Stony Run Sediment TMDL

Kiski-Conemaugh River Basin,
Allegheny River - Westmoreland County

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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TABLE OF CONTENTS

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Westmoreland County, Pennsylvania

Executive Summary

A Total Maximum Daily Load (TMDL) was developed to address impairments in Stony Run as noted in the *2016 Pennsylvania Integrated Water Quality Monitoring and Assessment Report* (Integrated List), initially listed in 2006 (see Table 2.). Stony Run is a tributary of the Kiski-Conemaugh River and the larger Allegheny River Basin. The watershed is in Derry Township, Westmoreland County.

The impairments were noted during bioassessments in the watershed (2005). Excessive siltation due to agriculture activities was the source identified as causing impairment to the designated aquatic life use (Cold Water Fish(ery) in Stony Run. No additional assessments have been conducted in this watershed as of the original impairment assessment (2005) and consecutive listing (2006). Because PA does not currently have water quality criteria for sediment, a TMDL endpoint was identified using a reference watershed approach

Based on a comparison to the similar, unimpaired Champion Run (tributary to Indian Creek and the greater Youghiogheny River basin, Fayette County), the maximum sediment loading (or TMDL) identified in Table 1. will allow water quality objectives to be met in the impaired segments of Stony Run. Allocations from the calculated TMDLs are summarized below:

Table 1. Summary of TMDL for Stony Run in lbs./yr.						
Pollutant	TMDL	WLA	MOS	LA	LNR	ALA
Sediment	**1,119,361.2**	**11,193.6**	**111,936.1**	**996,231.5**	**18,400.0**	**977,831.5**
Summary of TMDL for Stony Run in lbs./day						
Pollutant	TMDL	WLA	MOS	LA	LNR	ALA
Sediment	**3,066.7**	**30.7**	**306.7**	**2,729.4**	**50.4**	**2,679.0**

Load allocations were distributed to nonpoint sources, with 10% of the TMDL reserved explicitly as a margin of safety (MOS). The wasteload allocation (WLA) is that portion of the total load assigned to National Pollutant Discharge Elimination System (NPDES) permitted point source discharges. A search of the Pennsylvania Department of Environmental Protection's (Department) efacts permit database identified no point source discharges within Stony Run. 1% of the TMDL was incorporated into the WLA as a bulk reserve to take in account future permit activity.

The load allocation (LA) is that portion of the total load assigned to nonpoint sources, specifically all land use sources other than NPDES permitted point sources. Loads not reduced (LNR) are the portion of the LA associated with nonpoint sources other than agricultural (croplands, hay/pasture, and disturbed land), and stream bank. It is equal to the sum of modeled loading on forested land use, wetlands, and low development. The adjusted load allocation (ALA) represents the remaining portion of the LA distributed among agricultural land and associated stream banks.

The TMDL developed for the impaired Stony Run established a reduction in the current sediment loading to **32.3%.** This specific TMDL was completed to address the siltation impairments noted on the ***2016 Pennsylvania Integrated Water Quality Monitoring and Assessment Report, Streams, Category 5, Waterbodies, Pollutants Requiring a TMDL*** required under the Clean Water Act. The following gives a brief overview of sedimentation as a naturally process and as a pollutant, if erosion and loading surpass adequate watershed drainage. As a "pollutant", the Department develops a Total Maximum Daily Load when excess silt becomes detrimental to the ecological functions of a water body's aquatic biology.

Background in Sediment Loading

Sedimentation is an essential component of aquatic ecosystems, as it often contains minerals used by many aquatic organisms, and 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, excessive amounts of sediment can enter streams or erode from streams and cause undesirable effects (Bryan and Rutherford 1995).

Agricultural practices such as row cropping involve the tilling of landscapes to make the soil porous and fertile, which consequently loosens soil directly, as well as indirectly by removing plants whose roots once held soil in place. During rain events, loosened soil is directed toward nearby streams via overland runoff, and depending upon the density of vegetation along the shoreline, sediment enters the water.

The soil of pasture land is often more stable than that of cropland, yet in-stream sedimentation issues arise from the surface runoff associated with this land use. If the pasture land is grazed, the soil becomes compacted from the constant trampling by livestock, and therefore precipitation leaves the area via surface runoff and enters streams instead of infiltrating into the soil. In addition, because vegetation within pasture land typically has shallow roots and little water retention ability, precipitation that does infiltrate the soil saturates the soil quickly, which consequently reduces absorbance and increases surface runoff. The sudden increase in water volume in a stream raises the velocity of the flow to a point where soil from the streambanks begins to erode into the channel. Runoff volume from this land use is further increased in areas with steep topography, and areas in which cattle have overgrazed the vegetation. In addition to facilitating hydrology-related sedimentation issues, the overgrazing and trampling of vegetation in riparian zones leads to loosened soil that directly enters streams.

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, 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

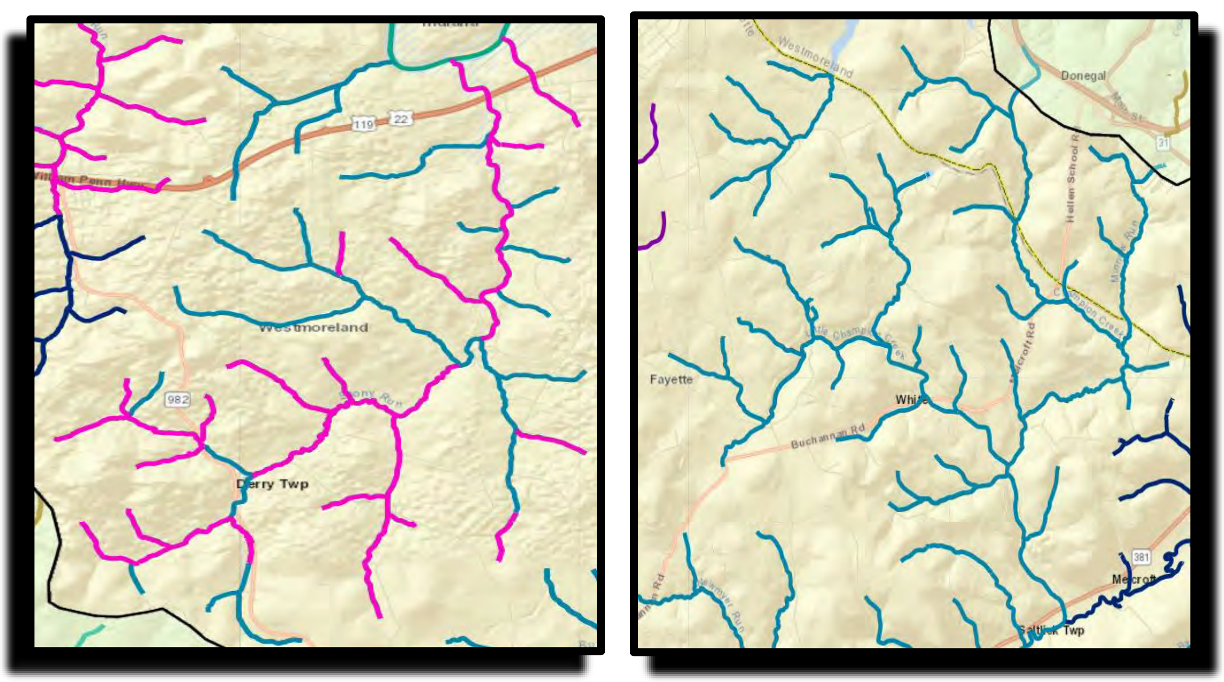
TMDLs Addressing Sediment Loading as an Excessive Pollutant

The TMDL developed for the Stony Run Watershed addresses sediment. Pennsylvania does not currently have specific numeric criteria for sediment loading requirements. Therefore, to establish endpoints such that the designated uses of the Stony Run watershed are attained and maintained, for all waterbodies, Pennsylvania utilizes its narrative water quality criteria, which state that:

> ***Water may not contain substances attributable to point or nonpoint source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life. (25 PA Code Chapter 93.6 (a)); and, in addition to other substances listed within or addressed by this chapter, specific substances to be controlled include, but are not limited to, floating materials, oil, grease, scum and substances which produce color, tastes, odors, turbidity or settle to form deposits. (25 PA Code, Chapter 93.6)***

Because neither Pennsylvania nor the U.S. Environmental Protection Agency (USEPA) has instream numerical water quality criteria for sediment, a method was developed to implement the applicable narrative criteria. The method for these types of TMDLs is termed the "Reference Watershed Approach." The Reference Watershed Approach compares two watersheds: one attaining its uses and one that is impaired based on biological assessments. Based on the reference watershed approach, a total load capacity (or endpoint) of **1,119,361.2** lbs./yr. of sediment loading was determined sufficient to be protective of all Cold-Water Fishery, aquatic life uses as it is maintained in the reference watershed, Champion Run, Fayette County. Meeting the water quality objectives specified for this TMDL will result in the impaired stream segment attaining its designated uses.

