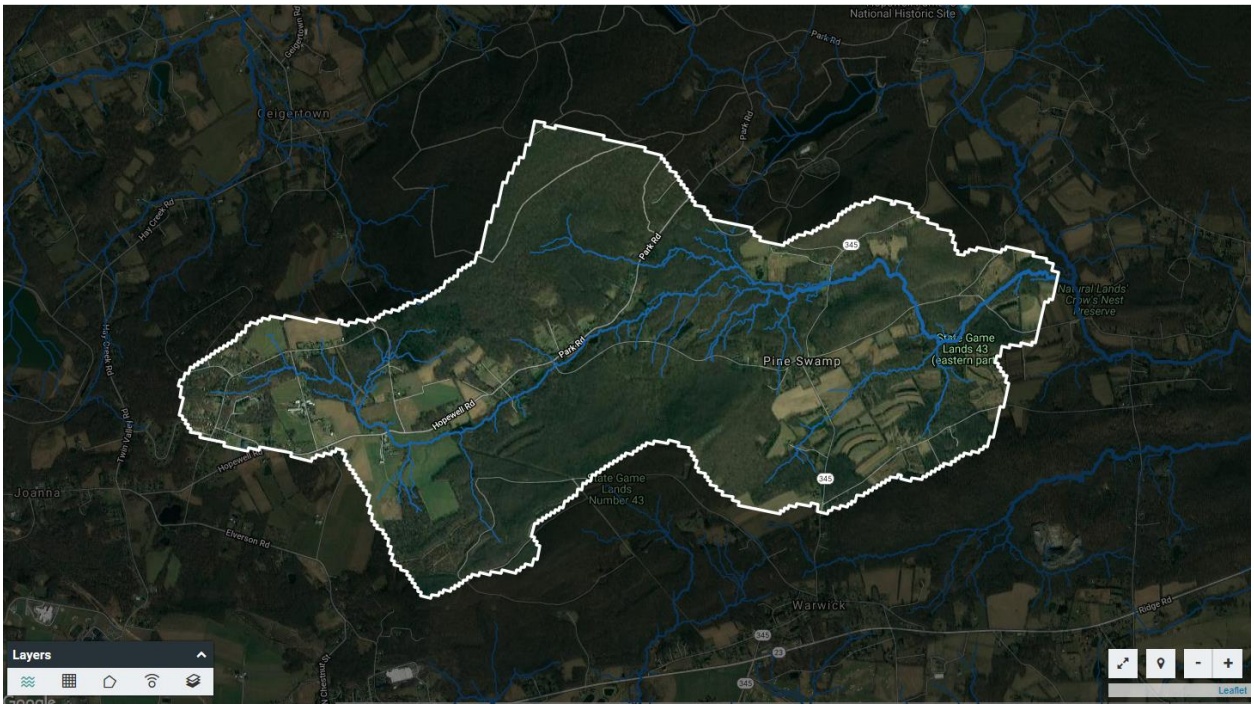

Figure A1. Pine Creek Watershed, Berks and Chester Counties

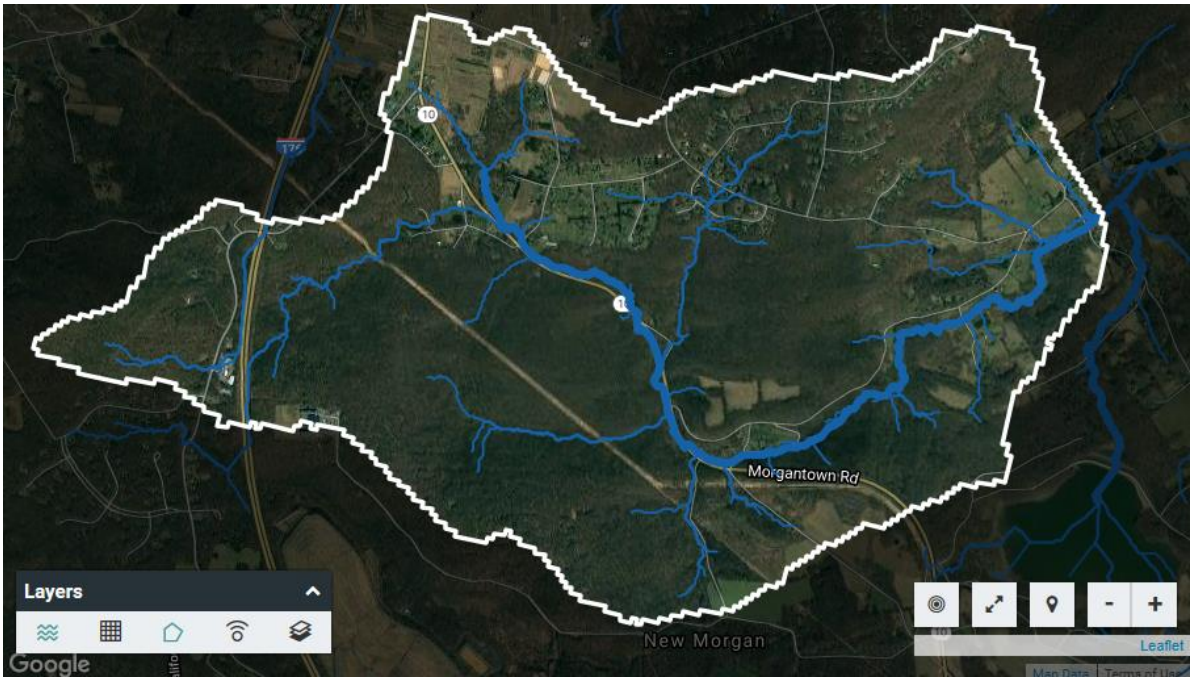

Figure A2. Hay Creek, Berks County

Attachment B

Equal Marginal Percent Reduction Method

Equal Marginal Percent Reduction (EMPR) (An Allocation Strategy)

The Equal Marginal Percent Reduction (EMPR) allocation method was used to distribute Adjusted Load Allocations (ALAs) between the appropriate contributing nonpoint sources. The load allocation and EMPR procedures were performed using a MS Excel spreadsheet. The 5 major steps identified in the spreadsheet are summarized below:

Step 1: Calculation of the TMDL based on impaired watershed size and unit area loading rate of reference watershed.

Step 2: Calculation of Adjusted Load Allocation based on TMDL, Margin of Safety, Waste Load Allocation and existing loads not reduced.

Step 3: Actual EMPR Process:

a. Each land use/source load is compared with the total ALA to determine if any contributor would exceed the ALA by itself. The evaluation is carried out as if each source is the only contributor to the pollutant load of the receiving waterbody. If the contributor exceeds the ALA, that contributor would be reduced to the ALA. If a contributor is less than the ALA, it is set at the existing load. This is the baseline portion of EMPR.

