FINAL

EAST BRANCH MAHONING CREEK WATERSHED TMDL

Clearfield and Jefferson Counties

For Acid Mine Drainage Affected Segments

Prepared by:

Pennsylvania Department of Environmental Protection

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TMDL[1]
East Branch Mahoning Creek Watershed
Clearfield and Jefferson Counties, Pennsylvania

Table 1. 303(d) Sub-List								
State Water Plan (SWP) Subbasin: 17-D East Branch Mahoning Creek								
Year	**Miles**	**Segment ID Assessment ID**	**DEP Stream Code**	**Stream Name**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1996	8.0		47974	East Branch Mahoning Creek	HQ-CWF	305(b) Report	RE	metals
1998*	8.0		47974	East Branch Mahoning Creek	HQ-CWF	SWMP	AMD	metals
2002	8.0		47974	East Branch Mahoning Creek	HQ-CWF	SWMP	AMD	metals
2004	5.8	20040930-1400-CLW	47974	East Branch Mahoning Creek	HQ-CWF	SWMP	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 a segment in the Upper East Branch Mahoning Creek 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. Impairments have 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 East Branch Mahoning Creek Watershed

The Upper East Branch Mahoning Creek Watershed is located in northwest region of Pennsylvania and is a tributary of the Allegheny River. The watershed area is found on United States Geological Survey maps covering Dayton, Dubois, Luthersburg, Mahaffey, Marion Center, McGees Mills, Punxsutawney, Renoldsville, Rochester Mills and Valier 7.5-Minute Quadrangles. The watershed area upstream from the confluence of Little Mahoning Creek is approximately 210 square miles and the length is roughly 35 miles.

[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.*

The watershed is situated within Clearfield, Indiana and Jefferson Counties. Portions of four municipalities fall within the Clearfield County area of the watershed and include: Bell, Brady, Penn and Sandy Townships along with the Borough of Troutville. The Jefferson County area of the watershed includes portions of the following municipalities: Bell, Gaskill, Henderson, McCalmont, Oliver, Perry, Porter, Winslow and Young Townships along with the Boroughs of Big Run, Punxsutawney and Sykesville. The Indiana County portion of the watershed includes the following municipalities: Banks, Canoe, North Mahoning and West Mahoning. The center of the watershed is located near the Borough of Punxsutawney.

Major tributaries to Upper Mahoning Creek Watershed include: East Branch Mahoning Creek, Stump Creek, Big Run, Rock Run, Canoe Creek, Elk Run, Sawmill Run, Rose Run, Nicely Run, Dutch Run, Perryville Run, Foundry Run, Steer Run, Carr Run, Hamilton Run, Sugarcamp Run and several unnamed tributaries. The two largest tributaries are East Branch Mahoning Creek (49 square miles) and Stump Creek (28 square miles).

The area covered by this report includes the watershed areas upstream of the confluence of East Branch Mahoning Creek and Stump Creek. The confluence of these two streams is located near Big Run, Pennsylvania. Included in this section of the watershed are the southeastern portion of Jefferson County and western portion of Clearfield County. The watershed area covered in the TMDL is approximately 42.3 square miles.

Land uses in the basin include agriculture, forest, mining, and residential/commercial development. Concentrated areas of oil and gas drilling also exist.

The Upper Mahoning Creek Watershed can be reached by traveling to Punxsutawney. Punxsutawney is easily accessed from Interstate 80 by traveling south on State Route 219 (6 miles) to State Route 119 south (16 miles) to Punxsutawney. State Route 119 passes through the town of Big Run and runs parallel to Mahoning Creek for several miles.

Hydrology and Geology

The area within the East Branch Mahoning Creek and Stump Creek watersheds consists of approximately 77 square miles. The East Branch Mahoning Creek Watershed consists of a main stem and the following named tributaries: Clover Run, Laurel Run, Beaver Run and Beech Run. The Stump Creek Watershed consists of a main stem and the following named tributaries: Poose Run, Limestone Run and Sugarcamp Run. East Branch Mahoning Creek flows from an elevation of 1860 feet above sea level in its headwaters and Stump Creek flows from an elevation of 1880 feet above sea level in its headwaters. At the confluence of the two streams the elevation is at 1260 feet above sea level. The two streams drain the area from the northeast to the southwest. The watersheds are part of the Allegheny River watershed.

The Mahoning Creek Watershed lies within the Appalachian Plateaus Physiographic Province. The watershed area is comprised of Pennsylvanian aged rocks. The coals are confined to the Allegheny Group. The Punxsutawney Syncline passes through the watershed near Punxsutawney in a northeast/southwest trend. Strata south of the syncline dip to the northwest and strata north of the syncline dip to the southeast.

Segments addressed in this TMDL

East Branch Mahoning Creek is affected by pollution from AMD. This pollution has caused high levels of metals in the watershed. There are two active mining permits currently discharging into 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 4 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:

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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.

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 portions of the Mahoning Creek Watershed covered by this report have been extensively mined by both strip and deep mine methods. The Lower Freeport coal seam has been extensively mined by large deep mines due to its thickness and quality. Underground mining was conducted from the 1800's into the early 1900's. Many of these mines were left abandoned. In the mid 1900's strip mining became the prevalent method of mining. Mining companies whose names have long ago been forgotten mined the land with little or no reclamation. All of the abandoned mines in the watershed have led to the degradation of the Mahoning Creek watershed. Today many of these sites are being remined and reclaimed which helps reduce the amount of spoils exposed to the weather and reduces the numbers of deep mines in the watershed.

ACTIVE MINING

The Hepburnia Coal Company, Bean/Mills Operation (40-59-31/78-45-12, SMP17900104) was issued on December 28, 1990. The Bean/Mills Operation total permit area is 537.6 acres with 98.5 acres to be affected. The coal seams to be mined are the Upper Freeport, Lower Freeport and Middle Kittanning. The site is currently active.

The Sky Haven Coal, Inc., Stoltz #1 Operation (41-01-51/78-44-04)(SMP45A76SM16, NPDES PA0256455) was issued on January 26, 2007. All mining has been completed on this mine site, all that remains is the treatment of a discharge of mine drainage.

The W. Ruskin Dressler, Ideal Operation (41-01-01/78-44-50, SMP17040105, NPDES PA0243795) was issued on April 6, 2005. The Ideal Operation total permit area is 63.9 acres with 47.6 total acres to be affected. The coal seams to be mined are the Upper Freeport and Lower Freeport coals. This site employs a non-discharge alternative. No ponds discharge directly to any streams. This site is currently active.

The W. Ruskin Dressler, McKee Operation (41-00-44/78-45-14, SMP17010111, NPDES PA0243141) was issued on December 31, 2001. The McKee Operation total permit area is 58.7 acres with 33.5 total acres to be affected. The coal seam mined was the Upper Freeport coal. In addition to the coal, shale and sandstone were also mined at this site. This site employs a non-discharge alternative. No ponds discharge directly to any streams. Mining is completed at the site and the final stages of backfilling are being done. This site is currently active.

COMPLETED MINING

The Johnson Brothers Coal Company, McMurray Operation (41-00-05/78-41-40, SMP17860133, PA0115606) was issued on June 17, 1987. The total permit area was 226.6 acres with 137.2 acres affected. The Lower Freeport and Upper Kittanning coal seams were mined. Mining was completed in the spring of 2001 and the site was backfilled and planted in the summer of 2001.

The Hepburnia Coal Company, Krick Operation (40-59-14/78-44-23, SMP 17890120) was issued on May 30, 1990. The total permit area was 292.3 acres with 205.5 acres affected. The Upper Freeport coal seam was mined. Mining was completed in the spring of 1998 and the site was back filled and planted in the summer of 1998.

The Whitetail Mining and reclamation Company, Inc., Wilson Operation (41-02-10/78-42-58, SMP 17900116, PA0206121) was issued on May 1, 1991. The Lower Freeport, Upper Kittanning, Luthersburg and Middle Kittanning coal seams were mined. Mining was completed in the spring of 2000 and the site was backfilled and planted in the summer of 2000.