Figure 1. Cold water comparison of in Stony Run (left) and Champion Creek (right):
(blue-not impaired CWF; pink-impaired CWF)



Impaired Watershed Characterization

Stony Run is currently designated as a Cold-Water Fish(ery) (CWF), (PA Code 25 § 93.9). A CWF provides for the maintenance or propagation, or both, of fish species including the family Salmonidae and additional flora and fauna which are indigenous to a cold-water habitat. This TMDL plan was developed for the watershed of Stony Run. This watershed is in north-eastern Westmoreland County, near Blairsville. Its watershed boundaries lie within Derry Township (USGS quadrangles – Derry and Blairsville) and flows northeast of SR 982, along Laughlin Farm Road approximately 7 miles before joining with the Conemaugh River, SR 22.

It has a total drainage area of 12.8 mi^2. The current land use estimated for the Stony Run watershed is as follows: Agriculture - 58%, Forest – 40%, Development – 2%. The watershed of Stony Run lies within the Pittsburgh Low Plateau Section of the Appalachian Plateau Province.

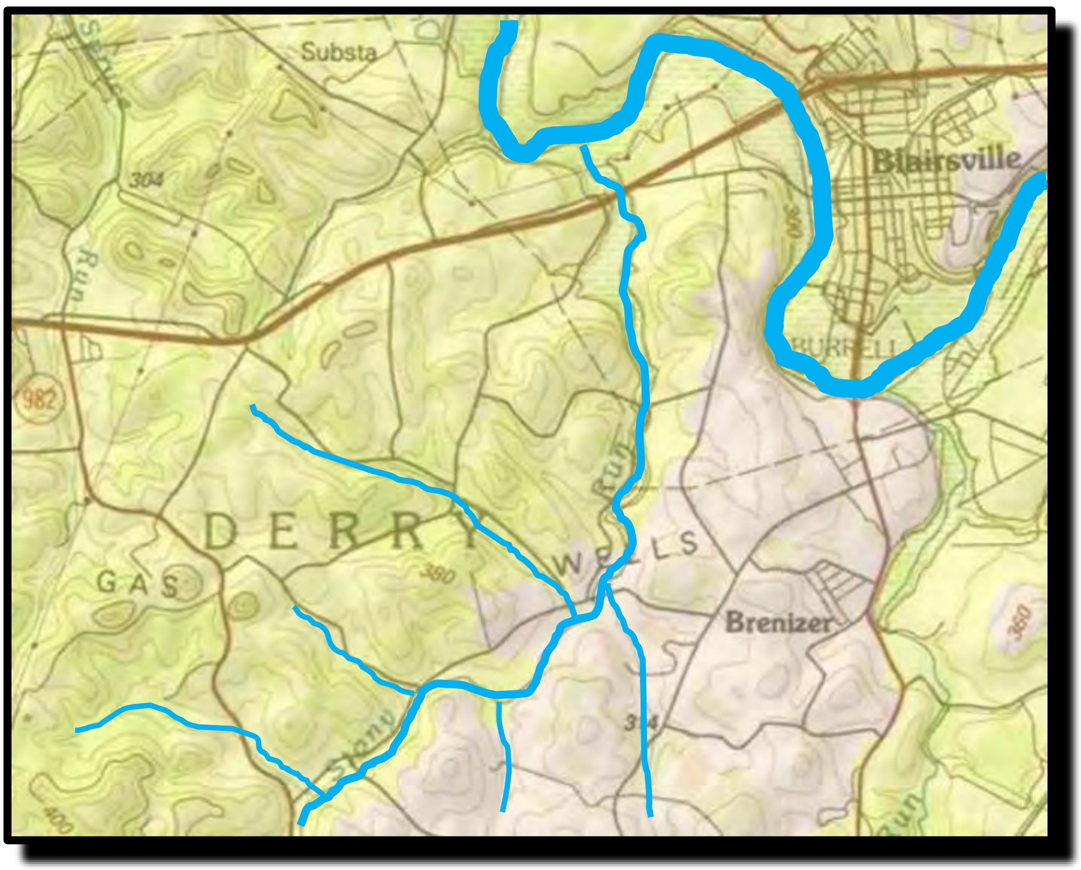


Figure 2. Overview map of geology in the Stony Run watershed

This section consists of a smooth, undulating upland surface cut by numerous, narrow, relatively shallow valleys. Elevation ranges from 997 to 1,398 feet above sea level. Rocks within the watershed are entirely interbedded sedimentary, and the underlying bedrock groups are the Monongahela Group, the Cassellman Formation, and the Glenshaw Formation (Figure 2. yellow- Cassellman, tan-Glenshaw.

The dominant hydrologic soil group is C; this soil group is characterized as having a slow infiltration rate when thoroughly wetted. Soil associations within the watershed are Gilpin-Wharton-Ernest (64%), Monongahela-Philo-Atkins (31%), and Gilpin-Westmoreland-Clarksburg (5%) (Figure 3.)

Figure 3. Overview map of land use in Stony Run

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 Stony Run. This approach is based on selecting a non-impaired, or reference, watershed and estimating its current loading rates for the pollutants of interest. The objective of the process is to reduce loading rates of those pollutants identified as causing impairment to a level equivalent to or lower than the loading rates in the reference watershed. This load reduction will result in conditions favorable to the return of a healthy biological community to the impaired stream segments.

First, there are three factors that should be considered when selecting a suitable reference watershed: impairment status, similarity of physical properties, and size of the watershed. A watershed that the Department has assessed and determined to be attaining water quality standards should be used as the reference.

Second, a watershed that closely resembles the impaired watershed in physical properties such as land use/land cover, physiographic province, elevation, slope and geology should be chosen. Finally, the size of the reference watershed should be within 20-30% 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, geologic formations layer, physiographic province layer, soils layer, Landsat-derived land cover/use grid, and the stream assessment information found on the Department's Instream Comprehensive Evaluation Protocol (ICE) GIS-based website.

Reference Watershed Characterization

Thus, Champion Creek was selected as the reference for developing the Stony Run Sediment TMDL (see maps on Figure 1. To 3.). It is designated as a Cold-Water Fish(ery) like Stony Run and is identified as attaining this aquatic life use. It is a tributary of Indian Creek and the greater Youghiogheny River basin, near Melcroft, Fayette County. Table 4. compares the respective impaired and reference headwaters in terms of size, location, and other physical characteristics.

