Final

NORTH BRANCH UPPER MORGAN RUN WATERSHED TMDL

Clearfield County

For Acid Mine Drainage Affected Segments

<u>Prepared by:</u>

Pennsylvania Department of Environmental Protection

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TABLE OF CONTENTS

FIGURES

TABLES

ATTACHMENTS

[1]TMDL

North Branch Upper Morgan Run Watershed
Clearfield County, Pennsylvania

Table 1. 303(d) Sub-List								
State Water Plan (SWP) Subbasin: 08-C North Branch Upper Morgan Run								
Year	**Miles**	**Segment ID Assessment ID**	**DEP Stream Code**	**Stream Name**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1996	2.7	7174	26216	North Branch Upper Morgan Run	CWF	305(b) Report	RE	Metals
1998	1.76	7174	26216	North Branch Upper Morgan Run	CWF	SWMP	AMD	Metals
2002	7.5	990819-1045-LMS	26216	North Branch Upper Morgan Run, Wolf Run	CWF	SWMP	AMD	Metals, p
2002	1.6	990819-1040-LMS		Upper Morgan Run	CWF	SWMP	AMD	Metals, p

Cold Water Fishery=CWF
Surface Water Monitoring Program = SWMP
Surface Water Assessment Program = SWAP
Resource Extraction = RE
Abandoned Mine Drainage = AMD
See Attachment D, *Excerpts Justifying Changes Between the 1996, 1998 and 2002 Section 303(d) Lists.*
The use designations for the stream segments in this TMDL can be found in PA Title 25 Chapter 93

Introduction

This Total Maximum Daily Load (TMDL) calculation has been prepared for segments in the North Branch Upper Morgan Run Watershed **(Attachment A)**. It was done to address the impairments noted on the 1996 Pennsylvania 303(d) list, required under the Clean Water Act, and covers one segment on this list (shown in Table 1). High levels of metals, and in some areas depressed pH, caused these impairments. 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.

[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 1996 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA.*

Directions to the North Branch Upper Morgan Run Watershed

The Upper Morgan Run Watershed is located in North Central Pennsylvania, occupying a southeastern portion of Clearfield County in Bigler, Decatur and Woodward Townships. The watershed area is found on United States Geological Survey maps covering Glen Richey, Ramey and Houtzdale 7.5-Minute Quadrangles. Land uses within the watershed include abandoned mine lands, active mining operations, homes in the headwaters of the watershed and forestlands in the lower reaches of the watershed.

North Branch of Upper Morgan Run flows beneath several roads and can be easily reached. State Route 153 crosses over North Branch of Upper Morgan Run near its midsection. State Route 153 connects Houtzdale and Clearfield. The watershed lies approximately 5 miles from Houtzdale and 15 miles from Clearfield along State Route 153. The lower reaches of the watershed can be reached by taking Township Road 569 Meases Road and the headwaters can be reached by taking State Route 2014 to New Castle Road. Both of these roads are accessed from State Route 153 just north of where it crosses North Branch of Upper Morgan Run.

Geology of Upper Morgan Run Watershed

The Upper Morgan Run watershed lies within the Appalachian Plateaus Physiographic Province. The watershed area is comprised of Pennsylvanian and Mississippian aged rocks. The watershed lies between the Houtzdale-Snow Shoe Syncline and the Laurel Hill Anticline. The strata in the watershed generally have a northeast-southwest trend and dip to the south or southeast.

Older Mississippian rocks of the Mauch Chunck Formation and the Pocono Formation are exposed in the valleys of the watershed and the younger Pennsylvanian aged rocks of the Pottsville and Allegheny Groups are on the hilltops and ridges surrounding the watershed.

Segments addressed in this TMDL

There are eight active mining operations (Attachment A) in the watershed. Each active mining operation has been assigned a waste load allocation based on the active NPDES permit for each site. These discharges are point source discharges. 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.

Both River Hill Coal Company sites (Kasubick and Betz #3 Operations) have polluting discharges on them that pre-date River Hill’s operations. Moravian Run Reclamation Company, Inc Excelsior Operation also has pre-dated discharges on it’s site. The permits, therefore, are issued under DEP’s subchapter F regulations, which provide that the permittee’s effluent limits are based on baseline pollution conditions rather than standard coal mining BAT standards. Therefore, the subchapter F discharges on these sites have been treated as nonpoint source for the purpose of doing the TMDL, however, waste load allocations have been assigned to the permitted NPDES discharge points for these three active mine sites.

North Branch Upper Morgan Run is affected by pollution from AMD. This pollution has caused high levels of metals in North Branch Upper Morgan Run. All of the remaining discharges in the watershed are from abandoned mines and will be treated as non-point sources.

