South Branch Plum Creek Watershed

TMDL

Indiana County, PA

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pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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EXECUTIVE SUMMARY

This TMDL was developed to address siltation impairments in the South Branch Plum Creek Watershed (Indiana County (17-E)). Streams within this watershed were identified on Pennsylvania's 2006 Integrated Water Quality Monitoring and Assessment Report as being impaired by siltation resulting primarily from agricultural activities and organic enrichment/low dissolved oxygen issues stemming from agricultural activities and onsite wastewater. Specific sediment/siltation sources in the watershed have been identified as streambank destabilization, in-stream erosion and direct sediment runoff from croplands and pastures. Listings for organic enrichment/low oxygen are not addressed in this TMDL and will be addressed by future TMDLs.

Using AVGWLF® (Attachment A), a headwater portion of a watershed that currently attains its water quality standards and has several relevant similarities with the impaired watershed was found: Little Mahoning Creek, Indiana County. It is similar except that it has vast areas of trees and grasses that buffer the flow of runoff from steep hills and agricultural areas, and livestock do not have unrestricted access to stream areas. Using the GWLF® model, the existing loads of sediment from non-point pollution sources were determined for both the impaired and reference watersheds. Using this data, the loading rate of the reference watershed was calculated, and used to determine the TMDL for the impaired watershed.

A 10% Margin of Safety (MOS), a 1% bulk reserve WLA and non-point source Loads Not Reduced (LNR) were then subtracted from the TMDL (Table 1). The remaining Adjusted Load Allocation (ALA) was then allocated among the non-point sources targeted for reductions. The overall required sediment reduction for the watershed was calculated to be 33.6%. Required reductions in the South Branch Plum Creek watershed can be achieved by implementing the Best Management Practices (BMPs) required by Pennsylvania Code. Based upon field assessments, the following BMPs are suggested: Pasture Land Management, Vegetative Buffer Strips and Streambank Protection. Sediment reduction efficiencies for these three BMPS are 13%, 58%, and 76%, respectively (Evans and Corradini 2001).

Table 1. Summary of TMDL for the South Branch Plum Creek Watershed in lbs./yr. & lbs./day						
Summary of TMDL for the South Branch Plum Creek Watershed (lbs./yr.)						
Pollutant	TMDL	WLA	MOS	LA	LNR	ALA
Sediment	14,023,972	140,240	1,402,397	12,481,335	268,200	12,213,135
Summary of TMDL for the South Branch Plum Creek Watershed (lbs./day)						
Pollutant	TMDL	WLA	MOS	LA	LNR	ALA
Sediment	38,422	384	3,842	34,195	735	33,461

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.

Despite these requirements, states, territories, authorized tribes, and EPA have not developed many TMDLs since 1972. Beginning in 1986, organizations in many states filed lawsuits against EPA for failing to meet the TMDL requirements contained in the federal Clean Water Act and its implementing regulations. While EPA has entered into consent agreements with the plaintiffs in several states, many lawsuits still are pending across the country.

In the cases that have been settled to date, the consent agreements require EPA to backstop TMDL development, track TMDL development, review state monitoring programs, and fund studies on issues of concern (e.g., Abandoned Mine Drainage (AMD), implementation of nonpoint source Best Management Practices (BMPs), etc.).

PENNSYLVANIA CLEAN STREAMS LAW REQUIREMENTS AND AGRICULTURAL OPERATIONS

All Pennsylvania farmers are subject to the water quality regulations authorized under the Pennsylvania Clean Streams Law, Title 25 Environmental Protection, and found within Chapters 91-93, 96, 102 and 105. These regulations include topics such as manure management, Concentrated Animal Operations (CAOs), Concentrated Animal Feeding Operations (CAFOs), Pollution Control and Prevention at Agricultural Operations, Water Quality Standards, Water Quality Standards Implementation, Erosion and Sediment Control Requirements, and Dam Safety and Waterway Management. To review these regulations, please refer to http://pacode.com/ or the Pennsylvania Water Quality Action Packet for Agriculture which is supplied by the County Conservation Districts. To find your County Conservation District's contact information, please refer to http://pacd.org/ or call any DEP office or the Pennsylvania Conservation Districts Headquarters at 717-238-7223.

LOCATION AND GENERAL DESCRIPTION OF WATERSHED

South Branch Plum Creek, stream code – 46577 is located in mid-eastern Armstrong County and mid-western Indiana County, Figure 1. Its watershed boundaries lie within five municipalities: Atwood Borough, Cowanshannock Township, Plumcreek Township, South Mahoning Township and Washington Township (USGS quadrangles – Clymer, Elderton, Ernest, Marion Center, and Rural Valley). From its headwaters, it flows southwesterly through sub-basin 17-E for about 17 miles before joining with North Branch Plum Creek to form Plum Creek. Its 40-mi^2 watershed receives water from about 103 miles of stream. Named tributaries are shown below.

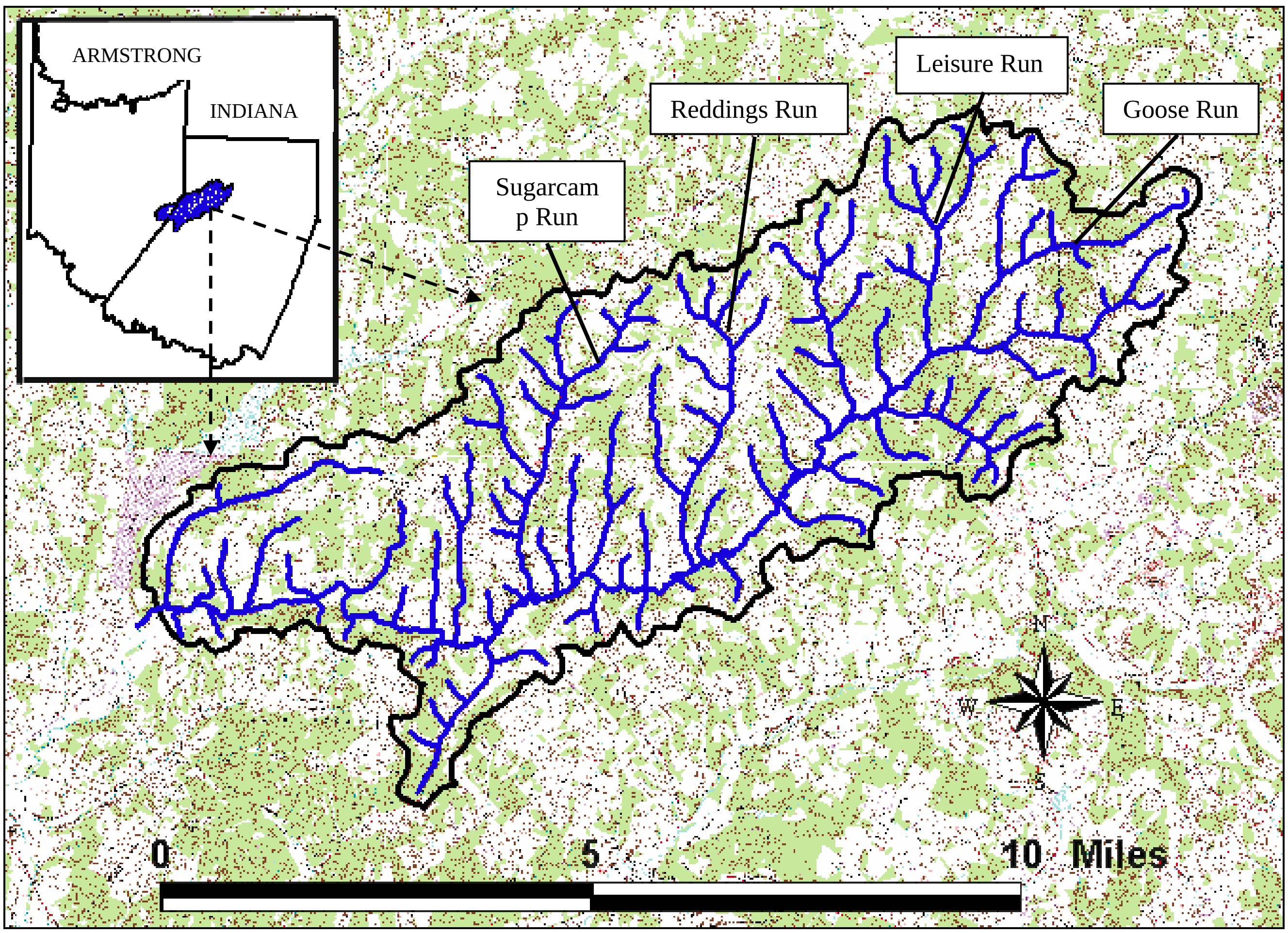

Figure 1. South Branch Plum Creek Tributaries.