b. After any necessary reductions have been made in the baseline, the multiple analyses are run. The multiple analyses will sum all of the baseline loads and compare them to the ALA. If the ALA is exceeded, an equal percent reduction will be made to all contributors' baseline values. After any necessary reductions in the multiple analyses, the final reduction percentage for each contributor can be computed.

Step 4: Calculation of total loading rate of all sources receiving reductions.

Step 5: Summary of existing loads, final load allocations, and percent reduction for each pollutant source.

1	AL				2	ALA=TMDL-(WLA+MOS+LNR)						
	AL = Sediment loading rate in ref. * Impaired Acres					509,218.72	509,218.72					
	593,565.89											
		Annual				Recheck	% reduction	Load			Allowable	%
3		Avg. Load	Load Sum	Check	Initial Adjust	Adjust	allocation	Reduction	Initial LA	Acres	Loading Rate	Reduction
	CROPLAND	863,965.31	1,019,695.19	bad	509,218.72		0.77	119,258.20	389,960.52	432.10	902.48	54.9%
	HAY/PASTURE	19,692.41		good	19,692.41	155,729.89	0.03	4,611.93	15,080.48	195.06	77.31	23.4%
	STREAMBANK	136,037.48		good	136,037.48		0.20	31,859.76	104,177.72	-		23.4%
					664,948.61		1.00		509,218.72			
4	All Ag. Loading Rate	645.83										
			Allowable		Current	Current	**Reduction**					
	Land Use	Acres	loading rate	Final LA	Loading Rate	Load	**Goal**			CURRENT LOAD	FINAL LOAD ALLOCATION	
5	CROPLAND	432	902	389,961	1,999	863,965	**55%**		HAY/PASTURE	19,692	15,080	
	HAY/PASTURE	195	77	15,080	101	19,692	**23%**		STREAMBANK	136,037	104,178	
	STREAMBANK	-		104,178		136,037	**23%**		CROPLAND	863,965	389,961	
	ALA			509,219		1,019,695	**50%**		ALA	1,019,695	509,219	

