FINAL

UNT 45603 STONYCREEK RIVER WATERSHED TMDL

Somerset County

For Acid Mine Drainage Affected Segments

Prepared by:

Pennsylvania Department of Environmental Protection

March 19, 2007

TABLE OF CONTENTS

TABLES

ATTACHMENTS

TMDL[1]
UNT 45603 Stonycreek River Watershed
Somerset County, Pennsylvania

Table 1. 303(d) Sub-List

State Water Plan (SWP) Subbasin: 18-E UNT 45603 Stonycreek River

Year	Miles	Segment ID	DEP Stream Code	Stream Name	Designated Use	Data Source	Source	EPA 305(b) Cause Code
1996	2.1	5164	45603	UNT 45603 Stonycreek River	CWF	305(b) Report	RE	metals
1998	2.1	NA*	45603	UNT 45603 Stonycreek River	CWF	SWMP	AMD	metals
2004	3.0	5164	45603	UNT 45603 Stonycreek River	CWF		AMD	metals

Resource Extraction=RE
Cold Water Fishes = CWF
Surface Water Monitoring Program = SWMP
Abandoned Mine Drainage = AMD
See Attachment D, *Excerpts Justifying Changes Between the 1996, 1998, 2002 and 2004 Section 303(d) Lists*. The use designations for the stream segments in this TMDL can be found in PA Title 25 Chapter 93.
*Not placed on GIS. Segment located on Part C of 1998 list.

Introduction

This report presents the Total Maximum Daily Loads (TMDLs) developed for segments in the UNT 45603 Stonycreek River Watershed (Attachments A). These were 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 this list. UNT 45603 Stonycreek River was listed as impaired for metals. All impairments resulted from acid drainage from abandoned coalmines. The TMDL addresses the three primary metals associated with acid mine drainage (iron, manganese, aluminum) and pH.

Directions to the UNT 45603 Stonycreek River Watershed

UNT 45603 Stonycreek River flows through the town of Hooversville near its mouth, just prior to its junction with the Stonycreek River. Hooversville can be reached by traveling south on SR219 to the Davidsville exit. Then travel south on SR403 for approximately 6.0 miles into Hooversville. Upon entering Hooversville, turn right on Church Street and continue until reaching Clark Street. Turn right on Clark Street and continue for approximately 160’ until reaching the road crossing over UNT Stonycreek River. At the point where Clark Road crosses over UNT 45603 Stonycreek River, the stream’s junction with the Stonycreek River is approximately 105’ further downstream.

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[1] Pennsylvania’s 1996, 1998, and 2002 Section 303(d) lists were approved by the Environmental Protection Agency (EPA). The 1996 Section 303(d) list provides the basis for measuring progress under the 1997 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA.*

Hydrology and Geology

The headwaters of UNT 45603 Stonycreek River start at a point approximately 3.0 miles east-southeast of the stream's junction with the Stonycreek River at Hooversville. From this point, UNT 45603 Stonycreek River flows in a generally west-northwest direction toward Hooversville. Although localized mapping of portion of the watershed do show small Unnamed Tributaries to UNT 45603 Stonycreek River, the quadrangles show no additional streams flow into UNT 45603 Stonycreek River that are large enough to warrant inclusion on the map. UNT 45603 Stonycreek River flows from an elevation of approximately 2,400 feet above sea level at its headwaters to an elevation of approximately 1,660 feet above sea level at its confluence with the Stonycreek River.

The UNT 45603 Stonycreek River Watershed lies within the Appalachian Plateau Physiographic Province. The watershed is located regionally on the northwestern limb of the Negro Mountain Anticline with the watershed headwaters lying approximately .75 miles northwest of the axis of the anticline. Strata and geologic structure within the watershed are regionally oriented with a SW to NE trend. The regional strike is approximately N21ºE. The prevailing direction of dip is to the northwest at approximately 3.5%.

The watershed area is comprised of Pennsylvanian aged rocks, which are divided into the Clarion, Kittanning and Freeport Formations of the Allegheny Groups. The Glenshaw Formation, of the Conemaugh Group, is also represented within the watershed. Rocks from the Glenshaw Formation form the ridge tops within the watershed. However, rocks from the Allegheny Formation form the majority of the geology within the watershed. The Allegheny Formation includes the Brookville, Clarion, Lower Kittanning, Middle Kittanning, Upper Kittanning, Lower Freeport and Upper Freeport coal seams.

Segments addressed in this TMDL

UNT 45603 Stonycreek River is affected by pollution from AMD. This pollution has caused high levels of metals in the watershed. There are two active mining operations in the watershed. Each segment on the Section 303(d) list will be addressed as a separate TMDL. These 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. See Table 3 for TMDL calculations and see Attachment C for TMDL explanations.

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 Environmental Protection Agency's (EPA) implementing regulations (40 CFR Part 130) require:

- States to develop lists of impaired waters for which current pollution controls are not stringent enough to meet water quality standards (the list is used to determine which streams need TMDLs);

- States to establish priority rankings for waters on the lists based on severity of pollution and the designated use of the waterbody; states must also identify those waters for which TMDLs will be developed and a schedule for development;

- States to submit the list of waters to EPA every two years (April 1 of the even numbered years);

- States to develop TMDLs, specifying a pollutant budget that meets state water quality standards and allocate pollutant loads among pollution sources in a watershed, e.g., point and nonpoint sources; and

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

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

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

These TMDLs were developed in partial fulfillment of the 1997 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, there must be sufficient data available to assess which streams are impaired and should be on the Section 303(d) list. With guidance from the EPA, the states have developed methods for assessing the waters within their respective jurisdictions.

