NEWPORT CREEK WATERSHED AMD TMDL

Luzerne County

Prepared for:

Pennsylvania Department of Environmental Protection

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Newport Creek Watershed
Luzerne County, Pennsylvania

INTRODUCTION

This report presents the Total Maximum Daily Loads (TMDLs) developed for impaired segments in the Newport Creek Watershed (Attachment A). These are done to address the impairments noted on the 1996 Pennsylvania Section 303(d) list of impaired waters, required under the Clean Water Act, and covers one segment on that list and six segments on later lists/reports. Newport Creek is listed as impaired for pH. In addition, high levels of metals impairment were discovered through field observation and laboratory analysis. Metals-impaired segments were also addressed in the Newport Creek Watershed TMDLs. All impairments resulted from abandoned coal mine drainage. The TMDL addresses the three primary metals associated with abandoned mine drainage (iron, aluminum, and manganese) and pH. Siltation impaired segments of the South Branch, resulting from abandoned coal mines, were addressed using ArcView Generalized Watershed Loading Function (see page 11).

Table 1. 303(d) Listed Segments

State Master Plan (SWP) Subbasin: 05B										
HUC: 02050107 Upper Susquehanna-Lackawanna										
Year	**Miles**	**Use Designation**	**Assessment ID**	**Segment ID**	**PADEP Stream Code**	**Stream Name**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1996	2.99	Aquatic Life	7546	4234	*	Newport Creek	CWF	305(b)	AMD	pH
2004	2.04	Aquatic Life	4054	20020705-1130-CJD	*	Newport Creek	CWF	305(b)	AMD	pH
2004	2.00	Aquatic Life	7547	4234b	*	UNT Newport Creek	CWF	305(b)	AMD	pH
2004	1.10	Aquatic Life	4054	20020705-1130-CJD	*	UNT Newport Creek	CWF	305(b)	AMD	pH
2004	3.56	Aquatic Life	5812	20030917-0930-CJD	*	South Branch	CWF	305(b)	AMD	pH, siltation
2004	1.12	Aquatic Life	5815	20030917-1020-CJD	*	UNT South Branch	CWF	305(b)	AMD	pH
2004	1.88	Aquatic Life	5812	20030917-0930-CJD	*	UNT South Branch	CWF	305(b)	AMD	pH, siltation

AMD = Abandoned Mine Drainage
CWF = Cold Water Fishery
See Attachment B, *Excerpts Justifying Changes Between the 1996, 1998, and 2002 Section 303(d) Lists and Integrated Report/List (2004, 2006).*
The use designations for the stream segments in this TMDL can found in PA Title 25 Chapter 93.

Location

The watershed is located on the U.S. Geological Survey 7.5 minute quadrangles of Nanticoke and Wilkes-Barre West Pennsylvania. The stream flows east-northeast from Glen Lyon to

Nanticoke, Pa., where it joins the Susquehanna River. The major tributaries to Newport Creek include South Branch of Newport Creek, UNT 28347, UNT 64681, UNT 28345, and UNT 28346. The largest municipalities include Glen Lyon, Nanticoke, Wanamie, Alden, Newport Center, and Sheatown. State Route 3002 travels parallel through the South Branch mainstem, and numerous township roads provide access to Newport Creek and its tributaries.

Hydrology, Geology and Land Use

The headwaters of Newport Creek begin in Glen Lyon, Pa. Newport Creek flows east-northeast into Nanticoke, Pa. The Newport Creek Watershed contains approximately 13.99 square miles and 14.41 stream miles. Newport Creek flows through the boroughs and towns of Glen Lyon, Wanamie, Alden, Sheatown, Newport Center, and Nanticoke. The mainstem of Newport Creek continues to flow east-northeast until its confluence with the Susquehanna River near the town of Nanticoke, Pa.

The Newport Creek Watershed lies within the Allegheny Mountain Section of the Ridge and Valley Physiographic Province. There is a vertical drop in the watershed of about 1,080 feet from its headwaters to the mouth. The average annual precipitation is 43 inches. The region is characterized by warm summers and long, cold winters. Temperatures change frequently and sometimes rapidly.

The watershed is dominated primarily by agriculture and forested land uses. Forested consists of 63 percent of the land use and is predominantly found throughout the Newport Creek Watershed. Agriculture accounts for nearly 14 percent and is concentrated near the mouth of Newport Creek and headwaters of the South Branch. The remaining 23 percent consists of 12 percent developed and 11 percent disturbed lands.

The Newport Creek Watershed is primarily interbedded sedimentary geology, which accounts for approximately 90 percent of the area. Sandstone comprises the remaining 10 percent of the area. The predominant soil associations in the watershed are the Udorthents-Urban Land-Volusia and the Lackawanna-Arnot-Morris. These two soils account for 95 percent of the Newport Creek Watershed. The remaining portion of the watershed is comprised of Wellsboro-Oquaga-Morris and Chenango-Pope-Holly soil associations.

Segments Addressed in this TMDL

Newport Creek is affected by pollution from abandoned mine drainage (AMD). This pollution has caused low pH, siltation and in some cases, high levels of metals in the watershed. There are nine active mining operations in the watershed with no NPDES permits: Susquehanna Coal Company (40920102R2), Silverbrook Anthracite (40880101CB, 40850203R4, 40900204, 40850203CR2), Northampton Fuel Supply Company Incorporated (40860101CB, 40763204R4, 40900203R2), and Emerald Anthracite (40050201). The TMDLs will be expressed as long-term average loadings. Due to the nature and complexity of mining effects on the watershed, expressing the TMDL as a long-term average gives a better representation of the data used for the calculations.

This AMD TMDL document contains one or more future mining Waste Load Allocations (WLA). These WLAs were requested by the (Knox, Moshannon, Greensburg, Cambria, or Pottsville) District Mining Office (DMO) to accommodate one or more future mining operations. The DMO determined the number and location of the future mining WLAs. This will allow speedier approval of future mining permits without the time-consuming process of amending this TMDL document. All comments and questions concerning the future mining WLAs in this TMDL are to be directed to the appropriate DMO. Future WLAs are calculated using the method described for quantifying pollutant load in Attachment F.

The following are examples of what is or is not intended by the inclusion of future mining WLAs. This list is by way of example and is not intended to be exhausted or exclusive:

1. The inclusion of one or more future mining WLAs is not intended to exclude the issuance of future nonmining NPDES permits in this watershed or any waters of the Commonwealth.
2. The inclusion of one or more future mining WLAs in specific segments of this watershed is not intended to exclude future mining in any segments of this watershed that does not have a future mining WLA.
3. The inclusion of future mining WLAs does not preclude the amending of this AMD TMDL to accommodate additional NPDES permits.

All of the remaining discharges in the watershed are from abandoned mines and will be treated as nonpoint sources. The distinction between nonpoint and point sources in this case is determined on the basis of whether or not there is a responsible party for the discharge.

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 U.S. Environmental Protection Agency's (USEPA) implementing regulations (40 CFR 130) require:

- States to develop lists (Section 303(d) 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 USEPA 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

- USEPA to approve or disapprove state lists and TMDLs within 30 days of final submission.

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

In the cases that have been settled to date, the consent agreements require USEPA to backstop TMDL development, track TMDL development, review state monitoring programs, and fund studies on issues of concern (e.g., AMD, implementation of nonpoint source Best Management Practices (BMPs), etc.). These TMDLs were developed in partial fulfillment of the 1996 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA*.

Section 303(d) Listing Process

Prior to developing TMDLs for specific waterbodies, sufficient data must be available to assess which streams are impaired and should be on the Section 303(d) list. With guidance from the USEPA, the states have developed methods for assessing the waters within their respective jurisdictions.

The primary method adopted by the Pennsylvania Department of Environmental Protection (PADEP) for evaluating waters changed between the publication of the 1996 and 1998 303(d) lists. Prior to 1998, data used to list streams were in a variety of formats, collected under differing protocols. Information also was gathered through the Section 305(b)[1] reporting process. Since that time, PADEP is now using the Unassessed Waters Protocol (UWP), a modification of the USEPA Rapid Bioassessment Protocol II (RPB-II), as the primary mechanism to assess Pennsylvania's waters. The UWP provides a more consistent approach to assessing Pennsylvania's streams.

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

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[1] Section 305(b) of the Clean Water Act requires a biannual description of the water quality of the waters of the state.

After the survey is completed, the biologist determines the status of the stream segment. The decision is based on the performance of the segment using a series of biological metrics. If the stream is determined to be impaired, the source and cause of the impairment are documented. An impaired stream must be placed on the state's 303(d) list with the documented source and cause. A TMDL must be developed for the stream segment. Each TMDL is for only one pollutant. If a stream segment is impaired by two pollutants, two TMDLs must be developed for that stream segment. In order for the process to be more effective, adjoining stream segments with the same source and cause listing are addressed collectively, and on a watershed basis.

Basic Steps for Determining a TMDL

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

1. Collect and summarize pre-existing data (watershed characterization, inventory contaminant sources, determination of pollutant loads, etc.);
2. Calculate TMDL for the waterbody using USEPA-approved methods and computer models;
3. Allocate pollutant loads to various sources;
4. Determine critical and seasonal conditions;
5. Begin public review and comment and comment period on draft TMDL;
6. Submit final TMDL; and
7. Obtain USEPA approval of the TMDL.

This document will present the information used to develop the Newport Creek Watershed TMDL.

Watershed History

Historical data show that mining began in this area in the mid-nineteenth century. A large portion of the watershed has been mined for coal. Unreclaimed abandoned mine lands, as well as active mining operations, line the hillsides. Both strip and deep mining have been conducted in the watershed. Coal mining has historically been the major economic force in the Newport Creek Watershed. The Llewellyn Formation and Pottsville Group contain mineable coal including the George, Abbott, Kidney, Hillman, Cooper, Forge, Top Baltimore, Bottom Baltimore, Top Ross, Bottom Ross, Top Red Ash, Bottom Red Ash, and Dunmore Number 4 coal seams. The deep mines were established in the mid-1800s, followed by strip mines in the mid-1900s. At the peak of mining in the 1920s, coal proved to be a valuable resource to the watershed with an output of 35 million tons per year. Deep mining in the watershed was dramatically halted in the 1950s and resulted in an extensive coverage of abandoned mine lands lining the hillsides. Strip mining in the Newport Creek Watershed has continued to operate today and provides economic importance to the local areas.

METALS AND ACIDITY TMDL DETERMINATION

A two-step approach was used for the TMDL analysis of AMD impaired stream segments. The first step uses a statistical method for determining the allowable instream concentration at the point of interest necessary to meet water quality standards. This is done at each point of interest (sample point) in the watershed. The second step is a mass balance of the loads as they pass through the watershed. Loads at these points are computed based on average annual flow.

The statistical analysis described below can be applied to situations where all of the pollutant loading is from nonpoint sources, as well as those where there are both point and nonpoint sources. The following defines point sources and nonpoint sources for the purposes of our evaluation. Point sources are defined as permitted discharges or a discharge that has a responsible party; nonpoint sources are any pollution sources that are not point sources. For situations where all of the impact is due to nonpoint sources, the equations shown below are applied using data for a point in the stream. The load allocation made at that point is for all of the watershed area that is above that point. For situations where there are point source impacts alone, or in combination with nonpoint sources, the evaluation uses the point source data and a mass balance is performed with the receiving water to determine the impact of the point source.

Allowable loads are determined for each point of interest using Monte Carlo simulation. Monte Carlo simulation is an analytical method meant to imitate real-life systems, especially when other analyses are too mathematically complex or too difficult to reproduce. Monte Carlo simulation calculates multiple scenarios of a model by repeatedly sampling values from the probability distribution of the uncertain variables and using those values to populate a larger dataset. Allocations were applied uniformly for the watershed area specified for each allocation point. For each source and pollutant, it was assumed that the observed data were log-normally distributed. Each pollutant source was evaluated separately using @Risk[2] by performing 5,000 iterations to determine the required percent reduction so that the water quality criteria, as defined in the *Pennsylvania Code, Title 25 Environmental Protection, Department of Environmental Protection, Chapter 93, Water Quality Standards,* will be met instream at least 99 percent of the time. For each iteration, the required percent reduction is:

PR = maximum {0, (1-Cc/Cd)} where (1)

PR = required percent reduction for the current iteration

Cc = criterion in mg/l

Cd = randomly generated pollutant source concentration in mg/l based on the observed data

Cd = RiskLognorm(Mean, Standard Deviation) where (1a)
Mean = average observed concentration

[2] @Risk – Risk Analysis and Simulation Add-in for Microsoft Excel, Palisade Corporation, Newfield, NY, 1990-1997.

Standard Deviation = standard deviation of observed data

The overall percent reduction required is the 99th percentile value of the probability distribution generated by the 5,000 iterations, so that the allowable long-term average (LTA) concentration is:

LTA = Mean * (1 – PR99) where (2)

LTA = allowable LTA source concentration in mg/l

Once the allowable concentration and load for each pollutant is determined, mass-balance accounting is performed starting at the top of the watershed and working down in sequence. This mass-balance or load tracking is explained below.

For pH TMDLs, acidity is compared to alkalinity. Each sample point used in the analysis of pH by this method must have measurements for total alkalinity and total acidity. Net alkalinity is alkalinity minus acidity, both in units of milligrams per liter (mg/l) $CaCO_3$. Statistical procedures are applied, using the average value for total alkalinity at that point as the target to specify a reduction in the acid concentration. By maintaining a net alkaline stream, the pH value will be in the range between six and eight. This method negates the need to specifically compute the pH value, which for streams affected by low pH from AMD may not a true reflection of acidity. This method assures that Pennsylvania's standard for pH is met when the acid concentration reduction is met.

Information for the TMDL analysis performed using the methodology described above is contained in the TMDLs by Segment section of this report.

TMDL Endpoints

One of the major components of a TMDL is the establishment of an instream numeric endpoint, which is used to evaluate the attainment of applicable water quality. An instream numeric endpoint therefore represents the water quality goal that is to be achieved by implementing the load reductions specified in the TMDL. The endpoint allows for comparison between observed instream conditions and conditions that are expected to restore designated uses. The endpoint is based on either the narrative or numeric criteria available in water quality standards.

Because of the nature of the pollution sources in the watershed, the TMDL's components makeup will be LAs that are specified above a point in the stream segment. All allocations will be specified as long-term average daily concentrations. These long-term average daily concentrations are expected to meet water quality criteria 99 percent of the time. Pa. Title 25 Chapter 96.3(c) specifies that the water quality standards must be met 99 percent of the time. The iron TMDLs are expressed as total recoverable as the iron data used for this analysis were reported as total recoverable. Table 2 shows the water quality criteria for the selected parameters.

Table 2. Applicable Water Quality Criteria

Parameter	Criterion Value (mg/l)	Total Recoverable/Dissolved
Aluminum (Al)	0.75	Total Recoverable
Iron (Fe)	1.50 0.3	30-Day Average Total Recoverable Dissolved
Manganese (Mn)	1.00	Total Recoverable
pH *	6.0-9.0	N/A

*The pH values shown will be used when applicable. In the case of freestone streams with little or no buffering capacity, the TMDL endpoint for pH will be the natural background water quality. These values are typically as low as 5.4 (Pennsylvania Fish and Boat Commission).

TMDL Elements (WLA, LA, MOS)

A TMDL equation consists of a waste load allocation (WLA), load allocation (LA), and a margin of safety (MOS). The WLA is the portion of the load assigned to point sources. The LA is the portion of the load assigned to nonpoint sources. The 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).

Allocations Summary

These TMDLs will focus remediation efforts on the identified numerical reduction targets for each watershed. The reduction schemes in Table 3 for each segment are based on the assumption that all upstream allocations are implemented and take into account all upstream reductions. Attachment D contains the TMDLs by segment analysis for each allocation point in a detailed discussion. As changes occur in the watershed, the TMDLs may be re-evaluated to reflect current conditions. An implicit MOS based on conservative assumptions in the analysis is included in the TMDL calculations.

The allowable LTA concentration in each segment is calculated using Monte Carlo Simulation as described previously. The allowable load is then determined by multiplying the allowable concentration by the average flow and a conversion factor at each sample point. The allowable load is the TMDL at that point.

Each permitted discharge in a segment is assigned a WLA and is included in this table. The WLAs have also been included at some points for future mining operations. The difference between the TMDL and the WLA at each point is the LA at the point. The LA at each point includes all loads entering the segment including those from upstream allocation points. The percent reduction is calculated to show the amount of load that needs to be reduced from nonpoint sources within a segment in order for water quality standards to be met at the point.

In some instances, instream processes, such as settling, are taking place within a stream segment. These processes are evidenced by a decrease in measured loading between consecutive sample points. It is appropriate to account for these losses when tracking upstream loading through a segment. The calculated upstream load lost within a segment is proportional to the difference in the measured loading between the sampling points.

Table 3. Newport Creek Watershed Summary Table

Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	NPS Load Reduction (lbs/day)	NPS % Reduction
NPT 7 – Newport Creek Headwaters (Glen Lyon, PA)						
Iron (lbs/day)	160.35	6.41	*4.52**	1.89	153.94	96.0%
Manganese (lbs/day)	51.75	9.83	*3.00*	6.83	41.92	81.0%
Aluminum (lbs/day)	91.24	5.47	*1.12*	4.35	85.77	94.0%
Acidity (lbs/day)	1,268.45	0.00	*0.00*	0.00	1,268.45	100.0%
NPT 6 – Newport Creek downstream of UNT 64681						
Iron (lbs/day)	258.95	7.77	*6.78*	0.99	97.24	92.6%
Manganese (lbs/day)	63.00	10.71	*4.50*	6.21	10.31	49.2%
Aluminum (lbs/day)	48.44	2.91	*1.68*	1.23	0.00	0.0%
Acidity (lbs/day)	854.00	17.08	*0.00*	17.08	0.00	0.0%
NPT 5 – Newport Creek downstream of UNT 28347						
Iron (lbs/day)	88.37	6.19	*4.52*	1.67	0.00	0.0%
Manganese (lbs/day)	64.78	10.36	*3.00*	7.36	2.13	17.1%
Aluminum (lbs/day)	22.41	2.24	*1.12*	1.12	0.00	0.0%
Acidity (lbs/day)	-1,646.51	-	*0.00*	-	-	-
NPT 4 – Newport Creek downstream of Newport Dump Discharge						
Iron (lbs/day)	1,121.72	56.09	*6.78*	49.31	983.45	94.6%
Manganese (lbs/day)	374.67	56.20	*4.50*	51.70	264.05	82.5%
Aluminum (lbs/day)	33.48	6.03	*1.68*	4.35	7.28	54.7%
Acidity (lbs/day)	153.13	131.69	*0.00*	131.69	21.44	14.0%
SNPT 4 – South Branch Headwaters (Wanamie, PA)						
Iron (lbs/day)	0.07	0.07	-	0.07	0.00	0.0%
Manganese (lbs/day)	0.45	0.20	-	0.20	0.25	55.6%
Aluminum (lbs/day)	0.56	0.14	-	0.14	0.42	75.0%
Acidity (lbs/day)	9.43	0.47	-	0.47	8.96	95.0%
SNPT 3 – South Branch downstream of UNT 28346						
Iron (lbs/day)	16.81	2.19	-	2.19	14.62	87.0%
Manganese (lbs/day)	10.77	1.29	-	1.29	5.57	52.9%
Aluminum (lbs/day)	22.82	0.91	-	0.91	21.49	95.9%
Acidity (lbs/day)	314.40	0.00	-	0.00	323.07	100.0%
SNPT 2 – South Branch downstream of Sheatown Discharge						
Iron (lbs/day)	40.96	4.10	*2.26*	1.84	22.24	84.4%
Manganese (lbs/day)	19.69	2.76	*1.50*	1.26	7.45	73.0%
Aluminum (lbs/day)	30.00	2.40	*0.56*	1.84	5.69	70.3%
Acidity (lbs/day)	377.36	0.00	*0.00*	0.00	62.96	100.0%
SNPT 1 – South Branch upstream of confluence with Newport Creek						
Iron (lbs/day)	13.32	5.73	*4.52*	1.21	0.00	0.0%
Manganese (lbs/day)	26.65	4.26	*3.00*	1.26	5.46	56.2%
Aluminum (lbs/day)	13.04	2.87	*1.12*	1.75	0.00	0.0%
Acidity (lbs/day)	166.56	24.98	*0.00*	24.98	0.00	0.0%
NPT 3 – Newport Creek downstream of confluence with South Branch						
Iron (lbs/day)	1,095.07	13.64	*6.78*	6.86	23.51	63.3%
Manganese (lbs/day)	340.73	47.70	*4.50*	43.20	11.67	19.7%
Aluminum (lbs/day)	27.84	7.52	*1.68*	5.84	0.00	0.0%
Acidity (lbs/day)	401.07	120.32	*0.00*	120.32	117.73	49.5%
NPT 2 – Newport Creek downstream of Susquehanna #7 Mine Discharge						
Iron (lbs/day)	2,735.57	109.42	*6.78*	102.64	1,990.47	94.8%
Manganese (lbs/day)	556.47	100.17	*4.50*	95.67	163.27	62.0%
Aluminum (lbs/day)	32.76	13.10	*1.68*	11.42	0.00	0.0%
Acidity (lbs/day)	-3,296.77	-	*0.00*	-	-	-
NPT 1 – Newport Creek downstream of Honeypot Discharge						
Iron (lbs/day)	3,165.10	189.91	*6.78*	183.13	349.04	64.8%
Manganese (lbs/day)	733.55	132.04	*4.50*	127.54	145.21	52.4%
Aluminum (lbs/day)	93.49	22.44	*1.68*	20.76	51.39	69.6%
Acidity (lbs/day)	-2,955.87	-	*0.00*	-	-	-

**Italicized numbers represent future mining allocations.*

The following is an example of how the allocations in Table 3, for a stream segment are calculated. For this example, iron allocations for NPT 6 of Newport Creek are shown. As demonstrated in the example, all upstream contributing loads are accounted for at each point. Attachment D contains the TMDLs by segment analysis for each allocation point in a detailed discussion. These analyses follow the example below. Attachment contains maps of the sampling point locations for reference.