The MB Energy, Inc., Three Forks Mine Operation (40-58-28/78-47-35, SMP 17940110, PA0219835) was issued on November 9, 1994. The Lower Freeport, Lower Freeport Rider and Upper Freeport coal seams were mined. The total permit area was 323.1 acres with 199.4 acres to be affected. Mining was completed in the summer of 2001 and the site was backfilled and planted in the fall of 2001.

The AA Smith Coal Company, Logan Mine Operation (41-12-25/78-43-10, SMP 17940112, PA0219851) was issued on February 12, 1997. The Lower Kittanning, Middle Kittanning, Upper Kittanning, Lower Freeport and Upper Freeport coal seams were mined. The total permit area was 86.7 acres with 77.1 acres to be affected. Mining was completed in the summer of 2000 and the site backfilled and planted in the fall of 2000.

The Falls Creek Energy Company, Inc., Joseph Mine Operation (41-01-19/78-46-24) (SMP17980103, PA0237914) was issued on February 4, 1999. The total permit area was 64.2 acres with 46.0 acres to be affected. The Lower Freeport coal and Lower Freeport shale were mined. Mining was completed in the fall of 2002. This site is currently backfilled and vegetated.

The Sky Haven Coal, Inc., Buck Run Operation (40-59-45/78-45-54)(SMP17960124, PA0220523) was issued on August 27, 1997. The total permit area was 127.0 acres with 120.0 acres to be affected. The coal seams mined were the Mahoning and Upper Freeport coal seams. Mining was completed in the fall of 1998 and the site was backfilled and planted in the spring of 1999. The site is currently active for reclamation activities only.

The P & N Coal Company, Inc., Gamelands Number 87 Mine (40-59-28/78-43-27)(SMP 17990117) was issued on December 11, 2000. The total permit area was 67.7 acres with 51.2

acres to be affected. The Upper Freeport, Lower Freeport and Upper Kittanning coal seams were mined. Mining was completed in 2005 and the site was regraded and planted in the fall of 2005.

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:

$$PR = \text{maximum } \{0, (1-Cc/Cd)\} \text{ where} \quad (1)$$

PR = required percent reduction for the current iteration

Cc = criterion in mg/l

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

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 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. 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 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.

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 in-stream 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 coalmines 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 in-stream 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
Al < 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. DEP 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. DEP 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 in-stream 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 2 mg/l x 0.01202 = 0.7 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 DEP'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 in-stream 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 are greater than the current level of mining activity, an additional WLA amount may be included in the allowed load to allow for future mining.

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.

Pollution sources in the watershed are from nonpoint sources and a point source, the TMDLs' component makeup will be Load Allocations (LAs) and a Waste Load Allocation (WLA). 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.

For High Quality waters, applicable water-quality criteria are determined using the unimpaired segment of the TMDL water or the 95th percentile of a reference WQN stream. For East Branch Mahoning Creek, WQN 873 West Branch Caldwell Creek is used as the reference water. The following table shows the criteria used in the East Branch Mahoning Creek TMDL development. Attachment D explains how to select a reference stream for HQ TMDL development.

Table 3. Reference West Branch Caldwell Creek Criteria

Parameter	*Criterion Value (mg/l)*
Aluminum (Al)	0.200
Iron (Fe)	0.482
Manganese (Mn)	0.026
Area	19 mi2
Alkalinity	24

TMDL Elements (WLA, LA, MOS)

$$TMDL = WLA + LA + MOS$$

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 4 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 4. East Branch Mahoning Creek Watershed Summary Table

Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	% Reduction
EB06 – East Branch Mahoning Creek on T354 near headwaters						
Aluminum (lbs/day)	ND	NA	0	NA	NA	NA
Iron (lbs/day)	5.26	1.59	0	1.59	3.67	70%
Manganese(lbs/day)	12.57	0.19	0	0.19	12.38	98%
Acidity (lbs/day)	234.86	88.08	0	88.08	146.78	62%
EB05 - Unnamed tributary 48030 at bridge on unnamed road						
Aluminum (lbs/day)	ND	NA	0.05	NA	NA	NA
Iron (lbs/day)	ND	NA	0.07	NA	NA	NA
Manganese(lbs/day)	14.52	0.08	0.05	0.03	14.44	99%
Acidity (lbs/day)	ND	NA	0	NA	NA	NA
EB04 – Unnamed tributary from beaver ponds iron staining present 48029						
Aluminum (lbs/day)	ND	NA	0	NA	NA	NA
Iron (lbs/day)	3.77	0.41	0	0.41	3.36	89%
Manganese(lbs/day)	16.81	0.04	0	0.04	16.77	99%
Acidity (lbs/day)	ND	NA	0	NA	NA	NA
EB03 – East Branch Mahoning Creek before confluence with Beech Run						
Aluminum (lbs/day)	ND	NA	0	NA	NA	NA
Iron (lbs/day)	16.90	16.90	0	NA	NA	NA
Manganese(lbs/day)	39.77	0.56	0	0.56	0.00	0%*
Acidity (lbs/day)	571.54	183.97	0	183.97	240.79	57%
BE01 – Beech Run before East Branch Mahoning Creek						
Aluminum (lbs/day)	ND	NA	0.7	NA	NA	NA
Iron (lbs/day)	ND	NA	1.1	NA	NA	NA
Manganese(lbs/day)	8.43	0.87	0.7	0.17	7.56	90%
Acidity (lbs/day)	871.59	432.84	0	432.84	438.75	50%
EB02 – Unnamed tributary to East Branch Mahoning Creek 48015 below bridge on Henry Road						
Aluminum (lbs/day)	ND	NA	0	NA	NA	NA
Iron (lbs/day)	ND	NA	0	NA	NA	NA
Manganese(lbs/day)	1.41	0.14	0	0.14	1.27	90%
Acidity (lbs/day)	213.45	107.62	0	107.62	105.83	50%
EB01 – East Branch Mahoning Creek above confluence with Beaver Run						
Aluminum (lbs/day)	ND	NA	0	NA	NA	NA
Iron (lbs/day)	ND	NA	0	NA	NA	NA
Manganese(lbs/day)	45.36	1.35	0	1.35	0.09	6%
Acidity (lbs/day)	1466.88	603.03	0	603.03	38.44	6%
BV01 – Beaver Run before confluence with East Branch Mahoning Creek						
Aluminum (lbs/day)	ND	NA	0	NA	NA	NA
Iron (lbs/day)	1.80	0.67	0	0.67	1.13	63%
Manganese(lbs/day)	0.83	0.09	0	0.09	0.74	89%
Acidity (lbs/day)	43.56	43.56	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

In the instance that the allowable load is equal to the existing load (e.g. manganese point BV01, Table 4), 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.