Table 2. Comparison of Stony Run (impaired) and Champion Creek (reference)

	Stony Run	**Champion Creek**
Physiographic Province	Appalachian Plateau Province (Pittsburgh Low Plateau Section)	Appalachian Plateau Province (Pittsburgh Low Plateau Section)
Area (acres)	8,234.0	8,262.0
% Agriculture	58	39
% Forest	40	51
% Other	2	10
Major Geology/Hydric Soils:		
% Interbedded Sed.	100	100
Group C-Slow Infiltration	45	57
Average Rainfall (in.)	44.71, 24 years	38.09, 24 years
Average Runoff (in.)	2.45, 24 years	1.08, 24 years

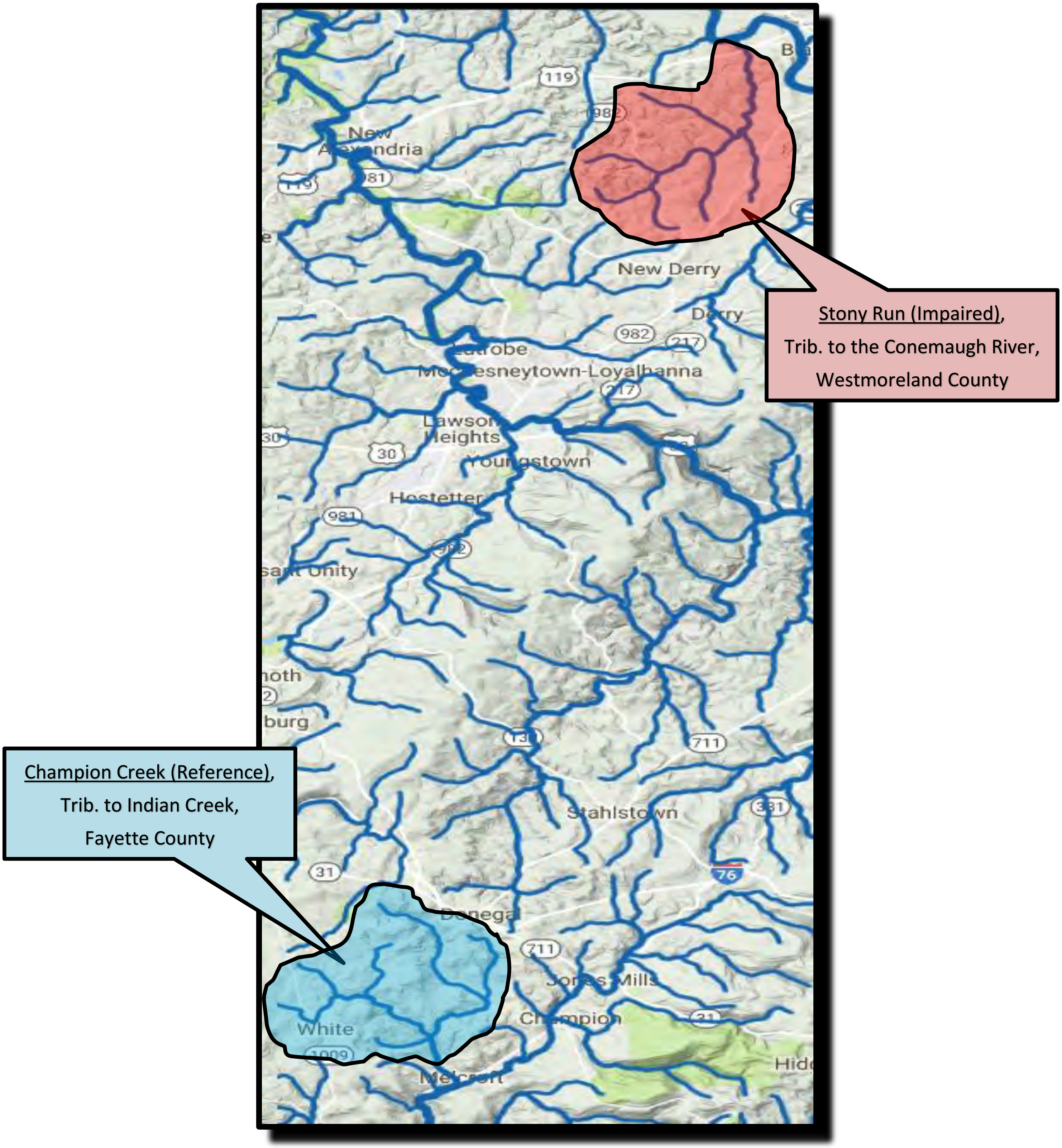


Figure 4. Overview map comparing land use in Stony Run (impaired) and Champion Creek

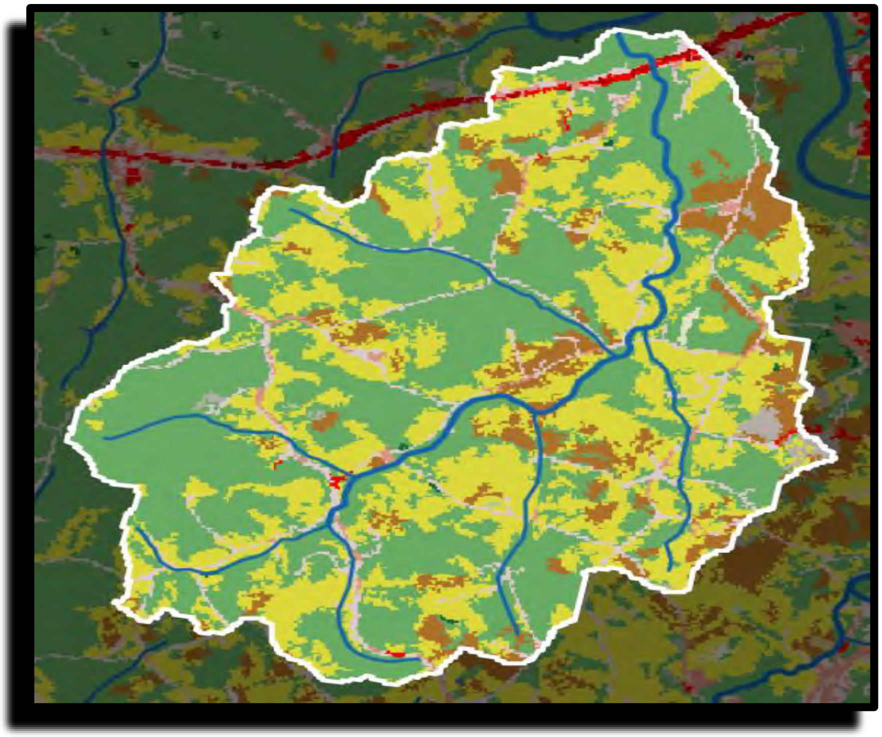
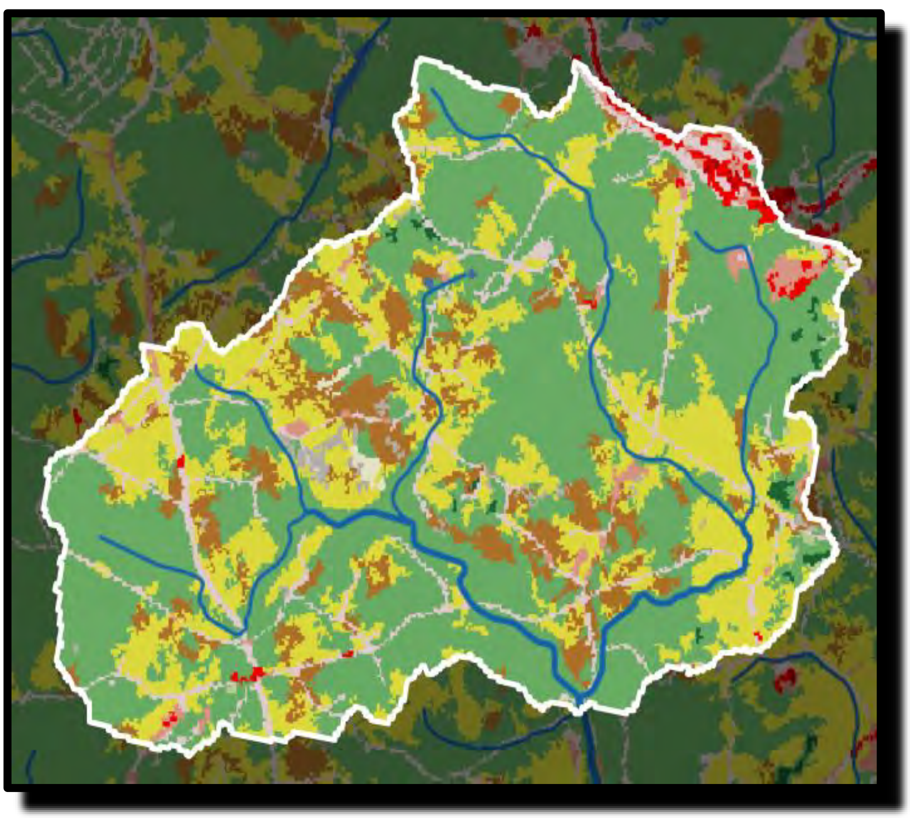


Figure 5. - Overview map of land use in Stony Run (impaired)
Figure 6. - Overview map of land use in Champion Creek (not impaired)



Background in Clean Water Protection in Pennsylvania

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. In an April 7, 1997, Memorandum of Understanding with EPA, the Department agreed to a 12-year schedule to develop TMDLs for impaired streams listed on the 1996 CWA Section 303(d) list. 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.).
Over the years, the Department has met those TMDL goals. As of 2009, the Consent has been lifted, but the Department is pursuant in successful Clean Water objective for protection of Commonwealth of Pennsylvania's resources.