Allocations for NPT 7	
	Al (lbs/day)
Existing load at NPT 7	212.59
Allowable load at NPT 7	8.50

Allowable Load = 8.50

Load input = 239.37
(Difference between
existing loads
At NPT 7 and NPT 6)

Allocations at NPT 6	
	Al (lbs/day)
Existing load at NPT 6	451.96
Difference of measured loads between loads that enter and existing NPT 6	239.37
Percent loss due calculated at NPT 6	0.0%
Additional loads tracked from above samples	8.50
Percentage of upstream loads that reach NPT 6	100.0%
Total load tacked between NPT 7 and NPT 6	247.87
Allowable load at NPT 6	18.08
Load Reduction at NPT 6	229.79
Percent reduction required at NPT 6	92.7%

Allowable load= 18.08

The allowable iron load tracked from NPT 6 is 8.50 lbs/day. The existing load at NPT 7 was subtracted from the existing load at NPT 6 to show the actual measured increase of iron load that has entered the stream between these upstream sites and NPT 6 (239.37 lbs/day). This increased value was then added to the calculated allowable load from NPT 7 to calculate the total load that was tracked between NPT7 and NPT 6 (allowable loads @ NPT 7 + the difference in existing load between NPT 7 and NPT 6). This total load tracked was then subtracted from the calculated allowable load at NPT 6 to determine the amount of load to be reduced at NPT 6. This total load was found to be 247.87 lbs/day; it was 229.79 lbs/day greater then the allowable load at NPT 6 18.08 lbs/day. Therefore, a 92.7% iron reduction at NPT 6 is necessary.

SEDIMENT TMDL DETERMINATION

Each pollutant on the 303(d) for the South Branch list will be addressed as a separate TMDL. These TMDLs are expressed as long-term average loadings. Due to the nature and complexity of mining effects on the watershed, expressing the TMDL as a long-term average gives better representation of the data used for calculations. Maps showing location, land use, geology, and soils of South Branch can be located in Attachment A.

1. The impaired stream segments addressed by this TMDL are located in Newport Township, Luzerne County, Pa. The stream segments drain approximately 5.05 square miles, as part of State Water Plan subbasin 5B. The aquatic life existing uses for South Branch, including its tributaries, are cold water fisheries (25 Pa. Code Chapter 93).

2. Pennsylvania's 2004 303(d) list identified 5.44 stream miles within the South Branch Watershed as impaired by sediment from abandoned mine drainage land use practices. The 2004 listings were based on data collected after 1996 through PADEP's Surface Water Monitoring Program. In order to ensure attainment and maintenance of water quality standards in the South Branch Watershed, mean annual loading for sediment will need to be limited to 1,995.095 pounds per day (lbs/day).

   The major components of the South Branch Watershed TMDL are summarized below.

South Branch Components	Sediment (lbs/day)
TMDL (Total Maximum Daily Load)	1,995.095
WLA (Waste load Allocation)	-
MOS (Margin of Safety)	199.510
LA (Load Allocation)	1,795.585

3. Mean annual sediment loadings are estimated to 2,936.489 lbs/day. To meet the TMDL, the sediment loadings will require reductions of 32 percent.

4. There are no point sources addressed in these TMDL segments.

5. The adjusted load allocation (ALA) is the actual portion of the LA distributed among nonpoint sources receiving reductions, or sources that are considered controllable. Controllable sources receiving allocations are hay/pasture, cropland, developed lands, and streambanks. The sediment TMDL includes a nonpoint source ALA of 1,347.585 lbs/day. Sediment loadings from all other sources, such as forested areas, were maintained at their existing levels. Allocations of sediment to controllable nonpoint sources, or the ALA, for the South Branch Watershed TMDL are summarized below.

South Branch: Adjusted Load Allocations for Sources of Sediment			
Pollutant	Current Loading (lbs/day)	Adjusted Load Allocation (lbs/day)	% Reduction
Sediment	2,936.489	1,347.585	54

6. Ten percent of the South Branch Watershed sediment TMDLs were set-aside as a margin of safety (MOS). The 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. The MOS for the sediment TMDL is 199.510 lbs/day.

7. The continuous simulation model used for developing the South Branch Watershed TMDL 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 accounts for seasonal variability.

Pollutants & Sources

Sediment has been identified as the pollutant causing designated use impairments in the South Branch Watershed TMDL, with the sources listed as abandoned mine drainage. At present, there are no point source contributions within the segments addressed in these TMDLs.

As stated in previous sections, the land use is dominantly forested. Disturbed land uses extend right up to the streambanks with little to no riparian buffer zones present. Based on visual observations, streambank erosion is severe in most reaches of the streams.

TMDL Endpoints

In an effort to address the sediment problem found in the South Branch Watershed, a TMDL was developed to establish loading limits for sediment. The TMDL is intended to address sediment impairments from developed and disturbed land uses that were first identified in Pennsylvania's 2004 303(d) list, as well as other nonpoint sources such as agriculture.

Reference Watershed Approach

The TMDL developed for the South Branch Watershed addresses sediment. Because neither Pennsylvania nor the 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." Meeting the water quality objectives specified for this TMDL will result in the impaired stream segment attaining its designated uses.

The Reference Watershed Approach compares two watersheds: one attaining its uses and one that is impaired based on biological assessments. Both watersheds ideally have similar land use/cover distributions. Other features such as base geologic formation should be matched to the extent possible; however, most variations can be adjusted in the model. The objective of the process is to reduce the loading rate of pollutants in the impaired stream segment to a level equivalent to the loading rate in the nonimpaired reference stream segment. This load reduction will result in conditions favorable to the return of a healthy biological community to the impaired stream segments.

Selection of the Reference Watershed

In general, three factors are considered when selecting a suitable reference watershed. The first factor is to use a watershed that PADEP has assessed and determined to be attaining water quality standards. The second factor is to find a watershed that closely resembles the impaired watershed in physical properties such as land cover/land use, physiographic province, and geology/soils. Finally, the size of the reference watershed should be within 20-30 percent of the impaired watershed area. The search for a reference watershed for the South Branch Watershed that would satisfy the above characteristics was created with several GIS coverages, including the Multi-Resolution Land Characteristics (MRLC), Landsat-derived land cover/use grid, Pennsylvania's streams database, and geologic rock types.

The Rush Brook Watershed was selected as the reference watershed for developing the South Branch TMDL. Rush Brook is located north of the town of Jermyn, in Lackawanna County, Pa. (Figure 1). The watershed is located in State Water Plan subbasin 5A, and protected uses include aquatic life and recreation. The tributary currently has no designation under §93.9z in Title 25 of the Pa. Code (Commonwealth of Pennsylvania, 2001). Based on PADEP assessments, Rush Brook is currently attaining its designated uses. The attainment of designated uses is based on sampling done by PADEP in 1997 as part of its State Surface Water Assessment Program.

Drainage area, location, and other physical characteristics of the impaired segments of the South Branch Watershed were compared to the Rush Brook Watershed (Table 4). Forested land is the dominant land use category in South Branch Watershed (58 percent) and Rush Brook Watershed (60 percent). The geology, soils, and precipitation in both are also similar (Table 4).

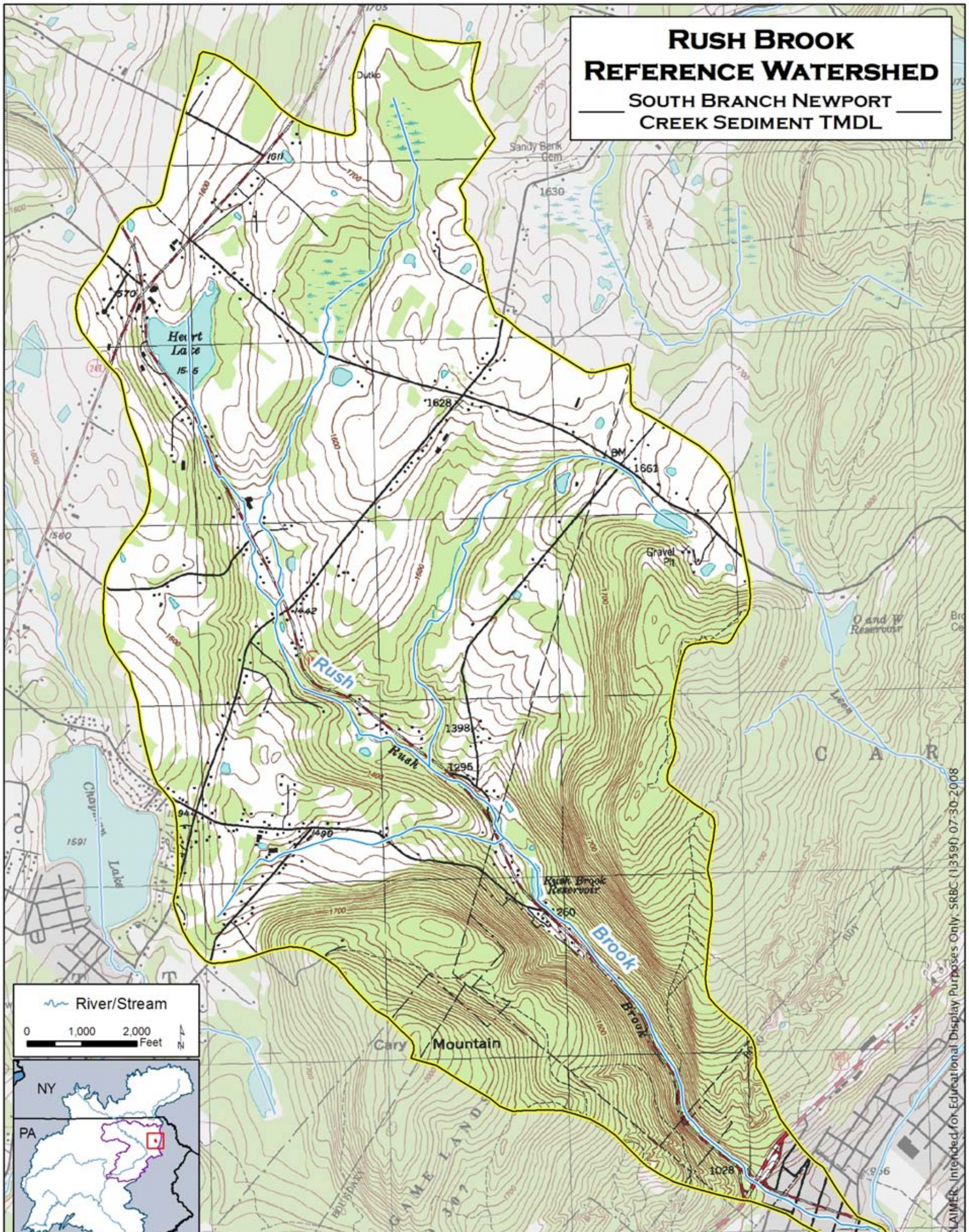


Figure 1. Location Map of the Rush Brook Reference Watershed

Table 4. Comparison between Impaired Segments of the South Branch and Rush Brook Watersheds

Attribute	Watershed	
	South Branch	**Rush Brook**
Physiographic Province	Ridge and Valley Province Appalachian Mountain Section – 100%	Appalachian Plateaus Province Glaciated Low Plateau – 75% Ridge and Valley Province Appalachian Mountain Section – 25%
Area (mi^2)	5.05	6.01
Land Use	Forested – 58% Agriculture – 13% Developed – 28% Other – 1%	Forested – 60% Agriculture – 35% Developed – 3% Other – 2%
Geology	Llewellyn Formation – 79% Pottsville Group – 7% Mauch Chunk – 7% Pocono Formation – 7%	Catskill Formation Undivided – 85% Pottsville Group – 8% Llewellyn Formation – 7%
Soils	Udorthents-Urban Land-Volusia – 70% Lackawanna-Arnot-Morris – 30%	Arnot-Oquaga-Dystrochepts – 55% Udorthents-Urban Land-Volusia – 45%
Dominant HSG	Udorthents-Urban Land- Volusia A – 2% B – 5% C – 18% D – 75% Lackawanna-Arnot-Morris A – 0% B – 3% C – 82% D – 15%	Arnot-Oquaga-Dystrochepts A – 21% B – 0% C – 48% D – 31% Udorthents-Urban Land-Volusia A – 2% B – 5% C – 18% D – 75%
K Factor	Udorthents-Urban Land-Volusia – 0.17 Lackawanna-Arnot-Morris – 0.24	Arnot-Oquaga-Dystrochepts – 0.21 Udorthents-Urban Land-Volusia – 0.17
20-Yr. Ave. Rainfall (in)	43.5	45.0
20-Yr. Ave. Runoff (in)	1.03	0.61

Watershed Assessment and Modeling

The TMDL for the impaired segments of the South Branch Watershed was developed using the ArcView Generalized Watershed Loading Function model (AVGWLF) as described in Attachment H. The AVGWLF model was used to establish existing loading conditions for the impaired segments of the South Branch Watershed and the Rush Brook reference watershed. All modeling inputs have been attached to this TMDL as Attachments I and J.

The AVGWLF model produced information on watershed size, land use, nutrients, and sediment loading. The sediment loads represent an annual average over a 24-year period, from 1975 to 1998, and for the South Branch and Rush Brook watersheds, respectively. This information was then used to calculate existing unit area loading rates for the two watersheds. Acreage and sediment loading information for both the impaired watershed and the reference watershed are shown in Tables 5 and 6, respectively.

Table 5. Existing Sediment Loads for the South Branch Watershed

Pollutant Source	Acreage	Sediment	
		Mean Annual Loading (lbs/day)	Unit Area Loading (lbs/ac/day)
HAY/PAST	729.00	1,512.712	2.075
CROPLAND	7.40	12.986	1.755
FOREST	1,853.30	447.507	0.241
WETLAND	39.50	0.493	0.012
COAL MINE	39.50	116.822	2.958
TRANSITION	27.20	285.151	10.483
LO_INT_DEV	328.60	80.767	0.246
HI_INT_DEV	177.90	40.767	0.229
Streambank		439.284	0.000
TOTAL	3,202.40	2,936.489	0.917

Table 6. Existing Sediment Loads for the Rush Brook Watershed

Pollutant Source	Acreage	Sediment	
		Mean Annual Loading (lbs/day)	Unit Area Loading (lbs/ac/day)
HAY/PAST	531.30	456.000	0.858
CROPLAND	140.80	553.808	3.933
FOREST	2,705.80	427.233	0.158
WETLAND	49.40	0.110	0.002
UNPAVED_RO	2.50	43.452	17.381
TRANSITION	9.90	178.137	17.994
LO_INT_DEV	363.20	77.863	0.214
HI INT DEV	4.90	0.055	0.011
Streambank		634.381	0.000
Total	3,807.80	2,371.039	0.623

The targeted TMDL value for the South Branch Watershed was established based on current loading rates for sediment in the Rush Brook Reference Watershed. Biological assessments have determined that Rush Brook is currently attaining its designated uses. Reducing the loading rate of sediment in the South Branch Watershed to levels equivalent to those in the reference watershed will provide conditions favorable for the reversal of current use impairments.

Background Pollutant Conditions

There are two separate considerations of background pollutants within the context of this TMDL. First, there is the inherent assumption of the reference watershed approach that because of the similarities between the reference and impaired watershed, the background pollutant contributions will be similar. Therefore, the background pollutant contributions will be considered when determining the loads for the impaired watershed that are consistent with the loads from the reference watershed. Second, the AVGWLF model implicitly considers background pollutant contributions through the soil and the groundwater component of the model process.

Targeted TMDLs

The targeted TMDL value for sediment was determined by multiplying the total area of the South Branch Watershed (3,202.40 acres) by the appropriate unit-area loading rate for the Rush Book reference watershed (Table 7). The existing mean annual loading of sediment to the South Branch (2,936.489 lbs/day) will need to be reduced by 32 percent to meet the targeted TMDL of 1,995.095 lbs/day.

Table 7. Targeted TMDL for the South Branch Watershed

Pollutant	Area (ac)	Unit Area Loading Rate UNT 18925 Reference Watershed (lbs/ac/day)	Targeted TMDL for UNT 19039 (lbs/day)
Sediment	3,202.40	0.623	1,995.095

Targeted TMDL values were used as the basis for LAs and reductions in the South Branch Watershed, using the following two equations:

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

where:

TMDL = Total Maximum Daily Load
WLA = Waste Load Allocation (point sources)
LA = Load Allocation (nonpoint sources)
ALA = Adjusted Load Allocation
LNR = Loads not Reduced

Margin of Safety

The 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 TMDLs for sediment were reserved as the MOS. Using 10 percent of the TMDL load is based on professional judgment and will provide an additional level of protection to the designated uses of the South Branch Watershed. The MOS used for the sediment TMDLs is shown below.

South Branch:
MOS (sediment) = 1,995.095 lbs/day (TMDL) x 0.1 = 199.510 lbs/day

Adjusted Load Allocation

The 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 or LNR) from the LA. Sediment reductions were made to the hay/pasture, cropland, developed areas (sum of LO_INT_DEV, HI_INT_DEV, COAL MINE, TRANSITION), and streambanks. Those land uses/sources for which existing loads were not reduced (FOREST, WETLANDS) were carried through at their existing loading values (Table 8).

Table 8. Load Allocations, Loads not Reduced, and Adjusted Load Allocation for the South Branch Watershed

	Sediment (lbs/day)
Load Allocation	1,995.095
Loads not Reduced	448.000
FOREST	447.507
WETLANDS	0.493
Adjusted Load Allocation	1,547.095

TMDLs

The sediment TMDL established for the South Branch Watershed consists of a LA, WLA, and MOS. The individual components of the TMDL are summarized in Table 9.