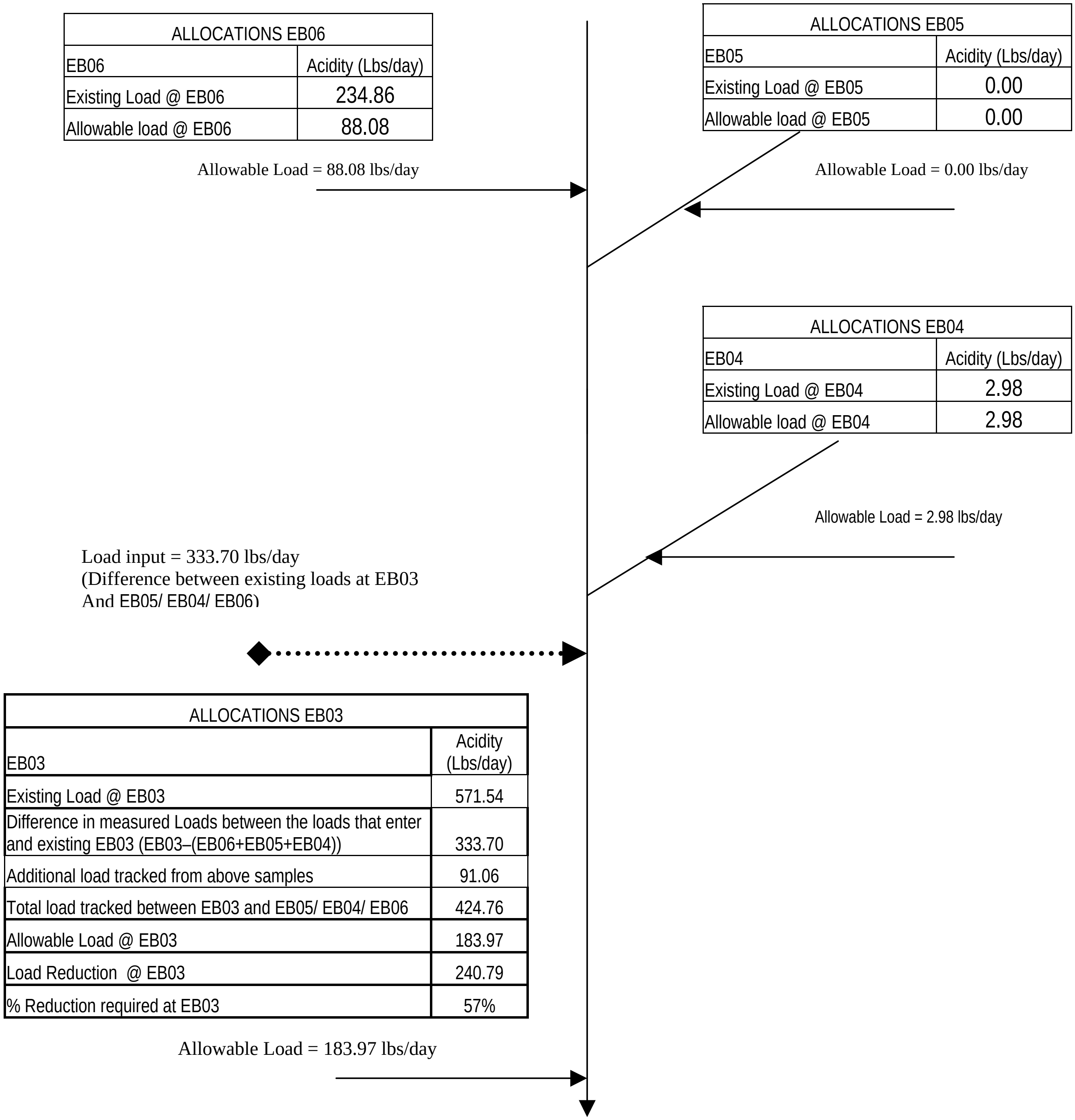
Waste Load Allocations were assigned to the permitted mine drainage discharges contained in the East Branch Mahoning Creek Watershed. The waste load allocation for Hepburnia Coal Company is calculated using the flow calculated in the Method to Quantify Treatment Pond Pollutant Load multiplied by the permitted BAT limits. The waste load allocation for Sky Haven Coal, Inc was calculated using the average discharge flow multiplied by the permitted BAT limits. The WLA for the Hepburnia Coal Company discharge is being evaluated at sample point BE01 near the mouth of Beech Run. Sky Haven's WLA is evaluated at EB05. No required reductions of permit limits are needed at this time. All necessary reductions are assigned to non-point sources.

Hepburnia Coal Company's calculated waste load allocation is evaluated downstream at sample point BE01. Calculated allowable loads at BE01 show that no reductions are necessary for aluminum and iron. Sky Haven's waste load allocation is evaluated at EB05. Aluminum and Iron was measured at less than detection limits. Since these parameters are attaining, the impact from upstream sources is negligible. Therefore, no reductions to the present waste load allocation are necessary at this time.

Table 5 Waste Load Allocations in East Branch Mahoning Creek Watershed

Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
HEPBURNIA COAL			
Al	2	0.0445	0.743
Fe	3	0.0445	1.114
Mn	2	0.0445	0.743
SKY HAVEN COAL			
Al	2	0.00288	0.048
Fe	3	0.00288	0.072
Mn	2	0.00288	0.048

Following is an example of how the allocations, presented in Table 4, for a stream segment are calculated. For this example, acidity allocations for EB03 of East Branch Mahoning Creek 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 EB06	
EB06	Acidity (Lbs/day)
Existing Load @ EB06	234.86
Allowable load @ EB06	88.08

ALLOCATIONS EB05	
EB05	Acidity (Lbs/day)
Existing Load @ EB05	0.00
Allowable load @ EB05	0.00

ALLOCATIONS EB04	
EB04	Acidity (Lbs/day)
Existing Load @ EB04	2.98
Allowable load @ EB04	2.98

ALLOCATIONS EB03	
EB03	Acidity (Lbs/day)
Existing Load @ EB03	571.54
Difference in measured Loads between the loads that enter and existing EB03 (EB03–(EB06+EB05+EB04))	333.70
Additional load tracked from above samples	91.06
Total load tracked between EB03 and EB05/ EB04/ EB06	424.76
Allowable Load @ EB03	183.97
Load Reduction @ EB03	240.79
% Reduction required at EB03	57%

The allowable acidic load tracked from EB06+EB05+EB04 was 91.06 lbs/day. The existing load at EB06+EB05+EB04 was subtracted from the existing load at EB03 to show the actual measured increase of acidic load that has entered the stream between these two sample points (333.70 lbs/day). This increased value was then added to the calculated allowable load from EB06+EB05+EB04 to calculate the total load that was tracked between EB06+EB05+EB04 and EB03 (allowable loads @ EB06+EB05 + EB04 + the difference in existing load between EB06+EB05 + EB04 and EB03). This total load tracked was then subtracted from the calculated allowable load at EB03 to determine the amount of load to be reduced at EB03. This total load value was found to be 424.76 lbs/day; it was 240.79 lbs/day greater then the EB03 allowable load of 183.97 lbs/day. Therefore, a 57% acidic reduction at EB03 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.