Clean Water Act Requirements

Section 303(d) of the 1972 Clean Water Act requires states, territories, and authorized tribes to establish water quality standards. The water quality standards identify the uses for each waterbody and the scientific criteria needed to support that use. Uses can include designations for drinking water supply, contact recreation (swimming), and aquatic life support. Minimum goals set by the Clean Water Act require that all waters be "fishable" and "swimmable."

Additionally, the federal Clean Water Act and the U.S. Environmental Protection Agency's (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 non-point sources; and

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

Despite these requirements, states, territories, authorized tribes, and EPA have not developed many TMDLs. 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, many lawsuits still are pending across the country.

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

These TMDLs were developed in partial fulfillment of the 1996 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA.*

Section 303(d) Listing Process

Prior to developing TMDLs for specific waterbodies, 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 stream segment can vary between sites. All the biological surveys included kick-screen sampling of benthic macroinvertebrates, habitat surveys, and measurements of pH, temperature, conductivity, dissolved oxygen, and alkalinity. Benthic macroinvertebrates 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 the performance of the segment using a series of biological metrics. If the stream is determined to be impaired, the source and cause of the impairment 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 TMDL for the waterbody using EPA approved methods and computer models;

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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.

3. Allocating pollutant loads to various sources;
4. Determining critical and seasonal conditions;
5. Public review and comment period on draft TMDL;
6. Submittal of final TMDL to EPA.
7. EPA approval of the TMDL.

Watershed History

The entire Upper Morgan Run watershed area is approximately 12 square miles. The North Branch Upper Morgan Run watershed is 4.03 square miles while the Upper Morgan Run watershed has an area of 6.65 miles while Wolf Run has an area of 1.28 miles. Much of the Upper Morgan Run watershed has been heavily mined by pre-law operations. 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 such as Swistock Associates Coal Company, John Deromo Coal Company and others 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 Upper Morgan Run 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 Kasubick Brothers Coal Company, Kasubick #4 Operation (SMP17820129) was issued on October 31, 1984. Actual mining on this site started in the early 1960's. The Kasubick #4 total permit area was 134.79 acres with 107.49 acres affected. The coal seams to be mined were the Clarion (107 acres), Lower Kittanning 1 (54 acres), Lower Kittanning 2 (52 acres), Lower Kittanning 3 (49 acres), Lower Kittanning 4 (28 acres) and the Middle Kittanning (12 acres). This site is still active today. This site is currently has sedimentation basins and treatment ponds that if discharging flow into Upper Morgan Run just above the Upper Morgan Run/North Branch Upper Morgan Run confluence.

The Harbison-Walker Refactories, Sanborne Strip Operation (MDP4475SM10) was issued on June 28, 1979. This permit was a continuation of the Swistock and George permit (MDP3269BSM11, Mining Permit 522-3C and Mining Permit 522-3C) that was issued in the early 1970's. The Harbison-Walker total permit area was 280 acres with 44 total acres to be affected. The coal seam mined was the Mercer coal (8 acres) and the Mercer clay was also mined (8 acres). In September of 1982, an application was submitted and approved for an additional mining on the site. This allowed 34.2 additional acres to be affected with the mining of the Mercer coal (7.6 acres) and Mercer clay (7.6 acres).

During this mining period a discharge developed onsite. This discharge was discovered in May of 1984. A compliance order was issued in July of 1984. This order required Harbison-Walker to immediately provide treatment to all discharges from the area disturbed by mining. The discharges were directed into the treatment ponds onsite. The site was backfilled in the winter of 1984. The treatment ponds were left onsite to continue the treatment of the discharges onsite. The discharge flows to a sediment pond where it is collected. Once enough water has accumulated in the sediment pond the water is pumped and flows through an aqua wheel where it is treated with soda ash. The water then travels through a series of three ponds prior to discharging to an unnamed tributary of Upper Morgan Run. This tributary enters Upper Morgan Run from the northeast near just upstream of the Upper Morgan Run/Clearfield Creek confluence. The treatment system is a batch treatment system and is still operating today. There have been no recent violations at the site.

The Sky Haven Coal, Inc., Erickson Operation (40-51-49/78-21-54 center of site) (17930124) was issued on April 10, 1995. The total permit area is 346 acres with 279.3 acres affected. The coal seams being mined are the Middle Kittanning (279.3 acres), Upper Kittanning (163.6 acres), Lower Freeport (135.5 acres) and Upper Freeport (83.7 acres). The Lower Freeport, Upper Kittanning and Middle Kittanning coals had previously been surfaced mined at the site. The current mining is reclaiming abandoned spoils from this previous mining. In addition the Upper and Lower Freeport coals have been deep mined on this site. These deep mines will be mined out with the current mining. The sedimentation and treatment ponds on this site discharge near the headwaters of North Branch of Upper Morgan Run. Mining commenced on the site in November of 1997 and continues today (July 2004).