TARGETED AREA OF WATERSHED

Sugarcamp Run, Figure 2, is impaired by mine drainage and therefore will not be included in this TMDL analysis. In addition, all segments downstream of Sugarcamp Run are not impaired, thus they will not be included in the TMDL either. By focusing on the targeted area instead of the entire watershed, a more site-specific reference watershed can be found and the determination of the total pollutant load will be more site specific as it will not be diluted by areas of the watershed that are not impaired. This targeted region of the watershed, Figure 2, is about 25 mi^2 and encompasses about 65 miles of stream.

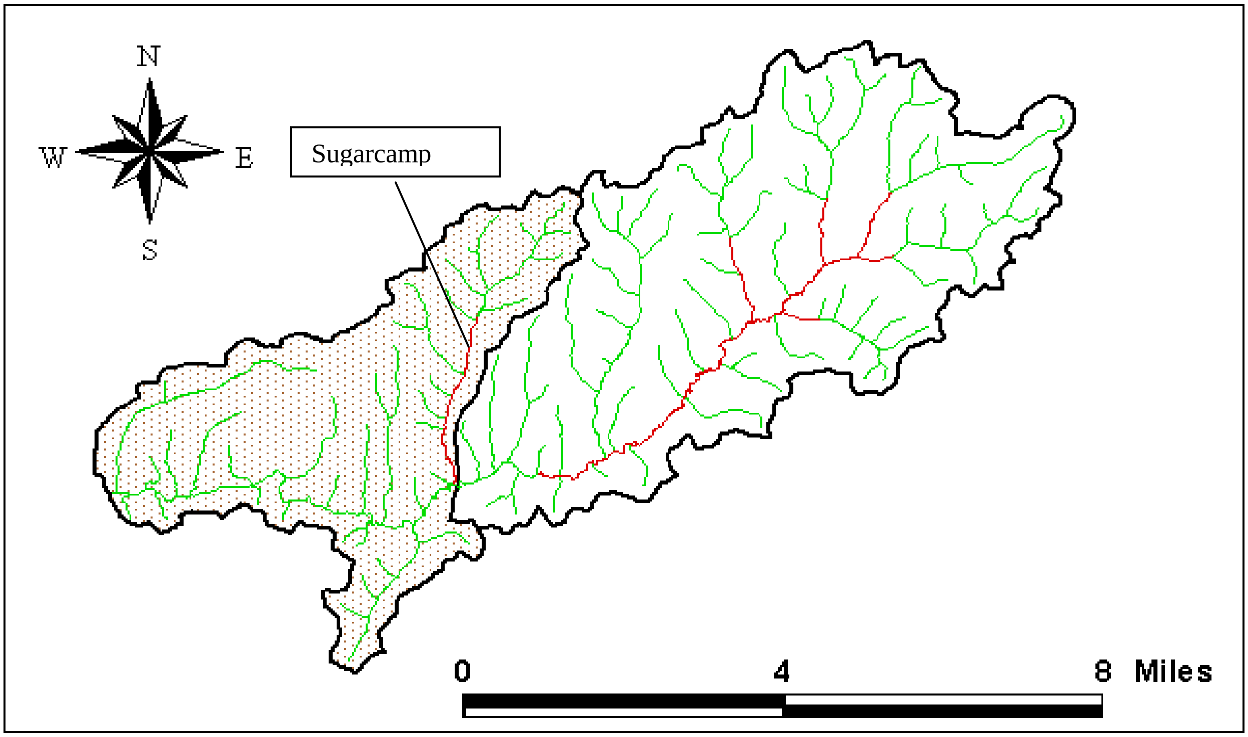

Figure 2. Area of South Branch Plum Creek watershed that will (non-shaded area) be included in TMDL analysis. Green streams are not impaired, red streams are impaired.

TOPOGRAPHY AND GEOLOGY

The targeted area of the South Branch Plum Creek watershed lies within the Pittsburgh Low Plateau Section of the Appalachian Plateau Province. This section consists of a smooth undulating upland surface cut by numerous, narrow, relatively shallow valleys. Elevation ranges from 335 to 475 m above sea level. Rocks within the watershed are entirely interbedded sedimentary. The two underlying bedrock groups are the Casselman Formation and Glenshaw Formation, with the latter being dominant. The strata of the Glenshaw Formation consist predominantly of sandstones and mudrocks with thin limestones and coals. Soil associations include Gilpin-Wharton-Ernest, Monongahela-Philo-Atkins, and Gilpin-Weikert-Ernest. The dominant hydrologic soil group is C; soils that are sandy clay loam. This soil group is characterized as having a low infiltration rate when thoroughly wetted and consists chiefly of soils with a layer that impedes downward movement of water and soil with moderately fine to fine structure.

LAND USE

The ArcView® Generalized Watershed Loading Function (AVGWLF®) model version 7.1.2, Attachment A, was used to estimate the landuse for the South Branch Plum Creek watershed, Figure 3. Field surveys were conducted to verify the accuracy of the model. The current land use for dominant categories is as follows: Agriculture - 45%, Forest – 53%, Other – 2%.

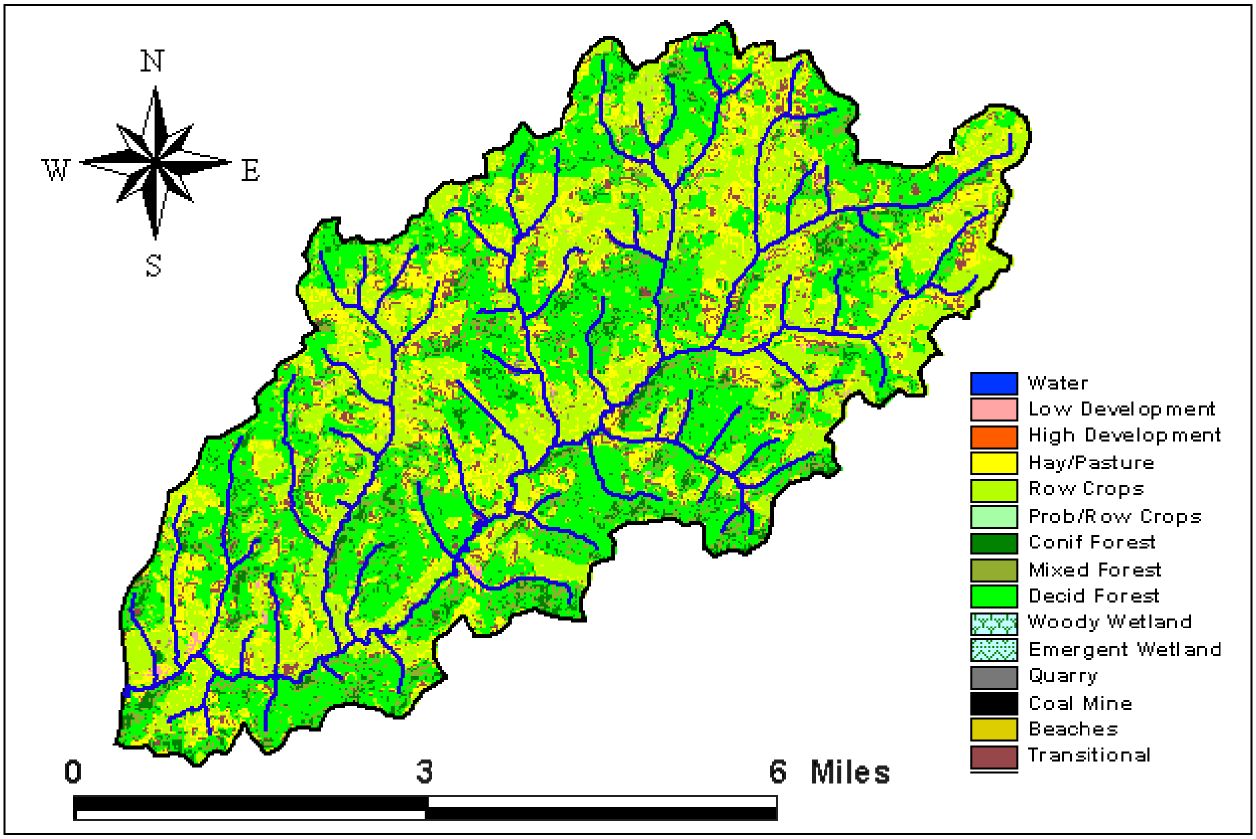

Figure 3. Landuse distribution for the targeted area of the South Branch Plum Creek watershed, Indiana County.