The primary method adopted by the Pennsylvania Department of Environmental Protection (DEP) for evaluating waters changed between the publication of the 1996 and 1998 Section 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)[2] reporting process. DEP is now using the Statewide Surface Waters Assessment Protocol (SSWAP), a modification of the EPA's 1989 Rapid Bioassessment Protocol II (RBP-II), as the primary mechanism to assess Pennsylvania's waters. The SSWAP 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. The biologist selects as many sites as necessary to establish an accurate assessment for a stream segment; the length of the assessed stream segment can vary between sites. All the biological surveys included kick-screen sampling of benthic macroinvertebrates and habitat evaluations. Benthic macroinvertebrates are identified to the family level in the field.

After the survey is completed, the biologist determines the status of the stream segment. The decision is based on habitat scores and a series of narrative biological statements used to evaluate the benthic macroinvertebrate community. If the stream is determined to be impaired, the source and cause of the impairment is documented. An impaired stream must be listed on the state's Section 303(d) list with the source and cause. A TMDL must be developed for the stream segment and each pollutant. 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, there are basic processes or steps that apply to all cases. They include:

1. Collection and summarization of pre-existing data (watershed characterization, inventory contaminant sources, determination of pollutant loads, etc.);
2. Calculating the TMDL for the waterbody using EPA approved methods and computer models;
3. Allocating pollutant loads to various sources;
4. Determining critical and seasonal conditions;
5. Public review and comment and comment period on draft TMDL;
6. Submittal of final TMDL; and
7. EPA approval of the TMDL.

Watershed History

The watershed for Unnamed Tributary to Stonycreek River, Stream Code 45603 is located in Western Pennsylvania, occupying a north-central portion of Somerset County in Shade Township. This stream is locally known as "Dixie Run". The UNT 45603 Stonycreek River Watershed is found on both the United States Geological Survey Hooversville and Windber 7.5-Minute Quadrangles. Approximately 1,016.4 acres, or 77%, of the watershed are located within

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

the Hooversville Quadrangle. The remaining approximately 303.6 acres, or 23%, of the upstream reaches of the watershed, are located within the Windber Quadrangle. The total area within the watershed consists of approximately 1,320 acres, or 2.06 square miles. Land uses within the watershed include abandoned mine lands, forestlands, rural residential properties and small communities.

The entire watershed has been extensively mined since the late 1940's. Underground mining focused on the Upper and Lower Kittanning Coal Seams. Surface mining operations were completed on the Lower Kittanning, Middle Kittanning, Upper Kittanning, Lower Freeport and Upper Freeport Coal Seams. These past mining operations have resulted in some scarring of the land within the watershed. Evidence of past mining activities includes abandoned pits, deep mine drifts and buildings connected with preparation plant operations.

There are currently two active mining operations in the watershed permitted to the Marquise Mining Corporation. The Marquise #11 Mine SMP No. 56050106, NPDES No. PA0249807 and the Baker Whitely Mine SMP No. 56010106, NPDES No. PA0249076 both have been given Waste Load Allocations in this TMDL.

AMD Methodology

A two-step approach is 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 will be computed based on average annual flow.

The statistical analysis described below can be applied to situations where all of the pollutant loading is from non-point sources as well as those where there are both point and non-point sources. The following defines what are considered point sources and non-point sources for the purposes of our evaluation; point sources are defined as permitted discharges or a discharge that has a responsible party, non-point sources are then any pollution sources that are not point sources. For situations where all of the impact is due to non-point sources, the equations shown below are applied using data for a point in the stream. The load allocation made at that point will be for all of the watershed area that is above that point. For situations where there are point-source impacts alone, or in combination with non-point sources, the evaluation will use the point-source data and perform a mass balance 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 data set. 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[3] 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

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.

Load tracking through the watershed utilizes the change in measured loads from sample location to sample location, as well as the allowable load that was determined at each point using the @Risk program.

There are two basic rules that are applied in load tracking; rule one is that if the sum of the measured loads that directly affect the downstream sample point is less than the measured load at the downstream sample point it is indicative that there is an increase in load between the points being evaluated, and this amount (the difference between the sum of the upstream and downstream loads) shall be added to the allowable load(s) coming from the upstream points to give a total load that is coming into the downstream point from all sources. The second rule is

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

that if the sum of the measured loads from the upstream points is greater than the measured load at the downstream point this is indicative that there is a loss of instream load between the evaluation points, and the ratio of the decrease shall be applied to the load that is being tracked (allowable load(s)) from the upstream point.

Tracking loads through the watershed gives the best picture of how the pollutants are affecting the watershed based on the information that is available. The analysis is done to insure that water quality standards will be met at all points in the stream. The TMDL must be designed to meet standards at all points in the stream, and in completing the analysis, reductions that must be made to upstream points are considered to be accomplished when evaluating points that are lower in the watershed. Another key point is that the loads are being computed based on average annual flow and should not be taken out of the context for which they are intended, which is to depict how the pollutants affect the watershed and where the sources and sinks are located spatially in the watershed.

For pH TMDLs, acidity is compared to alkalinity as described in Attachment B. Each sample point used in the analysis of pH by this method must have measurements for total alkalinity and total acidity. 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 be 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 a 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 most of the pollution sources in the watershed are nonpoint sources, the TMDLs' majority component makeup will be Load Allocations (LAs). The point sources will receive Waste Load Allocations (WLAs). All allocations will be specified as long-term average daily concentrations. These long-term average concentrations are expected to meet water-quality criteria 99% of the time as required in PA Title 25 Chapter 96.3(c). The following table shows the applicable 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	30 day average; Total Recoverable
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.

TMDL Elements (WLA, LA, MOS)

$$\text{TMDL} = \text{WLA} + \text{LA} + \text{MOS}$$

A TMDL equation consists of a waste load allocation (WLA), load allocation (LA), and a margin of safety (MOS). The waste load allocation is the portion of the load assigned to point sources. The load allocation is the portion of the load assigned to non-point sources. The margin of safety is applied to account for uncertainties in the computational process. The margin of safety may be expressed implicitly (documenting conservative processes in the computations) or explicitly (setting aside a portion of the allowable load). The TMDL allocations in this report are based on available data. Other allocation schemes could also meet the TMDL.