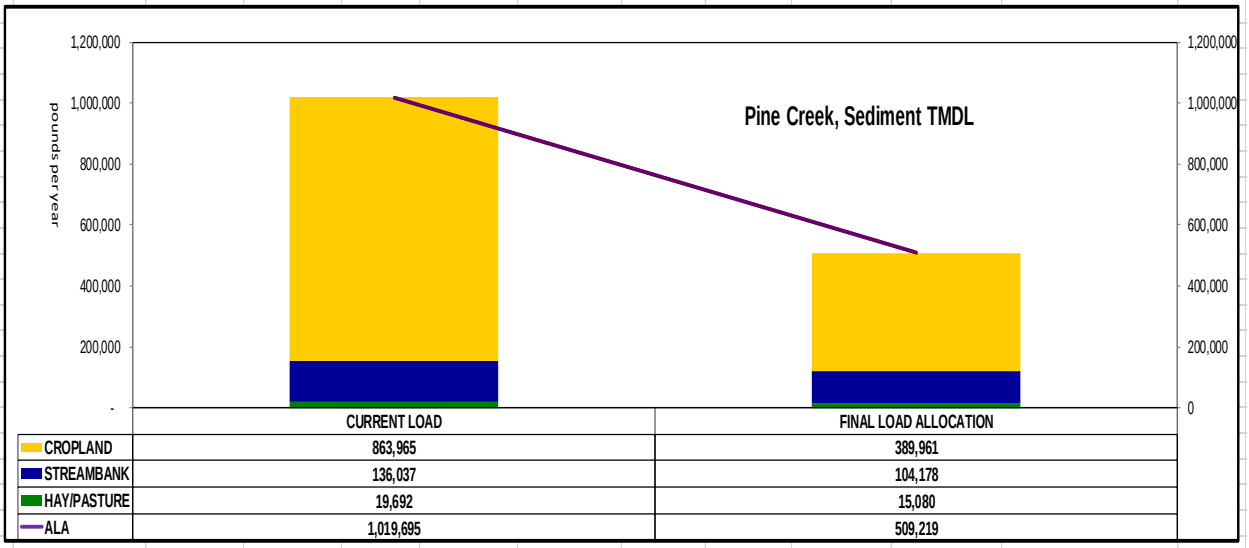

Table B1. Equal Marginal Percent Reduction calculations for the Pine Creek Watershed

Attachment C

Modeling Data Tables

Sources	Sediment (kg)	Total Nitrogen (kg)	Total Phosphorus (kg)
Hay/Pasture	8,930.80	46.2	19.9
Cropland	391,821.00	1,330.70	514.1
Wooded Areas	5,364.70	59.6	8.8
Wetlands	382.9	42.8	2.7
Open Land	1,520.90	12.7	2
Barren Areas	0	0	0
Low-Density Mixed	53.7	1.1	0.1
Medium-Density Mixed	129	2.6	0.3
High-Density Mixed	32.2	0.6	0.1
Low-Density Open Space	1,158.10	23.7	2.6
Farm Animals	0	1,943.10	459
Stream Bank Erosion	61,695.00	38	18
Subsurface Flow	0	8,671.90	129.9
Point Sources	0	0	0
Septic Systems	0	4.8	0

Table C1. Pollution outputs in the Pine Creek Watershed

Type	NLCD Code	Area (kmÂ²)	Coverage (%)	Active River Area (kmÂ²)
Open Water	11	0.01	0.06	0.01
Perennial Ice/Snow	12	0	0	0
Developed, Open Space	21	0.97	6.38	0.32
Developed, Low Intensity	22	0.04	0.3	0.03
Developed, Medium Intensity	23	0.01	0.08	0.01
Developed, High Intensity	24	0	0.02	0
Barren Land (Rock/Sand/Clay)	31	0	0	0
Deciduous Forest	41	8.69	57.35	1.81
Evergreen Forest	42	0.13	0.86	0.01
Mixed Forest	43	0.22	1.44	0.04
Shrub/Scrub	52	1.53	10.07	0.45
Grassland/Herbaceous	71	0.14	0.94	0.02
Pasture/Hay	81	0.79	5.19	0.21
Cultivated Crops	82	1.75	11.53	0.58
Woody Wetlands	90	0.87	5.77	0.87
Emergent Herbaceous Wetlands	95	0	0	0
Total		15.15	100	4.36