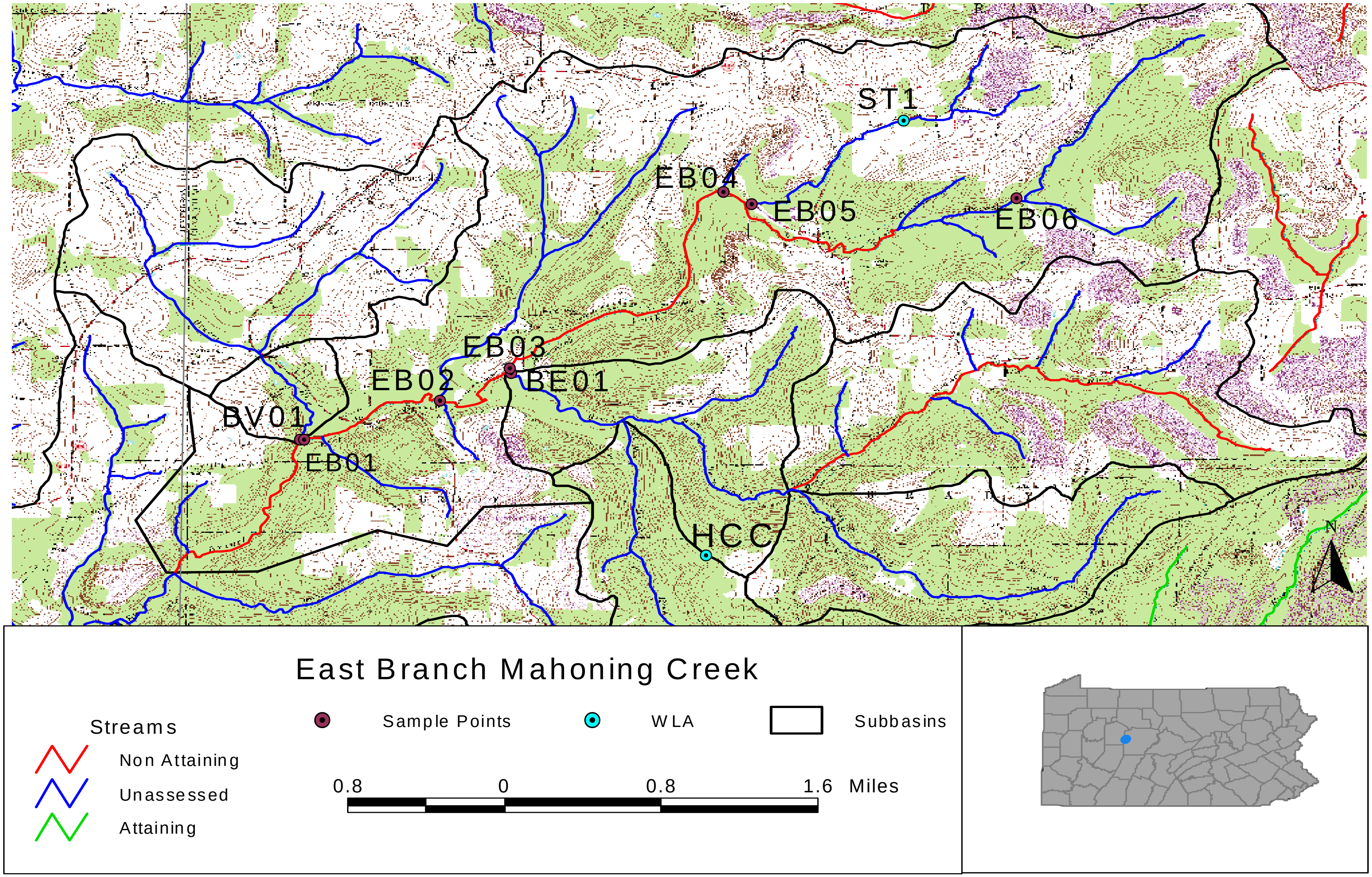
Upper Mahoning Creek Watershed Association is dedicated to protecting Mahoning Creek and it's tributaries.

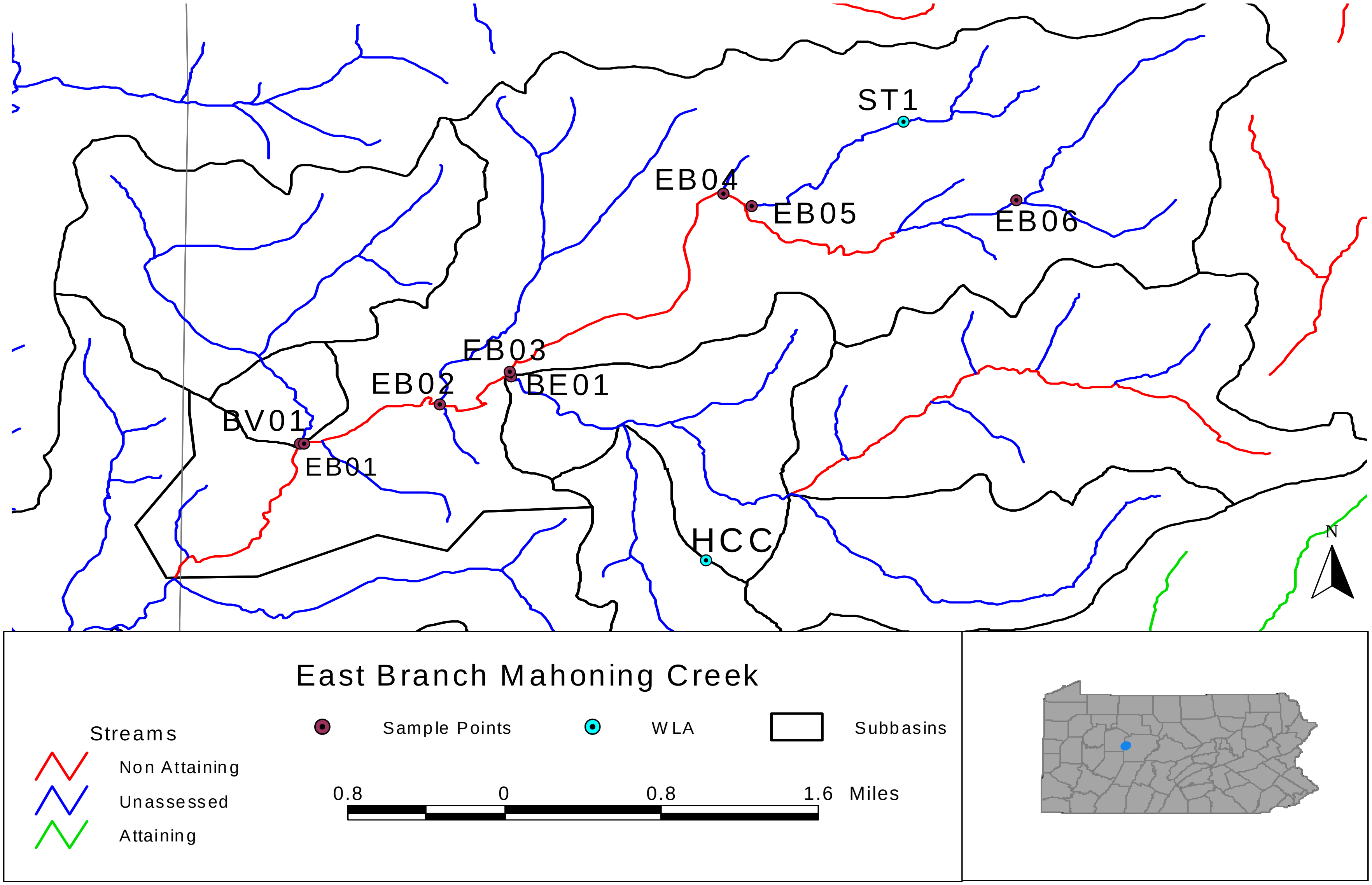
Public Participation

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* and the *The Progress* on January 24, 2007 to foster public comment on the allowable loads calculated. The public comment period on this TMDL was open from 12/23/2006 to 2/23/2007. A public meeting was held on February 7, 2007 at the Moshannon District Mining Office, to discuss the proposed TMDL.

Attachment A

East Branch Mahoning Creek Watershed Maps


ST1
EB04
EB05
EB06
EB03
BE01
EB02
BV01
EB01
HCC
N
East Branch Mahoning Creek
Streams
Non Attaining
Unassessed
Attaining
Sample Points
WLA
Subbasins
0.8
0
0.8
1.6
Miles



ST1
EB04
EB05
EB06
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EB02
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Streams
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1.6
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 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 EPA'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 Section 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. Therefore, net alkalinity will be used to evaluate pH in these TMDL calculations. This methodology assures that the standard for pH will be met because net alkalinity is a measure of the reduction of acidity. 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. Net alkalinity is alkalinity minus acidity, both being in units of milligrams per liter (mg/l) $CaCO_3$. 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.

There are several documented cases of streams in Pennsylvania having a natural background pH below six. If the natural pH of a stream on the Section 303(d) list can be established from its upper unaffected regions, then the pH standard will be expanded to include this natural range. The acceptable net alkalinity of the stream after treatment/abatement in its polluted segment will be the average net alkalinity established from the stream's upper, pristine reaches added to the acidity of the polluted portion in question. Summarized, if the pH in an unaffected portion of a stream is found to be naturally occurring below six, then the average net alkalinity for that portion (added to the acidity of the polluted portion) of the stream will become the criterion for the polluted portion. This "natural net alkalinity level" will be the criterion to which a 99 percent confidence level will be applied. The pH range will be varied only for streams in which a natural unaffected net alkalinity level can be established. This can only be done for streams that have upper segments that are not impacted by mining activity. All other streams will be required to reduce the acid load so the net alkalinity is greater than zero 99% of time.