The Shud’s Coal Hounds, Inc., Tana Rae #2 Operation (40-50-33/78-22-53)(SMP17000107) was issued on June 8, 2001. The total permit area is 146.8 acres with 130.3 acres to be affected. The coal seams being mined are the Mahoning (3.5 acres), Upper Freeport (30.6 acres), Lower Freeport (49.9 acres) and Upper Kittanning (45.5 acres). This mining operation, once completed, will have reclaimed 2 acres of abandoned mine lands and 50 acres of abandoned underground mines. Mining commenced in July of 2001 and continues today (July 2004).

The Moravian Run Reclamation Company, Inc., Excelsior Operation (SMP 17930108) was issued on July 22, 2002. This permit was initially issued to James I Cowfer under Surface Mining Permit 17930108 issued in 1993. Cowfer activated the permit by building a sediment pond, but they never mined the site. The total permit area is 286.7 acres with 272.4 acres to be affected. The coal seams to be mined are the Mahoning (2.2 acres), Upper Freeport (28 acres), Lower Freeport (239.9 acres) and Upper Kittanning (254.5 acres). The site has been deep mined in the past, especially the Lower Freeport coal seam. In addition, there are small areas of surface mining within the permit area, mainly associated with the Lower Freeport coal seam and its riders. This mining will reclaim 8.5 acres of abandoned surface mines and daylight 144.6 acres of abandoned deep mines on the Upper Kittanning coal seam, approximately 166.8 acres abandoned deep mines on the Lower Freeport coal seam, and approximately 9.5 acres of abandoned deep mines on the Upper Freeport coal seam. Daylighting these deep mines and special handling any deep mine refuse encountered will eliminate a source of pollution at this site. Mining commenced at this site in the spring of 2004 and continues today (July 2004). This permit was transferred to Amfire Mining Company, LCC on 8/19/2004 under the new permit number (17010106). Prior to mining The Moravian Run Reclamation Company established the existence of two (2) pre-existing pollutional discharges flowing from the refuse/previously mined areas. These include the following monitoring points: EX48 and EX49. These points will be monitored during the current mining to ensure that baseline pollutional loadings are not exceeded.

The River Hill Coal Company, Inc., Betz #3 Operation (40-51-40/78-25-30) (SMP17010110) was issued on August 15, 2002. The total permit area is 320.0 acres with 245.0 acres to be affected. The Lower Freeport (15.1 acres), Middle Kittanning (21.5 acres), Lower Kittanning (25.9 acres) and Clarion (55.1 acres) coal seams are to be mined. This mining will reclaim 40.0 acres of abandoned mine lands and 38.0 acres of abandoned underground mines. Mining has not yet commenced at this site as of July 2004. Prior to mining The River Hill Coal Company established the existence of four (4) pre-existing pollutional discharges flowing from the refuse/previously mined areas. These include the following monitoring points: MP5, MP15A, MP15B and MP15E. These points will be monitored during the current mining to ensure that baseline pollutional loadings are not exceeded.

The River Hill Coal Company, Inc., Kasubick Operation (40-50-30/78-24-33)(17990103) was issued on August 14, 2002. The total permit area is 228.8 acres with 218.8 acres to be affected. The Upper Freeport (27.6 acres), Lower Freeport (42.9 acres), Upper Kittanning (54.7 acres), Middle Kittanning (43.1 acres), Lower Kittanning (65.3 acres) and Clarion (150.7 acres) coal seams are to be mined. This mining will reclaim 70.3 acres of abandoned mine lands and 52.9 acres of abandoned underground mines. Mining commenced at this site in September of 2002 and continues today (July 2004). Prior to mining The River Hill Coal Company established the existence of fourteen (14) pre-existing pollutional discharges flowing from the refuse/previously mined areas. These include the following monitoring points: MP5, MP6, MP6A, MP6B, MP6C, MP7A, MP8A, MP9A, MP13C, MP14B, MP14C, MP21, MP22 and MP23. These points will be monitored during the current mining to ensure that baseline pollutional loadings are not exceeded.