Allocation 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 achieved and take into account all upstream reductions. Attachment C 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 flow and a conversion factor at each sample point. The allowable load is the TMDL.

Each permitted discharge in a segment is assigned a waste load allocation and the total waste load allocation for each segment is included in this table. The difference between the TMDL and the WLA at each point is the load allocation (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 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. UNT 45603 Stonycreek River Watershed Summary Table

Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	% Reduction
SP13 - UNT 45603 Stonycreek River below reclaimed strip mine						
Aluminum (lbs/day)	0.37	0.37	0	NA	NA	NA
Iron (lbs/day)	0.32	0.32	0	NA	NA	NA
Manganese(lbs/day)	0.07	0.07	0	NA	NA	NA
Acidity (lbs/day)	ND	NA	0	NA	NA	NA
SP12 - UNT 45603 Stonycreek River near mouth in Hooversville						
Aluminum (lbs/day)	11.46	4.72	1.50	3.22	6.74	59%
Iron (lbs/day)	19.81	14.97	2.25	12.72	4.84	24%
Manganese(lbs/day)	7.45	7.45	1.50	NA	NA	NA
Acidity (lbs/day)	ND	NA	0	NA	NA	NA

* Total of loads affecting this segment is less than the allowable load calculated at this point, therefore no reduction is necessary.
NA = not applicable, ND = not determined

In the instance that the allowable load is equal to the existing load (e.g. manganese point SP13, Table 3), the simulation determined that water quality standards are being met instream 99% of the time and no TMDL is necessary for the parameter at that point. Although no TMDL is necessary, the loading at the point is considered at the next downstream point. This is denoted as "NA" in the above table.

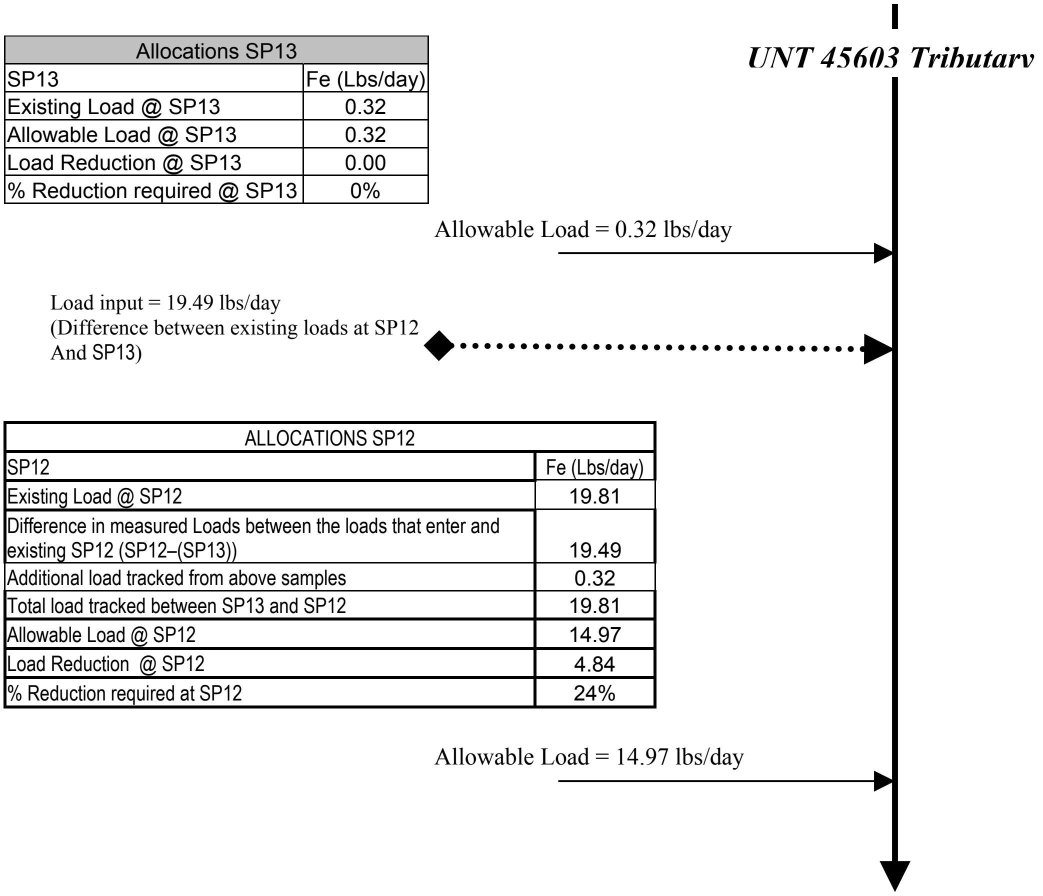
Waste Load Allocations were assigned to the permitted mine drainage discharges contained in the UNT 45603 Stonycreek River Watershed. Waste load allocations are calculated using the average flow value multiplied by the average monthly limitations in the issued mining permit. The WLA for the Marquise Mining Corporation Marquise #11 Mine discharge (M001) is being evaluated at sample point SP12. The WLA for Marquise Mining Corporation Baker Whitely Mine discharge (BW001) is also being evaluated at SP12. No required reductions of permit limits are needed at this time.

Table 4. Waste Load Allocations in UNT 45603 Stonycreek River Watershed

Marquise Mining Corporation			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
BW001			
Al	2	0.06	1.00
Fe	3	0.06	1.50
Mn	2	0.06	1.00

M001			
Al	2	0.03	0.50
Fe	3	0.03	0.75
Mn	2	0.03	0.50

Following is an example of how the allocations, presented in Table 3, for a stream segment are calculated. For this example, iron allocations for SP13 on UNT 45603 Stonycreek River are shown. As demonstrated in the example, all upstream contributing loads are accounted for at each point. Attachment C contains the TMDLs by segment analysis for each allocation point in a detailed discussion. These analyses follow the example. Attachment A contains maps of the sampling point locations for reference.