Table 9. Load Allocations, Loads not Reduced, and Adjusted Load Allocation for the South Branch Watershed

Component	Sediment (lbs/day)
TMDL (Total Maximum Daily Load)	1,995.095
MOS (Margin of Safety)	199.510
LA (Load Allocation)	1,795.585
LNR (Loads not Reduced)	448.000
ALA (Adjusted Load Allocation)	1,347.585

Calculation of Sediment Load Reductions

The ALA established in the previous section represents the annual total sediment load that is available for allocation between contributing sources in the South Branch Watershed. The ALA for sediment was allocated between agriculture, developed areas, and streambanks. LA and reduction procedures were applied to the entire South Branch Watershed using the Equal Marginal Percent Reduction (EMPR) allocation method (Attachment K). The LA and EMPR procedures were performed using MS Excel, and results are presented in Attachment L.

In order to meet the sediment TMDL, the load currently emanating from controllable sources must be reduced (Table 10). This can be achieved through reductions in current sediment loadings from cropland, hay/pasture, developed areas, and streambanks.

Table 10. Sediment Load Allocations & Reductions for the South Branch Watershed

Pollutant Source	Acres	Unit Area Loading Rate (lbs/ac/day)		Pollutant Loading (lbs/day)		% Reduction
		Current	Allowable	Current	Allowable (LA)	
Sediment						
Hay/Pasture	729.00	2.075	1.072	1,512.712	781.222	48
Cropland	7.40	1.755	1.072	12.986	7.930	39
Developed	573.20	0.913	0.530	523.507	303.642	42
Streambanks	-	-	-	439.284	254.791	42
Total	-	-	-	2,488.489	1,342.586	46

Consideration of Critical Conditions

The AVGWLF model is a continuous simulation model which uses daily time steps for weather data and water balance calculations. Monthly calculations are made for sediment loads based on the daily water balance accumulated to monthly values. 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 these analyses 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

Water quality improvement projects should be investigated on five large AMD sources to the Newport Creek Watershed; the Glen Lyon Borehole in the headwaters of Newport Creek, the Newport Dump Discharge just upstream of the South Branch confluence, the Susquehanna #7 on the mainstem just upstream of the confluence with Susquehanna River, the Honeypot Discharge just downstream of the Susquehanna #7 Discharge, and the Sheatown Discharge impacting the South Branch. Even though there are many more impacts in the watershed, the restoration of the Susquehanna #7 Discharge and these four other large sources would restore much of the watershed and possibly removing large sections from the Integrated List of Impaired Waters. Furthermore, additional water quality monitoring efforts were focused on these five discharges during the sampling of this TMDL. The Susquehanna River Basin Commission (SRBC) sampling included the standard TMDL protocol, with the addition of ferrous iron and dissolved aluminum. Although not included in this report, the discharge sampling data would be available upon request.

The Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR), SRBC, and Iron Oxide Recovery Inc. are presently pursuing a PADEP Growing Greener Initiative Grant for the abatement of the Susquehanna #7 AMD discharge to Newport Creek. Collectively, the partnership aims to redirect the flow of the Susquehanna #7 discharge through a series of engineered settling ponds and wetlands. The ponds will then serve as a resource of iron oxide that will be recovered and sold. The Susquehanna #7 discharge is the largest pollution load to Newport Creek, 0.6 miles from the confluence of the Susquehanna River, having an average flow of 5.8 MGD and average total iron concentration of 58 mg/L. The current application outlines a Phase I that would include: design of the treatment system, environmental assessments, hydro-geological investigation of the site, and pre-construction coordination efforts.

Other efforts in the watershed include "Effects of Historical Coal Mining and Drainage from Abandoned Mines of Streamflow and Water Quality in Newport and Nanticoke Creeks, Luzerne County", completed by the United States Geological Survey in 1999, provided a detailed description of the present AMD impacts within the watershed. The report provided water quality data of both stream and discharge sites. Another effort included, "The Impact of Mining on the Newport and Nanticoke Creek Watersheds, Luzerne County, Pa.," report completed by Wilkes University, resulted from a 2002 PADEP Growing Greener Initiative Grant that funded a one-year assessment of biological and physical impacts of the watershed. In addition to Wilkes University's effort, the Commonwealth is currently accepting bids for the reclamation of 36 acres of abandoned strip mine northeast of Nanticoke, Pa. The project will entail excavating approximately 367,000 cubic yards of onsite material and regrading approximately 3,150 feet of highwall ranging from 30 to 90 feet in height. The project area contains a hazardous waterbody and highwall that have accounted for six deaths since 1998. Also, the reclaiming of abandoned mine lands mainly in the South Branch Watershed would reduce sediment loading to the streams.

There are also stream sections in the watershed that lose surface water into the underground mine workings, thus increasing the flow and impact of the above mentioned discharges. These "losing reaches" should also be more specifically located so that stream channel grouting projects could be initiated to keep surface water on the surface, thus reducing the flow of many of the discharges fed by the underground mine workings.

Various methods to eliminate or treat pollutant sources, and provide a reasonable assurance that the proposed TMDLs can be met, exist in Pennsylvania. These methods include PADEP's primary efforts to improve water quality through reclamation of abandoned mine lands (for abandoned mining) and through the National Pollution Discharge Elimination System (NPDES) permit program (for active mining). Funding sources available that are currently being used for projects designed to achieve TMDL reductions include the USEPA's 319 grant program and Pennsylvania's Growing Greener Program. Federal funding is through the Department of the Interior's Office of Surface Mining (OSM) for reclamation and mine drainage treatment through the Appalachian Clean Streams Initiative and through Watershed Cooperative Agreements.

OSM reports that of the $8.5 billion of the nation's high priority (defined as Priority 1 & 2 features or those that threaten public health and safety) coal-related AML problems in the AML inventory, $6.6 billion (78%) have yet to be reclaimed; $3.6 billion of this total is attributable to Pennsylvania watershed costs. Almost 83 percent of the $2.3 billion of coal-related environmental problems (Priority 3) in the AML inventory are not reclaimed.

The Bureau of Abandoned Mine Reclamation, Pennsylvania's primary bureau in dealing with abandoned mine reclamation (AMR) issues, has established a comprehensive plan for abandoned mine reclamation throughout the Commonwealth to prioritize and guide reclamation efforts throughout the state to make the best use of valuable funds (www.dep.state.pa.us/dep/deputate/minres/bamr/complan1.htm). In developing and implementing a comprehensive plan for abandoned mine reclamation, the resources (both human and financial) of the participants must be coordinated to insure cost-effective results. The following set of principles is intended to guide this decision making process:

- Partnerships between the PADEP, watershed associations, local governments, environmental groups, other state agencies, federal agencies, and other groups organized to reclaim abandoned mine lands are essential to achieving reclamation and abating acid mine drainage in an efficient and effective manner.

- Partnerships between AML interests and active mine operators are important and essential in reclaiming abandoned mine lands.

- Preferential consideration for the development of AML reclamation or AMD abatement projects will be given to watersheds or areas for which there is an approved rehabilitation plan (guidance is given in Attachment M).

- Preferential consideration for the use of designated reclamation funds will be given to projects that have obtained other sources or means to partially fund the project or to projects that need the funds to match other sources of funds.

- Preferential consideration for the use of available funds from federal and other sources will be given to projects where there are institutional arrangements for any necessary long-term operation and maintenance costs.

- Preferential consideration for the use of available funds from federal and other sources will be given to projects that have the greatest worth.

- Preferential consideration for the development of AML projects will be given to AML problems that impact people over those that impact property.

- No plan is an absolute; occasional deviations are to be expected.

A detailed decision framework is included in the plan that outlines the basis for judging projects for funding, giving high priority to those projects whose cost/benefit ratios are most favorable and those in which stakeholder and landowner involvement is high and secure.

In addition to the abandoned mine reclamation program, regulatory programs also are assisting in the reclamation and restoration of Pennsylvania's land and water. PADEP has been effective in implementing the NPDES program for mining operations throughout the Commonwealth. This reclamation was done through the use of remining permits that have the potential for reclaiming abandoned mine lands at no cost to the Commonwealth or the federal government. Long-term

agreements were initialized for facilities/operators that need to assure treatment of post-mining discharges or discharges they degraded. These agreements will provide for long-term treatment of discharges. According to OSM, "PADEP is conducting a program where active mining sites are, with very few exceptions, in compliance with the approved regulatory program."
The Commonwealth is exploring all options to address its abandoned mine problem. During 2000-2006, many new approaches to mine reclamation and mine drainage remediation have been explored and projects funded to address problems in innovative ways. These include:

- Project XL – PADEP has proposed this XL Project to explore a new approach to encourage the remining and reclamation of abandoned coal mine sites. The approach would be based on compliance with instream pollutant concentration limits and implementation of best management practices (BMPs), instead of NPDES numeric effluent limitations measured at individual discharge points. This XL project would provide for a test of this approach in up to eight watersheds with significant AMD pollution. The project will collect data to compare instream pollutant concentrations versus the loading from individual discharge points. In addition, it will provide for the evaluation of the performance of BMPs and this alternate strategy in PADEP's efforts to address AMD.

- Awards of grants for: (1) proposals with economic development or industrial application as their primary goal and which rely on recycled mine water and/or a site that has been made suitable for the location of a facility through the elimination of existing Priority 1 or 2 hazards; and (2) new and innovative mine drainage treatment technologies that will provide waters of higher purity that may be needed by a particular industry at costs below conventional treatment costs, such as in common use today, or reduce the costs of water treatment below those of conventional lime treatment plants. Eight contracts totaling \$4.075 M were awarded in 2006 under this program.

- Projects using water from mine pools in an innovative fashion, such as the Shannopin Deep Mine Pool (in southwestern Pennsylvania), the Barnes & Tucker Deep Mine Pool (the Susquehanna River Basin into the Upper West Branch Susquehanna River), and the Wadesville Deep Mine Pool (Exelon Generation in Schuylkill County).

Along with EPCAMR, SRBC, and Wilkes University's Wetland Technical Team, the Earth Conservancy is another environmental organization interested in the Newport Creek Watershed. It is recommended that agencies support local interests to implement remediation projects in the watershed to abate effects of AMD pollution.

Candidate or federally-listed threatened and endangered species may occur in or near the watershed. While implementation of the TMDL should result in improvements to water quality, they could inadvertently destroy habitat for candidate or federally-listed species. TMDL implementation projects should be screened through the Pennsylvania Natural Diversity Inventory (PNDI) early in their planning process, in accordance with PADEP's policy titled "Policy for Pennsylvania Natural Diversity Inventory (PNDI) Coordination During Permit Review and Evaluation" (Document ID# 400-0200-001).

Public Participation

In the beginning stages of the Newport Creek Watershed TMDL, an early notification letter was sent to inform stakeholders and interested parties that a TMDL would be completed in their watershed and offer them the opportunity to submit information for TMDL development. PADEP considered all the information submitted and all pertinent information was included in the report.

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* on September 20, 2008, and *The Citizens' Voice* and *The Times Leader* newspapers on October 4, 2008 to foster public comment on the allowable loads calculated. A public meeting was held on October 7, 2008, at the Nanticoke Township Building to discuss the proposed TMDL.

Future TMDL Modifications

In the future, PADEP may adjust the load and/or WLAs 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 LA and WLA will only be made following an opportunity for public participation. A WLA 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 compared to the original calculations. 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 WQS, and any adjustment increasing a WLA will be supported by reasonable assurance demonstration that LAs will be met. PADEP will notify USEPA 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 USEPA Approval

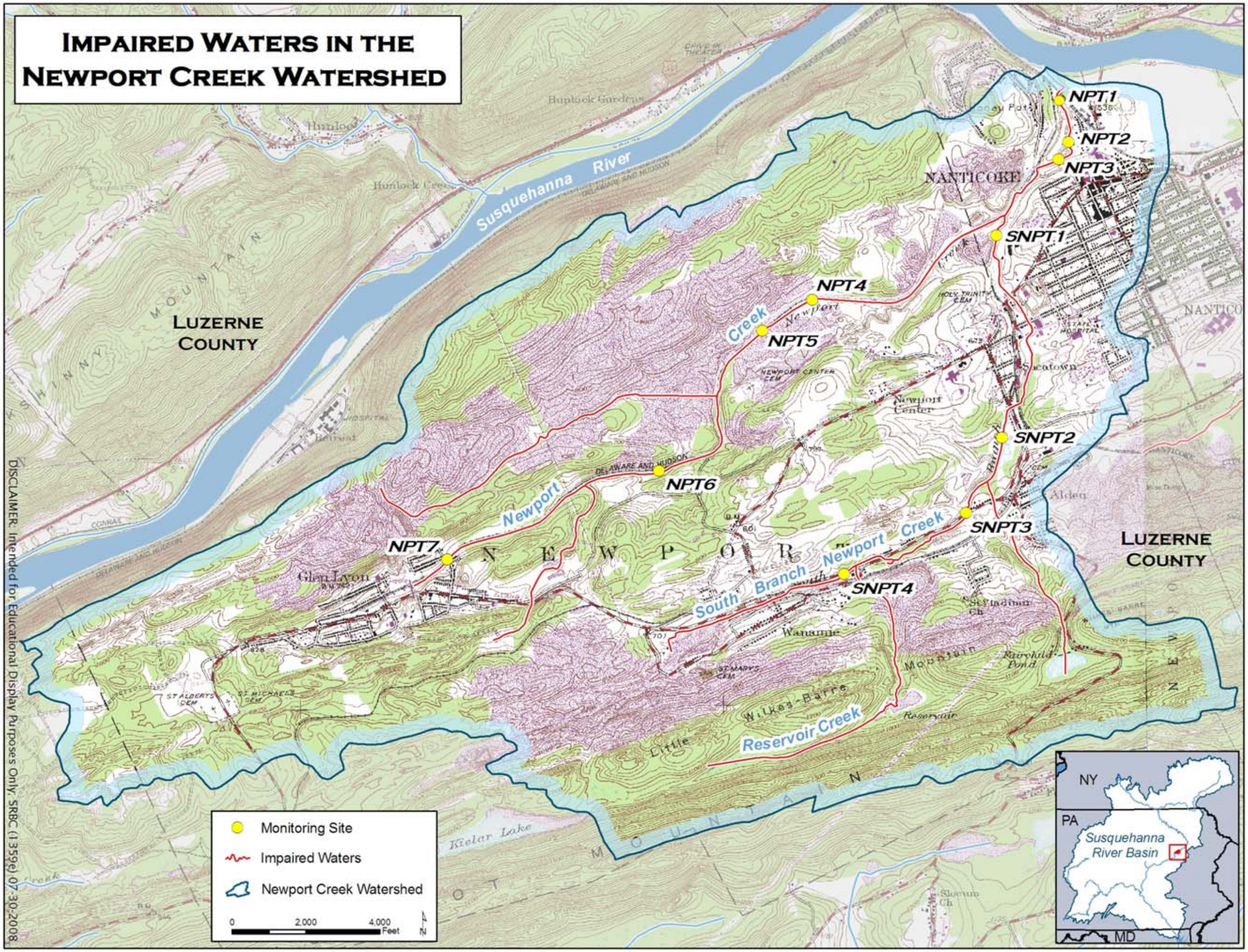
- Increase in total load capacity.
- Transfer of load between point (WLA) and nonpoint (LA) sources.
- Modification of the margin of safety (MOS).
- Change in water quality standards (WQS).
- Non-attainment of WQS with implementation of the TMDL.
- Allocations in trading programs.

Changes in TMDLs That May Not Require USEPA Approval

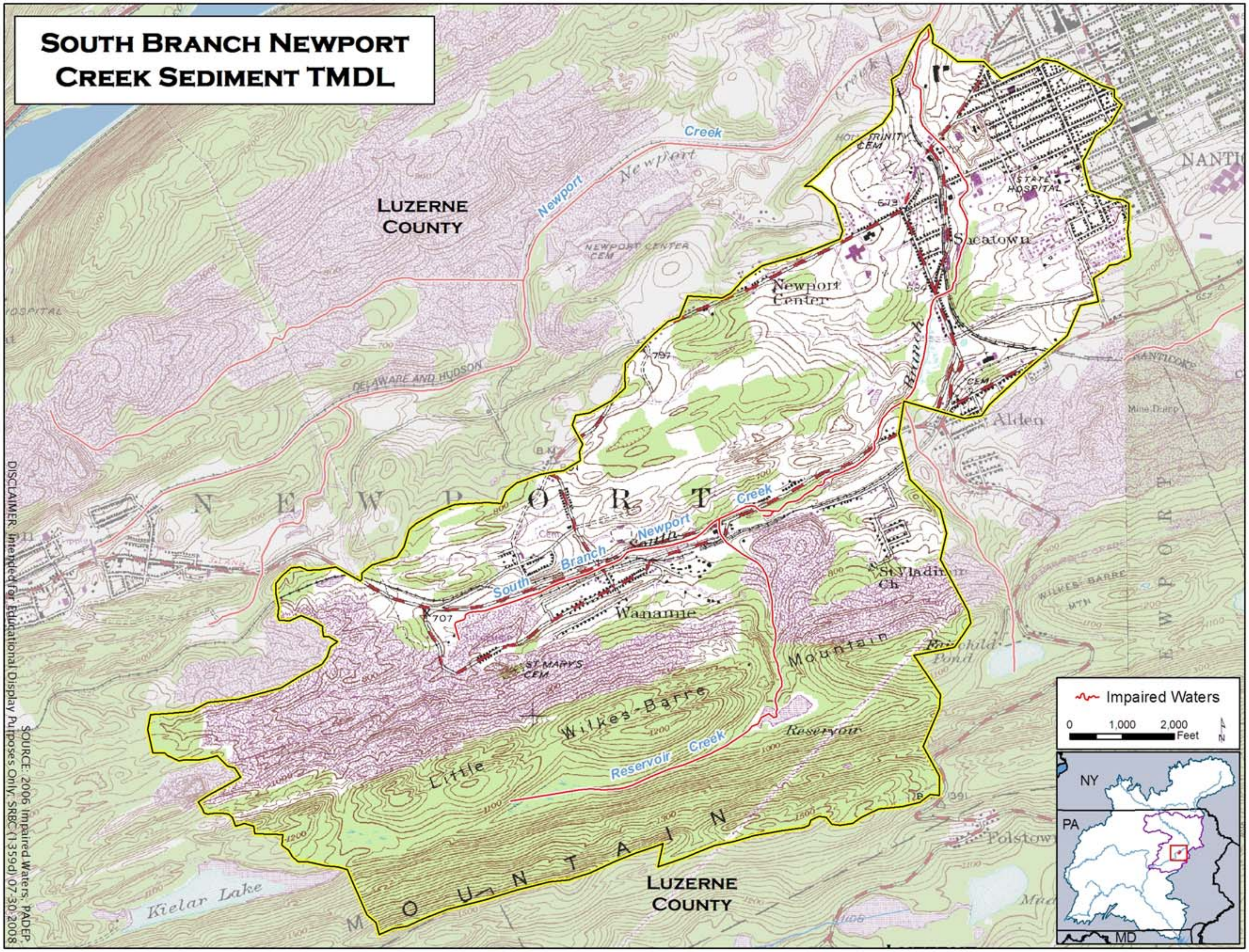
- Total loading shift less than or equal to 1% of the total load.
- Increase of WLA results in greater LA reductions provided reasonable assurance of implementation is demonstrated (a compliance/implementation plan and schedule).
- Changes among WLAs with no other changes; TMDL public notice concurrent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