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.*

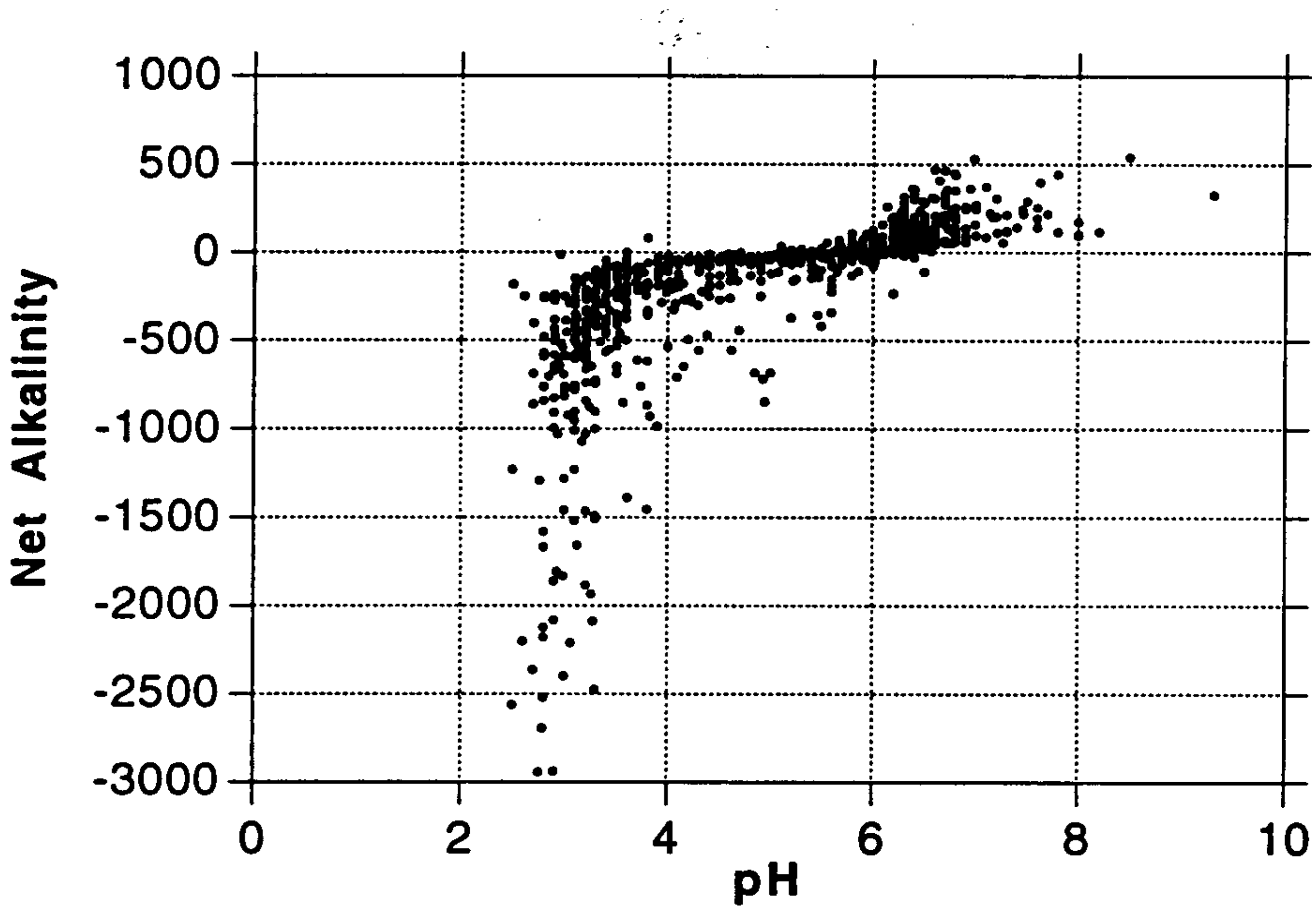


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

Attachment C

TMDLs By Segment

East Branch Mahoning Creek

The TMDL for East Branch Mahoning Creek consists of load allocations to one sampling site on UNT 48030 East Branch Mahoning Creek (EB05), a sample site on UNT 48029 East Branch Mahoning Creek (EB04), a sample site on Beech Run (BE01), a site on UNT 48018 East Branch Mahoning Creek (EB02), three sites on East Branch Mahoning Creek (EB06, EB03 and EB01) and one sample site on Beaver Run (BV01). All sample data was collected in Clearfield County. Sample data sets were collected during 2004 and 2005. 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.

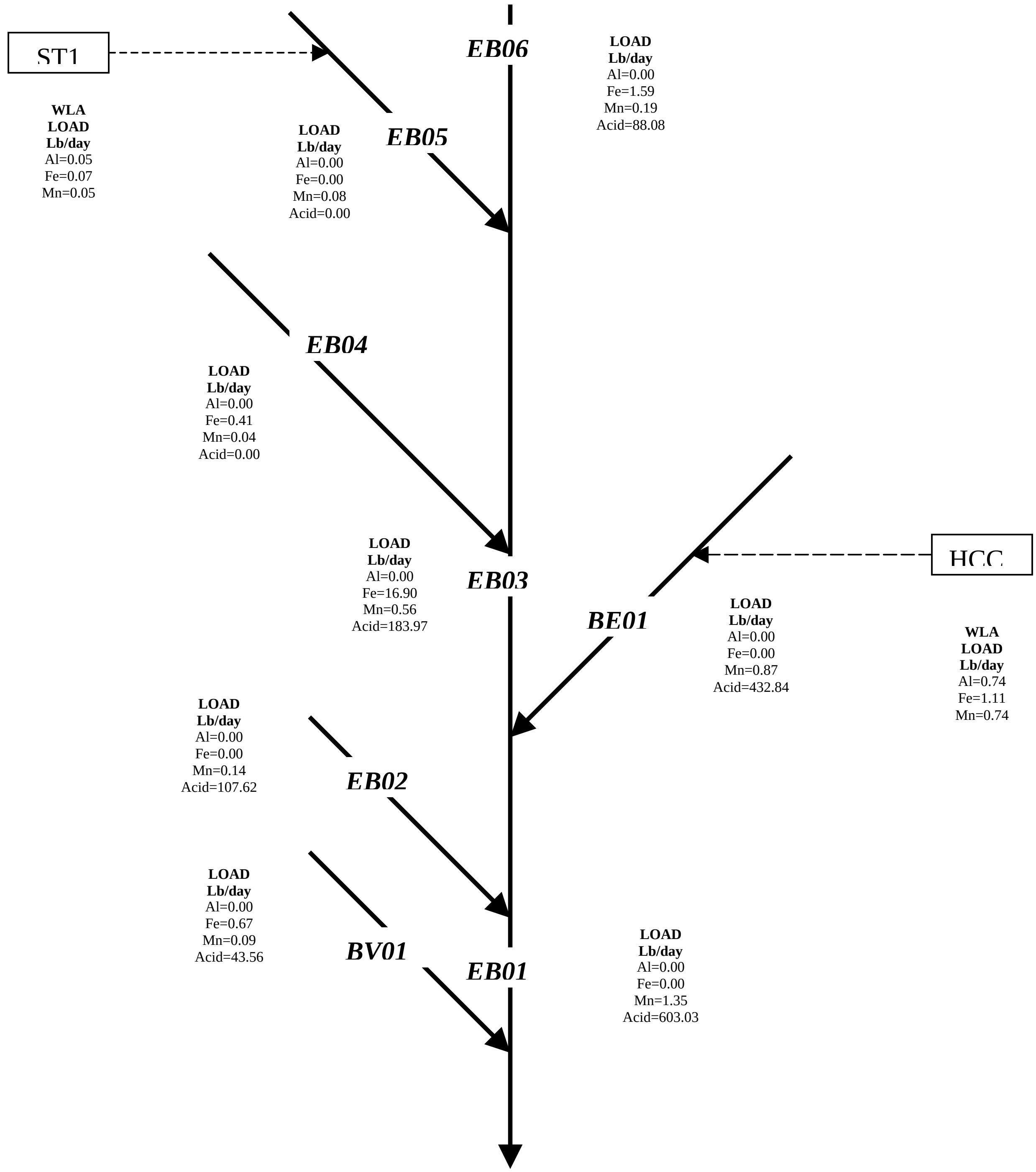
East Branch Mahoning Creek is listed on the 1996 PA Section 303(d) list for metals from AMD as being the cause of the degradation to this stream. Although this TMDL will focus primarily on metal loading to the East Branch Mahoning Creek watershed, reduced acid loading analysis will be performed. The 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. For HQ-CWF streams, a WQN stream is used as a reference. The applicable water quality criteria shown in Table 3 for WQN 873 West Branch Caldwell Creek will be used as the target endpoint.