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 in 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 SSWAP protocol that preceded the ICE protocol, the method 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 + or – 20% (160 to 240). The benthic macroinvertebrates in this subsample were 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 2. Impairment Documentation and Assessment Chronology

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

Integrated List= Integrated Water Quality Monitoring and Assessment Report
SSWAP= Statewide Surface Waters Assessment Protocol
ICE= Instream Comprehensive Evaluation Protocol

SOURCE ASSESSMENT

The Pennsylvania Integrated Water Quality Monitoring and Assessment Report lists stream segments within the South Branch Plum Creek watershed as impaired by siltation. Listings for organic enrichment/low oxygen will not be addressed in this TMDL as it specifically targets siltation. Impairments are listed in Table 3 and Attachment D.

Table 3. Integrated Water Quality Monitoring and Assessment Report Listed Segments				
State Water Plan (SWP) Subbasin: 17E				
HUC: 05010006– Middle Allegheny-Redbank				
Watershed – South Branch Plum Creek				
Source	EPA 305(b) Cause Code	Miles	Designated Use	Use Designation
Construction	Siltation	0.49	HQ-CWF	Aquatic Life
Grazing Related Agriculture	Organic Enrichment/Low D.O.	4.44	HQ-CWF	Aquatic Life
Grazing Related Agriculture	Siltation	8.21	HQ-CWF	Aquatic Life
On site Wastewater	Organic Enrichment/Low D.O.	1.60	HQ-CWF	Aquatic Life
Removal of Vegetation	Siltation	3.25	HQ-CWF	Aquatic Life

HUC= Hydrologic Unit Code
HQ-CWF= High Quality Waters - Cold Water Fishes
The use designations for the stream segments in this TMDL can be found in PA Title 25 Chapter 93.
See Attachments D & E, for more information on the listings and listing process.

NATURE OF IMPAIRMENTS, WATER QUALITY STANDARDS, AND POLLUTANTS

In accordance with Title 25 PA Code Chapter 93, all streams in Pennsylvania must be protected so that they can support an "Aquatic Life Use. South Branch Plum Creek and several of its tributaries were determined to be impaired, Figure 4 and Table 3. Listings for organic enrichment/low oxygen will not be addressed in this TMDL as it targets siltation. There currently are no point sources of pollution contributing to the listed cause of impairment for this watershed.

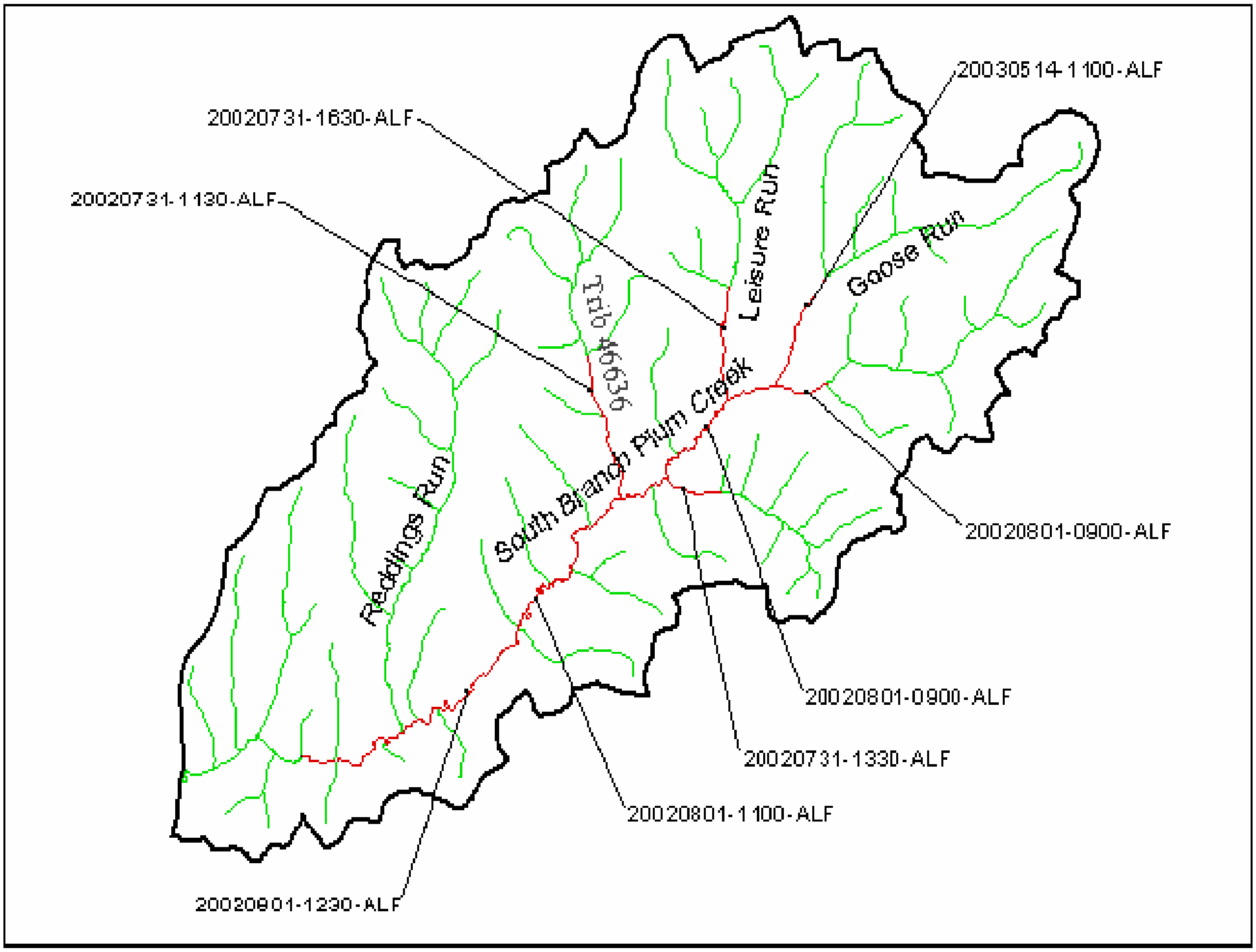

Figure 4. Impaired and non-impaired streams with the South Branch Plum Creek watershed.

Figure 5. Livestock with free access to the stream.

Figure 6. Unbuffered streambanks sloughing into the stream.

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 draft report for public review and comments; and
6. EPA approval of the TMDL.

SEDIMENT

Sediment is an essential component of aquatic ecosystems, as it often contains minerals used by many aquatic organisms, and also provides habitat. Sedimentation is a natural process that is caused by the weathering of landscape, whereby wind and water erode the surfaces of rocks and soils creating small particles. When these particles enter streams, they may flow with the current (suspended solids), or be deposited on the streambed. Typically, natural inputs of sediment to streams do not cause problems; however, when landscape is modified whereby soils become unstable, excessive amounts of sediment can enter streams and cause undesirable effects (Bryan and Rutherford 1995).

Agricultural practices such as row cropping typically involve the tilling of landscapes to make the soil porous and fertile. These practices loosen soil directly as well as indirectly by removing existing vegetation including roots which formerly held the soil in place. Croplands also increase the velocity of runoff because large flat and mostly sloping areas turn rain to high velocity sheet flow. Freeze/thaw erosion is also a problem in croplands because water in the soil expands to form ice crystals. These crystals displace soil. When they melt, that soil is transported downhill. During rain events and thaws, loosened soil is directed at increased velocity toward nearby streams by overland runoff from croplands.

The soil of pasture land is often more stable than that of cropland, yet sedimentation issues inherently arise from this landuse. Pasture lands are typically located near the stream with croplands found uphill of them. Vegetation grown within pasture land has little water retention, and often is not of sufficient density to impede overland runoff during rain events. Pasture lands that provide cattle unrestricted access to the stream also significantly increase sediment loads reporting to the stream due to the destruction of streambanks and riparian zones.

Significant volumes of overland runoff often enter nearby streams from pasture lands and/or croplands. Runoff is compounded in watersheds that lack BMPs by the additive effect of unmanaged cropland runoff plus pasture land runoff. The resulting increase in volume in the stream raises the velocity of flow to a point where soil from the streambanks begins to erode into the channel. Runoff volume from agricultural lands is further increased in areas with steep topography. In addition to facilitating hydrology-related sedimentation issues, cattle with free access to the stream cause streambanks to become destabilized and fall into the stream and increase the negative effects of freeze/thaw erosion by providing an increased surface area of susceptible soil, thus exacerbating siltation issues.

Eroded sediment can cause numerous problems for aquatic organisms. Suspended sediment causes turbidity, which can interfere with predation efficiency; cause respiration problems by clogging gills of aquatic organisms (Horne and Goldman 1994); and also reduces sunlight penetration which affects plant photosynthesis (Waters 1995). Causing a higher magnitude of problems, deposited sediment can 1) suffocate eggs of fish and other organisms, 2) suffocate small organisms, 3) severely reduce habitat and habitat diversity, and 4) alter flow patterns (USEPA 1999). Therefore, our endpoint was the reduction in sediment required to render this watershed unimpaired.