Allocations SP13	
SP13	Fe (Lbs/day)
Existing Load @ SP13	0.32
Allowable Load @ SP13	0.32
Load Reduction @ SP13	0.00
% Reduction required @ SP13	0%

ALLOCATIONS SP12	
SP12	Fe (Lbs/day)
Existing Load @ SP12	19.81
Difference in measured Loads between the loads that enter and existing SP12 (SP12–(SP13))	19.49
Additional load tracked from above samples	0.32
Total load tracked between SP13 and SP12	19.81
Allowable Load @ SP12	14.97
Load Reduction @ SP12	4.84
% Reduction required at SP12	24%

The allowable iron load tracked from SP13 was 0.32 lbs/day. The existing load at SP13 was subtracted from the existing load at SP12 to show the actual measured increase of iron load that has entered the stream between these two sample points (19.49 lbs/day). This increased value was then added to the calculated allowable load from SP13 to calculate the total load that was tracked between SP13 and SP12 (allowable loads @ SP13 + the difference in existing load between SP13 and SP12). This total load tracked was then subtracted from the calculated allowable load at SP12 to determine the amount of load to be reduced at SP12. This total load value was found to be 19.81 lbs/day; it was 4.84 lbs/day greater then the SP12 allowable load of 14.97 lbs/day. Therefore, a 24% iron reduction at SP12 is necessary.

Recommendations

Two primary programs provide maintenance and improvement of water quality in the watershed. DEP's efforts to reclaim abandoned mine lands, coupled with its duties and responsibilities for issuing NPDES permits, will be the focal points in water quality improvement.

Additional opportunities for water quality improvement are both ongoing and anticipated. Historically, a great deal of research into mine drainage has been conducted by BAMR, which administers and oversees the Abandoned Mine Reclamation Program in Pennsylvania, the United States Office of Surface Mining, the National Mine Land Reclamation Center, the National Environmental Training Laboratory, and many other agencies and individuals. Funding from EPA's 319 Grant program, and Pennsylvania's Growing Greener program have been used extensively to remedy mine drainage impacts. These many activities are expected to continue and result in water quality improvement.

The DEP Bureau of Mining and Reclamation administers an environmental regulatory program for all mining activities, mine subsidence regulation, mine subsidence insurance, and coal refuse disposal; conducts a program to ensure safe underground bituminous mining and protect certain structures form subsidence; administers a mining license and permit program; administers a regulatory program for the use, storage, and handling of explosives; provides for training, examination, and certification of applicants for blaster's licenses; and administers a loan program for bonding anthracite underground mines and for mine subsidence and administers the EPA Watershed Assessment Grant Program, the Small Operator's Assistance Program (SOAP), and the Remining Operators Assistance Program (ROAP).

Mine reclamation and well plugging refers to the process of cleaning up environmental pollutants and safety hazards associated with a site and returning the land to a productive condition, similar to DEP's Brownfields program. Since the 1960's, Pennsylvania has been a national leader in establishing laws and regulations to ensure reclamation and plugging occur after active operation is completed.

Pennsylvania is striving for complete reclamation of its abandoned mines and plugging of its orphaned wells. Realizing this task is no small order, DEP has developed concepts to make abandoned mine reclamation easier. These concepts, collectively called Reclaim PA, include legislative, policy land management initiatives designed to enhance mine operator, volunteer land DEP reclamation efforts. Reclaim PA has the following four objectives.

- To encourage private and public participation in abandoned mine reclamation efforts
- To improve reclamation efficiency through better communication between reclamation partners
- To increase reclamation by reducing remining risks
- To maximize reclamation funding by expanding existing sources and exploring new sources

Reclaim PA is DEP's initiative designed to maximize reclamation of the state's quarter million acres of abandoned mineral extraction lands. Abandoned mineral extraction lands in Pennsylvania constituted a significant public liability – more than 250,000 acres of abandoned surface mines, 2,400 miles of streams polluted with mine drainage, over 7,000 orphaned and abandoned oil and gas wells, widespread subsidence problems, numerous hazardous mine openings, mine fires, abandoned structures and affected water supplies – representing as much as one third of the total problem nationally.

The coal industry, through DEP-promoted remining efforts, can help to eliminate some sources of AMD and conduct some of the remediation identified in the above recommendations through the permitting, mining, and reclamation of abandoned and disturbed mine lands. Special consideration should be given to potential remining projects within these areas, as the environmental benefit versus cost ratio is generally very high.

Despite the extensive mining within the watershed, the overall water quality in UNT 45603 Stonycreek River reflects only a low to moderate level of degradation from the past mining activities within the watershed. This is based on the most recent water quality results as referenced in this document.