The Shud's Coal Hounds, Inc., Shud #1 Operation (40-50-07/78-23-38) (17000905) was issued on April 17, 2001. The total permit area is 5.7 acres with 0.1 acres affected. The Upper Freeport (0.1 acre) coal seam is to be mined. This mining is being done under an incidental coal extraction permit. The operator is in the process of reclaiming a dangerous highwall (150 feet) and restoring and abandoned mining area. Coal removal is limited to a single cut along the highwall that is being reclaimed.

There are fourteen preexisting discharges on the River Hill Coal Company, Inc. Kasubick Operation (MP5, MP6, MP6A, MP6B, MP6C, MP7A, MP8A, MP9A, MP13C, MP14B, MP14C, MP21, MP22 and MP23), four on the River Hill Coal Company, Inc. Betz #3 Operation (MP5, MP15A, MP15B and MP15E) and 2 on the Moravian Run Reclamation Company, Inc. Excelsior Operation (EX48 and EX49). The map in attachment A shows the location of these twenty discharges. The individual discharges are not assigned load allocations, however; discharge affects on the stream are taken into account at the closest downstream sampling point and it is noted that the discharges are a contributing pollutant source to the segment.

The reduction necessary to meet applicable water quality standards from preexisting conditions (including discharges from areas coextensive with areas permitted under the remining program Subchapter F or G) are expressed in the LA portion of the TMDL. The WLAs express the basis for applicable effluent limitations on point sources. Except for any expressed assumptions, any WLA allocated to a remining permittee does not require the permittee to necessarily implement the reductions from preexisting conditions set forth in the LA. Additional requirements for the permittee to address the preexisting conditions are set forth in the applicable NPDES/mining permit

COMPLETED MINING

The Flango Brothers Coal Company, Flango #28 Strip Mine (40-50-35/78-23-18) (MDP 4372SM) was issued on January 29, 1973. The initial total permit area was 251.63 acres and by December of 1977 the total permit area had expanded to 531.95 acres. The Lower Kittanning (29.95 acres), Middle Kittanning (94.85 acres), Upper Kittanning (118.87 acres), Lower Freeport (280.69 acres) and the Upper Freeport (88.37 acres) were the coal seams mined. Mining was completed at this site in the winter of 1983-1984.

The Sky Haven Coal, Inc., Jim #3 Operation (40-51-38/78-25-37) (SMP 17910128) was issued on October 18, 1993. The total permit area was 160.5 acres with 129.5 acres affected. The Lower Freeport (54.2 acres) and the Middle Kittanning (9.4 acres) coals were mined. This mining reclaimed 4.5 acres of abandoned surface mine lands and 54.2 acres of abandoned underground mines. Mining at this site was completed in the spring of 1995.

The River Hill Coal Company, Inc., Betz #4 Operation (40-50-48/78-25-11) (SMP17000101) was issued on September 13, 2001. The total permit area was 73.9 acres with 53.4 acres affected. The Lower Freeport (35.0 acres) coal seam was mined. This mining reclaimed 10.8 acres of abandoned mine lands and 24.2 acres of underground mines. Mining was completed at the site in the fall of 2002.

The G & S Timber, Inc., Mascot #2 Operation (40-50-55/78-23-37) (SMP 17000106) was issued on December 6, 2000. The total permit area was 7.3 acres with 7.3 acres affected. The Upper Kittanning (3.3 acres) and Middle Kittanning (5.0 acres) coal seams were mined. The mining reclaimed .4 acres of abandoned mine lands. Mining was completed at the site in the summer of 2001.

AMD Methodology

A two-step approach is used for the TMDL analysis of 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, 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.

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

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.

In Low 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 may not represent 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 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 nonpoint sources as well as point sources; therefore the TMDL is expressed as Load Allocations (LAs) and 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
Manganese (Mn)	1.00	Total Recoverable
pH *	6.0-9.0	N/A

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

TMDL Elements (WLA, LA, MOS)

TMDL = WLA + LA + MOS

A TMDL equation consists of a wasteload allocation, load allocation and a margin of safety. The wasteload 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. Table 3 contains the TMDL component summary for each point evaluated in the watershed. Refer to the maps in Attachment A.

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 also 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 margin of safety (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 and each TMDL includes upstream loads.