REFERENCE WATERSHED APPROACH

The first step of this approach is to find a reference non-impaired watershed that is similar to the impaired watershed in land-use, soil associations, drainage area, precipitation, physiographic province, and geology. The sediment loading rate for the reference watershed are then determined with the general objective of reducing the sediment loading of the impaired watershed to that of the reference watershed.

REFERENCE WATERSHED SELECTION

A headwater portion of a closely matched reference watershed with the same designated use, HQ-CWF, was found: Little Mahoning Creek (stream code – 47445), Indiana County (Figure 7). Pennsylvania's 303(d) list indicates that Little Mahoning Creek is not impaired. The Little Mahoning Creek Watershed is part of State Water Plan 17-D and the modeled portion has a total drainage area of 25.3 mi^2 and consists of about 56 stream miles.

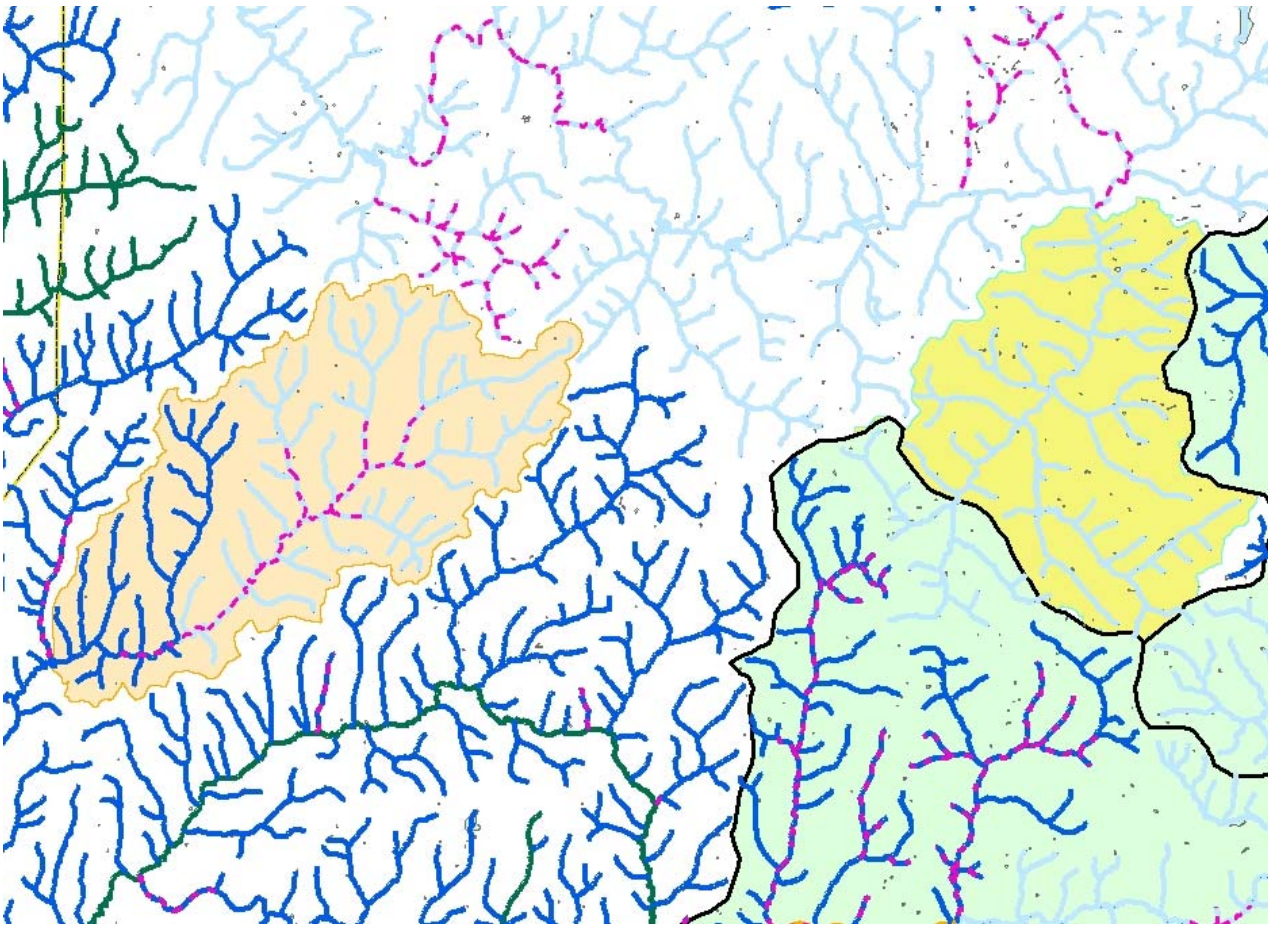

Figure 7. Modeled Portions of South Branch Plum Creek (Impaired HQ-CWF, Indiana County, tan) and Little Mahoning Creek (Reference HQ-CWF, Indiana County, yellow).

Both GIS imagery through ArcView®, and a physical survey indicate that the Little Mahoning Creek Watershed is similar to that of the South Branch Plum Creek Watershed. Table 4 illustrates the similarities between the watersheds. Because the impaired watershed was determined to be impaired by sedimentation from agricultural activities, it was important to find a reference watershed with a similar amount of agricultural landuse and since the impaired watershed is protected by an anti-degradation designation and subsequent regulations, a similarly designated High Quality reference was chosen.

Table 4. A comparison of the attributes used to deem Little Mahoning Creek a suitable reference watershed to be used in the TMDL development of South Branch Plum Creek.

ATTRIBUTE	WATERSHED	
	South Branch Plum Creek	***Little Mahoning Creek***
Physiographic Province	Appalachian Plateau Province (Pittsburgh Low Plateau Section)	Appalachian Plateau Province (Pittsburgh Low Plateau Section)
Drainage Area (mi^2)	25	25
Land-use Distribution	Agriculture – 45% Forested – 53% Other – 2%	Agriculture – 34% Forested – 65% Other – 1%
Geology	Interbedded Sedimentary (100%)	Interbedded Sedimentary (95%) Sandstone (5%)
Dominant Hydro Soil Group	C	C
23-Year Average Rainfall (in)	47.99	47.99
23-Year Average Runoff (in)	3.55	3.14

Although the impaired and reference watersheds are similar, differences were found to exist that likely explain why the Little Mahoning Creek Watershed is not impaired. It should be noted that some areas in the Little Mahoning Creek Watershed could be improved; however, there are more areas in this watershed that are protective of the streams relative to the South Branch Plum Creek watershed.

Figure 8. Cover crops, riparian buffers, contour farming and forested high gradient slopes in the reference watershed.

Figure 9. Riparian forest buffers in the reference watershed.

POLLUTANT LOADS

Table 5. Non-point sediment loads of sources within the watersheds of South Branch Plum Creek and Little Mahoning Creek.

	South Branch Plum Creek		Little Mahoning Creek	
Pollutant Source	Area (Acres)	Sediment (lbs/yr)	Area (Acres)	Sediment (lbs/yr)
Hay/Pasture	3434.8	916,000.0	3667.0	1,255,000.0
Cropland	3763.4	17,549,200.0	1759.4	11,039,800.0
Forest	8463.3	216,000.0	10586.0	251,200.0
Wetland	37.1	200.0	44.5	0.0
Coal Mines	0	0.0	27.2	17,800.0
Transitional	49.4	489,600.0	27.2	304,600.0
Low_Int_Dev	219.9	52,000.0	56.8	3,800.0
Streambank		1,887,400.0		1,327,600.0
TOTAL	15,967.9	21,110,400.0	16,168.1	14,199,800.0

REFERENCE WATERSHED LOADING RATE

The ArcView® Generalized Watershed Loading Function (AVGWLF®) model version 7.1.2 (Attachment A) was used to acquire pertinent information about the reference watershed. This model was used to generate the total area as well as non-point sediment loads of the reference watershed. Its loading rate for sediment was then determined by dividing its total sediment load by the total area of its watershed.

Reference Watershed Loading Rate = Total Load lbs/yr) / Total Area (Acres) = lbs/yr Sed / Acre

(Sediment) = 14,199,800.0 lbs/yr / 1 yr / 16,168.1 acres = 878.3 lbs/acre/yr

TOTAL MAXIMUM DAILY LOAD

The reference watershed loading rate was then multiplied by the total area of the impaired watershed. This value constitutes the “total maximum daily load” (TMDL) that the impaired water should be able to assimilate and still support an Aquatic Life Use, as this load is proportional to the load of the reference watershed, relative to total area.