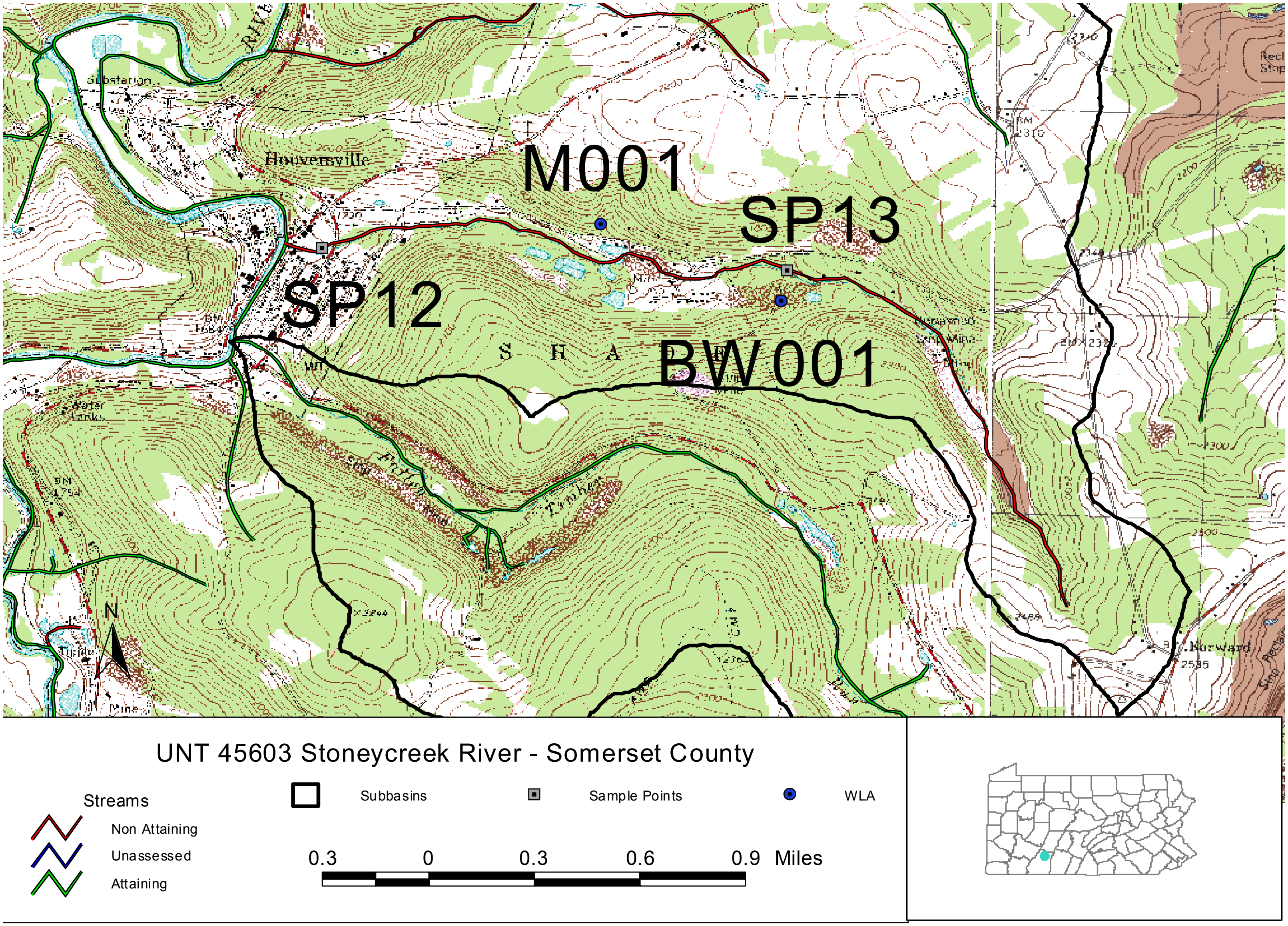
UNT 45603 Stonycreek River flows to the Stonycreek River, which does have a watershed association. However, the Department is not aware of any projects in-place to address abandoned mine lands and discharges within the UNT 45603 Stonycreek River Watershed. Any such efforts may be addressed either by the Bureau of Abandoned Mine Reclamation (BAMR), or through other programs within District Mining Operations (DMO), such as remining and Government Financed Construction Contracts (GFCC's). Any post-mining discharges of substandard quality might then be addressed through the Growing Greener Program.

Public Participation

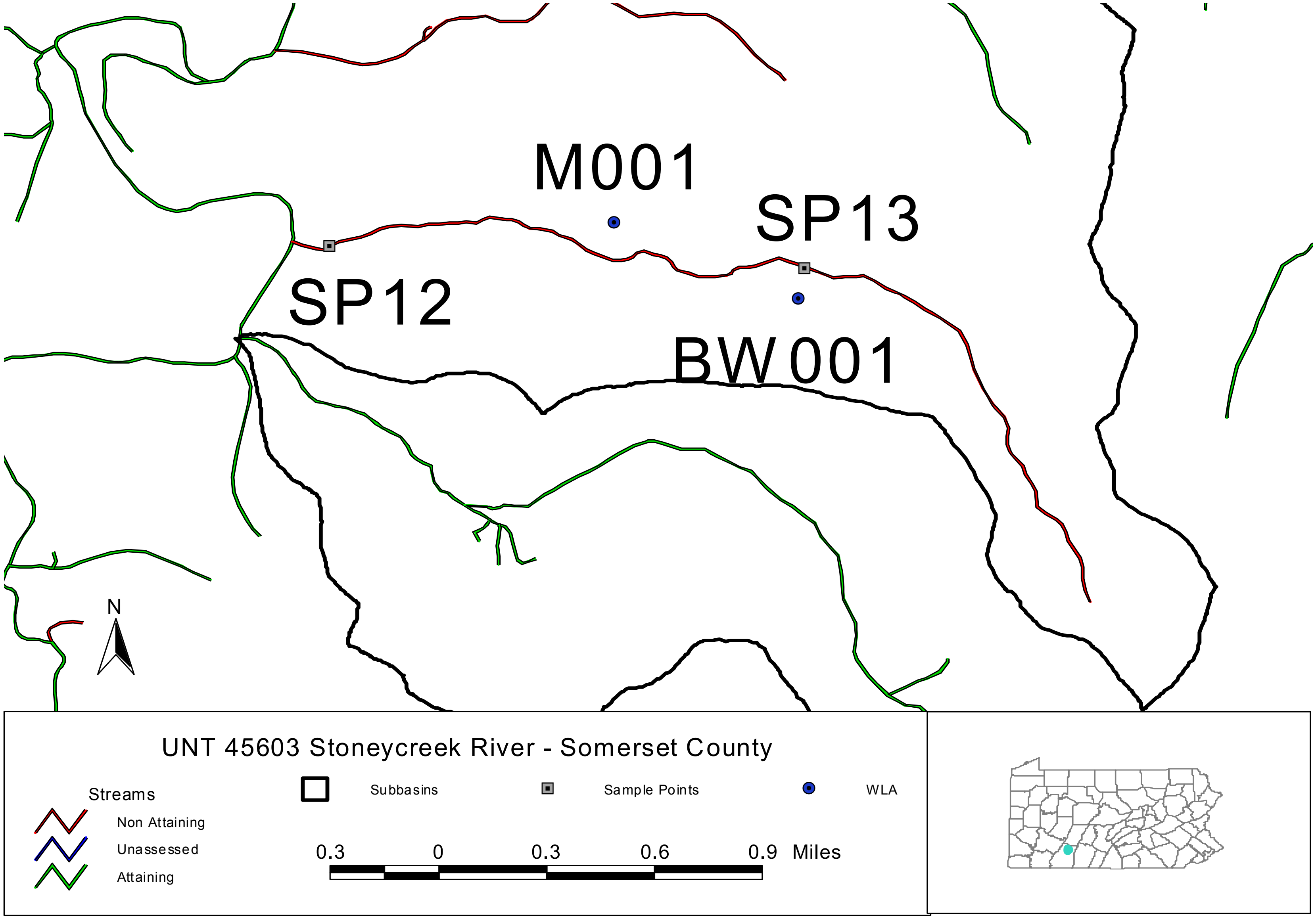
Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* and the *Somerset Daily American* on February 24, 2007 to foster public comment on the allowable loads calculated. A public meeting was held on March 7, 2007 at the Cambria District Mining Office in Ebensburg, to discuss the proposed TMDL.