Integrated WQ 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 kick-net 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 those pollutants receive separate and specific TMDLs within that stream segment. For the TMDL process to be most effective, adjoining stream segments with the same source and cause listing is 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 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

Table 4. 2016 Integrated WQ Monitoring & Assessment Report - Impaired Streams List

2016 Pennsylvania Integrated Water Quality Monitoring and Assessment Report - Streams, Category 4a, 4c, and 5 Waterbodies

Stream Nam / HUC	Use Assessed (Assessment ID) - Miles	Source	Cause	Date Listed	TMDL Date
Hydrologic Unit Code: 05010007-Conemaugh					
Stony Run (HUC: 05010007)	Aquatic Life (12700) - 7.36 miles	Agriculture	Siltation	2006	2019
Stony Run Unnamed Of (ID:123714547) (HUC: 05010007)	Aquatic Life (12700) - 0.49 miles	Agriculture	Siltation	2006	2019
Stony Run Unnamed Of (ID:123714550) (HUC: 05010007)	Aquatic Life (12700) - 0.37 miles	Agriculture	Siltation	2006	2019
Stony Run Unnamed Of (ID:123714567) (HUC: 05010007)	Aquatic Life (12700) - 1.55 miles	Agriculture	Siltation	2006	2019
Stony Run Unnamed Of (ID:123714579) (HUC: 05010007)	Aquatic Life (12700) - 0.66 miles	Agriculture	Siltation	2006	2019
Stony Run Unnamed Of (ID:123714591) (HUC: 05010007)	Aquatic Life (12700) - 0.35 miles	Agriculture	Siltation	2006	2019
Stony Run Unnamed Of (ID:123714594) (HUC: 05010007)	Aquatic Life (12700) - 0.43 miles	Agriculture	Siltation	2006	2019
Stony Run Unnamed Of (ID:123714596) (HUC: 05010007)	Aquatic Life (12700) - 0.56 miles	Agriculture	Siltation	2006	2019
Stony Run Unnamed Of (ID:123714597) (HUC: 05010007)	Aquatic Life (12700) - 0.53 miles	Agriculture	Siltation	2006	2019
Stony Run Unnamed Of (ID:123714602) (HUC: 05010007)	Aquatic Life (12700) - 0.52 miles	Agriculture	Siltation	2006	2019

Page 1 of 3

Stream Nam / HUC / Use Assessed (Assessment ID) - Miles / Source	Cause	Date Listed	TMDL Date
Stony Run Unnamed Of (ID:123714614) HUC: 05010007			
Aquatic Life (12700) - 0.48 miles			
Agriculture	Siltation	2006	2019
Stony Run Unnamed Of (ID:123714619) HUC: 05010007			
Aquatic Life (12700) - 0.23 miles			
Agriculture	Siltation	2006	2019
Stony Run Unnamed Of (ID:123718038) HUC: 05010007			
Aquatic Life (12700) - 0.31 miles			
Agriculture	Siltation	2006	2019
Stony Run Unnamed To (ID:123714506) HUC: 05010007			
Aquatic Life (12700) - 0.41 miles			
Agriculture	Siltation	2006	2019
Stony Run Unnamed To (ID:123714510) HUC: 05010007			
Aquatic Life (12700) - 1.27 miles			
Agriculture	Siltation	2006	2019
Stony Run Unnamed To (ID:123714527) HUC: 05010007			
Aquatic Life (12700) - 0.34 miles			
Agriculture	Siltation	2006	2019
Stony Run Unnamed To (ID:123714536) HUC: 05010007			
Aquatic Life (12700) - 0.35 miles			
Agriculture	Siltation	2006	2019
Stony Run Unnamed To (ID:123714541) HUC: 05010007			
Aquatic Life (12700) - 0.53 miles			
Agriculture	Siltation	2006	2019
Stony Run Unnamed To (ID:123714553) HUC: 05010007			
Aquatic Life (12700) - 0.45 miles			
Agriculture	Siltation	2006	2019
Stony Run Unnamed To (ID:123714558) HUC: 05010007			
Aquatic Life (12700) - 0.88 miles			
Agriculture	Siltation	2006	2019

2016 Pennsylvania Integrated Water Quality Monitoring and Assessment Report - Streams, Category 4a, 4c, and 5 Waterbodies

Stream Nam HUC Use Assessed (Assessment ID) - Miles Source	Cause	Date Listed	TMDL Date
Stony Run Unnamed To (ID:123714575) HUC: 05010007			
Aquatic Life (12700) - 2.29 miles			
Agriculture	Siltation	2006	2019
Stony Run Unnamed To (ID:123714578) HUC: 05010007			
Aquatic Life (12700) - 2.03 miles			
Agriculture	Siltation	2006	2019
Stony Run Unnamed To (ID:123714581) HUC: 05010007			
Aquatic Life (12700) - 0.44 miles			
Agriculture	Siltation	2006	2019
Stony Run Unnamed To (ID:123714583) HUC: 05010007			
Aquatic Life (12700) - 0.92 miles			
Agriculture	Siltation	2006	2019
Stony Run Unnamed To (ID:123714609) HUC: 05010007			
Aquatic Life (12700) - 1.54 miles			
Agriculture	Siltation	2006	2019
Stony Run Unnamed To (ID:123714612) HUC: 05010007			
Aquatic Life (12700) - 1.8 miles			
Agriculture	Siltation	2006	2019
Stony Run Unnamed To (ID:123714620) HUC: 05010007			
Aquatic Life (12700) - 1.45 miles			
Agriculture	Siltation	2006	2019
Stony Run Unnamed To (ID:123714628) HUC: 05010007			
Aquatic Life (12700) - 0.48 miles			
Agriculture	Siltation	2006	2019
Stony Run Unnamed To (ID:123718040) HUC: 05010007			
Aquatic Life (12700) - 0.28 miles			
Agriculture	Siltation	2006	2019

Page 3 of 3

Basic Steps for Developing 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. Collect and summarize pre-existing data (watershed characterization, inventory contaminant sources, determination of pollutant loads, etc.) and supplement data, as needed;
2. Calculate TMDL for the waterbody using EPA approved methods and computer models;
3. Determine critical and seasonal conditions;
4. Allocate pollutant loads to various sources;
5. Public notice the draft report for public review and comments;
6. Finalize TMDL report based on public comments; and
7. Submit TMDL for EPA approval.

TMDL Elements (WLA, LA, MOS)

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

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

- Changes among individual WLAs but not the total sum of the WLA with no other changes in the TMDL; 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.

Hydrologic / Water Quality Modeling

Part 1. Model Overview & Data Compilation

The TMDL for this watershed was calculated using the Loading Function (MAPSHED). The core watershed simulation model for the MAPSHED software application is the GWLF (Generalized Watershed Loading Function) model developed by Haith and Shoemaker. The original DOS version of the model was re-written in Visual Basic by Evans et al. (2002) to facilitate integration with ArcView, and tested extensively in the U.S. and elsewhere.

The GWLF model provides the ability to simulate runoff and corresponding sediment loading from a watershed given variable-size source areas (i.e., agricultural, forested, and developed land). It is a continuous simulation model that uses daily time steps for weather data and water balance calculations. Monthly calculations are made for sediment loading 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, but each area is assumed to be homogenous regarding 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 word, 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 models surface runoff using the Soil Conservation Service Curve Number, or 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 (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 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.