TMDL = Ref Watershed Loading Rate (lbs/acre) x Total Area Impaired Watershed (acres)

(Sediment) = 878.3 lbs/acre/yr x 15,967.9 acres = 14,023,972.3 lbs/yr*
*accounts for rounding in previous calculations

MARGIN OF SAFETY AND TOTAL ALLOWABLE LOAD

A margin of safety (MOS) is a percent of the TMDL that will not be included in the total load that is allocated among the various pollutant sources. This step was implemented to recognize and account for any uncertainty that may exist about the relationship between pollutant loads and receiving water quality. Use of a 10% MOS is standard practice in TMDL reports where water quality criteria are not explicitly defined for the targeted pollutant.

MOS (Margin of Safety) = 0.10 x TMDL

(MOS Sediment) = 0.10 x 14,023,972.3 lbs/yr = 1,402,397.2lbs/yr

WASTELOAD ALLOCATION AND LOAD ALLOCATION

The wasteload allocation (WLA) is the total load of a pollutant assigned to point sources, and the load allocation (LA) is the total load that non-point sources must be limited to. To determine the WLA, the total load from all point sources is calculated and added to a bulk reserve allocation of 1.0% of the TMDL; individual WLAs are typically calculated using permitted design flows and monthly average effluent limits. There are no permitted point sources in the watershed, thus the WLA equals the bulk reserve. The bulk reserve provides flexibility and accounts for changes in permit activity in the watershed.

The WLA and MOS are subtracted from the TMDL and the resulting value equals the LA. With this, the TMDL equals the sum of the MOS, WLA and LA.

LA (load allocation) = TMDL (total max daily load) – WLA - MOS (margin of safety)

(**WLA**) = 140,239.7 = (0.01 x 14,023,972.3) bulk reserve + ∑point sources

(**LA**) = 14,023,972.3 lbs/yr – 140,239.7 lbs/yr - 1,402,397.2 lbs/yr = 12,481,335.3 lbs/yr

LOADS NOT REDUCED AND ADJUSTED LOAD ALLOCATION

Loads not reduced (LNR) included all loads from non-point sources that were not subjected to a reduction. The loads of some pollution sources are natural, for example, a load coming from a forest. We also may not reduce a source’s load because its contribution to the total load may be minute, and therefore implementing land management practices to achieve a load reduction would not be practical, or meaningful. Because the loads from these sources were not subjected to a reduction, they were subtracted from the LA.

The adjusted load allocation (ALA) is the load that was allocated among the non-point pollutant sources that will receive reductions.

Table 6. Loads of pollutant sources that will not be reduced, Loads Not Reduced (LNR). These loads are produced naturally or are minute, thus are not reduced.

Loads Not Reduced (LNR)	Sediment (lbs/yr)
Forest	216,000.0
Wetland	200.0
Low Intensity Development	52,000.0
Total	268,200.0

ALA (adjusted load allocation) = LA – LNR

ALA Sediment = 12,481,335.3 lbs/yr – 268,200.0 lbs/yr = 12,213,135.3 lbs/yr

ADJUSTED LOAD ALLOCATION DISTRIBUTION AND REQUIRED REDUCTIONS

The adjusted load allocation (ALA) was allocated among the non-point pollutant sources using the Equal Marginal Percent Reduction (EMPR) spreadsheet. The computations within this spreadsheet determine the percentage of the ALA that the load of each non-point source constitutes (percent reduction allocation). Each source's load reduction is then produced by multiplying its percent reduction allocation by the ALA. The source's load reduction is then subtracted from its initial load, and its allocated load is produced. For more detail, see Attachment B.

Table 7. Allowable and existing sediment loads, as well as required reductions for individual non-point pollutant sources.

Pollutant Source	Current Loading Rate (lbs/yr/acre)	Allowable Loading Rate (lbs/yr/acre)	Current Load (lbs/yr))	Allowable Load (lbs/yr)	Percent Load Reduction
Hay/Pasture	266.7	210.0	916,000.0	721,471.3	21.2%
Cropland	4,663.1	2,556.1	17,549,200.0	9,619,461.7	45.2%
Transitional	9,910.9	7806.2	489,600.0	385,624.8	21.2%
Streambank			1,887,400.0	1,486,577.5	21.2%
TOTAL			20,842,200.0	12,213,135.3	41.4%

Table 8. Summary of major parameters.

Parameter	Sediment (lbs/yr)
WLA (Wasteload Allocation)	140,239.7
ALA (Adjusted Load Allocation)	12,213,135.3
LNRs (Loads not reduced)	268,200.0
MOS (Margin of Safety)	1,402,397.2
TMDL (Total Max Daily Load)	14,023,972.3
TMDL / 365 Days	38,421.8 (lbs/day)

CONSIDERATION OF CRITICAL CONDITIONS

The AVGWLF 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 upon the daily water balance accumulated to monthly values. Therefore, all flow conditions are taken into account for loading calculations. Because there is generally a significant lag time between the introduction of sediment to a waterbody and the resulting impact on beneficial uses, establishing these TMDLs 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 requires specification of the 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.

RECOMMENDATIONS

Sediment reductions in the TMDL are allocated to nonpoint sources in the watershed including: agricultural activities, transitional lands and stream banks. 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 concomitant with the reestablishment of a viable High Quality – Cold Water Fishes ecosystem.

From an agricultural perspective, reductions in the amount of sediment reaching the streams in the watershed can be made through the right combination of BMPs including, but not limited to: establishment of cover crops and field border filter strips, diversions, strip cropping, residue management, no till, crop rotation, contour farming, terracing, grazing systems, stabilizing heavy use areas and proper management of storm water. Vegetated or forested buffers are acceptable

BMPs to intercept any runoff from farm fields. For the pasturing of farm animals and animal heavy use areas, acceptable BMPs may include: manure storage, rotational grazing, livestock exclusion fencing and riparian forest buffers. Some of these BMPs were observed in the South Branch Plum Creek Watershed; however, they were more extensively used in the unimpaired reference watershed, Little Mahoning Creek, with riparian forest buffers being the predominant BMP in use. Since both watersheds have a considerable amount of agricultural activities, it is apparent that the greater use of BMPs, especially riparian forest buffers, in the reference watershed has contributed to its ability to maintain its attainment status as a High Quality Waters-Cold Waters Fishes (HQ-CWF) stream.

Stream banks contribute to the sediment load in South Branch Plum Creek. Stream bank stabilization projects would be acceptable BMPs for the eroded stream banks in the area. However, the establishment of riparian forest buffers is the most economical and effective BMP at providing stream bank stabilization and protection of the banks from freeze/thaw erosion and scouring flows. Riparian forest buffers are also essential to maintaining the biologically rich yet sensitive HQ-CWF habitat. Riparian forest buffers also provide important natural and durable connectivity of land and water. This connectivity is necessary to provide cover, nesting and nursery sites, shade and stable temperatures, and viable substrate for aquatic organisms of all layers of the food web protected under the HQ-CWF use designation.

Important to TMDLs, established riparian forest buffers act as nutrient and sediment sinks. This is because the highly active and concentrated biological communities they maintain will assimilate and remove nutrients and sediment from the water column instead of allowing them to pass downstream unchecked, thus riparian forest buffers work directly toward attaining the goals of the TMDL by reducing pollutant loads biologically. These riparian forest buffers also provide the stable conditions necessary to meet the HQ-CWF designated use of the waterways. Riparian forest buffers also provide habitat to rare and sensitive aquatic, amphibious and terrestrial organisms as well as migratory species and help to reestablish connectivity between biologically valuable but fragmented habitats. While riparian forest buffers are considered the most effective and important BMP to aquatic restoration, other possibilities for attaining the desired reductions in this TMDL may exist for the agricultural usages as well as for the stream banks.

DEP will support local efforts to develop and implement watershed restoration plans based on the reduction goals specified in this TMDL. Interested parties should contact the appropriate Watershed Manager in the Department’s Southwestern Regional Office (412-442-4149) for information regarding technical and financial assistance that is currently available. Individuals and/or local watershed groups interested in the reclamation of the watershed of South Branch Plum Creek are strongly encouraged to exploit funding sources available through DEP and other state and federal agencies (e.g., Growing Greener or 319 Program).

PUBLIC PARTICIPATION

Public notice of the draft TMDL was published in the PA Bulletin on 7/12/2008 to foster public comment on the allowable loads calculated. A public meeting to present the TMDL and solicit public comment was held in Davis, PA on July 30, 2008.