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.

East Branch Mahoning Creek Sampling Station Diagram

Arrows represent direction of flow

Diagram not to scale



TMDL calculations- EB06- East Branch Mahoning Creek on T354 near headwaters

The TMDL for sample point EB06 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for the headwaters of East Branch Mahoning Creek was computed using water-quality sample data collected at point EB06. The average flow, measured at the sampling point EB06 (1.52 MGD), is used for these computations. The allowable load allocations calculated at EB06 will directly affect the downstream point EB03.

Sample data at point EB06 shows that East Branch Mahoning Creek has a pH ranging between 6.9 and 7.1. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for iron, manganese and acidity has been calculated at EB06. The measured sample data for aluminum was measured to be below detection limits. Because water quality standards are met, a TMDL for this parameter isn't necessary and is not calculated. The existing and allowable loads for the aluminum parameter at EB06 in Table C1 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C1 shows the measured and allowable concentrations and loads at EB06. Table C2 shows the load reductions necessary for iron, manganese and acidity at EB06.

Table C1		Measured		Allowable	
Flow (gpm)=	1054.25	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA	ND	NA
	Iron	0.42	5.3	0.13	1.6
ND = non detection	Manganese	0.99	12.6	0.01	0.2
NA = not applicable	Acidity	18.55	234.9	6.96	88.1
	Alkalinity	24.00	303.9		

Table C2. Allocations EB06			
EB06	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ EB06	5.26	12.57	234.86
Allowable Load @ EB06	1.59	0.19	88.08
Load Reduction @ EB06	3.67	12.38	146.78
% Reduction required @ EB06	70%	98%	62%

Waste Load Allocation – Sky Haven Coal Inc, SMP 45A76SM16

The Sky Haven Coal, Inc, Stoltz #1 Operation, SMP 45A76SM16, NPDES permit no. PA0256455 has a permitted discharge that is evaluated in the calculated allowable loads at EB05. Waste load allocations are calculated using the average flow of the discharge and the permitted BAT limits for aluminum, iron and manganese. The following table shows the waste load allocation for this discharge.

This calculated waste load allocation is evaluated downstream at sample point EB05. Measured concentrations at EB05 show that aluminum and iron are at less than detection limits. Since these parameters are attaining, the impact from upstream sources is negligible. Therefore, no reductions to the present waste load allocation are necessary at this time.

Table C3. Waste Load Allocations at Sky Haven Coal, Inc.			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Sky Haven Coal			
Al	2	0.00288	0.048
Fe	3	0.00288	0.072
Mn	2	0.00288	0.048

TMDL calculations- EB05- Mouth of Unnamed Tributary 48030 East Branch Mahoning Creek

The TMDL for sample point EB05 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for UNT 48030 East Branch Mahoning Creek was computed using water-quality sample data collected at point EB05. The average flow, measured at the sampling point EB05 (1.15 MGD), is used for these computations. This is the most upstream point of this segment and the allowable load allocations calculated at EB05 will directly affect the downstream point EB03.

Sample data at point EB05 shows that UNT 48030 East Branch Mahoning Creek has a pH ranging between 7.5 and 7.8. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for manganese has been calculated. There was no acidity measured at this sample point. All aluminum and iron data was found to be at less than detection limits. Because water quality standards are met, a TMDL for aluminum, iron and acidity isn't necessary and is not calculated. The existing and allowable loads for the aluminum, iron and acidity at EB05 in Table C4 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C4 shows the measured and allowable concentrations and loads at EB05. Table C5 shows the percent reduction for manganese needed at EB05.

Table C4		Measured		Allowable	
Flow (gpm)=	798.25	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA	ND	NA
	Iron	ND	NA	ND	NA
ND = non detection	Manganese	1.51	14.5	0.01	0.1
NA = not applicable	Acidity	ND	NA	ND	NA
	Alkalinity	62.70	601.1		

Table C5. Allocations EB05	
EB05	Mn (Lbs/day)
Existing Load @ EB05	14.52
Allowable Load @ EB05	0.08
Load Reduction @ EB05	14.44
% Reduction required @ EB05	99%

TMDL calculations- EB04- Mouth of Unnamed Tributary 48029 East Branch Mahoning Creek

The TMDL for sample point EB04 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for UNT 48029 East Branch Mahoning Creek was computed using water-quality sample data collected at point EB04. The average flow, measured at the sampling point EB04 (0.34 MGD), is used for these computations. This is the most upstream point of this segment and the allowable load allocations calculated at EB04 will directly affect the downstream point EB03.

Sample data at point EB04 shows that UNT 48029 East Branch Mahoning Creek has a pH ranging between 6.9 and 7.0. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for iron and manganese has been calculated. All aluminum data was found to be at less than detection limits. Sample data shows that no reductions are necessary for acidity. Because water quality standards are met, a TMDL for aluminum and acidity isn't necessary and is not calculated. The existing and allowable loads for the aluminum at EB04 in Table C6 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C6 shows the measured and allowable concentrations and loads at EB04. Table C7 shows the percent reduction for iron and manganese needed at EB04.

Table C6		Measured		Allowable	
Flow (gpm)=	236.50	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA	ND	NA
	Iron	1.33	3.77	0.14	0.41
ND = non detection	Manganese	5.92	16.81	0.02	0.04
NA = not applicable	Acidity	1.05	2.98	1.05	2.98
	Alkalinity	24.00	68.17		

Table C7. Allocations EB04		
EB04	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ EB04	3.77	16.81
Allowable Load @ EB04	0.41	0.04
Load Reduction @ EB04	3.36	16.77
% Reduction required @ EB04	89%	100%

TMDL calculations- EB03- East Branch Mahoning Creek before confluence with Beech Run

The TMDL for sampling point EB03 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 East Branch Mahoning Creek was computed using water-quality sample data collected at point EB03. The average flow, measured at the sampling point EB03 (5.44 MGD), is used for these computations.

Sample data at point EB03 shows pH ranging between 6.9 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 EB03 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 EB06/EB05/EB04 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points EB06/EB05/EB04 and EB03 to determine a total load tracked for the segment of stream between EB03 and EB06/EB05/EB04. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at EB03.

A TMDL for manganese and acidity at EB03 has been calculated. All aluminum sample data was found to be less than detection limits. Sample data for iron was above detection limits but still under water quality standards. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. The existing and allowable loads for the aluminum parameter at EB03 in Table C8 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C8 shows the measured and allowable concentrations and loads at EB03. Table C9 shows the percent reduction for manganese and acidity needed at EB03.