For execution, the model requires two separate input files containing transport and weather-related data. The transport (transport.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 weather (weather.dat) file contains daily average temperature and total precipitation values for each year simulated.

Since its initial incorporation into MAPSHED, the GWLF model has been revised to include several routines and functions not found in the original model. For example, a significant revision in one of the earlier versions of MAPSHED was the inclusion of a streambank erosion routine. This routine is based on an approach often used in the field of geomorphology in which monthly streambank erosion is estimated by first calculating a watershed-specific lateral erosion rate (LER). After a value for LER has been computed, the total sediment load generated via streambank erosion is then calculated by multiplying the above erosion rate by the total length of streams in the watershed (in meters), the average streambank height (in meters), and the average soil bulk density (in kg/m3).

The inclusion of the various model enhancements mentioned above has necessitated the need for several more input files than required by the original GWLF model, including a “scenario” (*.scn) file, an animal data (animal.dat) file. Also, given all the new and recent revisions to the model, it has been renamed “GWLF-E” to differentiate it from the original model.

MAPSHED is used to parameterize input data for the GWLF-E model. In utilizing this interface, the user is prompted to load required GIS files and to provide other information related to various "non-spatial" model parameters (e.g., beginning and end of the growing season; the months during which manure is spread on agricultural land, etc.).

This information is subsequently used to automatically derive values for required model input parameters which are then written to the appropriate input files needed to execute the GWLF-E model. Also, accessed through the interface are Excel-formatted weather files containing daily temperature and precipitation information. (In the version of MAPSHED used in Pennsylvania, a statewide weather database was developed that contains about twenty-five (25) years of temperature and precipitation data for seventy-eight (78) weather stations around the state). This information is used to create the necessary weather.dat input file for a given watershed simulation.

Part 2. GIS Based Derivation of Input Data

The primary sources of data for this analysis were geographic information system (GIS) formatted databases and shapefiles. In using the MAPSHED 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 growing season, manure spreading period, etc.). This information is subsequently used to automatically derive values for required model input parameters, which are then written to the TRANSPRT.DAT and WEATHER.DAT input files needed to execute the GWLF model.

For use in Pennsylvania, MAPSHED 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 cropping practices. Complete GWLF-formatted weather files are also included for the seventy-eight weather stations around the state.

Table 5. lists GIS datasets and shapefiles used for the Stony Run TMDL calculations via MAPSHED and provides explanations of how they were used for development of the input files for the GWLF model.

Table 5. GIS Datasets	
DATASET	**DESCRIPTION**
county.shp	The county boundaries coverage lists data on conservation practices which provides C and P values in the Universal Soil Loss Equation (USLE).
padem	100 - meter digital elevation model; this is used to calculate land slope and slope length.
palumrlc	A satellite image derived land cover grid which is classified into 15 different landcover categories. This dataset provides landcover loading rates for the different categories in the model.
physprov.shp	A shapefile of physiographic provinces. This is used in rainfall erosion calculations.
smallsheds.shp	A coverage of watersheds derived at 1:24,000 scale. This coverage is used with the stream network to delineate the desired level watershed.
streams.shp	The 1:24,000 scale single line stream coverage of Pennsylvania. Provides a complete network of streams with coded stream segments.
PAgeo	A shapefile of the surface geology used to compare watersheds of similar qualities.
weathersta.shp	Historical weather files for stations around Pennsylvania to simulate flow.
soils.shp	A shapefile providing soil characteristics data. This is used in multiple calculations.
zipcodes.shp	This shapefile provides animal density numbers used in the LER calculation.

In the GWLF model, the nonpoint source load calculated is affected by terrain conditions such as amount of agricultural land, land slope, and inherent soil erodibility. It is also affected by farming practices utilized in the area. Various parameters are included in the model to account for these conditions and practices. Some of the more important parameters are summarized below:
Areal extent of different land use/cover categories: This is calculated directly from a GIS layer of land use/cover.

Curve number: This determines the amount of precipitation that infiltrates into the ground or enters surface water as runoff. It is based on specified combinations of land use/cover and hydrologic soil type, and is calculated directly using digital land use/cover and soils layers.

K factor: This factor relates to inherent soil erodibility, and affects the amount of soil erosion taking place on a given unit of land.

LS factor: This factor signifies the steepness and length of slopes in an area and directly affects the amount of soil erosion.

C factor: This factor is related to the amount of vegetative cover in an area. In agricultural areas, the crops grown and the cultivation practices utilized largely control this factor. Values range from 0 to 1.0, with larger values indicating greater potential for erosion.

P factor: This factor is directly related to the conservation practices utilized in agricultural areas. Values range from 0 to 1.0, with larger values indicating greater potential for erosion.

Sediment delivery ratio: This parameter specifies the percentage of eroded sediment that is delivered to surface water and is empirically based on watershed size.

Unsaturated available water-holding capacity: This relates to the amount of water that can be stored in the soil and affects runoff and infiltration. It is calculated using a digital soils layer.

Other less important factors that can affect sediment loads in a watershed are also included in the model.

Watershed Assessment and Modeling

The MAPSHED model was used to establish existing loading conditions for the impaired (siltation) Stony Run, Westmoreland County and the corresponding non-impaired, reference of Champion Creek, Fayette County. All MAPSHED data and outputs have been attached to this TMDL as Attachment B. Department staff visited the listed watersheds to get a better understanding of existing conditions that might influence the MAPSHED model. General observations (as detailed with the following photos and descriptions, see Figures 8 through 45; see maps on Figures 7. and 32.) of the individual watersheds of Stony Run and Champion Creek.

Based on field observations, no adjustments were made to specific parameters used in the MAPSHED model:

- In the BMP editor, "Stream Km with Vegetated Buffer Strips" was modified to an "Existing Km" of 2.0 (out of 4.0 Km of Streams in Ag Areas) based on a field tour with the Fayette County Conservation District and Mountain Watershed Association, and local property owners. Examples include vegetation on old fields, riparian lowlands, and conservation projects like CREP plantings and fencing.
- C factor: This factor is related to the amount of vegetative cover in an area. In agricultural areas, the crops grown and the cultivation practices utilized largely control this factor. Values range from 0 to 1.0, with larger values indicating greater potential for erosion. This was lowered under "Cropland" from a "C" of 0.163 to 0.100. Examples include rooted riparian buffer zones, strip and contour cropping along sloping topography, cover crops or free vegetative growth on fields, CREP: tree and shrub plantings.
- P factor: This factor is directly related to the conservation practices utilized in agricultural areas. Values range from 0 to 1.0, with larger values indicating greater potential for erosion. This was lowered under "Hay/Pasture" from a "P" of 1.00 to 0.95. Examples include controlled grazing areas and housing; primarily horse farms, CREP: retired or rotating pastureland, stream bank fencing, stream crossings, Fayette County funded water sourcing, low development with lowlands/ponds for water retention

Figure 7. – Ariel view of land cover and uses in Champion Creek, Fayette County

Figure 8. – The headwaters of Champion (west of Donegal) flow through rooted, riparian tracts from Myers and Thompson Roads downstream to County Line Road

Figure 9. – Dominant land use is specific crops, including orchards, and Controlled grazing areas and housing, such as horse farms

Figure 10. – Ag activities in the headwaters include strip and contour cropping adjacent the sloping topography in the watershed

Figure 11. – Traditional farms show some form of cover crops or rotation of activities

Figure 12. – Many landowners have participated in the PA Conservation Reserve Enhancement Program like tree and shrub plantings

Figure 13. – The lower portion of Champion Creek, (between County Line Road and Melcroft Road) begins to open up to development but free growth riparian is common

Figure 14. – Other examples of CREP projects include retired or rotating pastureland

Figure 15. – Stream bank fencing and riparian buffering along Champion, provides Maintenance of bank and property, but also successful silt loading

Figure 16. – CREP funded stream crossing for horses and Fayette County funded water sourcing

**Figure 17. – Minnow Run is a tributary to the upper Champion Creek;
and like Champion, its headwaters start near Donegal on wooded tracts to the south**