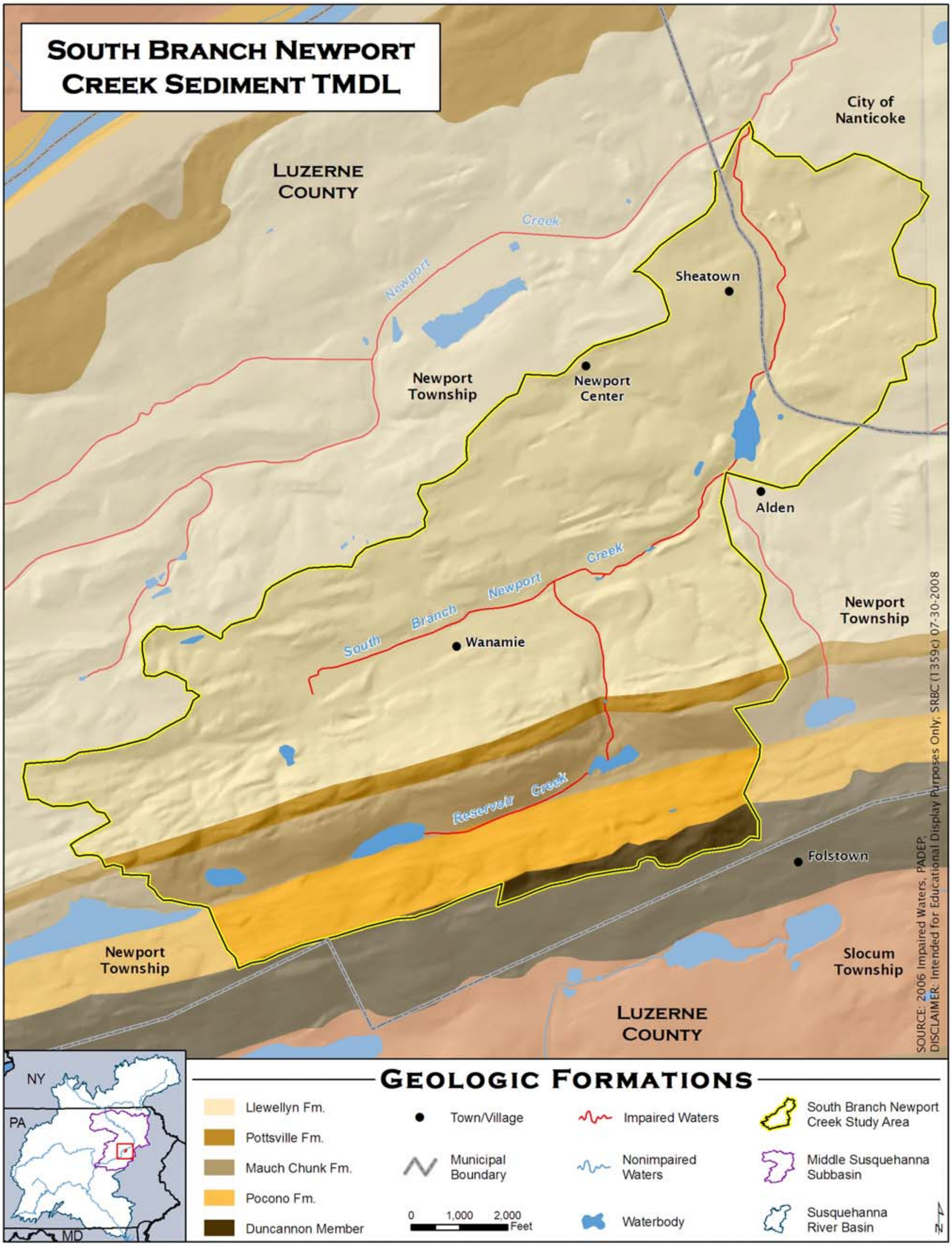
Attachment A

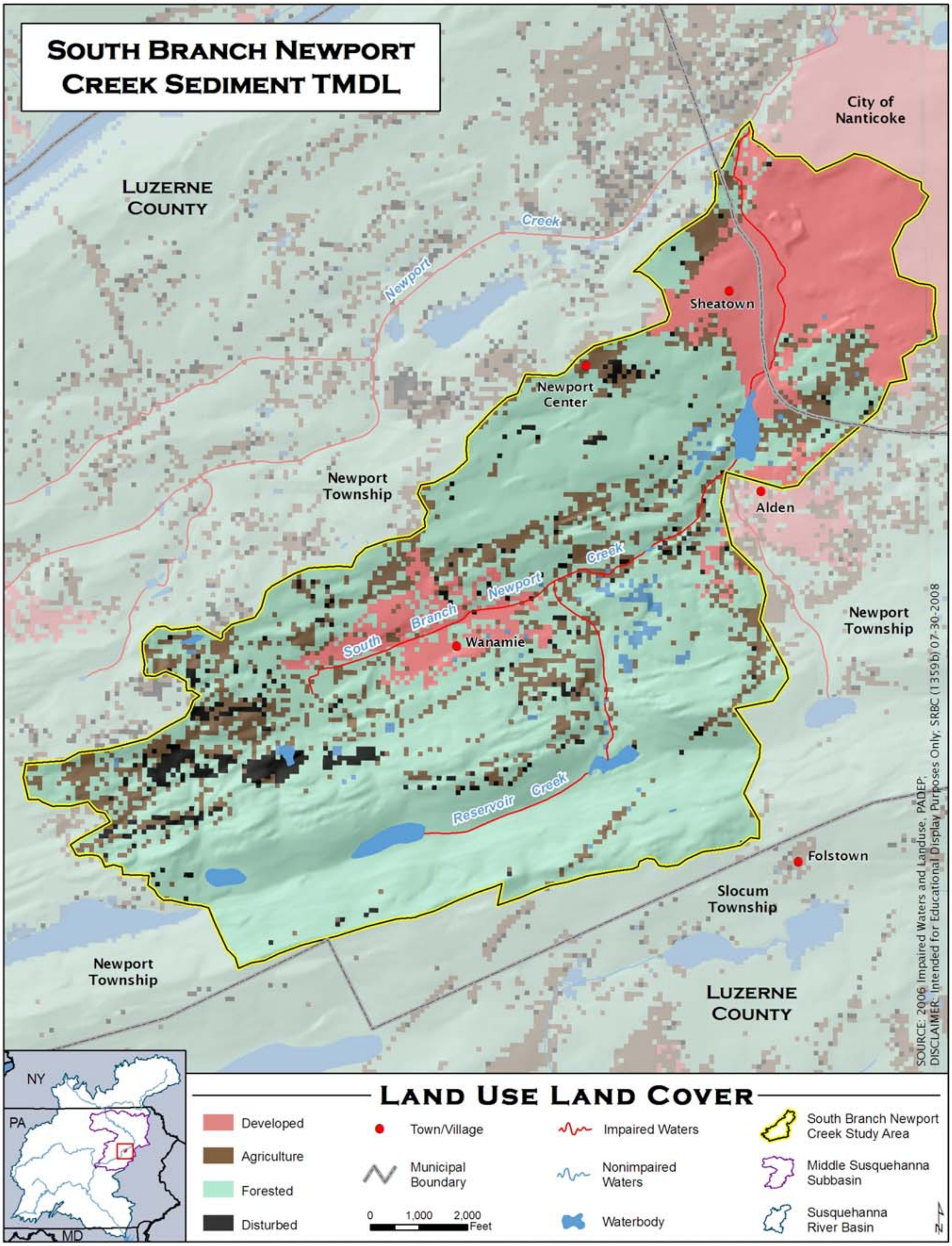
Newport Creek Watershed Maps

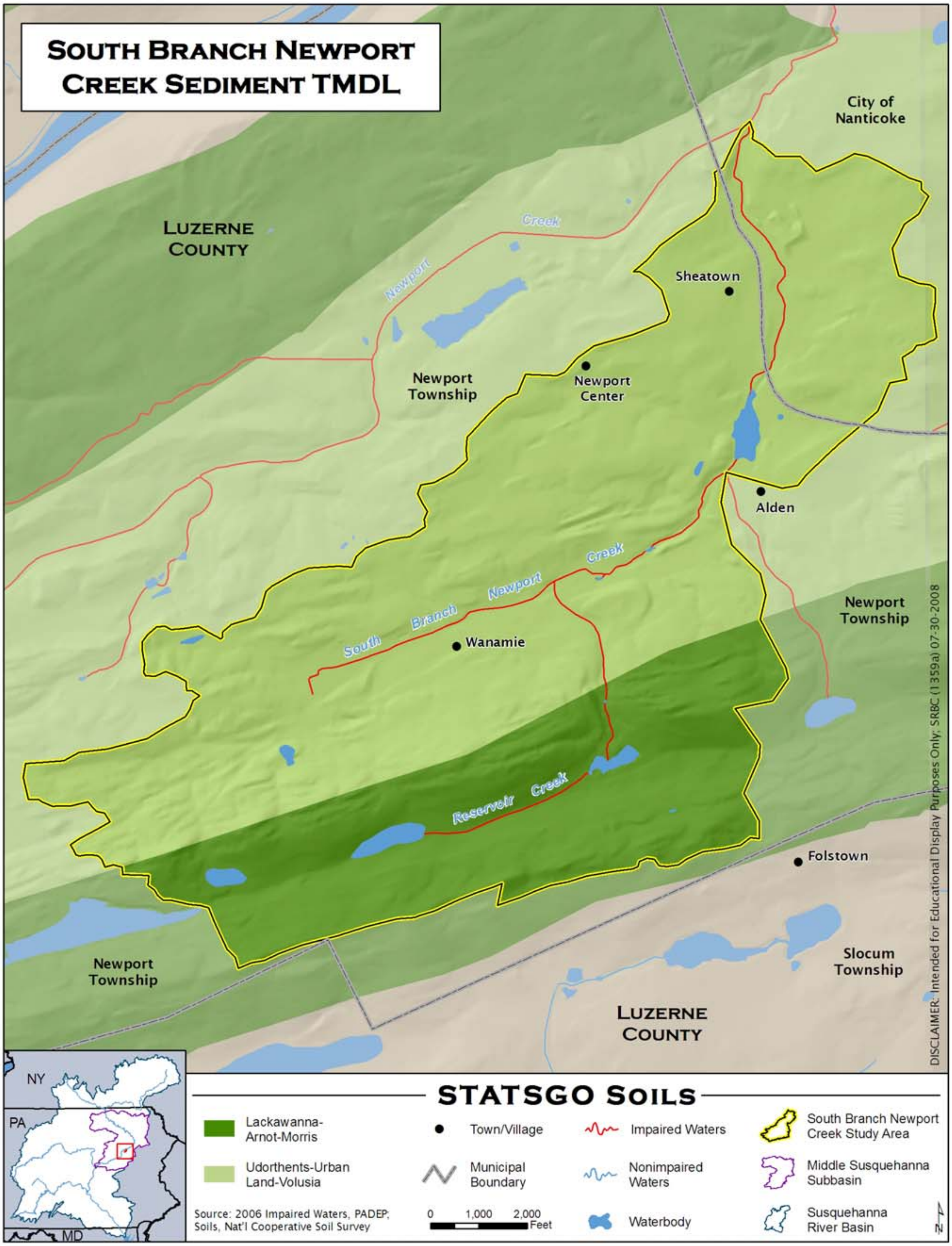


IMPAIRED WATERS IN THE NEWPORT CREEK WATERSHED
Susquehanna River
LUZERNE COUNTY
LUZERNE COUNTY
NANTICOKE
NPT1
NPT2
NPT3
NPT4
NPT5
NPT6
NPT7
SNPT1
SNPT2
SNPT3
SNPT4
Newport Creek
South Branch Newport Creek
Reservoir Creek
Glen Lyon
Wanamie
Alden
Newport Center
Sheatown
Kielar Lake
Little Wilkes-Barre Mountain
NEWPORT
Monitoring Site
Impaired Waters
Newport Creek Watershed
0
2,000
4,000
Feet
N
NY
PA
MD
Susquehanna River Basin
DISCLAIMER: Intended for Educational Display Purposes Only. SRBC (1359e) 07.30.2008


South Branch Newport Creek Sediment TMDL
Luzerne County
Luzerne County
Newport Creek
South Branch Newport Creek
Reservoir Creek
Newport Center
Sheatown
Alden
Wanamie
St Vladimir Ch
St Mary's Cem
Newport Center Cem
Trinity Cem
State Hospital
Delaware and Hudson
Wilkes-Barre Mountain
Little Wilkes-Barre Mountain
Kielar Lake
Fairchild Pond
Reservoir
Folstown
Nanti
Newport
Impaired Waters
0 1,000 2,000 Feet
N
NY
PA
MD
SOURCE: 2006 Impaired Waters, PADEP.
DISCLAIMER: Intended for Educational Display Purposes Only. SRBC (1359d) 07-30-2008


SOUTH BRANCH NEWPORT CREEK SEDIMENT TMDL
LUZERNE COUNTY
City of Nanticoke
Newport Creek
Sheatown
Newport Township
Newport Center
Alden
South Branch Newport Creek
Wanamie
Newport Township
Reservoir Creek
Folstown
Newport Township
Slocum Township
LUZERNE COUNTY
SOURCE: 2006 Impaired Waters, PADEP.
DISCLAIMER: Intended for Educational Display Purposes Only. SRBC (1359c) 07-30-2008
NY
PA
MD
GEOLOGIC FORMATIONS
Llewellyn Fm.
Pottsville Fm.
Mauch Chunk Fm.
Pocono Fm.
Duncannon Member
Town/Village
Municipal Boundary
0 1,000 2,000 Feet
Impaired Waters
Nonimpaired Waters
Waterbody
South Branch Newport Creek Study Area
Middle Susquehanna Subbasin
Susquehanna River Basin
N


SOUTH BRANCH NEWPORT CREEK SEDIMENT TMDL
City of Nanticoke
LUZERNE COUNTY
Creek
Newport
Sheatown
Newport Center
Newport Township
Alden
Creek
Newport
Branch
South
Wanamie
Newport Township
Reservoir Creek
Folstown
Slocum Township
Newport Township
LUZERNE COUNTY
SOURCE: 2006 Impaired Waters and Landuse, PADEP;
DISCLAIMER: Intended for Educational Display Purposes Only; SRBC (1359b) 07-30-2008
NY
PA
MD
LAND USE LAND COVER
Developed
Agriculture
Forested
Disturbed
Town/Village
Municipal Boundary
0 1,000 2,000 Feet
Impaired Waters
Nonimpaired Waters
Waterbody
South Branch Newport Creek Study Area
Middle Susquehanna Subbasin
Susquehanna River Basin
N


SOUTH BRANCH NEWPORT CREEK SEDIMENT TMDL
LUZERNE COUNTY
City of Nanticoke
Newport Creek
Sheatown
Newport Township
Newport Center
Alden
South Branch Newport Creek
Wanamie
Newport Township
Reservoir Creek
Folstown
Newport Township
Slocum Township
LUZERNE COUNTY
DISCLAIMER: Intended for Educational Display Purposes Only. SRBC (1359a) 07-30-2008
NY
PA
MD
STATSGO Soils
Lackawanna-Arnot-Morris
Udorthents-Urban Land-Volusia
Town/Village
Municipal Boundary
Impaired Waters
Nonimpaired Waters
Waterbody
South Branch Newport Creek Study Area
Middle Susquehanna Subbasin
Susquehanna River Basin
Source: 2006 Impaired Waters, PADEP; Soils, Nat'l Cooperative Soil Survey
0 1,000 2,000 Feet
N

Attachment B

Excerpts Justifying Changes Between the 1996, 1998, and 2002 Section 303(d) Lists and Integrated Report/List (2004, 2006)

The following are excerpts from the PADEP Section 303(d) narratives that justify changes in listings between the 1996, 1998, 2002, 2004, and 2006 303(d) Lists and Integrated Report/List (2006). 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 USEPA 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).

<u>Migration to National Hydrography Data (NHD)</u>

New to the 2006 report is use of the 1/24,000 National Hydrography Data (NHD) streams GIS layer. Up until 2006, PADEP 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, PADEP contracted with USGS to add missing streams and correct any errors in the NHD. A GIS contractor transferred the old PADEP stream assessment information to the improved NHD and the old PADEP 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 PADEP 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.

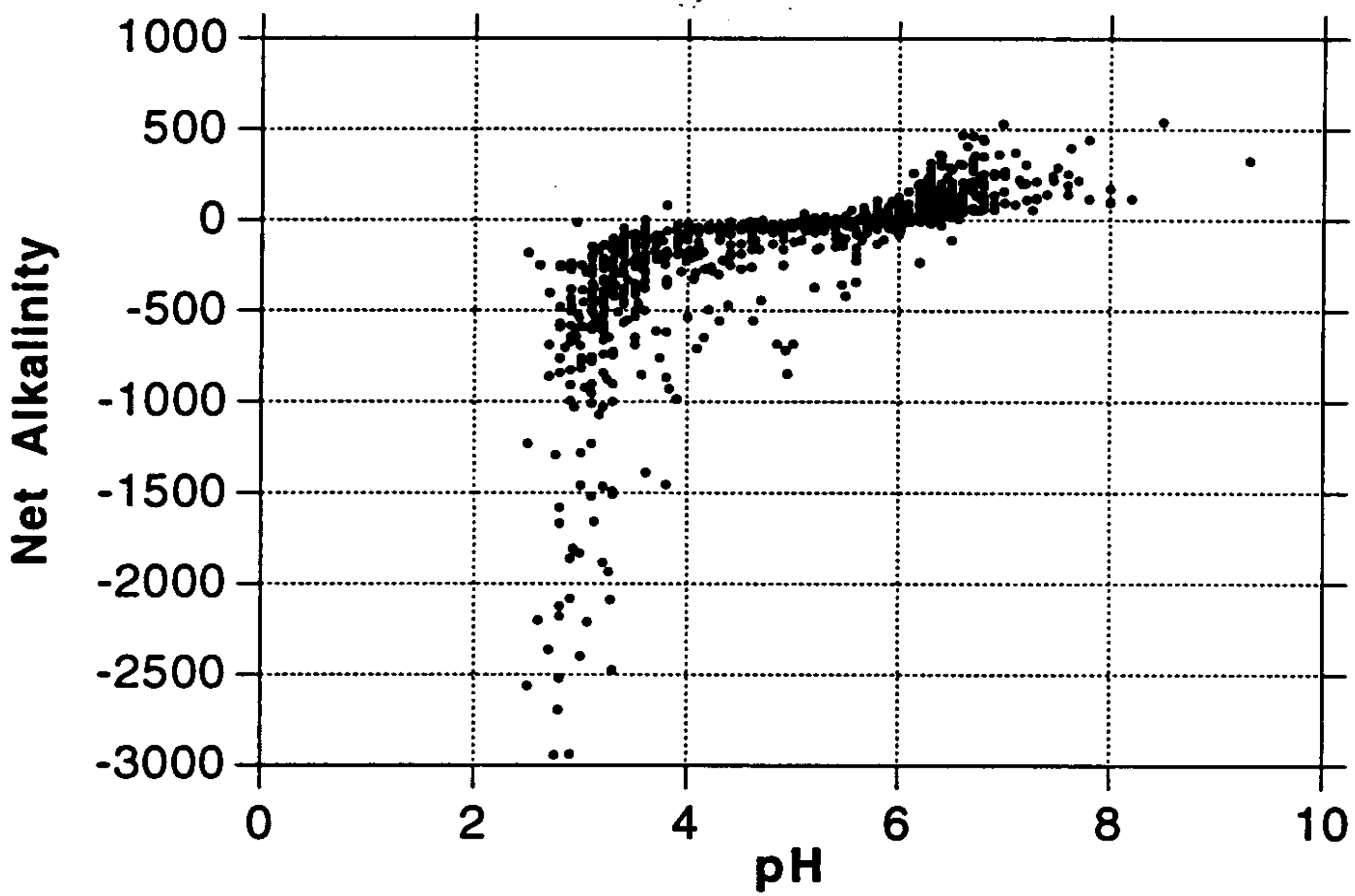
Attachment C
Method for Addressing 303(d) Listings for pH

There has been a great deal of research conducted on the relationship between alkalinity, acidity, and pH. Research published by PADEP demonstrates that by plotting net alkalinity (alkalinity-acidity) vs. pH for 794 mine sample points, the resulting pH value from a sample possessing a net alkalinity of zero is approximately equal to six (Figure C-1). Where net alkalinity is positive (greater than or equal to zero), the pH range is most commonly six to eight, which is within the USEPA's acceptable range of six to nine and meets Pennsylvania water quality criteria in Chapter 93.