Table C8		Measured		Allowable	
Flow (gpm)=	3777.00	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA	ND	NA
	Iron	0.37	16.90	0.37	16.90
ND = non detection	Manganese	0.88	39.77	0.01	0.56
NA = not applicable	Acidity	12.60	571.54	4.06	183.97
	Alkalinity	24.00	1088.65		

Table C9. Allocations EB03		
EB03	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ EB03	39.77	571.54
Difference in measured Loads between the loads that enter and existing EB03	-4.13	333.70
Percent loss due calculated at EB03	9.4%	NA
Additional load tracked from above samples	0.31	91.06
Percentage of upstream loads that reach the EB03	90.6%	NA
Total load tracked between EB06/EB05/EB04 and EB03	0.28	424.76
Allowable Load @ EB03	0.56	183.97
Load Reduction @ EB03	-0.28	240.79
% Reduction required at EB03	0%	57%

4.13 lbs/day of manganese fell out of the stream between EB06/EB05/EB04 and EB03. The total manganese load tracked was 0.28 lbs/day. The calculated allowable load was 0.56 lbs/day. Since the total manganese load tracked was less than the calculated allowable load, no manganese reduction is necessary. There is a 333.70 lbs/day increase of acidity at this sample point compared to the sum of measured loads from upstream segments. This increase entered this segment of stream between EB06/EB05/EB04 and EB03. The total acidic load measured was 240.79 lbs/day greater than the calculated allowable acidic load of 183.97 lbs/day, resulting in a 57% required acidic reduction necessary.

Waste Load Allocation – Hepburnia Coal Company, SMP 17900104

The Hepburnia Coal Company, Bean/Mills Operation, SMP 17900104, NPDES permit no. PA0116939 has a permitted discharge that is evaluated in the calculated allowable loads at BE01. Waste load allocations are calculated using the flow calculated in the Method to Quantify Treatment Pond Pollutant Load and the permitted BAT limits for aluminum, iron and manganese. The following table shows the waste load allocation for this discharge.

This calculated waste load allocation is evaluated downstream at sample point BE01. Calculated allowable loads at BE01 show that no reductions are necessary for aluminum and iron. Since these parameters are attaining, the impact from upstream sources is negligible. Therefore, no reductions to the present waste load allocation are necessary at this time.

Table C10. Waste Load Allocations at Hepburnia Coal Co.			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Hepburnia Coal			
Al	2	0.0445	0.743
Fe	3	0.0445	1.114
Mn	2	0.0445	0.743

<u>TMDL calculations- BE01- Beech Run before East Branch Mahoning Creek</u>

The TMDL for sample point BE01 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for Beech Run was computed using water-quality sample data collected at point BE01. The average flow, measured at the sampling point BE01 (8.43 MGD), is used for these computations. This is the most upstream point of this segment and the allowable load allocations calculated at BE01 will directly affect the downstream point EB01.

Sample data at point BE01 shows that Beech Run has a pH ranging between 6.8 and 7.1. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for manganese and acidity has been calculated. All aluminum and iron data was found to be at less than detection limits. Because water quality standards are met, a TMDL for aluminum and iron isn't necessary and is not calculated. The existing and allowable loads for the aluminum and iron at BE01 in Table C11 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C11 shows the measured and allowable concentrations and loads at BE01. Table C12 shows the percent reduction for manganese and acidity needed at BE01.

Table C11		Measured		Allowable	
Flow (gpm)=	5852.75	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA	ND	NA
	Iron	ND	NA	ND	NA
ND = non detection	Manganese	0.12	8.43	0.01	0.87
NA = not applicable	Acidity	12.40	871.59	6.16	432.84
	Alkalinity	24.00	1686.94		

Table C12. Allocations BE01		
BE01	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ BE01	8.43	871.59
Allowable Load @ BE01	0.87	432.84
Load Reduction @ BE01	7.56	438.75
% Reduction required @ BE01	90%	50%

TMDL calculations- EB02- Mouth of UNT 48015 to East Branch Mahoning Creek

The TMDL for sample point EB02 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for UNT 48015 East Branch Mahoning Creek was computed using water-quality sample data collected at point EB02. The average flow, measured at the sampling point EB02 (1.32 MGD), is used for these computations. This is the most upstream point of this segment and the allowable load allocations calculated at EB02 will directly affect the downstream point EB01.

Sample data at point EB02 shows that UNT 48015 East Branch Mahoning Creek has a pH ranging between 6.8 and 7.1. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for manganese and acidity has been calculated. All aluminum and iron data was found to be at less than detection limits. Because water quality standards are met, a TMDL for aluminum and iron isn't necessary and is not calculated. The existing and allowable loads for aluminum and iron at EB02 in Table C13 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C13 shows the measured and allowable concentrations and loads at EB02. Table C14 shows the percent reduction for manganese and acidity needed at EB02.

Table C13		Measured		Allowable	
Flow (gpm)=	918.50	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA	ND	NA
	Iron	ND	NA	ND	NA
ND = non detection	Manganese	0.13	1.41	0.01	0.14
NA = not applicable	Acidity	19.35	213.45	9.76	107.62
	Alkalinity	24.00	264.74		

Table C14. Allocations EB02		
EB02	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ EB02	1.41	213.45

Allowable Load @ EB02	0.14	107.62
Load Reduction @ EB02	1.27	105.83
% Reduction required @ EB02	90%	50%

<u>TMDL calculations- EB01- East Branch Mahoning Creek</u> <u>above confluence with Beaver Run</u>

The TMDL for sampling point EB01 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 East Branch Mahoning Creek was computed using water-quality sample data collected at point EB01. The average flow, measured at the sampling point EB01 (15.43 MGD), is used for these computations.

Sample data at point EB01 shows pH ranging between 6.8 and 7.2; 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 EB01 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 EB03/BE01/EB02 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points EB03/BE01/EB02 and EB01 to determine a total load tracked for the segment of stream between EB01 and EB03/BE01/EB02. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at EB01.

A TMDL for manganese and acidity at EB01 has been calculated. All aluminum and iron sample data was found to be less than detection limits. Because water quality standards are met, a TMDL for these parameters isn’t necessary and is not calculated. The existing and allowable loads for the aluminum and iron parameters at EB01 in Table C15 will be denoted as “NA”. The concentrations will be denoted as “ND”.

Table C15 shows the measured and allowable concentrations and loads at EB01. Table C16 shows the percent reduction for manganese and acidity needed at EB01.

Table C15		Measured		Allowable	
Flow (gpm)=	10714.25	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA	ND	NA
	Iron	ND	NA	ND	NA
ND = non detection	Manganese	0.35	45.36	0.01	1.35
NA = not applicable	Acidity	11.40	1466.88	4.69	603.03
	Alkalinity	24.00	3088.17		

Table C16. Allocations EB01		
EB01	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ EB01	45.36	1466.88
Difference in measured Loads between the loads that enter and existing EB01	-4.25	-189.70
Percent loss due calculated at EB03	8.6%	11.5%
Additional load tracked from above samples	1.57	724.43
Percentage of upstream loads that reach the EB03	91.4%	88.5%
Total load tracked between EB03/EB02/BE01 and EB01	1.44	641.47
Allowable Load @ EB01	1.35	603.03
Load Reduction @ EB01	0.09	38.44
% Reduction required at EB01	6%	6%

4.25 lbs/day of manganese fell out of this segment of stream. The total manganese load tracked was 0.09 lbs/day greater than the calculated allowable load of 1.35 lbs/day. Therefore a 6% manganese reduction was necessary. 189.70 lbs/day of acidity fell out of the stream between EB03/BE01/EB02 and EB01. The total acidic load tracked was 641.47 lbs/day. The calculated allowable load was 603.03 lbs/day. The total acidic load measured was 38.44 lbs/day greater than the calculated allowable acidic load, resulting in a 6% required acidic reduction necessary.

<u>TMDL calculations- BV01- Beaver Run before confluence with East Branch Mahoning Creek</u>

The TMDL for sample point BV01 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for Beaver Run was computed using water-quality sample data collected at point BV01. The average flow, measured at the sampling point BV01 (1.41 MGD), is used for these computations.

Sample data at point BV01 shows that Beaver Run has a pH ranging between 7.0 and 7.3. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for iron and manganese has been calculated. All aluminum data was found to be at less than detection limits. Sample data shows that no reductions are necessary for acidity. Because water quality standards are met, a TMDL for aluminum and acidity isn't necessary and is not calculated. The existing and allowable loads for the aluminum at BV01 in Table C17 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C17 shows the measured and allowable concentrations and loads at BV01. Table C18 shows the reductions necessary for iron and manganese at BV01.