Table C2. Land Uses in the Pine Creek Watershed

Sources	Sediment (kg)	Total Nitrogen (kg)	Total Phosphorus (kg)
Hay/Pasture	7,953.90	42.7	17.3
Cropland	119,447.00	444.9	159
Wooded Areas	5,360.50	54.8	8.6
Wetlands	26.5	2.3	0.1
Open Land	355.7	3	0.5
Barren Areas	0	0	0
Low-Density Mixed	149.2	3.1	0.3
Medium-Density Mixed	291.4	5.5	0.6
High-Density Mixed	45.3	0.9	0.1
Low-Density Open Space	1,801.80	37.8	4.1
Farm Animals	0	1,656.90	406.2
Stream Bank Erosion	71,328.00	53	22
Subsurface Flow	0	6,297.00	96.7
Point Sources	0	0	0
Septic Systems	0	15.9	0

Table C3. Pollution outputs in the Hay Creek Watershed

Type	NLCD Code	Area (kmÂ²)	Coverage (%)	Active River Area (kmÂ²)
Open Water	11	0	0	0
Perennial Ice/Snow	12	0	0	0
Developed, Open Space	21	1.47	12.62	0.42
Developed, Low Intensity	22	0.12	1.04	0.04
Developed, Medium Intensity	23	0.04	0.39	0.01
Developed, High Intensity	24	0.01	0.06	0.01
Barren Land (Rock/Sand/Clay)	31	0	0	0
Deciduous Forest	41	8.38	72.01	1.93
Evergreen Forest	42	0	0	0
Mixed Forest	43	0.02	0.17	0
Shrub/Scrub	52	0.45	3.9	0.11
Grassland/Herbaceous	71	0.03	0.26	0.01
Pasture/Hay	81	0.62	5.31	0.1
Cultivated Crops	82	0.43	3.71	0.16
Woody Wetlands	90	0.06	0.52	0.05
Emergent Herbaceous Wetlands	95	0	0	0
Total		11.64	100	2.85

Table C4. Land Uses in the Hay Creek Watershed

Attachment D

Pollutants Requiring a TMDL

Assessment ID:	Impairment Source:	Impairment Cause:	Reachcode:	COMID:	Length (mi):
17807	Agriculture	Siltation	02040203000682	25972334	0.7
17807	Agriculture	Siltation	02040203000682	25972336	2.2
17807	Agriculture	Siltation	02040203000682	25972594	0.1
				Total	**3.1**

Attachment E

Justification of Changes to 303(d) Lists, 1998-Present

The following are excerpts from the Pennsylvania DEP Section 303(d) narratives that justify changes in listings between the 1996-2002 303(d) Lists and the 2004 to present Integrated Water Quality Monitoring and Assessment Reports. The Section 303(d) listing process has undergone an evolution in Pennsylvania since the development of the 1996 list.

In the 1996 Section 303(d) narrative, strategies were outlined for changes to the listing process. Suggestions included, but were not limited to, a migration to a Geographic Information System (GIS), improved monitoring and assessment, and greater public input.

The migration to a GIS was implemented prior to the development of the 1998 Section 303(d) list. As a result of additional sampling and the migration to the GIS some of the information appearing on the 1996 list differed from the 1998 list. Most common changes included:

1. mileage differences due to recalculation of segment length by the GIS;
2. slight changes in source(s)/cause(s) due to new EPA codes;
3. changes to source(s)/cause(s), and/or miles due to revised assessments;
4. corrections of misnamed streams or streams placed in inappropriate SWP subbasins; and
5. unnamed tributaries no longer identified as such and placed under the named watershed listing.

Prior to 1998, segment lengths were computed using a map wheel and calculator. The segment lengths listed on the 1998 Section 303(d) list were calculated automatically by the GIS (ArcInfo) using a constant projection and map units (meters) for each watershed. Segment lengths originally calculated by using a map wheel and those calculated by the GIS did not always match closely. This was the case even when physical identifiers (e.g., tributary confluence and road crossings) matching the original segment descriptions were used to define segments on digital quad maps. This occurred to some extent with all segments, but was most noticeable in segments with the greatest potential for human errors using a map wheel for calculating the original segment lengths (e.g., long stream segments or entire basins).