FUTURE TMDL MODIFICATIONS

In the future, the Department may adjust the load and/or wasteload allocations in this TMDL to account for new information or circumstances that are developed or discovered during the implementation of the TMDL when a review of the new information or circumstances indicate that such adjustments are appropriate. Adjustment between the load and wasteload allocation will only be made following an opportunity for public participation. A wasteload allocation adjustment will be made consistent and simultaneous with associated permit(s) revision(s)/reissuances (i.e., permits for revision/reissuance in association with a TMDL revision will be made available for public comment concurrent with the related TMDLs availability for public comment). New information generated during TMDL implementation may include among other things, monitoring data, BMP effectiveness information, and land use information. All changes in the TMDL will be tallied and once the total changes exceed 1% of the total original TMDL allowable load, the TMDL will be revised. The adjusted TMDL, including its LAs and WLAs, will be set at a level necessary to implement the applicable water quality standards (WQS) and any adjustment increasing a WLA will be supported by reasonable assurance demonstration that load allocations will be met. The Department will notify EPA of any adjustments to the TMDL within 30 days of its adoption and will maintain current tracking mechanisms that contain accurate loading information for TMDL waters.

CHANGES IN TMDLS THAT MAY REQUIRE EPA APPROVAL

- Increase in total load capacity.
- Transfer of load between point (WLA) and nonpoint (LA) sources.
- Modification of the margin of safety (MOS).
- Change in water quality standards (WQS).
- Non-attainment of WQS with implementation of the TMDL.
- Allocation transfers in trading programs.

CHANGES IN TMDLS THAT MAY NOT REQUIRE EPA APPROVAL

- Total loading shift less than or equal to 1% of the total load.
- Increase of WLA results in greater LA reductions provided reasonable assurance of implementation is demonstrated (a compliance/implementation plan and schedule).
- Changes among WLAs with no other changes; TMDL public notice concurrent with permit public notice.
- Removal of a pollutant source that will not be reallocated.
- Reallocation between LAs.
- Changes in land use.

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ATTACHMENT A
AVGWLF Model Overview & GIS-Based Derivation of Input Data

The TMDL for the watershed of South Branch Plum Creek was developed using the Generalized Watershed Loading Function or GWLF model. The GWLF model provides the ability to simulate runoff and sediment loadings from watershed given variable-size source areas (e.g., agricultural, forested, and developed land). It also has algorithms for calculating septic system loads, and allows for the inclusion of point source discharge data. It is a continuous simulation model, which uses daily time steps for weather data and water balance calculations. Monthly calculations are made for sediment and nutrient loads, based on the daily water balance accumulated to monthly values.

GWLF is a combined distributed/lumped parameter watershed model. For surface loading, it is distributed in the sense that it allows multiple land use/cover scenarios. Each area is assumed to be homogenous in regard to various attributes considered by the model. Additionally, the model does not spatially distribute the source areas, but aggregates the loads from each 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 computed as the difference between precipitation and snowmelt minus surface runoff plus evapotranspiration.

GWLF models surface runoff using the Soil Conservation Service Curve Number (SCS-CN) approach with daily weather (temperature and precipitation) inputs. 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 (e.g., 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 conservation practices factor (P). A sediment delivery ratio based on watershed size and transport capacities based on average daily runoff are applied to the calculated erosion to determine sediment yield for each source area. Surface nutrient losses are determined by applying dissolved N and P coefficients to surface runoff and a sediment coefficient to the yield portion for each agricultural source area. Point source discharges can also contribute to dissolved losses to the stream and are specified in terms of kilograms per month. Manured areas, as well as septic systems, can also be considered. Urban nutrient inputs are all assumed to be solid-phase, and the model uses an exponential accumulation and washoff function for these loadings. Sub-surface losses are calculated using dissolved N and P coefficients for shallow groundwater contributions to stream nutrient loads, and the sub-surface sub-model only considers a single, lumped-parameter contributing area. 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.
All of the equations used by the model can be viewed in GWLF Users Manuel, available from the Department’s Bureau of Watershed Conservation, Division of Assessment and Standards.

For execution, the model requires three separate input files containing transport-, nutrient-, and weather-related data. The transport (TRANSPRT.DAT) file defines the necessary parameters for each source area to be considered (e.g., area size, curve number, etc.) as well as global parameters (e.g., initial storage, sediment delivery ratio, etc.) that apply to all source areas. The nutrient (NUTRIENT.DAT) file specifies the various loading parameters for the different source areas identified (e.g., number of septic systems, urban source area accumulation rates, manure concentrations, etc.). The weather (WEATHER.DAT) file contains daily average temperature and total precipitation values for each year simulated.

The primary sources of data for this analysis were geographic information system (GIS) formatted databases. A specially designed interface was prepared by the Environmental Resources Research Institute of the Pennsylvania State University in ArcView (GIS software) to generate the data needed to run the GWLF model, which was developed by Cornell University. The new version of this model has been named AVGWLF (ArcView Version of the Generalized Watershed Loading Function).

In using this interface, the user is prompted to identify required GIS files and to provide other information related to “non-spatial” model parameters (e.g., beginning and end of the growing season, the months during which manure is spread on agricultural land and the names of nearby weather stations). This information is subsequently used to automatically derive values for required model input parameters, which are then written to the TRANSPRT.DAT, NUTRIENT.DAT and WEATHER.DAT input files needed to execute the GWLF model. For use in Pennsylvania, AVGWLF has been linked with statewide GIS data layers such as land use/cover, soils, topography, and physiography; and includes location-specific default information such as background N and P concentrations and cropping practices. Complete GWLF-formatted weather files are also included for eighty weather stations around the state. The following table lists the statewide GIS data sets and provides an explanation of how they were used for development of the input files for the GWLF model.

GIS Data Sets	
DATASET	**DESCRIPTION**
Censustr	Coverage of Census data including information on individual homes septic systems. The attribute *usew_sept* includes data on conventional systems, and *sew_other* provides data on short-circuiting and other systems.
County	The County boundaries coverage lists data on conservation practices, which provides C and P values in the Universal Soil Loss Equation (USLE).
Gwnback	A grid of background concentrations of N in groundwater derived from water well sampling.
Land-use5	Grid of the MRLC that has been reclassified into five categories. This is used primarily as a background.
Majored	Coverage of major roads. Used for reconnaissance of a watershed.
MCD	Minor civil divisions (boroughs, townships and cities).
Npdespts	A coverage of permitted point discharges. Provides background information and cross check for the point source coverage.
Padem	100-meter digital elevation model. This used to calculate landslope and slope length.
Palumrlc	A satellite image derived land cover grid that is classified into 15 different landcover categories. This dataset provides landcover loading rate for the different categories in the model.
Pasingle	The 1:24,000 scale single line stream coverage of Pennsylvania. Provides a complete network of streams with coded stream segments.
Physprov	A shapefile of physiographic provinces. Attributes *rain_cool* and *rain_warm* are used to set recession coefficient
Pointsrc	Major point source discharges with permitted N and P loads.
Refwater	Shapefile of reference watersheds for which nutrient and sediment loads have been calculated.
Soilphos	A grid of soil Phosphorus loads, which has been generated from soil sample data. Used to help set phosphorus and sediment values.
Smallsheds	A coverage of watersheds derived at 1:24,000 scale. This coverage is used with the stream network to delineate the desired level watershed.
Statsgo	A shapefile of generalized soil boundaries. The attribute *mu_k* sets the k factor in the USLE. The attribute *mu_awc* is the unsaturated available capacity., and the *muhsg_dom* is used with land-use cover to derive curve numbers.
Strm305	A coverage of stream water quality as reported in the Pennsylvania's 305(b) report. Current status of assessed streams.
Surfgeol	A shapefile of the surface geology used to compare watersheds of similar qualities.
T9sheds	Data derived from a DEP study conducted at PSU with N and P loads.
Zipcode	A coverage of animal densities. Attribute *aeu_acre* helps estimate N & P concentrations in runoff in agricultural lands and over manured areas.
Weather Files	Historical weather files for stations around Pennsylvania to simulate flow.

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, 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 % reduction for each pollutant source.