The pH, a measurement of hydrogen ion acidity presented as a negative logarithm, is not conducive to standard statistics. Additionally, pH does not measure latent acidity. For this reason, and based on the above information, Pennsylvania is using the following approach to address the stream impairments noted on the 303(d) list due to pH. The concentration of acidity in a stream is at least partially chemically dependent upon metals. For this reason, it is extremely difficult to predict the exact pH values, which would result from treatment of abandoned mine drainage. When acidity in a stream is neutralized or is restored to natural levels, pH will be acceptable. Therefore, the measured instream alkalinity at the point of evaluation in the stream will serve as the goal for reducing total acidity at that point. The methodology that is applied for alkalinity (and therefore pH) is the same as that used for other parameters such as iron, aluminum, and manganese that have numeric water quality criteria.

Each sample point used in the analysis of pH by this method must have measurements for total alkalinity and total acidity. The same statistical procedures that have been described for use in the evaluation of the metals is applied, using the average value for total alkalinity at that point as the target to specify a reduction in the acid concentration. By maintaining a net alkaline stream, the pH value will be in the range between six and eight. This method negates the need to specifically compute the pH value, which for mine waters is not a true reflection of acidity. This method assures that Pennsylvania's standard for pH is met when the acid concentration reduction is met.

Reference: *Rose, Arthur W. and Charles A. Cravotta, III 1998. Geochemistry of Coal Mine Drainage. Chapter 1 in Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania. Pa. Dept. of Environmental Protection, Harrisburg, Pa.*



FigureC-1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

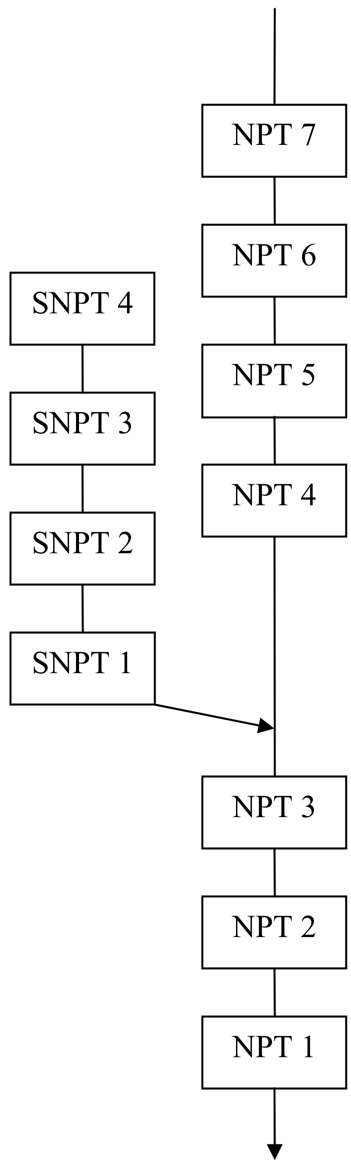
Attachment D
TMDLs By Segment

Newport Creek

The TMDL for Newport Creek consists of LAs to seven sampling sites on Newport Creek (NPT 7, NPT 6, NPT 5, NPT 4, NPT 3, NPT 2, and NPT1) and four sites to the South Branch (SNPT 4, SNPT 3, SNPT 2, and SNPT 1). Sample datasets were collected in 2008. All sample points are shown on the maps in Attachment A as well as on the loading schematic presented on the following page. Newport Creek is listed on the 1996 303(d) and 2006 Integrated List for pH from AMD as the cause of the stream degradation. Although this TMDL will focus primarily on pH loading to the Newport Creek Watershed, metal loading analysis will also be performed. Staff determined that Newport Creek Watershed was choked with metal influence. The method and rationale for addressing pH is contained in Attachment C.

An allowable long-term average instream concentration for iron, manganese, aluminum, and acidity is determined at each sample point. These analyses are designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent of the time. An analysis was performed using Monte Carlo simulation to determine the necessary long-term average concentration needed to attain water quality criteria 99 percent of the time. The simulation was run assuming the dataset was lognormally distributed. Using the mean and the standard deviation of the dataset, 5,000 iterations of sampling were completed and compared against the water quality criterion for that parameter. For each sampling event, a percent reduction was calculated, if necessary, to meet water quality criteria. A second simulation that multiplied the percent reduction times the sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this dataset represents that long-term daily average concentration that needs to be met to achieve water quality standards.

Newport Creek Sampling Diagram
Arrows represent direction of flow, and diagram is not to scale.



NPT 7: Newport Creek Headwaters

The headwaters of Newport Creek begin outside of Glen Lyon, Pa. Anthracite coal mining in the watershed severely disturbed the land surface and underground structure. The point NPT 7 is located at the upstream side of the bridge on Spring Street. This portion of the stream is visibly impaired by abandoned mine drainage with the presence of orange iron precipitate.

The TMDL for this section of Newport Creek consists of a load allocation to the watershed area above NPT 7. Addressing the mining impacts above this point addresses the impairment for the stream segment. An average instream flow measurement was available for point NPT 7 (1.387 MGD). The LAs made at point NPT 7 for this stream segment are presented in Table D1.

Table D1. TMDL Calculations at Point NPT 7				
Flow = 1.387 MGD	*Measured Sample Data*		*Allowable*	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	13.85	160.35	0.55	6.41
Mn	4.47	51.75	0.85	9.83
Al	7.88	91.24	0.47	5.47
Acidity	109.56	1,268.45	0.00	0.00
Alkalinity	0.00	0.00	-	-

Reductions at point NPT 7 are necessary for any parameter that exceeds the allowable load at this point. Necessary reductions at point NPT 7 are shown in Table D2.

Table D2. Calculation of Load Reduction Necessary at Point NPT 7				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load at NPT 7	160.35	51.75	91.24	1,268.45
Allowable load at NPT 7	6.41	9.83	5.47	0.00
Load Reduction at NPT 7	153.94	41.92	85.77	1,268.45
Percent reduction required at NPT 7	96.0%	81.0%	94.0%	100.0%

The TMDL for point NPT 7 requires a load allocation for total iron, total manganese, total aluminum, and acidity. A waste load allocation for future mining was included for this segment for Newport Creek, allowing for two operations with two active pits (1500’ x 300’) to be permitted in the future on this segment (Table D3).

Table D3. Waste Load Allocation for Future Mining Operations			
Parameter	*Monthly Avg. Allowable Conc. (mg/L)*	*Average Flow (MGD)*	*Allowable Load (lbs/day)*
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.26
Mn	2.0	0.090	1.50
Future Operation 2			
Fe	0.75	0.090	0.56
Al	3.0	0.090	2.26
Mn	2.0	0.090	1.50

NPT 6: Newport Creek downstream of UNT 64681

NPT 6 is located just east of Glen Lyon, Pa., and is accessed through a gated road controlled by Newport Township. All measurements were recorded next to a group of hemlocks that were down an old logging road north of the gate. This portion of the stream is visibly impaired by abandoned mine drainage with the presence of orange iron precipitate.

The TMDL for this section of Newport Creek consists of a load allocation to the watershed area between NPT 7 and NPT 6. Addressing the mining impacts above this point addresses the impairment for the stream segment. An average instream flow measurement was available for point NPT 6 (1.705 MGD). The LAs made at point NPT 6 for this stream segment are presented in Table D4.

Table D4. TMDL Calculations at Point NPT 6				
Flow = 1.705 MGD	*Measured Sample Data*		*Allowable*	
Parameter	*Conc. (mg/l)*	*Load (lbs/day)*	*LTA Conc. (mg/l)*	*Load (lbs/day)*
Fe	18.20	258.95	0.55	7.77
Mn	4.43	63.00	0.75	10.71
Al	3.41	48.44	0.20	2.91
Acidity	60.03	854.00	1.20	17.08
Alkalinity	4.80	68.28	-	-

The loading reduction for point NPT 7 was used to show the total load that was removed from upstream sources. For each parameter, the total load that was removed upstream was subtracted from the existing load at point NPT 6. This value was compared to the allowable load at point NPT 6. Reductions at point NPT 6 are necessary for any parameter that exceeds the allowable load at this point. Necessary reductions at point NPT 6 are shown in Table D5.

Table D5. Calculation of Load Reduction Necessary at Point NPT 6				
	Fe (lbs/day)	*Mn (lbs/day)*	*Al (lbs/day)*	*Acidity (lbs/day)*
Existing load at NPT 6	258.95	63.00	48.44	854.00
Difference of measured loads between loads that enter and existing NPT 6	98.60	11.25	-42.80	-414.45
Percent loss due calculated at NPT 6	0.0%	0.0%	46.9%	32.7%
Additional loads tracked from above samples	6.41	9.83	5.47	0.00
Percentage of upstream loads that reach NPT 6	100.0%	100.0%	53.1%	67.3%
Total load tacked between NPT 7 and NPT 6	105.01	21.08	2.90	0.00
Allowable load at NPT 6	7.77	10.71	2.91	17.08
Load Reduction at NPT 6	97.24	10.31	0.00	0.00
Percent reduction required at NPT 6	92.6%	49.2%	0.0%	0.0%

The TMDL for point NPT 6 requires a load allocation for total iron, and total manganese. A waste load allocation for future mining was included for this segment for Newport Creek, allowing for three operations with two active pits (1500' x 300') to be permitted in the future on this segment (Table D6).

Table D6. Waste Load Allocation for Future Mining Operations			
Parameter	*Monthly Avg. Allowable Conc. (mg/L)*	*Average Flow (MGD)*	*Allowable Load (lbs/day)*
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.26
Mn	2.0	0.090	1.50
Future Operation 2			
Fe	0.75	0.090	0.56
Al	3.0	0.090	2.26
Mn	2.0	0.090	1.50
Future Operation 3			
Fe	0.75	0.090	0.56
Al	3.0	0.090	2.26
Mn	2.0	0.090	1.50

NPT 5: Newport Creek downstream of UNT 28347

NPT 5 is located just north of Newport Center, Pa., and is accessed through an unpaved road to the Newport Cemetery. All measurements were recorded upstream of an ATV trail/crossing on Newport Creek. This portion of the stream is visibly impaired by abandoned mine drainage with the presence of orange iron precipitate.

The TMDL for this section of Newport Creek consists of a load allocation to the watershed area between NPT 6 and NPT 5. Addressing the mining impacts above this point addresses the impairment for the stream segment. An average instream flow measurement was available for point NPT 5 (2.165 MGD). The LAs made at point NPT 5 for this stream segment are presented in Table D7.

Table D7. TMDL Calculations at Point NPT 5				
Flow = 2.165 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	4.89	88.37	0.34	6.19
Mn	3.59	64.78	0.57	10.36
Al	1.24	22.41	0.12	2.24
Acidity	-91.15	-1,646.51	-	-
Alkalinity	117.28	2,118.57	-	-

The loading reduction for point NPT 6 was used to show the total load that was removed from upstream sources. For each parameter, the total load that was removed upstream was subtracted from the existing load at point NPT 5. This value was compared to the allowable load at point NPT 5. Reductions at point NPT 5 are necessary for any parameter that exceeds the allowable load at this point. Necessary reductions at point NPT 8 are shown in Table D6.

Table D8. Calculation of Load Reduction Necessary at Point NPT 5				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load at NPT 5	88.37	64.78	22.41	-
Difference of measured loads between loads that enter and existing NPT 5	-170.58	1.78	-26.03	-
Percent loss due calculated at NPT 5	65.9%	0.0%	53.7%	-
Additional loads tracked from above samples	7.77	10.71	2.91	-
Percentage of upstream loads that reach NPT 5	34.1%	100.0%	46.3%	-
Total load tacked between NPT 6 and NPT 5	2.65	12.49	1.36	-
Allowable load at NPT 5	6.19	10.36	2.24	-
Load Reduction at NPT 5	0.00	2.13	0.00	-
Percent reduction required at NPT 5	0.0%	17.1%	0.0%	-

The TMDL for point NPT 5 requires a load allocation for total manganese. A waste load allocation for future mining was included for this segment for Newport Creek, allowing for two operations with two active pits (1500' x 300') to be permitted in the future on this segment (Table D9).

Table D9. Waste Load Allocation for Future Mining Operations			
Parameter	***Monthly Avg. Allowable Conc. (mg/L)***	***Average Flow (MGD)***	***Allowable Load (lbs/day)***
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.26
Mn	2.0	0.090	1.50
Future Operation 2			
Fe	0.75	0.090	0.56
Al	3.0	0.090	2.26
Mn	2.0	0.090	1.50

NPT 4: Newport Creek downstream of Newport Dump

NPT 4 is located just north of Newport Center, Pa., and is accessed through an unpaved road to the Newport Cemetery. All measurements were recorded downstream of the outfall from Newport Lake (Newport Dump). The Newport Dump is an abandoned stripping pit that significantly degrades Newport Creek. This portion of the stream is visibly impaired by abandoned mine drainage with the presence of orange iron precipitate.

The TMDL for this section of Newport Creek consists of a load allocation to the watershed area between NPT 5 and NPT 4. Addressing the mining impacts above this point addresses the impairment for the stream segment. An average instream flow measurement was available for point NPT 4 (8.469 MGD). The LAs made at point NPT 4 for this stream segment are presented in Table D10.

Table D10. TMDL Calculations at Point NPT 4

Flow = 8.469 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	15.87	1,121.72	0.79	56.09
Mn	5.30	374.67	0.80	56.20
Al	0.47	33.48	0.09	6.03
Acidity	2.17	153.13	1.86	131.69
Alkalinity	24.90	1,759.80	-	-

The loading reduction for point NPT 5 was used to show the total load that was removed from upstream sources. For each parameter, the total load that was removed upstream was subtracted from the existing load at point NPT 4. This value was compared to the allowable load at point NPT 5. Reductions at point NPT 4 are necessary for any parameter that exceeds the allowable load at this point. Necessary reductions at point NPT 4 are shown in Table D11.

Table D11. Calculation of Load Reduction Necessary at Point NPT 4

	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load at NPT 4	1,121.72	374.67	33.48	153.13
Difference of measured loads between loads that enter and existing NPT 4	1,033.35	309.89	11.07	153.13
Percent loss due calculated at NPT 4	0.0%	0.0%	0.0%	0.0%
Additional loads tracked from above samples	6.19	10.36	2.24	-
Percentage of upstream loads that reach NPT 4	100.0%	100.0%	100.0%	100.0%
Total load tacked between NPT 5 and NPT 4	1,039.54	320.25	13.31	153.13
Allowable load at NPT 4	56.09	56.20	6.03	131.69
Load Reduction at NPT 4	983.45	264.05	7.28	21.44
Percent reduction required at NPT 4	94.6%	82.5%	54.7%	14.0%

The TMDL for point NPT 4 requires a load allocation for total iron, total manganese, total aluminum, and acidity. A waste load allocation for future mining was included for this segment for Newport Creek, allowing for three operations with two active pits (1500' x 300') to be permitted in the future on this segment (Table D12).

Table D12. Waste Load Allocation for Future Mining Operations			
Parameter	***Monthly Avg. Allowable Conc. (mg/L)***	***Average Flow (MGD)***	***Allowable Load (lbs/day)***
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.26
Mn	2.0	0.090	1.50
Future Operation 2			
Fe	0.75	0.090	0.56
Al	3.0	0.090	2.26
Mn	2.0	0.090	1.50
Future Operation 3			
Fe	0.75	0.090	0.56
Al	3.0	0.090	2.26
Mn	2.0	0.090	1.50

SNPT 4: South Branch Headwaters

SNPT 4 is located near Wanamie, Pa., and is accessed by SR3004. All measurements were recorded upstream of the SR3004 bridge just east of Wanamie, Pa.

The TMDL for this section of South Branch consists of a load allocation to the watershed area upstream of SNPT 4. Addressing the mining impacts above this point addresses the impairment for the stream segment. An average instream flow measurement was available for point SNPT 4 (0.033 MGD). The LAs made at point SNPT 4 for this stream segment are presented in Table D13.

Table D13. TMDL Calculations at Point SNPT 4				
Flow = 0.033 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	0.26	0.07	0.26	0.07
Mn	1.61	0.45	0.71	0.20
Al	2.00	0.56	0.52	0.14
Acidity	33.80	9.43	1.69	0.47
Alkalinity	2.30	0.64	-	-

Reductions at point SNPT 4 are necessary for any parameter that exceeds the allowable load at this point. Necessary reductions at point SNPT 4 are shown in Table D14.

Table D14. Calculation of Load Reduction Necessary at Point SNPT 4				
	***Fe* (lbs/day)**	***Mn* (lbs/day)**	***Al* (lbs/day)**	***Acidity* (lbs/day)**
Existing load at SNPT 4	0.07	0.45	0.56	9.43
Allowable load at SNPT 4	0.07	0.20	0.14	0.47
Load Reduction at SNPT 4	0.00	0.25	0.42	8.96
Percent reduction required at SNPT 4	0.0%	55.6%	75.0%	95.0%

The TMDL for point SNPT 4 requires a load allocation for total iron, total manganese, total aluminum, and acidity.

SNPT 3: South Branch downstream of UNT 28346

SNPT 3 is located near Alden, Pa., and is accessed by SR3004. All measurements were recorded upstream of the SR3004 bridge just west of Alden, Pa.

The TMDL for this section of South Branch consists of a load allocation to the watershed area between SNPT 4 and SNPT 3. Addressing the mining impacts above this point addresses the impairment for the stream segment. An average instream flow measurement was available for point SNPT 3 (0.603 MGD). The LAs made at point SNPT 3 for this stream segment are presented in Table D15.

Table D15. TMDL Calculations at Point SNPT 3				
Flow = 0.603 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	3.34	16.81	0.43	2.19
Mn	2.14	10.77	0.26	1.29
Al	4.53	22.82	0.18	0.91
Acidity	62.47	314.40	0.00	0.00
Alkalinity	0.00	0.00	-	-

The loading reduction for point SNPT 4 was used to show the total load that was removed from upstream sources. For each parameter, the total load that was removed upstream was subtracted from the existing load at point SNPT 3. This value was compared to the allowable load at point SNPT 3. Reductions at point SNPT 3 are necessary for any parameter that exceeds the allowable load at this point. Necessary reductions at point SNPT 3 are shown in Table D16.

Table D16. Calculation of Load Reduction Necessary at Point SNPT 3				
	***Fe* (lbs/day)**	***Mn* (lbs/day)**	***Al* (lbs/day)**	***Acidity* (lbs/day)**
Existing load at SNPT 3	16.81	10.77	22.82	314.40
Difference of measured loads between loads that enter and existing SNPT 3	16.74	10.32	22.26	304.97
Percent loss due calculated at SNPT 3	0.0%	0.0%	0.0%	0.0%
Additional loads tracked from above samples	0.07	0.20	0.14	0.47
Percentage of upstream loads that reach SNPT 3	100.0%	100.0%	100.0%	100.0%
Total load tacked between SNPT 4 and SNPT 3	16.81	10.52	22.40	305.44
Allowable load at SNPT 3	2.19	1.29	0.91	0.00
Load Reduction at SNPT 3	14.62	5.57	21.49	305.44
Percent reduction required at SNPT 3	87.0%	52.9%	95.9%	100.0%

The TMDL for point SNPT 3 requires a load allocation for total iron, total manganese, total aluminum, and acidity.

SNPT 2: South Branch downstream of Sheatown Discharge

SNPT 2 is located near Alden, Pa., and is accessed by an unpaved road north SR3004. All measurements were recorded downstream of the unpaved road bridge just east of Alden, Pa.