Migration to National Hydrography Data (NHD)

New to the 2006 report is use of the 1/24,000 National Hydrography Data (NHD) streams GIS layer. Up until 2006 the Department relied upon its own internally developed stream layer. Subsequently, the United States Geologic Survey (USGS) developed 1/24,000 NHD streams layer for the Commonwealth based upon national geodatabase standards. In 2005, DEP contracted with USGS to add missing streams and correct any errors in the NHD. A GIS contractor transferred the old DEP stream assessment information to the improved NHD and the old DEP streams layer was archived. Overall, this marked an

improvement in the quality of the streams layer and made the stream assessment data compatible with national standards but it necessitated a change in the Integrated Listing format. The NHD is not attributed with the old DEP five digit stream codes so segments can no longer be listed by stream code but rather only by stream name or a fixed combination of NHD fields known as reachcode and ComID. The NHD is aggregated by Hydrologic Unit Code (HUC) watersheds so HUCs rather than the old State Water Plan (SWP) watersheds are now used to group streams together. A more basic change was the shift in data management philosophy from one of "dynamic segmentation" to "fixed segments". The dynamic segmentation records were proving too difficult to manage from an historical tracking perspective. The fixed segment methods will remedy that problem. The stream assessment data management has gone through many changes over the years as system requirements and software changed. It is hoped that with the shift to the NHD and OIT's (Office of Information Technology) fulltime staff to manage and maintain SLIMS the systems and formats will now remain stable over many Integrated Listing cycles.

Attachment F

Comment and Response

No comments were received.

Attachment G

Water Quality Regulations for Agricultural Operations

§ 102.4. Erosion and sediment control requirements.

(a) For agricultural plowing or tilling activities or for animal heavy use areas, the following erosion and sediment control requirements apply:

(1) The implementation and maintenance of erosion and sediment control BMPs are required to minimize the potential for accelerated erosion and sedimentation, including for those activities which disturb less than 5,000 square feet (464.5 square meters).

(2) Written E&S Plans are required for the following activities that disturb 5,000 square feet (464.5 square meters) or more of land:

(i) Agricultural plowing or tilling activities.

(ii) Animal heavy use areas.

(3) The landowner, and any lessee, renter, tenant or other land occupier, conducting or planning to conduct agricultural plowing or tilling activities, or operating an animal heavy use area, are jointly and individually responsible for developing a written E&S Plan and implementing and maintaining BMPs, including those identified in the E&S Plan.

(4) The E&S Plan must include cost-effective and reasonable BMPs designed to minimize the potential for accelerated erosion and sedimentation from agricultural plowing or tilling activities and animal heavy use areas.

(i) For agricultural plowing or tilling activities, the E&S Plan must, at a minimum, limit soil loss from accelerated erosion to the soil loss tolerance (T) over the planned crop rotation.

(ii) For agricultural plowing and tilling activities that will occur on fields with less than 25% plant cover or crop residue cover and within 100 feet of a river, or perennial or intermittent stream, additional BMPs shall be implemented to minimize accelerated erosion and sedimentation.

(iii) For animal heavy use areas, the E&S Plan must identify BMPs to minimize accelerated erosion and sedimentation. BMPs and their design standards are listed in the current amended and updated version of the appropriate National Resources Conservation Service conservation practice standards such as Heavy Use Area Protection, Critical Area Planting, Fencing, Wastewater Treatment Strip, Constructed Wetland, Use Exclusion, Animal Trails and Walkways, Diversions and Roof Runoff Structure.

(5) The E&S Plan must contain plan maps that show the location of features including surface waters of this Commonwealth, and drainage patterns, field and property boundaries, buildings and farm structures, animal heavy use areas, roads and crossroads, and BMPs; soils maps; and a description of BMPs including animal heavy use area practices and procedures, tillage systems, schedules, and crop rotations. The plan must be consistent with the current conditions and activities on the agricultural operation.

(6) The E&S Plan must contain an implementation schedule. The plan shall be implemented according to the schedule, and the BMPs shall be operated and maintained as long as there are agricultural plowing or tilling activities or animal heavy use areas, on the agricultural operation.

(7) The portion of a conservation plan that identifies BMPs utilized to minimize accelerated erosion and sedimentation from agricultural plowing or tilling activities, or from operation of animal heavy use areas, may be used to satisfy the E&S Plan requirements of this subsection if it meets the requirements of paragraphs (4)—(6).

(8) The E&S Plan shall be available for review and inspection at the agricultural operation.