1	TMDL Total Load	S.Br.PlumCk.			2	Adjusted LA = (TMDL total load - MOS- WLA - loads not reduced)						
	Load = Sediment loading rate in ref. * Acres in Impaired					12213135.3	12213135.3					
	14023972.3											
		Annual Average					% reduction				Allowable	
3		Load	Load Sum	Check	Initial Adjust	Recheck	allocation	Load Reduction	Initial LA	Acres	Loading Rate	% Reduction
	CROPLAND	17549200.0	20842200.0	bad	12213135.3	ADJUST	0.8	2593673.7	9619461.7	3763.4	2556.1	45.2%
	HAY/PASTURE	916000.0		good	916000.0	3293000.0	0.1	194528.7	721471.3	3434.8	210.0	21.2%
	Transitional	489600.0		good	489600.0		0.0	103975.2	385624.8	49.4	7806.2	21.2%
	Streambank	1887400.0		good	1887400.0		0.1	400822.5	1486577.5	0.0		21.2%
					15506135.3		1.0		12213135.3			
4	All Ag. Loading Rate	1480.02										
			Allowable (Target)		Current							
		Acres	loading rate	Final LA	Loading Rates	Current Load	% Red.			Current Load	Final LA	
5	CROPLAND	3763.4	2556.1	9619461.7	4663.1	17549200.0	45.2%		CROPLAND	17549200	9619462	
	HAY/PASTURE	3434.8	210.0	721471.3	266.7	916000.0	21.2%		HAY/PASTURE	916000	721471	
	transitional	49.4	7806.2	385624.8	9910.9	489600.0	21.2%		TRANSITION	489600	385625	
	Streambank	0		1486577.5		1887400.0	21.2%		STREAMBANK	1887400	1486577	
				12213135.3		20842200.0	41.4%					

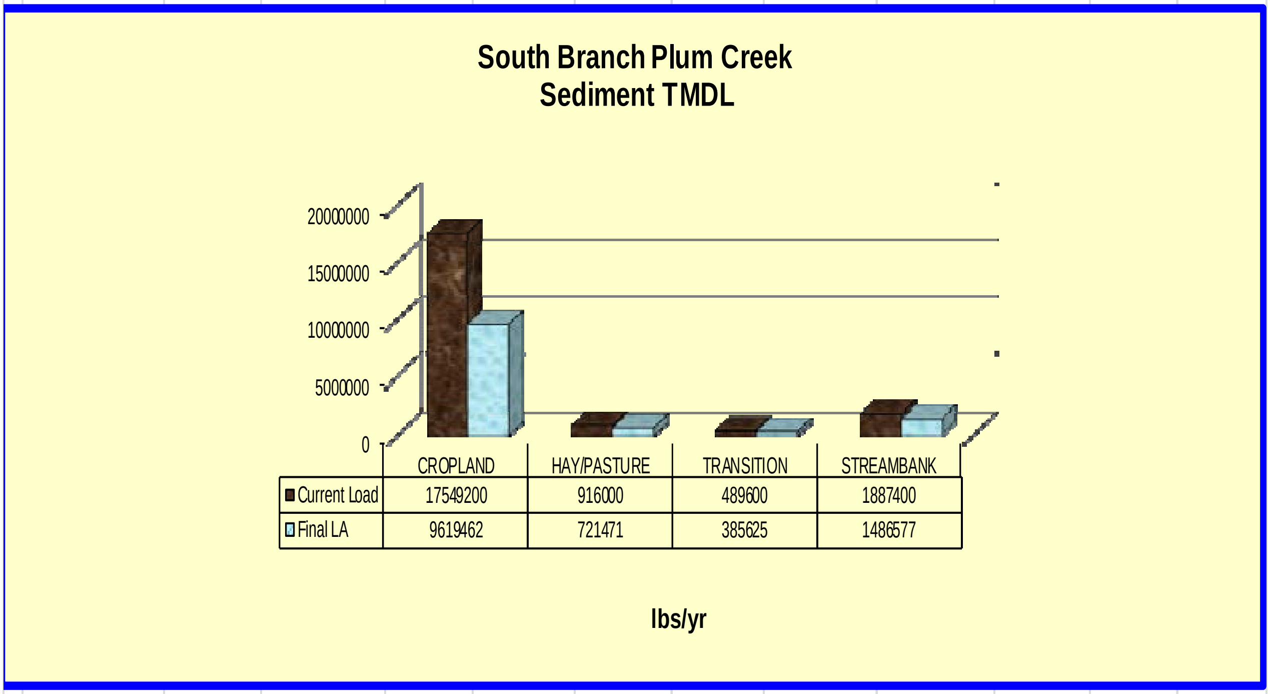

Table B1. Equal Marginal Percent Reduction calculations for Sediment in the South Branch Plum Creek Watershed.

ATTACHMENT C
GWLF Output for South Branch Plum Creek

Rural LU	Area (ha)	CN	K	LS	C	P
Hay/Past	1390	75	0.298	2.176	0.03	0.45
Cropland	1523	82	0.3	2.7	0.42	0.45
Forest	3425	73	0.293	2.749	0.002	0.52
Wetland	15	87	0.367	0.462	0.01	0.1
	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Bare Land	**Area (ha)**	**CN**	**K**	**LS**	**C**	**P**
	0	0	0	0	0	0
Transition	20	87	0.296	1.716	0.8	0.8
Urban LU	**Area (ha)**	**CN**	**K**	**LS**	**C**	**P**
Lo_Int_Dev	89	83	0.316	1.538	0.08	0.2
	0	0	0	0	0	0

Month	Ket	Day Hours	Season	Eros Coef	Stream Extract	Ground Extract
Jan	0.61	9.4	0	0.08	0	0
Feb	0.66	10.4	0	0.08	0	0
Mar	0.69	11.8	0	0.08	0	0
Apr	0.7	13.2	0	0.26	0	0
May	0.89	14.4	1	0.26	0	0
Jun	0.99	14.9	1	0.26	0	0
Jul	1.05	14.6	1	0.26	0	0
Aug	1.09	13.6	1	0.26	0	0
Sep	1.11	12.2	1	0.08	0	0
Oct	0.95	10.8	0	0.08	0	0
Nov	0.86	9.6	0	0.08	0	0
Dec	0.8	9.1	0	0.08	0	0

Init Unsat Stor (cm)	10	Initial Snow (cm)	0	Recess Coefficient	0.1
Init Sat Stor (cm)	0	Sed Delivery Ratio	0.13	Seepage Coefficient	0
Unsat Avail Wat (cm)	11.3291	Tile Drain Ratio	0.5	Sediment A Factor	2.8120E-04
		Tile Drain Density	0	Sed A Adjustment Factor	1

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Table C1. Data contained in TRANSPRT.DAT for South Branch Plum Creek Watershed

GWLF Total Loads for file: sbplumck-0

Period of analysis: 19 years from 1975 to 1993

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dis N	Total N	Dis P	Total P
Hay/Past	3434.8	3.1	3523.0	458.0	6396.5	9144.4	663.8	974.3
Cropland	3763.4	5.7	67496.9	8774.6	12667.5	65315.1	1305.4	7254.6
Forest	8463.3	2.6	830.7	108.0	965.0	1612.9	30.5	103.7
Wetland	37.1	8.8	0.7	0.1	14.0	14.6	0.4	0.5
Transition	49.4	8.8	1882.8	244.8	285.6	1754.2	19.7	185.7
Lo_Int_Dev	219.9	6.2	200.4	26.0	0.0	128.8	0.0	17.2
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				943.7		94.4		41.5
Groundwater					104113.2	104113.2	1676.0	1676.0
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					433.9	433.9	69.5	69.5
Totals	15967.9	3.60	73934.6	10555.2	124875.6	182611.5	3765.3	10322.9