Figure 18. – Open land by residents or farms are left to wild growth for crop retirement, habitat for wildlife, or riparian buffering that adds shade and bank integrity

Figure 19. – Low development, including schools and campgrounds, have lowland and ponds for storm water retention

Figure 20. – From Kings Way to Mountain View Road, Minnow Run flows south and most its length, is along stable and forested banks

Figure 21. – Siltation builds up as agriculture creeps closer toward the mouth of Minnow Run near it's confluence with the upper Champion Creek (south of County Line Road)

Figure 22. – Upstream of its confluence with Minnow Run, Champion Creek exhibits erosion downstream and south of Red Dog Road, while again proceeding through forested corridors

Figure 23. – Champion Creek meets with Little Champion Creek, near Albright Road and Melcroft Road

Figure 24. – The headwaters of Little Champion Creek encompass drainage off the eastern flank of Chestnut Ridge (south of Bear Rocks, south of Route 31), Fayette County

Figure 25. – The mainstem generally runs through free growth, riparian zones and act as buffering strips between intermingling open space (between Breakneck Road and SR 1009)

Figure 26. – At the end of Freeman Lane, Little Champion intersects its first tributary where CREP projects such as stream bank fencing and stream side plantings can be seen

Figure 27. – Rooted banks with trees and shrubs stabilize soil during high flow events

Figure 28. – Little Champion travels east to another tributary that starts at Donegal Lake, flowing southwest through wooded lots adjacent to Coffman Road

Figure 29. – After meeting with this previous trib., Little Champion continues through for about quarter mile of wooded, private landowners, upstream of Willow Lane

Figure 30. – Little Champion confluences with Champion Creek another quarter mile downstream of Buchannan Road

Figure 31. –The reference section of Champion Creek used for Stony Run ends directly downstream of the confluence of Little Champion and mainstem Champion (near Albright Rd.)

Figure 32. –Aerial view of land uses biologically impairing Stony Run, Westmoreland County

Figure 33. – The headwaters of Stony Run start in two small valley drainages on the western flank of Chestnut Ridge (west of Route 982)

Figure 34. – The mainstem flows generally northeast, along McCullough Road, for about a half mile through shrubby, low cut tracts, with pastureland dominant

Figure 35. – The first major tributary of Stony Run (adjacent to Route 982) flows west through primarily forest tracts and then north through ag. lands

Figure 36. – The change of having more vegetative, riparian buffering than The mainstem of Stony Run is seen in less sediment build up on the substrate

Figure 37. – Upstream of SR 982 and SR 1027 pastureland induced cutting of banks during storm water events perpetuate downstream

Figure 38. – Stream banks along Stony Run widen and become part of the substrate

Figure 39. – Approximately three fourths of a mile of stream length (along SR 1027) comprise of different tracts of rooted bank buffering and stabilization

Figure 40. – Adjacent benthic substrate has limited silt layering and is clear in flow

Figure 41. – On the lower two miles of Stony Run, two major tributaries contrast differences in land use and stream quality; this tributary (originating southeast of I-119) has a general land cover of forest and fields

Figure 42. – Another tributary (northwest of SR 1012) has heavy pasture land use

Figure 43. – Tributary is susceptible to incising and bank deuteriation

Figure 44. – The lower mile of the Stony Run watershed is in lowland where an increased load of sediment and elevated stream bed creating wetland and pooling

Figure 45. – Stream banking compression and slumping, as well as, lowland water retention has produced silt loaded stream beds wide enough to cause wetlands upstream the mouth of Stony Run

Development of Sediment TMDL

The target TMDL value for the biologically impaired Stony Run was established based on current loading rates for sediment in the reference Champion Creek. As described in the previous section, sediment loading rates were computed for the reference stream using the MAPSHED model. The target TMDL value for sediment was determined by multiplying the unit area loading rates for the reference stream by the total area of the biologically impaired one (Table 6).

Table 6. Target TMDL Using Reference Loading Rate with Total Area of Impaired

Pollutant	Loading Rate in Reference (lb./ac.-yr.)	Total Area Impaired Watershed (ac.)	Target TMDL Value (lb./yr.)	Target TMDL Value (lb./day)
Sediment	**135.5**	**8,262.0**	**1,119,361.2**	**3,066.7**

The target TMDL value was then used as the basis for load allocations and reductions in the Stony Run, using the following two equations:

1. TMDL = WLA + LA + MOS
2. LA = ALA + LNR where:

TMDL = Total Maximum Daily Load   MOS = Margin of Safety
WLA = Waste Load Allocation (Point Sources)   ALA = Adjusted Load Allocation
LA = Load Allocation (Nonpoint Sources)   LNR = Loads Not Reduced

Waste Load Allocation

The waste load allocation (WLA) portion of the sediment TMDL equation is the total loading of a pollutant that is assigned to point sources. A search of the Pennsylvania Department of Environmental Protection's (Department) efacts permit database identified no point source discharges within the Stony Run watershed. A WLA allocation of 1% of the Sediment TMDL (1,119,361.2 lbs./yr.) was incorporated as a bulk reserve (11,193.6 lbs./yr.) for the dynamic nature of future permit activity.

WLA = 1,119,361.2 lbs./yr. (TMDL) * 0.1 = 11,193.6 lbs./yr. or 30.7 lbs./day

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 10% of the TMDL load is based on professional judgment and will provide an additional level of protection to the designated uses of Stony Run. The MOS used for the Sediment TMDL was set at 111,936.1 lbs./yr.

MOS = 1,119,361.2 lbs./yr. (TMDL) * 0.1 = 111,936.1 lbs./yr. 306.7 lbs./day

Load Allocation

The load allocation (LA) is that portion of the TMDL that is assigned to nonpoint sources. The LA for the Sediment TMDL was computed by subtracting the MOS value and the WLA from the TMDL value. The LA for the Sediment TMDL was set at 1,128,798.9 lbs./yr.

LA = 1,119,361.2 lbs./yr. (TMDL) – 111,936.1 lbs./yr. (MOS) – 11,193.6 lbs./yr. (WLA)
LA = 996,231.5 lbs./yr. 2,729.4 lbs./day

Adjusted Load Allocation

The adjusted load allocation (ALA) is the actual portion of the LA distributed among those nonpoint sources receiving reductions. It is computed by subtracting those nonpoint source loads that are not being considered for reductions (loads not reduced (LNR)) from the LA. The Stony Run was developed to address impairments caused by agricultural activities. Land uses associated with agricultural activities include hay/pastureland, cropland, including associated stream banks, and bare riparian areas. Land uses/source loads not reduced (LNR) were carried through at their existing loading values. The ALA for the Sediment TMDL was set at 977,831.5 lbs./year (Table 7.).

ALA (adjusted load allocation) = LA – LNRs

Table 7. Loads of pollutant sources that will not be reduced (LNRs).

	Sediment (lbs./yr.)
Load Allocation	**996,231.5**
Loads Not Reduced	**18,400.0**
FOREST	**11,600.0**
WETLAND	**0.0**
BARREN LAND	**200.0**
LO_INT_DEV	**4,400.0**
HI_INT_DEV	**200.0**
MD_INT_DEV	**1,400.0**
OPEN SPACE	**600.0**
Adjusted load allocation	**977,831.5** **(2,679.0)**

TMDL Summary

The sediment TMDL established for Stony Run consists of a Load Allocation (LA) and a Margin of Safety (MOS). The individual components TMDL are summarized in Table 9.

Table 8. TMDL Components for Stony Run

Parameter	Sediment (lbs./yr.)	
TMDL (Total Max Daily Load)	**1,119,361.2**	**3,066.7**
WLA (Wasteload Allocation)	**11,193.6**	**30.7**
MOS (Margin of Safety)	**111,936.1**	**306.7**
LA (Load Allocation)	**996,231.5**	**2,729.4**
LNRs (Loads not reduced)	**18,400.0**	**50.4**
ALA (Adjusted Load Allocation)	**977,831.5**	**2,679.0**

Calculation of Sediment Load Reductions

The adjusted load allocation established in the previous section represents the sediment load that is available for allocation between agricultural activities (cropland and hay/pastureland) and associated stream banks in the Stony Run. 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 stream banks. 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 was more than the adjusted load allocation (ALA).