(9) Nothing in this section negates the requirements under other provisions of this chapter, such as those applicable to construction activities.

(b) For earth disturbance activities other than agricultural plowing or tilling or animal heavy use areas, the following erosion and sediment control requirements apply:

(1) The implementation and maintenance of E&S BMPs are required to minimize the potential for accelerated erosion and sedimentation, including those activities which disturb less than 5,000 square feet (464.5 square meters).

(2) A person proposing earth disturbance activities shall develop and implement a written E&S Plan under this chapter if one or more of the following criteria apply:

(i) The earth disturbance activity will result in a total earth disturbance of 5,000 square feet (464.5 square meters) or more.

(ii) The person proposing the earth disturbance activities is required to develop an E&S Plan under this chapter or under other Department regulations.

(iii) The earth disturbance activity, because of its proximity to existing drainage features or patterns, has the potential to discharge to a water classified as a High Quality or Exceptional Value water under Chapter 93 (relating to water quality standards).

(3) The E&S Plan shall be prepared by a person trained and experienced in E&S control methods and techniques applicable to the size and scope of the project being designed.

(4) Unless otherwise authorized by the Department or conservation district after consultation with the Department, earth disturbance activities shall be planned and implemented to the extent practicable in accordance with the following:

(i) Minimize the extent and duration of the earth disturbance.

(ii) Maximize protection of existing drainage features and vegetation.

(iii) Minimize soil compaction.

(iv) Utilize other measures or controls that prevent or minimize the generation of increased stormwater runoff.

(5) The E&S Plan must contain drawings and narrative which describe the following:

(i) The existing topographic features of the project site and the immediate surrounding area.

(ii) The types, depth, slope, locations and limitations of the soils.

(iii) The characteristics of the earth disturbance activity, including the past, present and proposed land uses and the proposed alteration to the project site.

(iv) The volume and rate of runoff from the project site and its upstream watershed area.

(v) The location of all surface waters of this Commonwealth which may receive runoff within or from the project site and their classification under Chapter 93.

(vi) A narrative description of the location and type of perimeter and onsite BMPs used before, during and after the earth disturbance activity.

(vii) A sequence of BMP installation and removal in relation to the scheduling of earth disturbance activities, prior to, during and after earth disturbance activities that ensure the proper functioning of all BMPs.

(viii) Supporting calculations and measurements.

(ix) Plan drawings.

(x) A maintenance program which provides for the operation and maintenance of BMPs and the inspection of BMPs on a weekly basis and after each stormwater event, including the repair or replacement of BMPs to ensure effective and efficient operation. The program must provide for completion of a written report documenting each inspection and all BMP repair, or replacement and maintenance activities.

(xi) Procedures which ensure that the proper measures for the recycling or disposal of materials associated with or from the project site will be undertaken in accordance with this title.

(xii) Identification of the naturally occurring geologic formations or soil conditions that may have the potential to cause pollution during earth disturbance activities and include BMPs to avoid or minimize potential pollution and its impacts from the formations.

(xiii) Identification of potential thermal impacts to surface waters of this Commonwealth from the earth disturbance activity including BMPs to avoid, minimize or mitigate potential pollution from thermal impacts.

(xiv) The E&S Plan shall be planned, designed and implemented to be consistent with the PCSM Plan under § 102.8 (relating to PCSM requirements). Unless otherwise approved by the Department, the E&S Plan must be separate from the PCSM Plan and labeled ‘‘E&S’’ or ‘‘Erosion and Sediment Control Plan’’ and be the final plan for construction.

(xv) Identification of existing and proposed riparian forest buffers.

(6) To satisfy the antidegradation implementation requirements in § 93.4c(b) (relating to implementation of antidegredation requirements), for an earth disturbance activity that requires a permit under this chapter and for which any receiving surface waters of this Commonwealth is classified as High Quality or Exceptional Value under Chapter 93, the person proposing the activity shall, in the permit application, do the following:

(i) Evaluate and include nondischarge alternatives in the E&S Plan, unless a person demonstrates that nondischarge alternatives do not exist for the project.

(ii) If the person makes the demonstration in subparagraph (i) that nondischarge alternatives do not exist for the project, the E&S Plan must include ABACT, except as provided in § 93.4c(b)(1)(iii).