The TMDL for this section of South Branch consists of a load allocation to the watershed area between SNPT 3 and SNPT 2. Addressing the mining impacts above this point addresses the impairment for the stream segment. An average instream flow measurement was available for point SNPT 2 (1.062 MGD). The LAs made at point SNPT 2 for this stream segment are presented in Table D17.

Table D17. TMDL Calculations at Point SNPT 2				
Flow = 1.062 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	4.62	40.96	0.46	4.10
Mn	2.22	19.69	0.31	2.76
Al	3.38	30.00	0.27	2.40
Acidity	42.57	377.36	0.00	0.00
Alkalinity	0.00	0.00	-	-

The loading reduction for point SNPT 3 was used to show the total load that was removed from upstream sources. For each parameter, the total load that was removed upstream was subtracted from the existing load at point SNPT 2. This value was compared to the allowable load at point SNPT 2. Reductions at point SNPT 2 are necessary for any parameter that exceeds the allowable load at this point. Necessary reductions at point SNPT 2 are shown in Table D18.

Table D18. Calculation of Load Reduction Necessary at Point SNPT 2				
	Fe (lbs/day)	*Mn (lbs/day)*	*Al (lbs/day)*	*Acidity (lbs/day)*
Existing load at SNPT 2	40.96	19.69	30.00	377.36
Difference of measured loads between loads that enter and existing SNPT 2	24.15	8.92	7.18	62.96
Percent loss due calculated at SNPT 2	0.0%	0.0%	0.0%	0.0%
Additional loads tracked from above samples	2.19	1.29	0.91	0.00
Percentage of upstream loads that reach SNPT 2	100.0%	100.0%	100.0%	100.0%
Total load tacked between SNPT 3 and SNPT 2	26.34	10.21	8.09	62.96
Allowable load at SNPT 2	4.10	2.76	2.40	0.00
Load Reduction at SNPT 2	22.24	7.45	5.69	62.96
Percent reduction required at SNPT 2	84.4%	73.0%	70.3%	100.0%

The TMDL for point SNPT 2 requires a load allocation for total iron, total manganese, total aluminum, and acidity. A waste load allocation for future mining was included for this segment for South Branch allowing for one operation with two active pits (1500' x 300') to be permitted in the future on this segment (Table D19).

Table D19. Waste Load Allocation for Future Mining Operations			
Parameter	***Monthly Avg. Allowable Conc. (mg/L)***	***Average Flow (MGD)***	***Allowable Load (lbs/day)***
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.26
Mn	2.0	0.090	1.50

SNPT 1: South Branch upstream of confluence with Newport Creek

SNPT 1 is located near Nanticoke, Pa., and is accessed by SR3004. All measurements were recorded downstream of the SR3004 bridge just east of Nanticoke, Pa.

The TMDL for this section of South Branch consists of a load allocation to the watershed area between SNPT 2 and SNPT 1. Addressing the mining impacts above this point addresses the impairment for the stream segment. An average instream flow measurement was available for point SNPT 1 (1.432 MGD). The LAs made at point SNPT 1 for this stream segment are presented in Table D20.

Table D20. TMDL Calculations at Point SNPT 1				
Flow = 1.432 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	1.11	13.32	0.48	5.73
Mn	2.23	26.65	0.36	4.26
Al	1.09	13.04	0.24	2.87
Acidity	13.93	166.56	2.09	24.98
Alkalinity	9.10	108.78	-	-

The loading reduction for point SNPT 2 was used to show the total load that was removed from upstream sources. For each parameter, the total load that was removed upstream was subtracted from the existing load at point SNPT 1. This value was compared to the allowable load at point SNPT 1. Reductions at point SNPT 1 are necessary for any parameter that exceeds the allowable load at this point. Necessary reductions at point SNPT 1 are shown in Table D21.

Table D21. Calculation of Load Reduction Necessary at Point SNPT 1				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load at SNPT 1	13.32	26.65	13.04	166.56
Difference of measured loads between loads that enter and existing SNPT 1	-27.62	6.96	-16.96	-210.80
Percent loss due calculated at SNPT 1	67.4%	0.0%	56.5%	55.9%
Additional loads tracked from above samples	4.10	2.76	2.40	0.00
Percentage of upstream loads that reach SNPT 1	32.6%	100.0%	43.5%	44.1%
Total load tacked between SNPT 2 and SNPT 1	1.34	9.72	1.04	0.00
Allowable load at SNPT 1	5.73	4.26	2.87	24.98
Load Reduction at SNPT 1	0.00	5.46	0.00	0.00
Percent reduction required at SNPT 1	0.0%	56.2%	0.0%	0.0%

The TMDL for point SNPT 1 requires a load allocation of total manganese. A waste load allocation for future mining was included for this segment for South Branch, allowing for two operations with two active pits (1500' x 300') to be permitted in the future on this segment (Table D22).

Table D23. Waste Load Allocation for Future Mining Operations			
Parameter	***Monthly Avg. Allowable Conc. (mg/L)***	***Average Flow (MGD)***	***Allowable Load (lbs/day)***
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.26
Mn	2.0	0.090	1.50
Future Operation 2			
Fe	0.75	0.090	0.56
Al	3.0	0.090	2.26
Mn	2.0	0.090	1.50

NPT 3: Newport Creek downstream of confluence with South Branch

NPT 3 is located just north of Nanticoke, Pa., and is accessed through Access Road. All measurements were recorded upstream of the outfall from Susquehanna #7 Mine Discharge.

The TMDL for this section of Newport Creek consists of a load allocation to the watershed area between NPT 4 and NPT 3. Addressing the mining impacts above this point addresses the impairment for the stream segment. An average instream flow measurement was available for point NPT 3 (8.100 MGD). The LAs made at point NPT 3 for this stream segment are presented in Table D23.

Table D23. TMDL Calculations at Point NPT 3				
Flow = 8.100 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	10.09	682.23	0.20	13.64
Mn	5.04	340.73	0.71	47.70
Al	0.41	27.84	0.11	7.52
Acidity	5.93	401.07	1.78	120.32
Alkalinity	16.20	1,095.07	-	-

The loading reduction for point NPT 4 was used to show the total load that was removed from upstream sources. For each parameter, the total load that was removed upstream was subtracted from the existing load at point NPT 3. This value was compared to the allowable load at point NPT 3. Reductions at point NPT 3 are necessary for any parameter that exceeds the allowable load at this point. Necessary reductions at point NPT 3 are shown in Table D24.

Table D24. Calculation of Load Reduction Necessary at Point NPT 3				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load at NPT 3	682.23	340.73	27.84	401.07
Difference of measured loads between loads that enter and existing NPT 3	-452.81	-7.29	-18.68	81.38
Percent loss due calculated at NPT 3	39.9%	1.8%	40.2%	0.0%
Additional loads tracked from above samples	61.82	60.46	8.90	156.67
Percentage of upstream loads that reach NPT 3	60.1%	98.2%	59.8%	100.0%
Total load tacked between NPT 4, SNPT 1 and NPT 3	37.15	59.37	5.32	238.05
Allowable load at NPT 3	13.64	47.70	7.52	120.32
Load Reduction at NPT 3	23.51	11.67	0.00	117.73
Percent reduction required at NPT 3	63.3%	19.7%	0.0%	49.5%

The TMDL for point NPT 3 requires a load allocation for total iron, total manganese and acidity. A waste load allocation for future mining was included for this segment for Newport Creek, allowing for three operations with two active pits (1500' x 300') to be permitted in the future on this segment (Table D25).

Table D25. Waste Load Allocation for Future Mining Operations			
Parameter	***Monthly Avg. Allowable Conc. (mg/L)***	***Average Flow (MGD)***	***Allowable Load (lbs/day)***
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.26
Mn	2.0	0.090	1.50
Future Operation 2			
Fe	0.75	0.090	0.56
Al	3.0	0.090	2.26
Mn	2.0	0.090	1.50
Future Operation 3			
Fe	0.75	0.090	0.56
Al	3.0	0.090	2.26
Mn	2.0	0.090	1.50

NPT 2: Newport Creek downstream of Susquehanna #7 Mine Discharge

NPT 2 is located just north of Nanticoke, Pa., and is accessed through Access Road. All measurements were recorded downstream of the outfall from Susquehanna #7 Mine Discharge. The Susquehanna #7 Mine Discharge is a large discharge that significantly impairs Newport Creek. This portion of Newport Creek is visually impaired with the presence of iron precipitate.

The TMDL for this section of Newport Creek consists of a load allocation to the watershed area between NPT 3 and NPT 2. Addressing the mining impacts above this point addresses the impairment for the stream segment. An average instream flow measurement was available for point NPT 2 (14.889 MGD). The LAs made at point NPT 2 for this stream segment are presented in Table D26.

Table D26. TMDL Calculations at Point NPT 2				
Flow = 14.889 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	22.02	2,735.57	0.88	109.42
Mn	4.48	556.47	0.81	100.17
Al	0.26	32.76	0.11	13.10
Acidity	-26.53	-3,296.77	-	-
Alkalinity	54.80	6,808.90	-	-

The loading reduction for point NPT 3 was used to show the total load that was removed from upstream sources. For each parameter, the total load that was removed upstream was subtracted from the existing load at point NPT 2. This value was compared to the allowable load at point NPT 2. Reductions at point NPT 2 are necessary for any parameter that exceeds the allowable load at this point. Necessary reductions at point NPT 2 are shown in Table D27.

Table D27. Calculation of Load Reduction Necessary at Point NPT 2				
	Fe (lbs/day)	*Mn (lbs/day)*	*Al (lbs/day)*	*Acidity (lbs/day)*
Existing load at NPT 2	2,735.57	556.47	32.76	-
Difference of measured loads between loads that enter and existing NPT 2	2,053.34	215.74	4.92	-
Percent loss due calculated at NPT 2	0.0%	0.0%	0.0%	-
Additional loads tracked from above samples	13.64	47.70	7.52	-
Percentage of upstream loads that reach NPT 2	100.0%	100.0%	100.0%	-
Total load tacked between NPT 3 and NPT 2	2,099.89	263.44	12.44	-
Allowable load at NPT 2	109.42	100.17	13.10	-
Load Reduction at NPT 2	1,990.47	163.27	0.00	-
Percent reduction required at NPT 2	94.8%	62.0%	0.0%	-

The TMDL for point NPT 2 requires a load allocation for total iron and total manganese. A waste load allocation for future mining was included for this segment for Newport Creek, allowing for three operations with two active pits (1500' x 300') to be permitted in the future on this segment (Table D28).

Table D28. Waste Load Allocation for Future Mining Operations			
Parameter	*Monthly Avg. Allowable Conc. (mg/L)*	*Average Flow (MGD)*	*Allowable Load (lbs/day)*
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.26
Mn	2.0	0.090	1.50
Future Operation 2			
Fe	0.75	0.090	0.56
Al	3.0	0.090	2.26
Mn	2.0	0.090	1.50
Future Operation 3			
Fe	0.75	0.090	0.56
Al	3.0	0.090	2.26
Mn	2.0	0.090	1.50

NPT 1: Newport Creek downstream of Honeypot Mine Discharge

NPT 2 is located just north of Nanticoke, Pa., and is accessed through Access Road. All measurements were recorded downstream of the outfall from Honeypot Mine Discharge. The Honeypot Mine Discharge is a large discharge that significantly impairs Newport Creek. This portion of Newport Creek is visually impaired with the presence of iron precipitate.

The TMDL for this section of Newport Creek consists of a load allocation to the watershed area between NPT 2 and NPT 1. Addressing the mining impacts above this point addresses the impairment for the stream segment. An average instream flow measurement was available for point NPT 1 (20.290 MGD). The LAs made at point NPT 1 for this stream segment are presented in Table D29.

Table D29. TMDL Calculations at Point NPT 1				
Flow = 20.290 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	18.69	3,165.10	1.12	189.91
Mn	4.33	733.55	0.78	132.04
Al	0.55	93.49	0.13	22.44
Acidity	-17.46	-2,955.87	-	-
Alkalinity	44.77	7,580.75	-	-

The loading reduction for point NPT 2 was used to show the total load that was removed from upstream sources. For each parameter, the total load that was removed upstream was subtracted from the existing load at point NPT 1. This value was compared to the allowable load at point NPT 1. Reductions at point NPT 1 are necessary for any parameter that exceeds the allowable load at this point. Necessary reductions at point NPT 1 are shown in Table D30.

Table D30. Calculation of Load Reduction Necessary at Point NPT 1				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load at NPT 1	3,165.10	733.55	93.49	-
Difference of measured loads between loads that enter and existing NPT 1	429.53	177.08	60.73	-
Percent loss due calculated at NPT 1	0.0%	0.0%	0.0%	-
Additional loads tracked from above samples	109.42	100.17	13.10	-
Percentage of upstream loads that reach NPT 1	100.0%	100.0%	100.0%	-
Total load tacked between NPT 2 and NPT 1	538.95	277.25	73.83	-
Allowable load at NPT 1	189.91	132.04	22.44	-
Load Reduction at NPT 1	349.04	145.21	51.39	-
Percent reduction required at NPT 1	64.8%	52.4%	69.6%	-

The TMDL for point NPT 1 requires a load allocation for total iron, total manganese, and total aluminum. A waste load allocation for future mining was included for this segment for Newport Creek, allowing for three operations with two active pits (1500’ x 300’) to be permitted in the future on this segment (Table D31).

Table D31. Waste Load Allocation for Future Mining Operations			
Parameter	***Monthly Avg. Allowable Conc. (mg/L)***	***Average Flow (MGD)***	***Allowable Load (lbs/day)***
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.26
Mn	2.0	0.090	1.50
Future Operation 2			
Fe	0.75	0.090	0.56
Al	3.0	0.090	2.26
Mn	2.0	0.090	1.50
Future Operation 3			
Fe	0.75	0.090	0.56
Al	3.0	0.090	2.26
Mn	2.0	0.090	1.50

Margin of Safety (MOS)

An implicit MOS was used in these TMDLs derived from the Monte Carlo statistical analysis employing the @Risk software. Pa. Title 25 Chapter 96.3(c) states that water quality criteria must be met at least 99 percent of the time. All of the @Risk analyses results surpass the minimum 99 percent level of protection. Other MOS used for this TMDL analyses are:

- Effluent variability plays a major role in determining the average value that will meet water-quality criteria over the long term. The value that provides this variability in our analysis is the standard deviation of the dataset. The simulation results are based on this variability and the existing stream conditions (an uncontrolled system). The general assumption can be made that a controlled system (one that is controlling and stabilizing the pollution load) would be less variable than an uncontrolled system. This implicitly builds in a MOS.

- An additional MOS is that the calculations were performed using a daily iron average, instead of the 30-day average.

- The method used to calculate a flow for a WLA using the area of the pit and ungraded portions of an active mine is conservative and an implicit MOS.

Seasonal Variation

Seasonal variation is implicitly accounted for in these TMDLs because the data used represent all seasons.

Critical Conditions

The reductions specified in this TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis.

Attachment E
Water Quality Data Used in TMDL Calculations

			PARAMETER									
STATION	**Date**	**Time**	**Flow cfs**	**Temp. C**	**D.O. mg/L**	**TSS mg/L**	**Fe mg/L**	**Alk. mg/L**	**Mn mg/L**	**Acidity mg/L**	**Al mg/L**	**pH (lab) SU**
NPT1	3/14/2008	730	70.090	6.10	8.85	58.00	16.800	21.60	3.764	10.20	1.814	6.00
	3/17/2008	1130	42.098	9.40	10.30	34.00	17.500	26.40	3.930	3.00	1.070	6.20
	4/24/2008	1000	25.384	15.50	6.84	30.00	17.400	57.20	4.378	-27.60	0.258	6.50
	5/6/2008	915	32.421	14.00	5.68	12.00	18.500	46.80	4.380	-17.40	0.240	6.30
	5/29/2008	815	21.140	12.90	4.83	22.00	21.000	51.80	4.360	-23.80	0.100	6.40
	6/24/2008	800	15.157	17.60	7.60	32.00	18.550	56.00	4.480	-30.40	0.100	6.50
	8/19/2008	745	13.465	17.00	6.68	30.00	21.100	53.60	5.034	-36.20	0.283	6.60
AVERAGE			**31.394**	**13.214**	**7.254**	**31.143**	**18.693**	**44.771**	**4.332**	**-17.457**	**0.552**	**6.357**
STAND. DEV			**19.746**	**4.177**	**1.862**	**14.041**	**1.725**	**14.643**	**0.409**	**17.537**	**0.649**	**0.207**
NPT2	3/17/2008	1315	44.261	10.00	9.20	48.00	25.500	27.40	3.837	1.00	1.082	6.20
	4/24/2008	1100	22.884	15.70	6.79	32.00	24.200	60.00	4.582	-28.40	0.100	6.40
	5/6/2008	1015	29.089	15.70	4.46	18.00	14.000	53.80	4.500	-21.60	0.100	6.40
	5/29/2008	930	19.966	15.20	4.72	22.00	21.700	61.20	4.370	-30.60	0.100	6.50
	6/24/2008	900	13.031	18.70	5.06	30.00	22.700	62.40	4.590	-33.60	0.100	6.50
	8/19/2008	845	8.991	17.30	6.77	26.00	24.000	64.00	4.993	-46.00	0.100	6.60
AVERAGE			**23.037**	**15.433**	**6.167**	**29.333**	**22.017**	**54.800**	**4.479**	**-26.533**	**0.264**	**6.433**
STAND. DEV			**12.601**	**2.962**	**1.799**	**10.482**	**4.139**	**13.872**	**0.377**	**15.693**	**0.401**	**0.137**
NPT3	3/17/2008	1345	28.065	8.30	9.40	32.00	10.200	0.80	4.086	32.00	1.608	5.30
	4/24/2008	1130	12.770	16.50	6.70	12.00	39.480	24.00	4.991	-1.80	0.237	6.60
	5/6/2008	1045	16.499	15.50	4.93	8.00	4.030	20.20	4.810	1.80	0.326	6.50
	5/29/2008	1000	7.885	14.70	4.79	2.50	4.130	22.60	4.980	1.40	0.100	6.60
	6/24/2008	930	6.056	20.80	5.07	10.00	1.470	20.00	5.300	1.80	0.100	6.60
	8/19/2008	915	3.923	20.00	5.10	2.50	1.246	9.60	6.077	0.40	0.100	6.20
AVERAGE			**12.533**	**15.967**	**5.998**	**11.167**	**10.093**	**16.200**	**5.041**	**5.933**	**0.412**	**6.300**
STAND. DEV			**8.885**	**4.484**	**1.807**	**10.921**	**14.755**	**9.088**	**0.650**	**12.842**	**0.593**	**0.514**
NPT4	3/17/2008	1515	24.050	11.90	7.50	38.00	13.800	3.00	4.608	26.20	2.342	5.50
	4/24/2008	1300	11.587	19.00	6.42	30.00	18.400	37.40	5.350	-1.20	0.100	6.40
	5/6/2008	1145	16.262	17.40	4.25	18.00	18.300	31.00	5.180	-7.20	0.100	6.20
	5/29/2008	1100	10.499	16.80	4.25	24.00	20.600	37.00	5.400	-1.80	0.100	6.40
	6/24/2008	1030	9.383	22.20	5.08	24.00	14.300	29.40	5.380	-2.80	0.100	6.40
	8/19/2008	1015	6.841	20.80	5.41	18.00	9.830	11.60	5.890	-0.20	0.100	6.00
AVERAGE			**13.104**	**18.017**	**5.485**	**25.333**	**15.872**	**24.900**	**5.301**	**2.167**	**0.474**	**6.150**
STAND. DEV			**6.196**	**3.619**	**1.277**	**7.659**	**3.947**	**14.259**	**0.415**	**12.022**	**0.915**	**0.356**