2. After any necessary reductions, have been made in the baseline, the multiple analyses are run. The multiple analyses will sum all 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 32.3% reduction in current sediment loading for agricultural activities (cropland, hay/pastureland), bare riparian, and associated stream banks.

Tables 9. (Annual and Daily Values) contains the results of the EMPR in sediment loading. The load allocations for each land use is shown along with the percent reduction of current loads necessary to reach the targeted LA.

Table 9. Sediment Load Allocations/Reductions for Land Uses and Stream Banks in the Stony Run (Annual and Daily Values)

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
Cropland	914.1	618.9	655,400.0	443,754.9	**32.3%**
Hay/Pastureland	135.2	91.5	370,400.0	250,788.9	**32.3%**
Streambank	**-**	**-**	418,400.0	283,288.1	**32.3%**
Pollutant Source	**Current Loading Rate (lbs/day/acre)**	**Allowable Loading Rate (lbs/day/acre)**	**Current Load (lbs/day)**	**Allowable Load (lbs/day)**	**Percent Load Reduction**
Cropland	2.5	1.7	1795.6	1,215.7	**32.3%**
Hay/Pastureland	0.4	0.3	1014.8	687.1	**32.3%**
Streambank	-	-	1146.3	776.1	**32.3%**

Consideration of Critical Conditions

The MAPSHED model 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 daily water balance accumulated in monthly values. Therefore, all flow conditions are considered 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 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 several 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.

Consideration of Background Contributions

The MAPSHED model accounts for all land uses within the watershed and their respective contributions to the sediment load. The only background sources of sediment within the watershed would be from forested areas. There are no additional "upstream" these non-point sources to this watershed. The remaining land uses are anthropogenic sources of sediment to the watershed, thus will not be considered background.

Recommendations

Sediment loading 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 are called for per 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 the streams in the watershed can be made through the right combination of BMPs including, but not limited to: establishment of cover crops, strip cropping, residue management, no till, crop rotation, contour farming, terracing, 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 forested riparian buffers. Some of these BMPs were observed in the biologically impaired Stony Run; however, they were more extensively used in the unimpaired, reference Champion Creek with forested riparian 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 forested riparian buffers, in the reference watershed has contributed to its ability to maintain its attainment status as a Cold Waters Fishery (CWF) stream.

Stream banks contribute to the sediment load in Stony Run. Stream bank stabilization projects would be acceptable BMPs for the eroded stream banks in the area. However, the establishment of forested riparian 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. Forested riparian buffers are also essential to maintaining the biologically rich yet sensitive CWF habitat. Forested riparian 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 CWF use designation.

Important to TMDLs, established forested riparian buffers act as a sediment loading sink. This is because the highly active and concentrated biological communities they maintain will assimilate and remove sediment loading from the water column instead of allowing them to pass downstream, thus forested riparian buffers work directly toward attaining the goals of the TMDL by reducing pollutant loads. These forested riparian buffers also provide the essential conditions necessary to meet the CWF designated use of the waterway. Forested riparian buffers also provide critical habitat to rare and sensitive amphibious and terrestrial organisms as well as migratory species. While forested riparian buffers are considered the most effective BMP, other possibilities for attaining the desired reductions may exist for the agricultural usages, as well as for the stream banks.

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, or online at http://wcdpa.com/wp-content/uploads/PA-Water-Quality-Action-Packet-for-Agriculture-6-08.pdf. 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.

Funding Sources

The Federal Nonpoint Source Management Program (§ 319 of the Clean Water Act) is one funding source for nonpoint source pollution reduction BMPs, such as those described above. This grant program provides funding to assist in implementing Pennsylvania's Nonpoint Source Management Program. This includes funding for abandoned mine drainage, agricultural and urban run-off, and natural channel design/stream bank stabilization projects.
Information on Pennsylvania's Nonpoint Source Management Program can be found at:
http://www.portal.state.pa.us/portal/server.pt/community/nonpoint_source_management/10615

As mentioned before, a second funding source is Pennsylvania's Growing Greener Watershed Grants, which provides nearly $547 million in funding to clean up non-point sources of pollution throughout Pennsylvania. The grants were established by the Environmental Stewardship and Watershed Protection Act.
Information on Pennsylvania's Growing Greener Watershed Grants can be found at:
http://www.depweb.state.pa.us/portal/server.pt/community/growing_greener/13958

Stream Restoration Efforts

Westmoreland Conservation District Nutrient Management Specialist/Agriculture Conservation Technician Dan Griffith has been coordinating improvements on farms in the Stony Run Watershed to significantly reduce this pollution with funding provided by PA Growing Greener and the USDA Natural Resources Conservation Service Environmental Quality Incentive Program (EQIP).

A variety of conservation best management practices were recently installed on the Ken Laughlin farm to protect Stony Run including a riparian buffer nearly a mile long, an animal walkway, two animal stream crossings and a manure storage area.

Conservation best management practices currently being installed on the Duncan farm include a roofed heavy use area for animals, spring development, water trough, diversion ditch and gutters and downspouts on the barn – all to help keep storm water from washing excess nutrients into the Stony Run.

Figure 46. - Storm water diversion near a manure stacking area

A five-year effort to improve water quality in the Stony Run Watershed in Derry Township – formerly one of the highest in Westmoreland County in the amount of sediment and nutrient pollution – was completed during the year. Seven farms received a total of nearly 40 separate conservation improvements, including streambank fencing, animal walkways, stream crossings, stabilized pads, gutters and downspouts, spring developments with water troughs, diversion ditches, and heavy-use areas.

The improvements were financed with a Growing Greener II grant of some $133,500, funding from the Natural Resources Conservation Service's Environmental Quality Incentives Program, and contributions by the farm owners.

The nutrient management specialist/agricultural technician provided technical assistance to some 48 farmers during the year, often suggesting specific measures they could implement on their property to improve animal health, production yields, and/or water specialist/agricultural conservation technician also worked with more than 20 area farmers to explain new from a manure spreader – to have and follow a written plan for how the manure will be managed. Each of these farmers created a manure management plan per guidelines in a manual developed by the state.

Figure 47. - The circle in this photo highlights the area of the Clevenger Farm in the Stony Run Watershed near Blairsville where conservation best management practices were installed to help control sediment and nutrient pollution.

Public Participation

Public notice of the TMDL will be published in the Pennsylvania Bulletin on September 30, 2017 to foster public comment on the allowable loads calculated. A 30-day period will be provided for the submittal of comments and notice. Any public contribution will be placed in the Comments and Response, Section B, Pg. 59.

References

USDA (United States Department of Agriculture). 1981. Soil Survey of Allegheny County, Pennsylvania, National Cooperative Soil Survey. 93 pp

USEPA (United States Environmental Protection Agency). 1992. TMDL case study: Sycamore Creek, Michigan. EPA841-F-92-012. U.S. Environmental Protection Agency, Office of Water, Assessment and Watershed Protection Division, Washington, DC

USEPA (United States Environmental Protection Agency). 1999a. Protocol for developing sediment and nutrient TMDLS, EPA841-B-99-007., U.S. Environmental Protection Agency, Office of Water, Assessment and Watershed Protection Division, Washington, DC

Byran, C.F. and D.A. Rutherford. 1995. Impacts of warm water streams: Guidelines for evaluation (2nd Edition). Southern Division, American Fisheries Society, Little Rock, Arkansas. 285 pp.

Evans, B.M and K.J. Corradini. 2001 (In Review). BMP pollution reduction guidance document. Environmental Resources Research Institute, Pennsylvania State University, State College, PA. 15 pp.

Horne, A.J. and C.R. Goldman. 1994. Limnology (2nd Edition). McGraw-Hill Inc, New York, New York. 576 pp.

Novotny, Vladimir. 2003. Water quality, diffuse pollution and watershed management. Second Edition. John Wiley & Sons, Inc, New York, New York. 424 p.

Stickney, R.R. 1994. Principles of aquaculture. John Wiley & Sons, Inc, New York, New York. 502 p.