(iii) For purposes of this chapter, nondischarge alternatives and ABACT and their design standards are listed in the *Erosion and Sediment Pollution Control Program Manual*, Commonwealth of Pennsylvania, Department of Environmental Protection, No. 363-2134-008 (April 2000), as amended and updated.

(7) The Department may approve alternative BMPs which will maintain and protect existing water quality and existing and designated uses.

(8) The E&S Plan, inspection reports and monitoring records shall be available for review and inspection by the Department or the conservation district at the project site during all stages of the earth disturbance activity.

(9) Upon complaint or site inspection, the Department or conservation district may require that the E&S Plan be submitted for review and approval to ensure compliance with this chapter.

(c) The Department may require, or the conservation district after consultation with the Department may require, other information necessary to adequately review a plan, or may require alternative BMPs, on a case-by-case basis, when necessary to ensure the maintenance and protection of water quality and existing and designated uses.

(d) A person proposing or conducting an earth disturbance activity shall obtain the other necessary permits and authorizations from the Department or conservation district, related to the earth disturbance activity, before commencing the earth disturbance activity.

(e) Persons proposing an earth disturbance activity that requires permit coverage under § 102.5 (relating to permit requirements) shall have permit coverage prior to commencing the earth disturbance activity.

§ 92a.29. CAFO.

(a) Except as provided in subsections (b)—(d), each CAFO shall have applied for an NPDES permit on the following schedule, and shall have obtained a permit:

(1) By May 18, 2001, for any CAFO in existence on November 18, 2000, with greater than 1,000 AEUs.

(2) By February 28, 2002, for any other CAFO in existence on November 18, 2000.

(3) Prior to beginning operation, for any new or expanded CAFO that began operation after November 18, 2000, and before October 22, 2005.

(b) A poultry operation that is a CAFO, which is in existence on October 22, 2005, and that is not using liquid manure handling systems, shall apply for an NPDES permit no later than the following, and shall obtain a permit:

(1) By April 24, 2006, for operations with 500 or more AEUs.

(2) By January 22, 2007, for all other operations.

(c) After October 22, 2005, a new operation, and an existing operation that will become a CAFO due to changes in operations such as additional animals or loss of land suitable for manure application, shall do the following:

(1) Apply for an NPDES permit at least 180 days before the operation commences or changes.

(2) Obtain an NPDES permit prior to commencing operations or making changes, as applicable.

(d) Other operations not described in subsections (a)—(c) that will become newly regulated as a CAFO for the first time due to the changes in the definition of a CAFO in § 92a.2 (relating to definitions) shall apply for a permit by April 24, 2006, and obtain a permit.

(e) The NPDES permit application requirements include, but are not limited to, the following:

(1) A nutrient management plan meeting the requirements of Chapter 83, Subchapter D (relating to nutrient management) and approved by the county conservation district or the State Conservation Commission. The plan must include:

(i) Manure application setbacks for the CAFO of at least 100 feet, or vegetated buffers at least 35 feet in width.

(ii) A statement that manure that is stockpiled for 15 consecutive days or longer shall be under cover or otherwise stored to prevent discharge to surface water during a storm event up to and including the appropriate design storm for that type of operation under § 91.36(a)(1) and (5) (relating to pollution control and prevention at agricultural operations).

(2) An erosion and sediment control plan meeting the requirements of Chapter 102 (relating to erosion and sediment control).

(3) When required under § 91.36(a), a water quality management permit, permit application, approval or engineer's certification, as required.

(4) A preparedness, prevention and contingency plan for pollutants related to the CAFO operation.

(5) A water quality management permit application as required under this chapter and Chapter 91 (relating to general provisions), when treatment facilities that would include a treated wastewater discharge are proposed.

(6) Measures to be taken to prevent discharge to surface water from storage of raw materials such as feed and supplies. These measures may be included in the nutrient management plan.

§ 91.36. Pollution control and prevention at agricultural operations.

(a) *Animal manure storage facilities.*

(1) Except when more stringent requirements are contained in paragraphs (2)—(5), a manure storage facility shall be designed, constructed, operated and maintained in accordance with current engineering and agronomic practices to ensure that the facility is structurally sound, water-tight, and located and sized properly, to prevent pollution of surface water and groundwater, including design to prevent discharges to surface waters during a storm up to and including a 25-year/24-hour storm.

(i) The Manure Management Manual and the Pennsylvania Technical Guide contain current engineering and agronomic practices which can be used to comply with the requirements in paragraph (1).