STATION	Date	Time	Flow cfs	Temp. C	D.O. mg/L	TSS mg/L	Fe mg/L	Alk. mg/L	Mn mg/L	Acidity mg/L	Al mg/L	pH (lab) SU
NPT5	3/17/2008	1615	12.550	12.80	7.80	40.00	12.100	0.60	4.119	22.80	4.022	5.00
	4/24/2008	1330	2.783	19.60	6.63	16.00	4.709	91.60	3.964	-65.80	1.347	7.30
	5/6/2008	1230	2.338	16.10	4.27	15.00	4.620	92.70	3.745	-64.30	1.245	7.20
	5/29/2008	1200	1.700	13.60	5.18	18.00	5.310	176.60	3.750	-133.00	0.630	7.50
	6/24/2008	1100	0.717	18.90	5.90	10.00	1.260	252.60	3.390	-226.00	0.100	7.90
	8/19/2008	1100	0.007	19.40	5.25	10.00	1.354	89.60	2.549	-80.60	0.100	7.80
AVERAGE			**3.349**	**16.733**	**5.838**	**18.167**	**4.892**	**117.283**	**3.586**	**-91.150**	**1.241**	**7.117**
STAND. DEV			**4.622**	**3.024**	**1.242**	**11.179**	**3.948**	**86.573**	**0.564**	**82.940**	**1.464**	**1.072**
NPT6	3/18/2008	1000	10.787	7.40	8.15	50.00	20.500	0.00	4.663	101.60	6.785	3.40
	4/24/2008	1415	2.242	19.60	6.63	12.00	19.200	0.00	4.635	76.60	4.598	3.70
	5/6/2008	1330	1.646	16.50	4.29	10.00	18.200	0.00	4.750	76.00	4.870	3.40
	5/29/2008	1230	0.843	14.00	4.34	12.00	28.500	6.80	4.940	68.80	2.260	4.50
	6/24/2008	1130	0.300	17.30	4.54	22.00	8.120	0.00	4.050	38.60	1.820	3.80
	8/19/2008	1130	0.007	15.50	4.08	14.00	14.700	22.00	3.534	-1.40	0.100	5.90
AVERAGE			**2.638**	**15.050**	**5.338**	**20.000**	**18.203**	**4.800**	**4.429**	**60.033**	**3.406**	**4.117**
STAND. DEV			**4.078**	**4.188**	**1.667**	**15.284**	**6.727**	**8.854**	**0.530**	**36.242**	**2.439**	**0.962**
NPT7	3/18/2008	830	7.856	9.70	7.30	20.00	22.200	0.00	4.813	141.80	9.451	3.20
	4/24/2008	1515	1.194	15.70	5.82	16.00	11.200	0.00	4.565	106.40	8.883	3.30
	5/6/2008	1400	1.042	12.50	3.56	2.50	16.800	0.00	4.680	109.20	8.450	3.20
	5/29/2008	1300	0.588	16.50	4.51	6.00	8.850	0.00	4.140	102.00	6.770	3.30
	6/24/2008	1200	0.053	17.10	6.35	6.00	10.200	0.00	4.150	88.40	5.850	3.30
	8/19/2008	1200	na	na	na	na	na	na	na	na	na	na
AVERAGE			**2.147**	**14.300**	**5.508**	**10.100**	**13.850**	**0.000**	**4.470**	**109.560**	**7.881**	**3.260**
STAND. DEV			**3.222**	**3.124**	**1.484**	**7.487**	**5.563**	**0.000**	**0.309**	**19.713**	**1.513**	**0.055**
SNPT1	3/18/2008	1215	5.284	5.80	8.41	8.00	2.435	0.00	1.553	26.00	1.941	4.90
	4/24/2008	1545	2.147	14.10	5.03	6.00	1.043	9.40	3.227	16.00	1.144	5.20
	5/7/2008	930	2.761	13.10	4.36	6.00	0.606	7.00	1.560	20.20	1.550	4.90
	5/29/2008	1515	1.623	17.30	4.05	8.00	0.672	7.30	1.499	19.20	0.908	4.95
	6/24/2008	1400	1.059	21.60	3.04	6.00	0.923	23.40	1.390	-7.20	0.100	6.60
	8/19/2008	1415	0.424	22.10	4.50	12.00	1.008	7.50	4.415	9.40	0.900	4.90
AVERAGE			**2.216**	**15.667**	**4.898**	**7.667**	**1.115**	**9.100**	**2.274**	**13.933**	**1.091**	**5.242**
STAND. DEV			**1.710**	**6.093**	**1.842**	**2.338**	**0.671**	**7.715**	**1.257**	**11.697**	**0.631**	**0.676**

STATION	Date	Time	Flow cfs	Temp. C	D.O. mg/L	TSS mg/L	Fe mg/L	Alk. mg/L	Mn mg/L	Acidity mg/L	Al mg/L	pH (lab) SU
SNPT2	3/18/2008	1130	4.492	5.80	8.70	18.00	3.958	0.00	1.733	36.80	3.007	4.60
	4/24/2008	1615	2.069	13.60	6.02	2.50	2.222	0.00	1.678	43.60	2.835	3.70
	5/7/2008	900	1.734	10.90	4.22	2.50	2.840	0.00	1.720	35.20	2.370	3.80
	5/29/2008	1445	1.193	15.70	4.46	2.50	2.624	0.00	0.606	36.80	1.908	3.80
	6/24/2008	1300	0.247	18.10	3.91	12.00	6.920	0.00	3.050	41.80	3.530	3.90
	8/19/2008	1315	0.127	18.10	5.20	26.00	9.157	0.00	4.540	61.20	6.654	3.70
AVERAGE			**1.644**	**13.700**	**5.418**	**10.583**	**4.620**	**0.000**	**2.221**	**42.567**	**3.384**	**3.917**
STAND. DEV			**1.597**	**4.754**	**1.778**	**9.907**	**2.801**	**0.000**	**1.375**	**9.692**	**1.695**	**0.343**
SNPT3	3/18/2008	1100	2.276	4.30	9.40	2.00	1.721	0.00	0.811	33.20	2.061	3.90
	4/24/2008	1600	0.918	16.80	5.57	2.50	2.312	0.00	1.592	55.80	3.987	3.50
	5/7/2008	830	1.409	9.90	5.18	2.50	1.910	0.00	1.000	36.20	2.260	3.80
	5/29/2008	1430	0.809	17.70	4.48	2.50	2.340	0.00	1.510	56.80	3.300	3.50
	6/24/2008	1230	0.102	19.30	5.10	6.00	4.420	0.00	3.150	75.80	5.300	3.40
	8/19/2008	1300	0.085	19.80	6.50	6.00	7.339	0.00	4.775	117.00	10.300	3.20
AVERAGE			**0.933**	**14.633**	**6.038**	**3.583**	**3.340**	**0.000**	**2.140**	**62.467**	**4.535**	**3.550**
STAND. DEV			**0.831**	**6.193**	**1.776**	**1.882**	**2.185**	**0.000**	**1.531**	**30.902**	**3.064**	**0.259**
SNPT4	3/18/2008	1030	0.133	5.60	5.90	4.00	0.224	0.00	1.299	37.20	2.404	4.30
	4/24/2008	1545	0.050	14.10	5.03	2.50	0.258	3.60	1.560	27.60	1.957	4.10
	5/7/2008	800	0.014	10.30	4.66	2.50	0.332	3.00	1.790	36.80	1.970	4.10
	5/29/2008	1400	0.010	16.70	2.32	2.50	0.242	2.60	1.800	33.60	1.660	4.10
	6/24/2008	1230	na	na	na	na	na	na	na	na	na	na
	8/19/2008	1230	na	na	na	na	na	na	na	na	na	na
AVERAGE			**0.052**	**11.675**	**4.478**	**2.875**	**0.264**	**2.300**	**1.612**	**33.800**	**1.998**	**4.150**
STAND. DEV			**0.057**	**4.828**	**1.529**	**0.750**	**0.047**	**1.587**	**0.236**	**4.436**	**0.306**	**0.100**

Attachment F

Method for Calculating Loads from Mine Drainage Treatment Facilities from Surface Mines

Method to Quantify Treatment Pond Pollutant Load

Calculating Waste Load Allocations for Active Mining in the TMDL Stream Segment.

The end product of the TMDL report is to develop Waste Load Allocations (WLA) and Load Allocations (LA) that represent the amount of pollution the stream can assimilate while still achieving instream limits. The LA is the load from abandoned mine lands where there is no NPDES permit or responsible party. The WLA is the pollution load from active mining that is permitted through NPDES.

In preparing the TMDL, calculations are done to determine the allowable load. The actual load measured in the stream is equal to the allowable load plus the reduced load.

Total Measured Load = Allowed Load + Reduced Load

If there is active mining or anticipated mining in the near future in the watershed, the allowed load must include both a WLA and a LA component.

Allowed Load (lbs/day) = WLA (lbs/day) + LA (lbs/day)

The following is an explanation of the quantification of the potential pollution load reporting to the stream from permitted pit water treatment ponds that discharge water at established effluent limits.

Surface coal mines remove soil and overburden materials to expose the underground coal seams for removal. After removal of the coal, the overburden is replaced as mine spoil and the soil is replaced for revegetation. In a typical surface mining operation, the overburden materials is removed and placed in the previous cut where the coal has been removed. In this fashion, an active mining operation has a pit that progresses through the mining site during the life of the mine. The pit may have water reporting to it, as it is a low spot in the local area. Pit water can be the result of limited shallow groundwater seepage, direct precipitation into the pit, and surface runoff from partially regarded areas that have been backfilled but not yet revegetated. Pit water is pumped to nearby treatment ponds where it is treated to the required treatment pond effluent limits. The standard effluent limits are as follows, although stricter effluent limits may be applied to a mining permit's effluent limits to insure that the discharge of treated water does not cause instream limits to be exceeded.

Standard Treatment Pond Effluent Limits:
Alkalinity > Acidity
6.0 <= pH <= 9.0
Fe < 3.0 mg/l
Mn < 2.0 mg/l

Discharge from treatment ponds on a mine site is intermittent and often varies as a result of precipitation events. Measured flow rates are almost never available. If accurate flow data are available, they can be used to quantify the WLA. The following is an approach that can be used to determine a waste load allocation for an active mining operation when treatment pond flow rates are not available. The methodology involves quantifying the hydrology of the portion of a surface mine site that contributes flow to the pit and then calculating waste load allocation using NPDES treatment pond effluent limits.

The total water volume reporting to ponds for treatment can come from two primary sources: direct precipitation to the pit and runoff from the unregraded area following the pit's progression through the site. Groundwater seepage reporting to the pit is considered negligible compared to the flow rates resulting from precipitation.

In an active mining scenario, a mine operator pumps pit water to the ponds for chemical treatment. Pit water is often acidic with dissolved metals in nature. At the treatment ponds, alkaline chemicals are added to increase the pH and encourage dissolved metals to precipitate and settle. Pennsylvania averages 41.4 inches of precipitation per year (Mid-Atlantic River Forecast Center, National Weather Service, State College, PA, 1961-1990, http://www.dep.state.pa.us/dep/subject/hotopics/drought/PrecipNorm.htm). A maximum pit dimension without special permit approval is 1500 feet long by 300 feet wide. Assuming that 5 percent of the precipitation evaporates and the remaining 95 percent flows to the low spot in the active pit to be pumped to the treatment ponds, results in the following equation and average flow rates for the pit area.

41.4 in. precip./yr x 0.95 x 1 ft./12/in. x 1500'x300'/pit x 7.48 gal/ft^3 x 1yr/365days x 1day/24hr. x 1hr./60 min. =

= 21.0 gal/min average discharge from direct precipitation into the open mining pit area.

Pit water can also result from runoff from the unregraded and revegetated area following the pit. In the case of roughly backfilled and highly porous spoil, there is very little surface runoff. It is estimated that 80 percent of precipitation on the roughly regarded mine spoil infiltrates, 5 percent evaporates, and 15 percent may run off to the pit for pumping and potential treatment (Jay Hawkins, Office of Surface Mining, Department of the Interior, Personal Communications 2003). Regrading and revegetation of the mine spoil is conducted as the mining progresses. PADEP encourages concurrent backfilling and revegetation through its compliance efforts and it is in the interest of the mining operator to minimize the company's reclamation bond liability by keeping the site reclaimed and revegetated. Experience has shown that reclamation and revegetation is accomplished two to three pit widths behind the active mining pit area. PADEP uses three pit widths as an area representing potential flow to the pit when reviewing the NPDES permit application and calculating effluent limits based on best available treatment technology and insuring that instream limits are met. The same approach is used in the following equation, which represents the average flow reporting to the pit from the unregraded and unrevegetated spoil area.

41.4 in. precip./yr x 3 pit areas x 1 ft./12/in. x 1500'x300'/pit x 7.48 gal/ft^3 x 1yr/365days x 1day/24hr. x 1hr./60 min. x 15 in. runoff/100 in. precipitation =

= 9.9 gal./min. average discharge from spoil runoff into the pit area.

The total average flow to the pit is represented by the sum of the direct pit precipitation and the water flowing to the pit from the spoil area as follows:

Total Average Flow = Direct Pit Precipitation + Spoil Runoff

Total Average Flow = 21.0 gal./min + 9.9 gal./min. = 30.9 gal./min.

The resulting average waste load from a permitted treatment pond area is as follows.

Allowable Iron Waste Load Allocation:
30.9 gal./min. x 3 mg/l x 0.01202 = 1.1 lbs./day

Allowable Manganese Waste Load Allocation:
30.9 gal./min. x 2 mg/l x 0.01202 = 0.7 lbs./day

Allowable Aluminum Waste Load Allocation:
30.9 gal./min. x 0.75 mg/l x 0.01202 = 0.3 lbs./day

(Note: 0.01202 is a conversion factor to convert from a flow rate in gal/min. and a concentration in mg/l to a load in units of lbs./day.)

There is little or no documentation available to quantify the actual amount of water that is typically pumped from active pits to treatment ponds. Experience and observations suggest that the above approach is very conservative and overestimates the quantity of water, creating a large margin of safety in the methodology. County specific precipitation rates can be used in place of the long-term state average rate, although the margin of safety is greater than differences from individual counties. It is common for many mining sites to have very "dry" pits that rarely accumulate water that would require pumping and treatment.

Also, it is the goal of PADEP's permit review process to not issue mining permits that would cause negative impacts to the environment. As a step to insure that a mine site does not produce acid mine drainage, it is common to require the addition of alkaline materials (waste lime, baghouse lime, limestone, etc.) to the backfill spoil materials to neutralize any acid-forming materials that may be present. This practice of 'alkaline addition' or the incorporation of naturally occurring alkaline spoil materials (limestone, alkaline shale or other rocks) may produce alkaline pit water with very low metals concentrations that does not require treatment. A comprehensive study in 1999 evaluated mining permits issued since 1987 and found that only 2.2 percent resulted in a post-mining pollution discharge (Evaluation of Mining Permits Resulting in Acid Mine Drainage 1987-1996: A Post Mortem Study, March 1999). As a result of efforts to insure that acid mine drainage is prevented, most mining operations have alkaline pit water that often meets effluent limits and requires little or no treatment.

While most mining operations are permitted and allowed to have a standard 1500' x 300' pit, most are well below that size and have a corresponding decreased flow and load. Where pit dimensions are greater than the standard size or multiple pits are present, the calculations to define the potential pollution load can be adjusted accordingly. Hence, the above calculated

Waste Load Allocation is very generous and likely high compared to actual conditions that are generally encountered. A large margin of safety is included in the WLA calculations.

The allowable load for the stream segment is determined by modeling of flow and water quality data. The allowable load has a potential Waste Load Allocation (WLA) component if there is active mining or anticipated future mining and a Load Allocation (LA). So, the sum of the Load Allocation and the Waste Load Allocation is equal to the allowed load. The WLA is determined by the above calculations and the LA is determined by the difference between the allowed load and the WLA.

Allowed Load = Waste Load Allocation + Load Allocation
Or
Load Allocation = Allowed Load – Waste Load Allocation

This is an explanation of the quantification of the potential pollution load reporting to the stream from permitted pit water treatment ponds that discharge water at established effluent limits. This allows for including active mining activities and their associated Waste Load in the TMDL calculations to more accurately represent the watershed pollution sources and the reductions necessary to achieve instream limits. When a mining operation is concluded, its WLA is available for a different operation. Where there are indications that future mining in a watershed may be greater than the current level of mining activity, an additional WLA amount may be included in the allowed load to allow for future mining.

Attachment G

Information Sheet for the South Branch Newport Creek Sediment TMDL

What is being proposed?
Total Maximum Daily Load (TMDL) plans have been developed to improve water quality in the South Branch Watershed.

Who is proposing the plans? Why?
The Pennsylvania Department of Environmental Protection (PADEP) is proposing to submit the plans to the U.S. Environmental Protection Agency (USEPA) for review and approval as required by federal regulation. In 1995, USEPA was sued for not developing TMDLs when Pennsylvania failed to do so. PADEP has entered into an agreement with USEPA to develop TMDLs for certain specified waters over the next several years. This TMDL has been developed in compliance with the state/USEPA agreement.

What is a TMDL?
A TMDL sets a ceiling on the pollutant loads that can enter a waterbody so that it will meet water quality standards. The Clean Water Act requires states to list all waters that do not meet their water quality standards even after pollution controls required by law are in place. For these waters, the state must calculate how much of a substance can be put in the water without violating the standard, and then distribute that quantity to all the sources of the pollutant on that waterbody. A TMDL plan includes WLAs for point sources, LAs for nonpoint sources, and a margin of safety. The Clean Water Act requires states to submit their TMDLs to USEPA for approval. Also, if a state does not develop the TMDL, the Clean Water Act states that USEPA must do so.

What is a water quality standard?
The Clean Water Act sets a national minimum goal that all waters be "fishable" and "swimmable." To support this goal, states must adopt water quality standards. Water quality standards are state regulations that have two components. The first component is a designated use, such as "warm water fishes" or "recreation." States must assign a use or several uses to each of their waters. The second component relates to the instream conditions necessary to protect the designated use(s). These conditions or "criteria" are physical, chemical, or biological characteristics such as temperature and minimum levels of dissolved oxygen, and maximum concentrations of toxic pollutants. It is the combination of the "designated use" and the "criteria" to support that use that make up a water quality standard. If any criteria are being exceeded, then the use is not being met and the water is said to be in violation of water quality standards.

What is the purpose of the plans?
The South Branch Watershed is impaired due to sediment emanating from abandoned mine drainage and other nonpoint sources. The plans include a calculation of the loading for sediment that will correct the problem and meet water quality objectives.

Why was the South Branch Watershed selected for TMDL development?
In 2004, PADEP listed segments of the South Branch Watershed under Section 303(d) of the federal Clean Water Act as impaired due to causes linked to sediment.

What pollutants do these TMDLs address?
The proposed plans provide calculations of the stream's total capacity to accept sediment.

Where do the pollutants come from?
The sediment related impairments in the Newport Creek Watershed come from nonpoint sources of pollution, primarily overland runoff from developed areas and agricultural lands, as well as from streambank erosion.

How was the TMDL developed?
PADEP used a reference watershed approach to estimate the necessary loading reduction of sediment that would be needed to restore a healthy aquatic community. The reference watershed approach is based on selecting a nonimpaired watershed that has similar land use characteristics and determining the current loading rates for the pollutants of interest. This is done by modeling the loads that enter the stream using precipitation and land use characteristic data. For this analysis, PADEP used the AVGWLF model (the Environmental Resources Research Institute of the Pennsylvania State University's ArcView-based version of the Generalized Watershed Loading Function model developed by Cornell University). This modeling process uses loading rates in the nonimpaired watershed as a target for load reductions in the impaired watershed. The impaired watershed is modeled to determine the current loading rates and determine what reductions are necessary to meet the loading rates of the nonimpaired watershed. The reference stream approach was used to set allowable loading rates in the affected watershed because neither Pennsylvania nor USEPA has instream numerical water quality criteria for sediment.