Attachment A

UNT 45603 Stonycreek River Watershed Maps



UNT 45603 Stoneycreek River - Somerset County


M001
SP13
SP12
BW001
N
UNT 45603 Stoneycreek River - Somerset County
Streams
Non Attaining
Unassessed
Attaining
Subbasins
Sample Points
WLA
0.3
0
0.3
0.6
0.9
Miles

Attachment B

Method for Addressing Section 303(d) Listings for pH

Method for Addressing Section 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 the Pa. Department of Environmental Protection 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 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.*

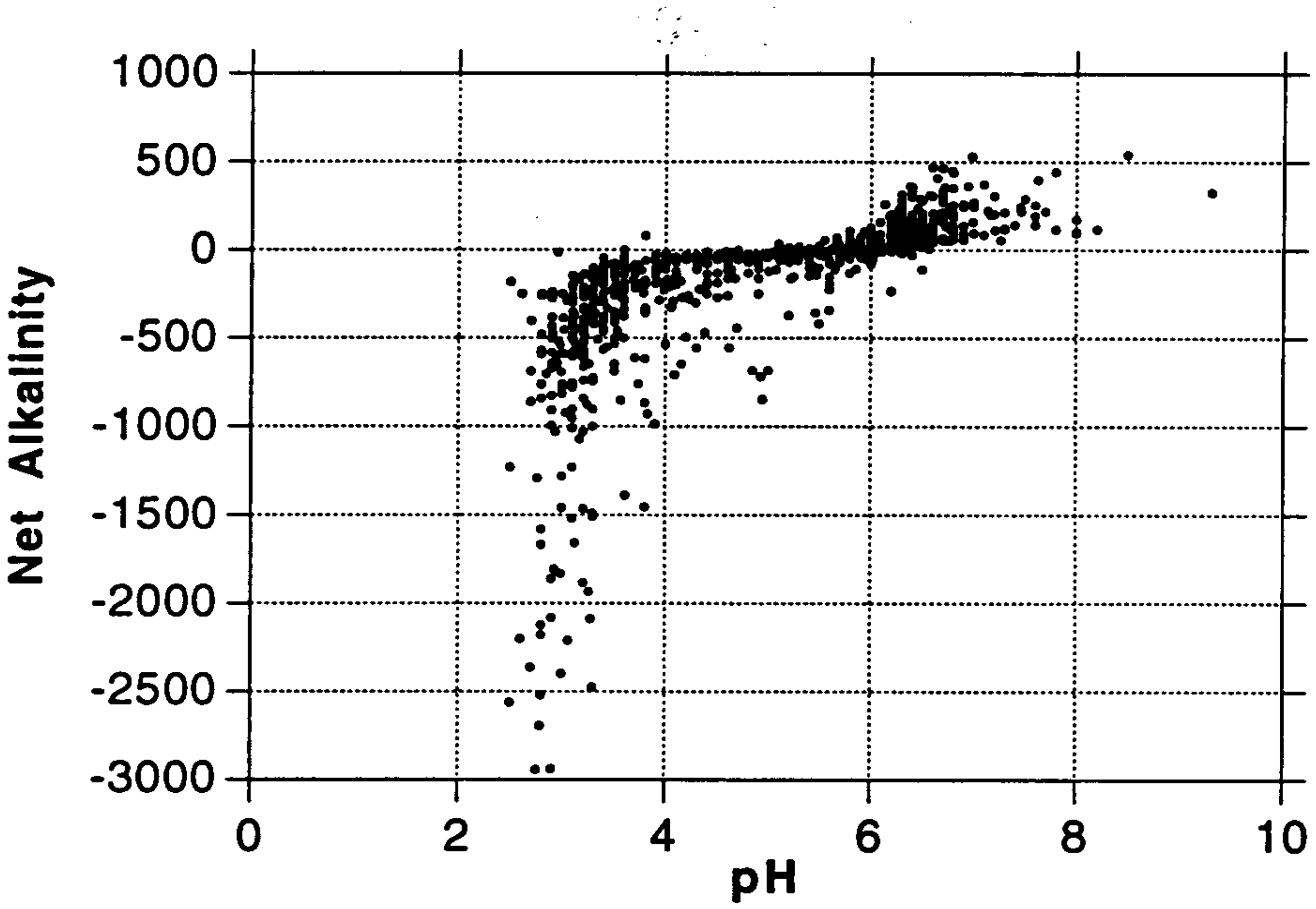


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

Attachment C

TMDLs By Segment

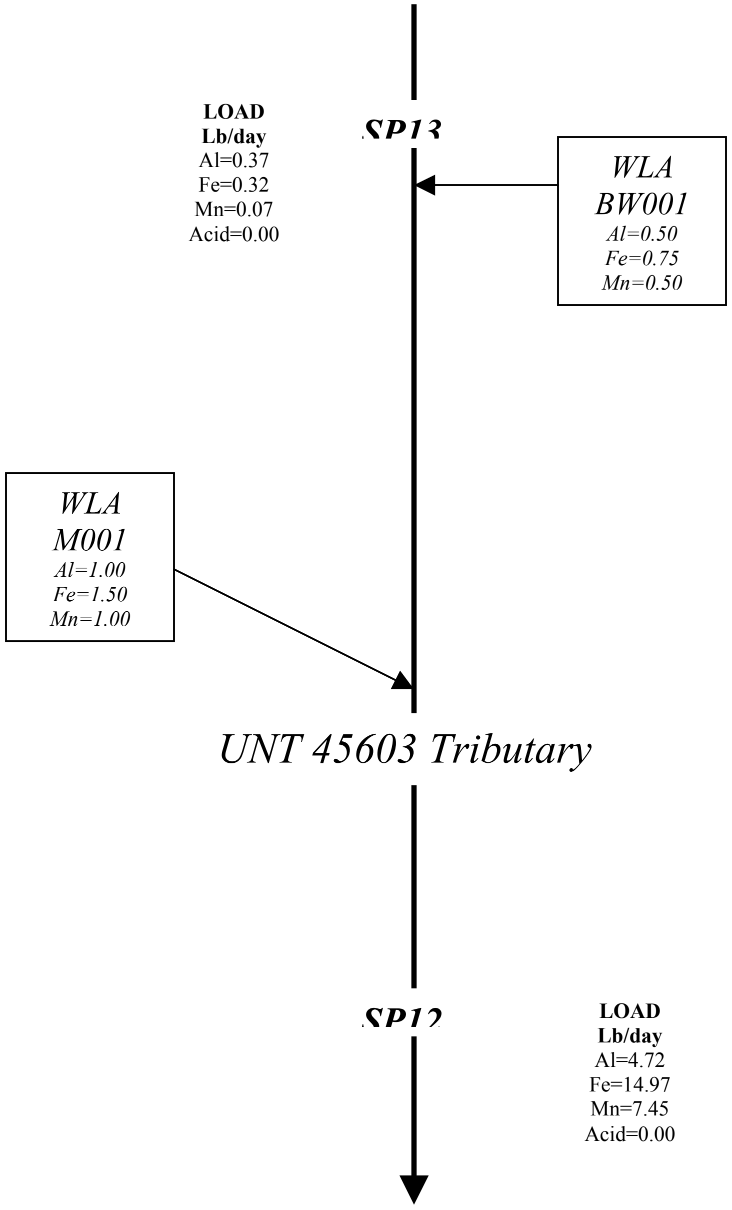
UNT 45603 Stonycreek River

The TMDL for UNT 45603 Stonycreek River consists of load allocations to two sampling sites on UNT 45603 Stonycreek River (SP13 and SP12). Sample data sets were collected throughout 2004. All sample points are shown on the maps included in Attachment A as well as on the loading (allowable) schematic presented on the following page.

UNT 45603 Stonycreek River is listed on the 1996 PA Section 303(d) list for metals from AMD as being the cause of the degradation to this stream. Although this TMDL will focus primarily on metal loading to the UNT 45603 Stonycreek River watershed, reduced acid loading analysis will be performed. The objective is to reduce acid loading to the stream, which will in turn raise the pH to the desired range and keep a net alkalinity above zero, 99% of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 2). The method and rationale for addressing pH is contained in Attachment B.