(ii) If the criteria in the Manure Management Manual and the Pennsylvania Technical Guide are not followed, the owner or operator shall obtain a water quality management permit or other approval from the Department for the manure storage facility.

(2) For liquid or semisolid manure storage facilities constructed after January 29, 2000, the owner or operator shall obtain a water quality management permit from the Department for the manure storage facility unless the design and construction of the facility are certified to meet the ''Manure Management Manual'' and ''Pennsylvania Technical Guide'' by a registered professional engineer. The owner or operator shall retain a copy of the certification at the operation and provide a copy to the Department upon request.

(3) In the case of a new or expanded liquid or semisolid manure storage facility located at an animal operation with over 1,000 AEUs for the first time after January 29, 2000, a water quality management permit is required.

(4) For a new or expanded liquid or semisolid manure storage facility after October 22, 2005:

(i) Where the manure storage capacity is between 1 million and 2.5 million gallons, a water quality management permit is required for any manure storage facility that is a pond and one of the following applies:

(A) The nearest downgradient stream is classified as a High Quality or Exceptional Value water under Chapter 93 (relating to water quality standards).

(B) The nearest downgradient stream has been determined by the Department to be impaired from nutrients from agricultural activities.

(ii) Where the manure storage capacity is 2.5 million gallons or more, a water quality management permit is required.

(5) For new or expanded CAFOs that commenced operations after April 13, 2003, and that include swine, poultry or veal calves, the CAFO shall prevent discharges to surface waters during a storm event up to and including a 100-year/24-hour storm from manure storage facilities that contain manure from those swine, poultry or veal calves.

(6) For a liquid or semisolid manure storage facility, the following minimum freeboard requirements apply and shall be maintained:

(i) For an agricultural operation with over 1,000 AEUs that was a new or expanded operation after January 29, 2000, a minimum 24-inch freeboard, except for enclosed facilities that are not exposed to rainfall, which must have a minimum freeboard of 6 inches.

(ii) For all other facilities, a minimum 12-inch freeboard for manure storage facilities that are ponds, and a minimum 6-inch freeboard for all other manure storage facilities.

(7) The requirements in this section are in addition to and do not replace any more stringent requirements in Chapter 83, Subchapter D (relating to nutrient management).

(b) *Land application of animal manure and agricultural process wastewater; setbacks and buffers.*

(1) The land application of animal manures and agricultural process wastewater requires a permit or approval from the Department unless the operator can demonstrate that the land application meets one of the following:

(i) The land application follows current standards for development and implementation of a plan to manage nutrients for water quality protection, including soil and manure testing and calculation of proper levels and methods of nitrogen and phosphorus application. The Manure Management Manual contains current standards for development and implementation of a plan to manage nutrients for water quality protection which can be used to comply with the requirements in paragraph (1).

(ii) For CAOs, the land application is in accordance with an approved nutrient management plan under Chapter 83, Subchapter D.

(iii) For CAFOs, the land application is in accordance with a CAFO permit as described in § 92.5a (relating to CAFOs).

(2) Unless more stringent requirements are established by statute or regulation, the following agricultural operations may not mechanically land apply manure within 100 feet of surface water, unless a vegetated buffer of at least 35 feet in width is used, to prevent manure runoff into surface water:

(i) A CAO.

(ii) An agricultural operation receiving manure from a CAO directly, or indirectly through a broker or other person.

(iii) An agricultural operation receiving manure from a CAFO directly, or indirectly through a broker or other person.

(3) CAFOs shall meet the setback requirements in § 92.5a(e)(1)(i).

(4) For purposes of paragraph (2) only, ‘‘surface water’’ means a perennial or intermittent stream with a defined bed and bank, a lake or a pond.

(c) *Discharge of pollutants.*

(1) It is unlawful for agricultural operations to discharge pollutants to waters of this Commonwealth except as allowed by regulations or a permit administered by the Department. The Department is authorized to take an enforcement action against any agricultural operation in violation of this requirement.

(2) An operation that has a discharge that is not authorized under the act and that meets the definition of either a medium or small CAFO under 40 CFR 122.23 (relating to concentrated animal feeding operations (applicable to State NPDES programs, see 123.25)) is considered to have an illegal discharge and is subject to enforcement action under the act.

(3) When an agricultural operation is found to be in violation of the act, the Department may require the agricultural operation to develop and implement a nutrient management plan under Chapter 83, Subchapter D, for abatement or prevention of the pollution.