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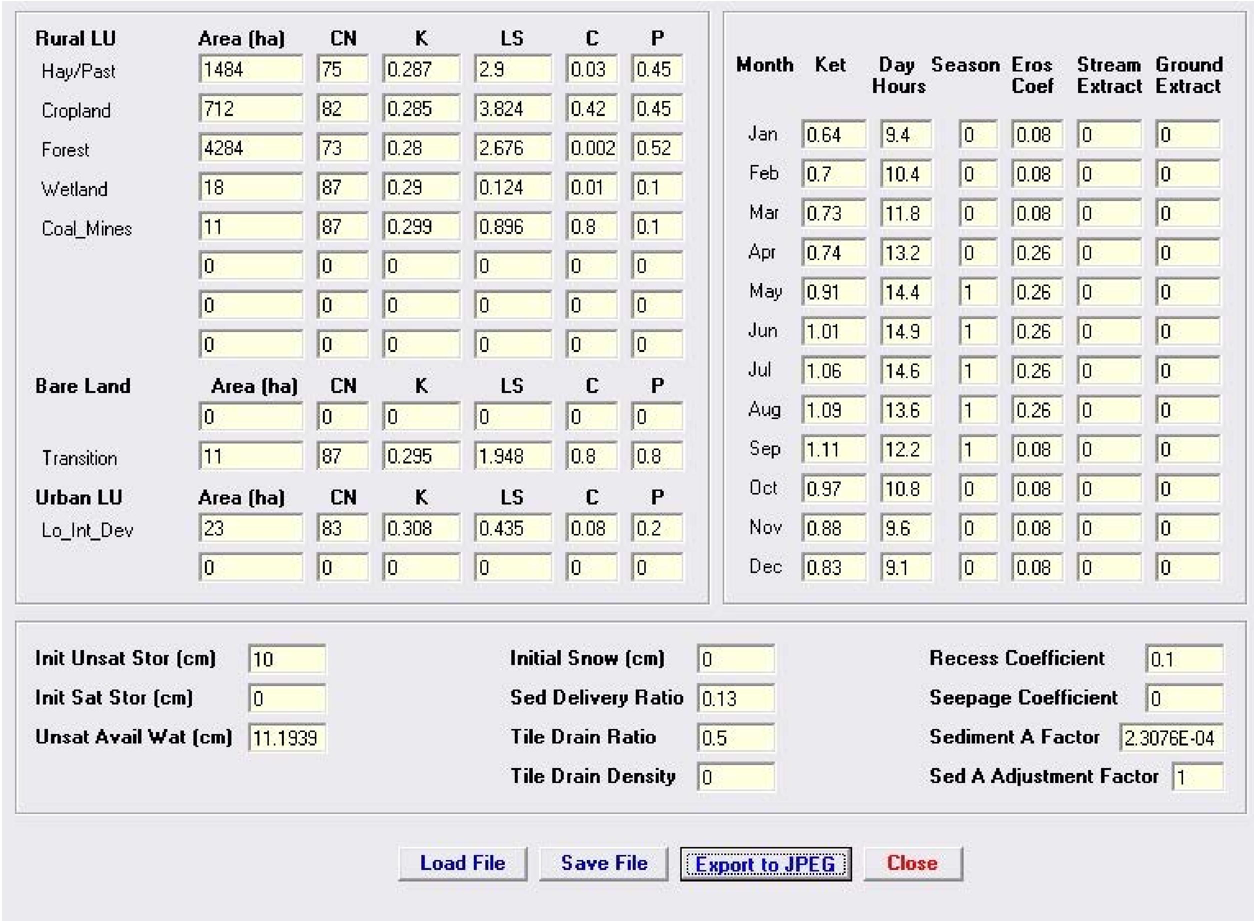
Table C2. Outputs for South Branch Plum Creek Watershed



Rural LU	Area (ha)	CN	K	LS	C	P
Hay/Past	1484	75	0.287	2.9	0.03	0.45
Cropland	712	82	0.285	3.824	0.42	0.45
Forest	4284	73	0.28	2.676	0.002	0.52
Wetland	18	87	0.29	0.124	0.01	0.1
Coal_Mines	11	87	0.299	0.896	0.8	0.1
	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0

Bare Land	Area (ha)	CN	K	LS	C	P
	0	0	0	0	0	0
Transition	11	87	0.295	1.948	0.8	0.8

Urban LU	Area (ha)	CN	K	LS	C	P
Lo_Int_Dev	23	83	0.308	0.435	0.08	0.2
	0	0	0	0	0	0

Month	Ket	Day Hours	Season	Eros Coef	Stream Extract	Ground Extract
Jan	0.64	9.4	0	0.08	0	0
Feb	0.7	10.4	0	0.08	0	0
Mar	0.73	11.8	0	0.08	0	0
Apr	0.74	13.2	0	0.26	0	0
May	0.91	14.4	1	0.26	0	0
Jun	1.01	14.9	1	0.26	0	0
Jul	1.06	14.6	1	0.26	0	0
Aug	1.09	13.6	1	0.26	0	0
Sep	1.11	12.2	1	0.08	0	0
Oct	0.97	10.8	0	0.08	0	0
Nov	0.88	9.6	0	0.08	0	0
Dec	0.83	9.1	0	0.08	0	0

Init Unsat Stor (cm)	10	Initial Snow (cm)	0	Recess Coefficient	0.1
Init Sat Stor (cm)	0	Sed Delivery Ratio	0.13	Seepage Coefficient	0
Unsat Avail Wat (cm)	11.1939	Tile Drain Ratio	0.5	Sediment A Factor	2.3076E-04
		Tile Drain Density	0	Sed A Adjustment Factor	1

Table C3. Data contained in TRANSPRT.DAT for Little Mahoning Creek Watershed

GWLF Total Loads for file: lmahoningref-0

Period of analysis: 19 years from 1975 to 1993

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dis N	Total N	Dis P	Total P
Hay/Past	3667.0	3.1	4826.9	627.5	6829.0	10594.0	710.8	1199.0
Cropland	1759.4	5.7	42460.7	5519.9	5922.0	39041.4	612.1	4906.6
Forest	10586.0	2.6	966.4	125.6	1207.0	1960.8	38.1	135.8
Wetland	44.5	8.8	0.2	0.0	16.8	17.0	0.5	0.6
Coal_Mines	27.2	8.8	68.3	8.9	0.6	53.9	0.1	7.0
Transition	27.2	8.8	1171.3	152.3	157.1	1070.7	10.8	129.3
Lo_Int_Dev	56.8	6.2	14.3	1.9	0.0	33.3	0.0	4.4
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				663.8		66.4		29.2
Groundwater					56589.5	56589.5	1401.8	1401.8
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					423.6	423.6	69.5	69.5
Totals	16168.1	3.10	49508.1	7099.8	71145.7	109850.5	2843.9	7883.3

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Table C4. Outputs for Little Mahoning Creek Watershed

ATTACHMENT D

Pennsylvania Integrated Water Quality Monitoring and Assessment Report: Streams, Category 5 Waterbodies, Pollutants Requiring a TMDL

Stream Name / Use Designation (Assessment ID) / Source	Cause	Date Listed	TMDL Date

Hydrologic Unit Code: 05010006 - Middle Allegheny-Redbank

Goose Run
HUC: 05010006

Source	Cause	Date Listed	TMDL Date
Aquatic Life (4857) - 1.00 miles; 1 Segment(s)*			
Grazing Related Agric	Siltation	2004	2017

Leisure Run
HUC: 05010006

Source	Cause	Date Listed	TMDL Date
Aquatic Life (4306) - 0.89 miles; 1 Segment(s)*			
On site Wastewater	Organic Enrichment/Low D.O.	2004	2017

South Branch Plum Creek
HUC: 05010006

Source	Cause	Date Listed	TMDL Date
Aquatic Life (4307) - 3.41 miles; 10 Segment(s)*			
Grazing Related Agric	Organic Enrichment/Low D.O.	2004	2017
Grazing Related Agric	Siltation	2004	2017
Aquatic Life (4312) - 1.04 miles; 3 Segment(s)*			
Grazing Related Agric	Organic Enrichment/Low D.O.	2004	2017
Grazing Related Agric	Siltation	2004	2017
Aquatic Life (4318) - 2.77 miles; 7 Segment(s)*			
Grazing Related Agric	Siltation	2004	2017
Removal of Vegetation	Siltation	2004	2017

South Branch Plum Creek (Unt 46636)
HUC: 05010006

Source	Cause	Date Listed	TMDL Date
Aquatic Life (4288) - 0.71 miles; 1 Segment(s)*			
On site Wastewater	Organic Enrichment/Low D.O.	2004	2017
Aquatic Life (4294) - 0.49 miles; 1 Segment(s)*			
Removal of Vegetation	Siltation	2004	2017

South Branch Plum Creek (Unt 46643)
HUC: 05010006

Source	Cause	Date Listed	TMDL Date
Aquatic Life (4300) - 0.49 miles; 1 Segment(s)*			
Construction	Siltation	2004	2017

Report Summary

Watershed Summary

	Stream Miles	Assessment Units	Segments (COMIDs)
Watershed Characteristics	66.20	8	155

Impairment Summary

Source	Cause	Miles	Assessment Units	Segments (COMIDs)
Construction	Siltation	.49	1	1

*Segments are defined as individual COM IDs.

Stream Name Use Designation (Assessment ID) Source	Cause	Date Listed	TMDL Date

Impairment Summary

Source	Cause	Miles	Assessment Units	Segments (COMIDs)
Grazing Related Agric	Organic Enrichment/Low D.O.	4.44	2	13
Grazing Related Agric	Siltation	8.21	4	21
On site Wastewater	Organic Enrichment/Low D.O.	1.60	2	2
Removal of Vegetation	Siltation	3.25	2	8
		10.79 **	**8** **	**25** **

**Totals reflect actual miles of impaired stream. Each stream segment may have multiple impairments (different sources or causes contributing to the impairment), so the sum of individual impairment numbers may not add up to the totals shown.

Use Designation Summary

	Miles	Assessment Units	Segments (COMIDs)
Aquatic Life	10.79	8	25

*Segments are defined as individual COM IDs.

ATTACHMENT E

Excerpts Justifying Changes between the 1998-2002 Section 303(d) Lists and the 2004 to present Integrated Water Quality Monitoring and Assessment Reports

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 Global 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 mange 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 public comments were received for the South Branch Plum Creek Watershed TMDL.