How much pollution is too much?
The allowable amount of pollution in a waterbody varies depending on several conditions. TMDLs are set to meet water quality standards at the critical flow condition. For a free-flowing stream impacted by nonpoint source pollution loading of sediment, the TMDL is expressed as an annual loading. This accounts for pollution contributions over all streamflow conditions. PADEP established the water quality objectives for sediment by using the reference watershed approach. This approach assumes that the impairment is eliminated when the impaired watershed achieves loadings similar to the reference watershed. Reducing the current loading rates for sediment in the impaired watershed to the current loading rates in the reference watershed will result in meeting the water quality objectives.

How will the loading limits be met?
Best Management Practices (BMPs) will be encouraged throughout the watershed to achieve the necessary load reductions.

How can I get more information on the TMDL?
To request a copy of the full report, contact William Brown at (717) 783-2951 between 8:00 a.m. and 3:00 p.m., Monday through Friday. Mr. Brown also can be reached by mail at the Office of Water Management, PADEP, Rachel Carson State Office Building, 400 Market Street, Harrisburg, PA 17105 or by e-mail at wbrown@state.pa.us.

How can I comment on the proposal?
You may provide e-mail or written comments postmarked no later than Date, to the above address.

Attachment H

AVGWLF Model Overview & GIS-Based Derivation of Input Data

The TMDL for the South Branch was developed using the Generalized Watershed Loading Function or GWLF model. The GWLF model provides the ability to simulate runoff, sediment, and nutrient (nitrogen and phosphorus) 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 subsurface loading, the model acts as a lumped parameter model using a water balance approach. No distinctly separate areas are considered for subsurface flow contributions. Daily water balances are computed for an unsaturated zone as well as a saturated subsurface 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, transport capacity, and average daily runoff is applied to the calculated erosion for determining sediment yield for each source area. Surface nutrient losses are determined by applying dissolved nitrogen and phosphorus coefficients to surface runoff and a sediment coefficient to the yield portion for each agricultural source area. Point source discharges also can 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. Subsurface losses are calculated using dissolved nitrogen and phosphorus coefficients for shallow groundwater contributions to stream nutrient loads, and the subsurface submodel 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 Manual.

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 nitrogen and phosphorus concentrations and cropping practices. Complete GWLF-formatted weather files also are included for 80 weather stations around the state.

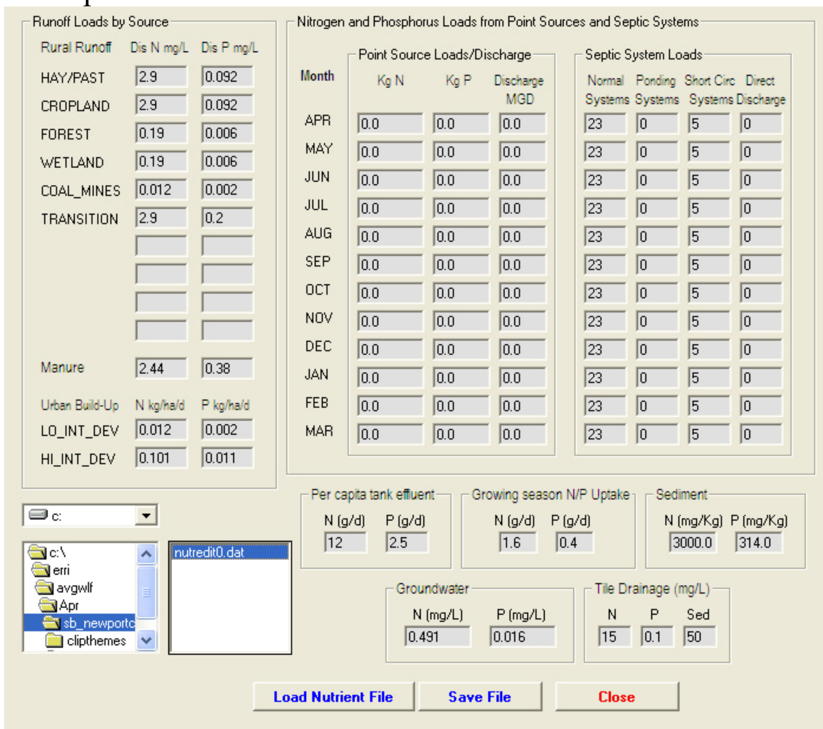
The following table lists the statewide GIS datasets and provides an explanation of how they were used for development of the input files for the GWLF model.

GIS Datasets	
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.
Landuse5	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. Used to calculate landslope and slope length.
Palumrlc	A satellite image derived land cover grid that is classified into 15 different land cover categories. This dataset provides land cover 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 nitrogen and phosphorus loads.
Refwater	Shapefile of reference watersheds for which nutrient and sediment loads have been calculated.
Soilphos	A grid of soil phosphorous 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 PADEP 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.

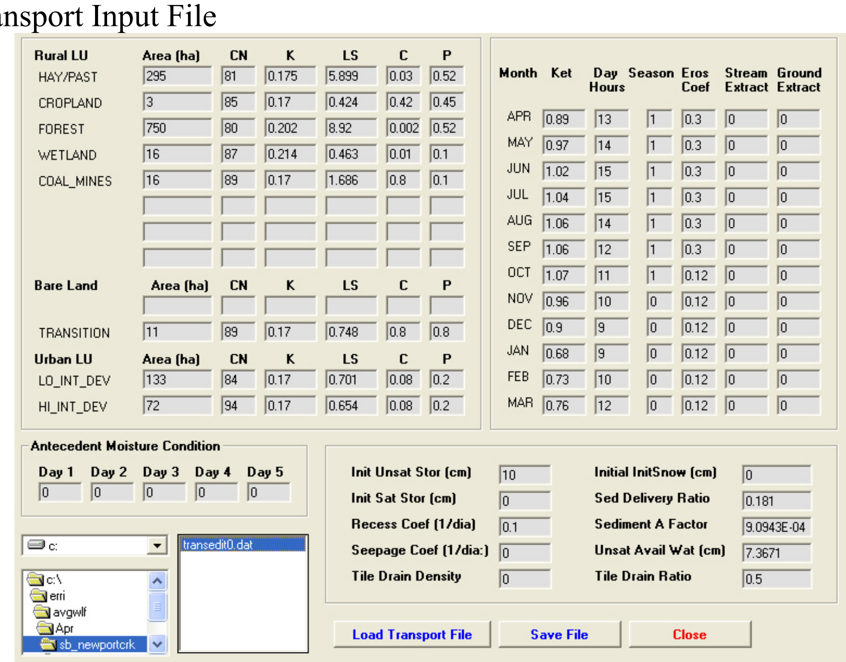
Attachment I

AVGWLF Model Inputs for the South Branch Watershed

South Branch Nutrient Input File



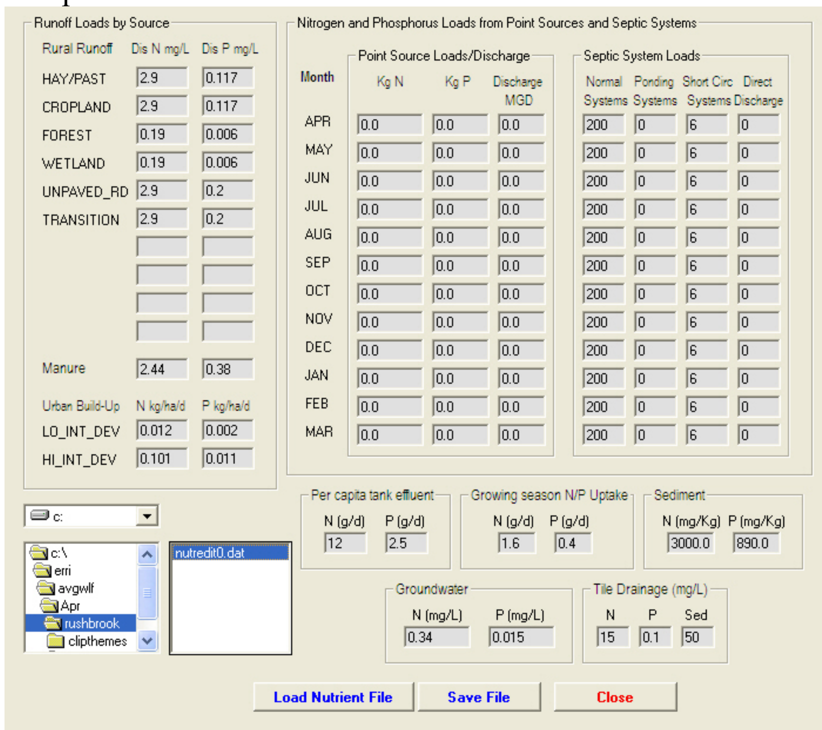
South Branch Transport Input File



Attachment J

AVGWLF Model Inputs for the Rush Brook Reference Watershed

Rush Brook Nutrient Input File



Runoff Loads by Source

Rural Runoff	Dis N mg/L	Dis P mg/L
HAY/PAST	2.9	0.117
CROPLAND	2.9	0.117
FOREST	0.19	0.006
WETLAND	0.19	0.006
UNPAVED_RD	2.9	0.2
TRANSITION	2.9	0.2
Manure	2.44	0.38

Urban Build-Up	N kg/ha/d	P kg/ha/d
LO_INT_DEV	0.012	0.002
HI_INT_DEV	0.101	0.011

Nitrogen and Phosphorus Loads from Point Sources and Septic Systems

Month	Point Source Loads/Discharge: Kg N	Kg P	Discharge MGD	Septic System Loads: Normal Systems	Ponding Systems	Short Circ Systems	Direct Discharge
APR	0.0	0.0	0.0	200	0	6	0
MAY	0.0	0.0	0.0	200	0	6	0
JUN	0.0	0.0	0.0	200	0	6	0
JUL	0.0	0.0	0.0	200	0	6	0
AUG	0.0	0.0	0.0	200	0	6	0
SEP	0.0	0.0	0.0	200	0	6	0
OCT	0.0	0.0	0.0	200	0	6	0
NOV	0.0	0.0	0.0	200	0	6	0
DEC	0.0	0.0	0.0	200	0	6	0
JAN	0.0	0.0	0.0	200	0	6	0
FEB	0.0	0.0	0.0	200	0	6	0
MAR	0.0	0.0	0.0	200	0	6	0

Per capita tank effluent: N (g/d) 12, P (g/d) 2.5

Growing season N/P Uptake: N (g/d) 1.6, P (g/d) 0.4

Sediment: N (mg/Kg) 3000.0, P (mg/Kg) 890.0

Groundwater: N (mg/L) 0.34, P (mg/L) 0.015

Tile Drainage (mg/L): N 15, P 0.1, Sed 50

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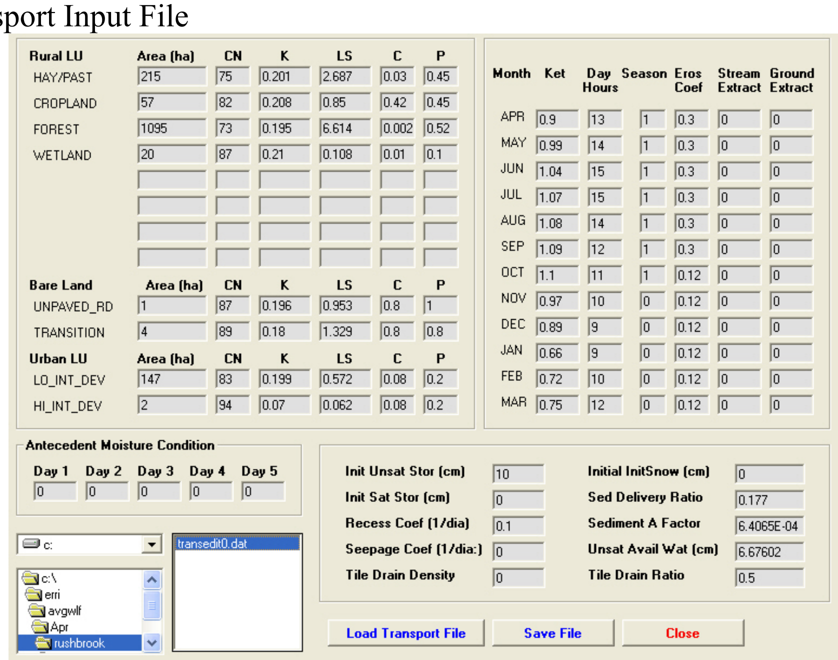
Load Nutrient File | Save File | Close

Rush Brook Transport Input File



Rural LU	Area (ha)	CN	K	LS	C	P
HAY/PAST	215	75	0.201	2.687	0.03	0.45
CROPLAND	57	82	0.208	0.85	0.42	0.45
FOREST	1095	73	0.195	6.614	0.002	0.52
WETLAND	20	87	0.21	0.108	0.01	0.1
Bare Land	**Area (ha)**	**CN**	**K**	**LS**	**C**	**P**
UNPAVED_RD	1	87	0.196	0.953	0.8	1
TRANSITION	4	89	0.18	1.329	0.8	0.8
Urban LU	**Area (ha)**	**CN**	**K**	**LS**	**C**	**P**
LO_INT_DEV	147	83	0.199	0.572	0.08	0.2
HI_INT_DEV	2	94	0.07	0.062	0.08	0.2

Month	Ket	Day Hours	Season	Eros Coef	Stream Extract	Ground Extract
APR	0.9	13	1	0.3	0	0
MAY	0.99	14	1	0.3	0	0
JUN	1.04	15	1	0.3	0	0
JUL	1.07	15	1	0.3	0	0
AUG	1.08	14	1	0.3	0	0
SEP	1.09	12	1	0.3	0	0
OCT	1.1	11	1	0.12	0	0
NOV	0.97	10	0	0.12	0	0
DEC	0.89	9	0	0.12	0	0
JAN	0.66	9	0	0.12	0	0
FEB	0.72	10	0	0.12	0	0
MAR	0.75	12	0	0.12	0	0

Antecedent Moisture Condition

Day 1	Day 2	Day 3	Day 4	Day 5
0	0	0	0	0

Init Unsat Stor (cm)	10	**Initial InitSnow (cm)**	0
Init Sat Stor (cm)	0	**Sed Delivery Ratio**	0.177
Recess Coef (1/dia)	0.1	**Sediment A Factor**	6.4065E-04
Seepage Coef (1/dia:)	0	**Unsat Avail Wat (cm)**	6.67602
Tile Drain Density	0	**Tile Drain Ratio**	0.5

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Attachment K

Equal Marginal Percent Reduction Method

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 the MS Excel and results are presented in Attachment G. The five major steps identified in the spreadsheet are summarized below:

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

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

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 the 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.

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

5. Summary of existing loads, final LAs, and percent reduction for each pollutant source.

Attachment L

Equal Marginal Percent Reduction Calculations for the South Branch Watershed TMDL

Step 1:	TMDL Total Load				Step 2:	Adjusted LA = (TMDL total load - MOS) - uncontrollable							
	Load = loading rate in ref. * Acres in Impaired					1347.586	1348						
	1995.095												
	SEDIMENT LOADING												
Step 3:		Non-MS4 Daily Average Load	Load Sum	Check	Initial Adjust	Recheck	% reduction allocation	Load Reduction	Initial LA	Acres	Allowable Loading Rate	% Reduction	
	Hay/Past.	1512.7120	2488.489	bad	1348	ADJUST	0.58	565.965	781.620	729.00	1.072	48%	
	Cropland	12.9860		good	13	976	0.01	5.454	7.532	7.40	1.018	42%	
	Developed	523.5070		good	524		0.23	219.865	303.642	573.20	0.530	42%	
	Streambank	439.2840		good	439		0.19	184.493	254.791			42%	
	Total	2488.4890			2323.36268		1.00		1347.586				
Step 4:	All Ag. Loading Rate	1.07											
Step 5:		Acres	Allowable (Target) Loading Rate	Final LA	Current Loading Rates	Current Load	% Red.						
	Final Hay/Past. LA	729.00	1.072	781.222	2.075	1512.712	48%						
	Final Cropland LA	7.40	1.072	7.930	1.755	12.986	39%						
	Developed	573.20	0.530	303.642	0.913	523.507	42%						
	Streambank			254.791		439.284	42%						
	Total			1347.586		2488.489	46%						
	SB Newport Creek												

Attachment M
TMDLs and NPDES Permitting Coordination

NPDES permitting is unavoidably linked to TMDLs through WLAs and their translation, through the permitting program, to effluent limits. Primary responsibility for NPDES permitting rests with the District Mining Offices (for mining NPDES permits) and the Regional Offices (for industrial NPDES permits). Therefore, the DMOs and Regions will maintain tracking mechanisms of available WLAs, etc., in their respective offices. The TMDL program will assist in this effort. However, the primary role of the TMDL program is TMDL development and revision/amendment (the necessity for which is as defined in the Future Modifications section) at the request of the respective office. All efforts will be made to coordinate public notice periods for TMDL revisions and permit renewals/reissuances.

Load Tracking Mechanisms

PADEP has developed tracking mechanisms that will allow for accounting of pollution loads in TMDL watersheds. This will allow permit writers to have information on how allocations have been distributed throughout the watershed of interest while making permitting decisions. These tracking mechanisms will allow PADEP to make minor changes in WLAs without the need for USEPA to review and approve a revised TMDL. Tracking will also allow for the evaluation of loads at downstream points throughout a watershed to ensure no downstream impairments will result from the addition, modification, or movement of a permit.

Options for Permittees in TMDL Watersheds

PADEP is working to develop options for mining permits in watersheds with approved TMDLs.

Options identified

- Build excess WLA into the TMDL for anticipated future mining. This could then be used for a new permit. Permittee must show that there has been actual load reduction in the amount of the proposed permit or must include a schedule to guarantee the reductions using current data referenced to the TMDL prior to permit issuance.
- Use WLA that is freed up from another permit in the watershed when that site is reclaimed. If no permits have been recently reclaimed, it may be necessary to delay permit issuance until additional WLA becomes available.
- Re-allocate the WLA(s) of existing permits. WLAs could be reallocated based on actual flows (as opposed to design flows) or smaller than approved pit/spoil areas (as opposed to default areas). The "freed-up" WLA could be applied to the new permit. This option would require the simultaneous amendment of the permits involved in the reallocation.
- Non-discharge alternative.

Other possible options

The following two options have also been identified for use in TMDL watersheds. However, before recommendation for use as viable implementation options, a thorough regulatory (both state and federal) review must be completed. These options should not be implemented until the completion of the regulatory review and development of any applicable administrative mechanisms.

- Issue the permit with instream water quality criteria values as the effluent limits. The instream criteria value would represent the monthly average, with the other limits adjusted accordingly (e.g., for Fe, the limits would be 1.5 mg/L monthly average, 3.0 mg/L daily average, and 4.0 instantaneous max mg/L).

The applicant would agree to treat an existing source (point or nonpoint) where there is no responsible party and receive a WLA based on a portion of the load reduction to be achieved. The result of using these types of offsets in permitting is a net improvement in long-term water quality through the reclamation or treatment of an abandoned source.

Attachment N
Comment and Response

COMMENTER: Eastern Pennsylvania Coalition for Abandoned Mine Reclamation

Comment: You may want to reference this report in your Final TMDL for the Newport Creek, Luzerne County, PA under the Recommendations Section on page 20 of the Draft.

Effects of Historical Coal Mining and Drainage from Abandoned Mines of Streamflow and Water Quality in Newport and Nanticoke Creeks, Luzerne County, PA 199-2000

This Scientific Investigations Report was completed prior to Wilkes University's in 2002. Jeff Chaplin, Chuck Cravotta, Jeff Weitzel and Professor Ken Klemow-Wilkes University completed this report that would be very valuable to your TMDL Publication.

Response: A reference to *The Effects of Historical Coal Mining and Drainage from Abandoned Mines of Streamflow and Water Quality in Newport and Nanticoke Creeks*, was added to the "Recommendations" section.