Table C17		Measured		Allowable	
Flow (gpm)=	980.25	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA	ND	NA

	Iron	0.15	1.8	0.06	0.7
ND = non detection	Manganese	0.07	0.8	0.01	0.1
NA = not applicable	Acidity	3.70	43.6	3.70	43.6
	Alkalinity	39.05	459.7		

Table C18. Allocations BV01		
BV01	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ BV01	1.80	0.83
Allowable Load @ BV01	0.67	0.09
Load Reduction @ BV01	1.13	0.74
% Reduction required @ BV01	63%	89%

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.

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

Use of reference stream for High Quality waters

Streams placed on the 1996 303 (d) list with a designated use of High Quality (HQ) will be subject to Pennsylvania's anti degradation policy. Therefore, DEP must establish instream goals for TMDLs that restore the waterbody to existing (pre-mining) quality.

This is accomplished by sampling an unaffected stretch of stream to use as a reference. This stretch typically is the headwaters segment of the High Quality stream in question. If an unaffected stretch isn't available, a nearby-unimpaired stream will function as a surrogate reference.

The reference stream data will be selected from statewide ambient Water Quality Network (WQN) stations. To determine which WQN station represents existing water quality appropriate for use in developing TMDLs for HQ waters, alkalinity and drainage area are considered.

1. First step is to match alkalinities of TMDL stream and WQN reference stream. If alkalinities for candidate stream are not available, use pH as a surrogate. As a last resort, if neither pH nor alkalinity are available match geologies using current geological maps.
2. The second consideration is drainage area.
3. Finally, from the subset of stations with similar alkalinity and drainage area select the station nearest the TMDL stream.

Once a reference stream is selected, the 95th percentile confidence limit on the median for aluminum, iron and manganese is used as the applicable water quality criteria and run the @Risk model.

Attachment E

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 2002and 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 F

Water Quality Data Used In TMDL Calculations

EB06	pH*	Alkalinity^	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	ug/l	ug/l	ug/l	gpm
4/28/2004	6.9	22.0	36.40	0.00	757.00	0.00	2196
8/30/2004	7.1	37.6	7.20	704.00	1170.00	0.00	661
11/10/2004	6.9	29.8	13.40	620.00	1260.00	0.00	644
3/18/2005	7.0	26.8	17.20	338.00	784.00	0.00	716
AVERAGE	7.0	29.1	18.6	415.5	992.8	0.0	1054.3
ST DEV	0.1	6.5	12.6	318.2	259.5	0.0	761.8

EB05	pH*	Alkalinity^	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	ug/l	ug/l	ug/l	gpm
4/28/2004	7.5	49	-5.60	0.00	2310.00	0.00	1573
8/30/2004	7.8	77.0	-46.20	0.00	198.00	0.00	403
11/16/2004	7.5	65.0	-41.40	0.00	1380.00	0.00	364
3/18/2005	7.6	59.8	-24.80	0.00	2170.00	0.00	853
AVERAGE	7.6	62.7	-29.5	0.0	1514.5	0.0	798.3
ST DEV	0.1	11.6	18.4	0.0	968.5	0.0	562.1

EB04	pH*	Alkalinity^	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	ug/l	ug/l	ug/l	gpm
4/28/2004	7	36.8	16.00	780.00	5560.00	0.00	377
8/30/2004	6.9	46.4	-5.00	593.00	5750.00	0.00	233
11/16/2004	7.0	65.0	-2.20	2530.00	7800.00	0.00	142
3/18/2005	6.9	49.2	-4.60	1410.00	4560.00	0.00	194
AVERAGE	7.0	49.4	1.1	1328.3	5917.5	0.0	236.5
ST DEV	0.1	11.7	10.0	874.1	1359.2	0.0	100.8

EB03	pH*	Alkalinity^	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	ug/l	ug/l	ug/l	gpm
4/28/2004	6.9	24.8	35.20	407.00	996.00	0.00	7573
8/31/2004	7.3	38.6	-0.40	385.00	411.00	0.00	2332
11/16/2004	6.9	32.2	5.00	347.00	1050.00	0.00	1883
3/18/2005	7.0	30.2	10.20	351.00	1050.00	0.00	3320
AVERAGE	7.0	31.5	12.5	372.5	876.8	0.0	3777.0
ST DEV	0.2	5.7	15.7	28.6	311.5	0.0	2600.9

BE01	pH*	Alkalinity^	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	ug/l	ug/l	ug/l	gpm
4/28/2004	6.8	15.4	26.20	0.00	118.00	0.00	14064
8/31/2004	7.1	27.4	3.80	0.00	61.00	0.00	3110
11/16/2004	6.9	24.6	9.80	0.00	142.00	0.00	2147
3/18/2005	6.8	18.6	9.80	0.00	159.00	0.00	4090

AVERAGE	6.9	21.5	12.4	0.0	120.0	0.0	5852.8
ST DEV	0.1	5.5	9.6	0.0	42.8	0.0	5531.3

EB02	**pH***	**Alkalinity^**	**Acidity**	**Iron**	**Manganese**	**Aluminum**	**Flow**
Date	**Lab**	**mg/l**	**mg/l**	**ug/l**	**ug/l**	**ug/l**	**gpm**
4/28/2004	6.8	15.6	31.20	0.00	95.00	0.00	2054
8/31/2004	7.1	32.0	11.60	529.00	101.00	0.00	527
11/10/2004	6.9	23.8	14.60	0.00	187.00	0.00	423
3/18/2005	6.8	16.4	20.00	0.00	130.00	0.00	670
AVERAGE	6.9	22.0	19.4	132.3	128.3	0.0	918.5
ST DEV	0.1	7.6	8.6	264.5	42.0	0.0	763.7

EB01	**pH***	**Alkalinity^**	**Acidity**	**Iron**	**Manganese**	**Aluminum**	**Flow**
Date	**Lab**	**mg/l**	**mg/l**	**ug/l**	**ug/l**	**ug/l**	**gpm**
4/28/2004	6.8	18.2	29.00	0.00	357.00	0.00	24055
8/31/2004	7.2	31.8	2.00	0.00	128.00	0.00	5869
11/16/2004	6.9	27.8	6.60	0.00	437.00	0.00	4516
3/18/2005	6.9	23.8	8.00	0.00	488.00	0.00	8417
AVERAGE	7.0	25.4	11.4	0.0	352.5	0.0	10714.3
ST DEV	0.2	5.8	12.0	0.0	159.1	0.0	9039.7

BV01	**pH***	**Alkalinity^**	**Acidity**	**Iron**	**Manganese**	**Aluminum**	**Flow**
Date	**Lab**	**mg/l**	**mg/l**	**ug/l**	**ug/l**	**ug/l**	**gpm**
4/28/2004	7.0	27.0	10.80	0.00	102.00	0.00	2313
8/31/2004	7.3	53.0	-8.80	613.00	0.00	0.00	486
11/16/2004	7.1	44.8	-6.00	0.00	84.00	0.00	555
3/18/2005	7.1	31.4	4.00	0.00	95.00	0.00	567
AVERAGE	7.1	39.1	0.0	153.3	70.3	0.0	980.3
ST DEV	0.1	12.0	9.1	306.5	47.4	0.0	889.2

Attachment G
Comment and Response

Comments from Kurt Weist of PennFuture

Comment:
The TMDL must include a Waste Load Allocation for the permitted, post-mining discharge of treated mine drainage from the Sky Haven Coal, Inc. Stoltz #1 Operation.

Response:
A Waste Load Allocation for Sky Haven Coal, Inc. Stoltz #1 has been added to this TMDL. Their permit was reissued January 26, 2007.

Comment:
The average flow rate in Table C9 should be 0.0445 million gallons per day.

Response:
This flow rate has been corrected in the table mentioned as well as in Table 5. *Waste Load Allocations in East Branch Mahoning Creek Watershed.*