Waters, T.F. 1995. Sediment in streams: Sources, biological effects, and control. American Fisheries Society Monograph 7. American Fisheries Society, Bethesda, Maryland. 251 p.

Attachment A
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) among the appropriate contributing non-point sources. The load allocation and EMPR procedures were performed using MS Excel and results are presented in Figure A3. 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 water-body. 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 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.

FIGURE A1. GWLF Output for Stony Run

GWLF Total Loads for file: stonyrun-0 Period of analysis: 30 years from 1961 to 1990

Source	Area (Acres)	Runoff (in)	Tons: Erosion	Tons: Sediment	Total Loads (Pounds): Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	2740	0.9	1181.5	185.2	515.7	1256.7	188.0	503.8
Cropland	717	2.2	2090.2	327.7	1037.6	2348.4	116.9	675.6
Forest	4127	1.3	36.8	5.8	230.7	253.8	12.1	22.0
Wetland	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Disturbed	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turfgrass	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Open Land	9	4.1	1.7	0.3	4.2	5.2	0.1	0.5
Bare Rock	67	4.1	0.5	0.1	18.9	19.2	0.6	0.8
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LD Mixed	573	1.5	0.0	2.2	43.1	130.6	5.6	14.0
MD Mixed	24	6.6	0.0	0.7	9.4	28.5	1.2	2.9
HD Mixed	5	10.1	0.0	0.1	1.9	5.8	0.2	0.6
LD Residential	0	1.5	0.0	0.0	0.0	0.0	0.0	0.0
MD Residential	0	3.2	0.0	0.0	0.0	0.0	0.0	0.0
HD Residential	0	4.7	0.0	0.0	0.0	0.0	0.0	0.0
Farm Animals						1583.6		387.1
Tile Drainage				0.0		0.0		0.0
Stream Bank				209.2		209.3		89.1
Groundwater					6371.2	6371.2	271.1	271.1
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					78.1	78.1	0.0	0.0
Totals	8261.7	3.0	3310.6	731.3	8310.8	12290.5	595.9	1967.6

Go Back | Pathogen Loads | Export to JPEG | Print | Close

FIGURE A2. GWLF Output for Champion Creek

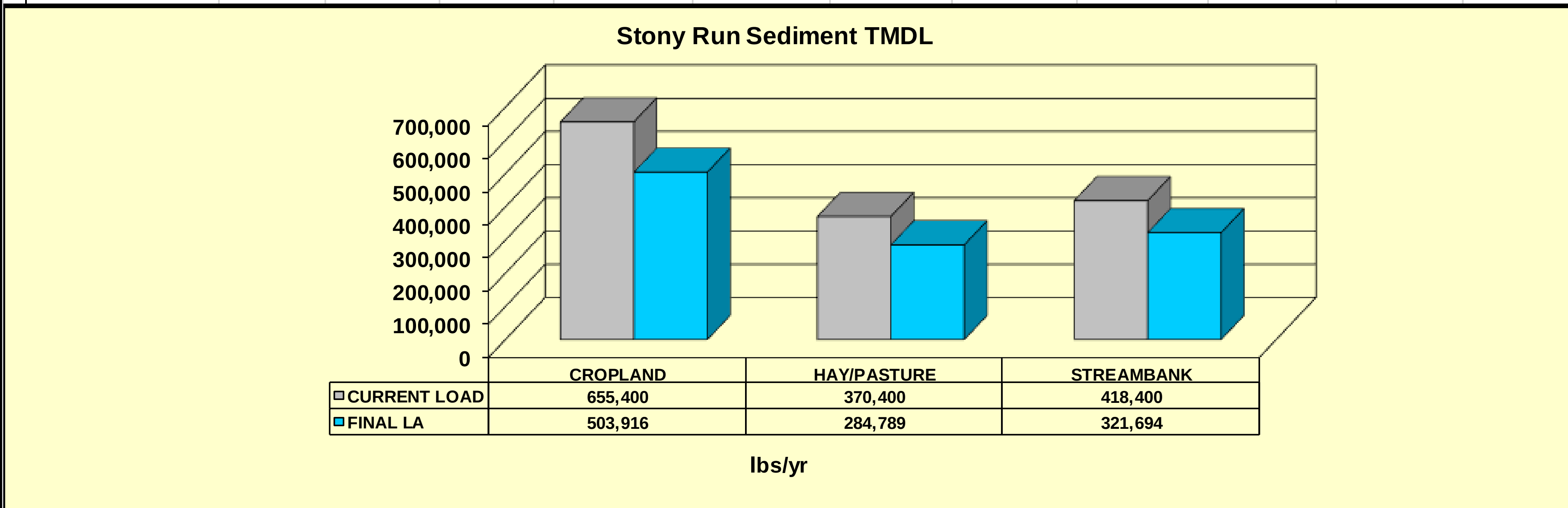
GWLF Total Loads for file: ChampionCreek_FieldMod_ Period of analysis: 30 years from 1961 to 1990

			Tons		Total Loads (Pounds)			
Source	Area (Acres)	Runoff (in)	Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	2288	0.9	903.3	141.8	430.5	997.8	174.5	456.0
Cropland	944	2.2	1774.5	204.8	1086.3	1972.3	137.1	579.6
Forest	4189	0.7	26.4	4.1	133.0	149.6	7.0	15.2
Wetland	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Disturbed	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turfgrass	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Open Land	29	5.4	4.1	0.7	17.4	20.0	0.4	1.6
Bare Rock	85	4.1	0.4	0.1	24.1	24.3	0.8	0.9
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LD Mixed	638	1.5	0.0	2.5	48.0	145.6	6.3	15.7
MD Mixed	13	6.6	0.0	0.4	4.9	14.9	0.6	1.5
HD Mixed	1	10.1	0.0	0.0	0.4	1.2	0.0	0.1
LD Residential	0	1.5	0.0	0.0	0.0	0.0	0.0	0.0
MD Residential	0	3.2	0.0	0.0	0.0	0.0	0.0	0.0
HD Residential	0	4.7	0.0	0.0	0.0	0.0	0.0	0.0
Farm Animals						1400.8		355.7
Tile Drainage				0.0		0.0		0.0
Stream Bank				199.8		199.8		99.2
Groundwater					9107.0	9107.0	321.9	321.9
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					39.0	39.0	0.0	0.0
Totals	8185.1	2.5	2708.8	554.1	10890.8	14072.4	648.6	1847.5

Go Back | Pathogen Loads | Export to JPEG | Print | Close

FIGURE A3. Equal Marginal Percent Reduction Calculations for Stony Run

1	TMDL				2	Adjusted LA = TMDL total load - ((MOS) - loads not reduced)						
	TMDL = Sediment loading rate in ref. * Impaired Acres					977831.5	977831.5					
	1119361.2											
		Annual				Recheck	% reduction	Load			Allowable	%
3		Avg. Load	Load Sum	Check	Initial Adjust	Adjust	allocation	Reduction	Initial LA	Acres	Loading Rate	Reduction
	CROPLAND	655400.0	1444200.0	good	655400.0		0.5	211645.1	443754.9	717.0	618.9	32.3%
	HAY/PASTURE	370400.0		good	370400.0	466368.5	0.3	119611.5	250788.5	2740.0	91.5	32.3%
	STREAMBANK	418400.0		good	418400.0		0.3	135111.9	283288.1			32.3%
					1444200.0		1.0		977831.5			
4	All Ag. Loading Rate	#REF!										
			Allowable		Current	Current						
		Acres	loading rate	Final LA	Loading Rate	Load	% Red.			CURRENT LOAD	FINAL LA	
5	CROPLAND	717.0	618.9	443754.9	914.1	655400.0	32.3%		CROPLAND	655,400	443,755	
	HAY/PASTURE	2740.0	91.5	250788.5	135.2	370400.0	32.3%		HAY/PASTURE	370,400	250,789	
	STREAMBANK			283288.1		418400.0	32.3%		STREAMBANK	418,400	283,288	
				977831.5		1444200.0	32.3%					



Attachment B
Comment and Response

Any public notice contribution for the Stony Run TMDL will be placed in this section upon completion of the 30-day comment period after September 30, 2017.   No comments were submitted.