An allowable long-term average in-stream concentration was determined at each sample point for metals and acidity. The analysis is designed to produce an average value that, when met, will be protective of the water-quality criterion for that parameter 99% 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% of the time. The simulation was run assuming the data set was log normally distributed. Using the mean and standard deviation of the data set, 5000 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% of the time. The mean value from this data set represents the long-term average concentration that needs to be met to achieve water-quality standards. Following is an explanation of the TMDL for each allocation point.

UNT 45603 Stonycreek River Sampling Station Diagram
Arrows represent direction of flow
Diagram not to scale



TMDL calculations- SP13 - UNT 45603 Stonycreek River below reclaimed strip mine

The TMDL for sample point SP13 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment of UNT 45603 Stonycreek River was computed using water-quality sample data collected at point SP13. The average flow, measured at the sampling point SP13 (0.23 MGD), is used for these computations. The allowable load allocations calculated at SP13 will directly affect the downstream point SP12.

Sample data at point SP13 shows that this segment of UNT 45603 Stonycreek River has a pH ranging between 7.7 and 8.1. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

No TMDLs have been calculated at SP13. The measured sample data for aluminum, iron and manganese was above detection limits but still less than water quality criteria. Sample data shows that no acidity was measured at SP13. Because water quality standards are met 99% of the time, a TMDL for these parameters isn't necessary and is not calculated.

Table C1 shows the measured and allowable concentrations and loads at SP13.

Table C1		Measured		Allowable	
Flow (gpm)=	156.40	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.20	0.4	0.20	0.4
	Iron	0.17	0.3	0.17	0.3
ND = not determined	Manganese	0.04	0.1	0.04	0.1
NA = not applicable	Acidity	ND	NA	ND	NA
	Alkalinity	73.71	138.5		

Waste Load Allocations – Marquise Mining Corporation

Marquise Mining Corporation has two active mining operations in the UNT 45603 Stonycreek River Watershed. The Marquise #11 Mine (SMP 56050106, NPDES permit no. PA0249807) and the Baker Whitely Mine (SMP 56010106, NPDES permit No. PA0249076) have permitted discharges that are evaluated in the calculated allowable loads at SP12. Waste load allocations are calculated using observed flows multiplied by the permit BAT limits for aluminum, iron and manganese.

Table C1. Waste Load Allocations at Cooney Bros Coal Co.			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
BW001			
Al	2	0.06	0.50
Fe	3	0.06	0.75
Mn	2	0.06	0.50
M001			
Al	2	0.03	1.00
Fe	3	0.03	1.50
Mn	2	0.03	1.00

TMDL calculations- SP12 - UNT 45603 Stonycreek River near mouth in Hooversville

The TMDL for sampling point SP12 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment of UNT 45603 Stonycreek River was computed using water-quality sample data collected at point SP12. The average flow, measured at the sampling point SP12 (1.70 MGD), is used for these computations.

Sample data at point SP12 shows pH ranging between 6.5 and 7.3; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point SP12 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points SP13 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points SP13 and SP12 to determine a total load tracked for the segment of stream between SP12 and SP13. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at SP12.

A TMDL for aluminum, and iron at SP12 has been calculated. The measured sample data for manganese was above detection limits but still less than water quality criteria. Sample data shows that no acidity was measured at SP12. Table C2 shows the measured and allowable concentrations and loads at SP12. Table C3 shows the percent reduction for aluminum and iron needed at SP12.

Table C2		Measured		Allowable	
Flow (gpm)=	1178.50	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.81	11.5	0.33	4.7
	Iron	1.40	19.8	1.06	15.0
ND = not determined	Manganese	0.53	7.5	0.53	7.5
NA = not applicable	Acidity	ND	NA	ND	NA
	Alkalinity	16.45	232.9		

Table C3. Allocations SP12		
SP12	Al (Lbs/day)	Fe (Lbs/day)
Existing Load @ SP12	11.46	19.81
Difference in measured Loads between the loads that enter and existing SP12	11.09	19.49
Additional load tracked from above samples	0.37	0.32
Total load tracked between SP13 and SP12	11.46	19.81
Allowable Load @ SP12	4.72	14.97
Load Reduction @ SP12	6.74	4.84
% Reduction required @ SP12	59%	24%

11.09 lbs/day of aluminum entered the stream between SP13 and SP12. The total aluminum load tracked was 11.46 lbs/day. The calculated allowable load was 4.72 lbs/day. 59% of the total aluminum load needs to be reduced to reach the calculated allowable load. There is a 19.49 lbs/day increase of iron at this sample point compared to the sum of measured loads from upstream segments. This increase entered this segment of stream between SP13 and SP12. The total iron load measured was 4.84 lbs/day greater than the calculated allowable iron load of 14.97 lbs/day, resulting in a 24% required iron reduction necessary.

Margin of Safety

For this study the margin of safety is applied implicitly. A MOS is implicit because the allowable concentrations and loadings were simulated using Monte Carlo techniques and employing the @Risk software. Other margins of safety used for this TMDL analysis include the following:

- 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 margin of safety.
- An additional MOS is provided because that the calculations were done with a daily Fe average instead of the 30-day average.

Seasonal Variation

Seasonal variation is implicitly accounted for in these TMDLs because the data used represents 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 D

Excerpts Justifying Changes Between the 1996, 1998, 2002 and 2004 Section 303(d) Lists

The following are excerpts from the Pennsylvania DEP Section 303(d) narratives that justify changes in listings between the 1996, 1998, 2002 and 2004 list. The Section 303(d) listing process has undergone an evolution in Pennsylvania since the development of the 1996 list.

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

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

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

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

Attachment E

Water Quality Data Used In TMDL Calculations

Site	Site Name	Bottle ID	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)
13	Trib to		040713-1455	No Flow						
13	Stonycreek River		040805-1135	No Flow						
13		19C	040919-1335	557	7.76	-56.4	62.8	0.4	0.43	0.02
13		52C	041003-1200	24	8.08	-73.7	78.6	0.18	0.22	0.02
13		14D	041030-1230	14.6	7.75	-74.6	80.8	0.11	0.02	0.05
13		28D	041109-1115	30	7.74	-68.9	72.7	0.1	0.02	0.05
average				156.400	7.833	-68.385	73.713	0.198	0.173	0.035
st dev				267.142	0.165	8.368	8.056	0.140	0.196	0.017
Site	Site Name	Bottle ID	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)
12	Trib to	60A	040713-1500	800	6.53	-3.6	11.2	0.42	1.5	0.56
12	Stonycreek River	9B	040805-1140	862	6.70	-4.5	13.3	0.44	1.7	0.59
12		18C	040919-1310	3069	7.27	-19.8	27.8	1.2	1.1	0.51
12		51C	041003-1135	921	6.75	-10.2	17.8	0.99	1.2	0.51
12		13D	041030-1205	658	6.47	-2.9	13.8	0.81	1.4	0.5
12		27D	041109-1155	761	6.61	-5.8	14.8	1.0	1.5	0.49
average				1178.500	6.722	-7.782	16.453	0.810	1.400	0.527
st dev				930.479	0.288	6.409	5.956	0.319	0.219	0.039

Attachment F

Comment and Response

No official comments were received for this TMDL