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. There are currently seven permitted discharges in the North Branch Upper Morgan Run watershed. The difference between the TMDL and the WLA 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 to the area upstream of the point 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. North Branch Upper Morgan Run Watershed Summary Table

Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	% Reduction
NBUMR08						
Aluminum (lbs/day)	0.06	0.02	0	0.02	0.04	67%
Iron (lbs/day)	0.29	0.05	0	0.05	0.24	83%
Manganese (lbs/day)	0.69	0.03	0	0.03	0.66	96%
Acidity (lbs/day)	5.82	0.56	0	0.56	5.26	90%

NBUMR07						
Aluminum (lbs/day)	12.39	0.98	0	0.98	11.37	92%
Iron (lbs/day)	3.24	3.24	0	NA	NA	NA
Manganese (lbs/day)	48.85	1.3	0	1.3	46.9	97%
Acidity (lbs/day)	179.90	2.6	0	2.6	172.03	99%
NBUMR06						
Aluminum (lbs/day)	16.88	0.8	0	0.8	16.11	95%
Iron (lbs/day)	1.65	1.65	0	NA	NA	NA
Manganese (lbs/day)	29.23	1.1	0	1.1	28.14	96%
Acidity (lbs/day)	241.4	2.5	0	2.5	238.88	99%
NBUMR05						
Aluminum (lbs/day)	87.41	6.6	0.7	5.9	53.34	89%
Iron (lbs/day)	18.99	18.99	1.1	17.89	NA	NA
Manganese (lbs/day)	189.06	11.2	0.7	10.5	102.21	90%
Acidity (lbs/day)	1203.65	17.6	0	17.6	769.9	98%
NBUMR04						
Aluminum (lbs/day)	4.85	1.4	0	1.4	3.45	71%
Iron (lbs/day)	0.42	0.42	0	NA	NA	NA
Manganese (lbs/day)	7.88	1.8	0	1.8	6.06	77%
Acidity (lbs/day)	148.57	15.9	0	15.9	132.72	89%
NBUMR03						
Aluminum (lbs/day)	91.48	9.1	0	9.1	0	0%*
Iron (lbs/day)	20.06	13.5	0	13.5	6.54	33%
Manganese (lbs/day)	194.89	12.2	0	12.2	0.60	5%
Acidity (lbs/day)	1772.6	27.9	0	27.9	425.95	94%
NBUMR02						
Aluminum (lbs/day)	4.9	1.98	0	1.98	2.92	60%
Iron (lbs/day)	ND	NA	0	NA	NA	NA
Manganese (lbs/day)	16.76	4.97	0	4.97	11.79	70%
Acidity (lbs/day)	293.35	34.9	0	34.9	258.46	88%
NBUMR01						
Aluminum (lbs/day)	127.17	16.7	0	16.7	25.17	60%
Iron (lbs/day)	20.31	20.31	0	NA	NA	NA
Manganese (lbs/day)	284.71	23.0	0	23.0	67.3	75%
Acidity (lbs/day)	3062.46	73.9	0	73.9	985.35	93%
UMR06						
Aluminum (lbs/day)	143.74	12.6	4.2	8.4	131.19	91%
Iron (lbs/day)	71.96	39.1	6.6	32.5	32.91	46%
Manganese (lbs/day)	263.19	18.1	4.2	13.9	245.05	93%
Acidity (lbs/day)	2284.14	0	0	0	2284.14	100%
UMR05						
Aluminum (lbs/day)	246.36	30.0	0	30.0	0	0%*
Iron (lbs/day)	163.21	61.3	0	61.3	69.02	53%
Manganese (lbs/day)	515.29	45.1	0	45.1	0	0%*
Acidity (lbs/day)	4845.00	32.9	0	32.9	34.1	51%

UMR04						
Aluminum (lbs/day)	ND	NA	0	NA	NA	NA
Iron (lbs/day)	ND	NA	0	NA	NA	NA
Manganese (lbs/day)	0.02	0.02	0	NA	NA	NA
Acidity (lbs/day)	8.74	1.7	0	1.7	7.02	80%
UMR03						
Aluminum (lbs/day)	261.93	34.3	0	34.3	11.21	25%
Iron (lbs/day)	152.81	68.3	0	68.3	0	0%*
Manganese (lbs/day)	535.76	48.8	0	48.8	16.71	25%
Acidity (lbs/day)	5746.46	42.7	0	42.7	884.66	95%
UMR02						
Aluminum (lbs/day)	4.56	2.05	0.05	2.0	2.51	55%
Iron (lbs/day)	ND	NA	0.07	NA	NA	NA
Manganese (lbs/day)	6.98	2.81	0.05	2.76	4.17	60%
Acidity (lbs/day)	205.46	26.3	0	26.3	179.18	87%
UMR01						
Aluminum (lbs/day)	262.93	37.1	0	37.1	0	0%*
Iron (lbs/day)	144.62	77.6	0	77.6	0	0%*
Manganese (lbs/day)	539.86	50.8	0	50.8	0.6	1%
Acidity (lbs/day)	6084.24	45.1	0	45.1	156.21	78%

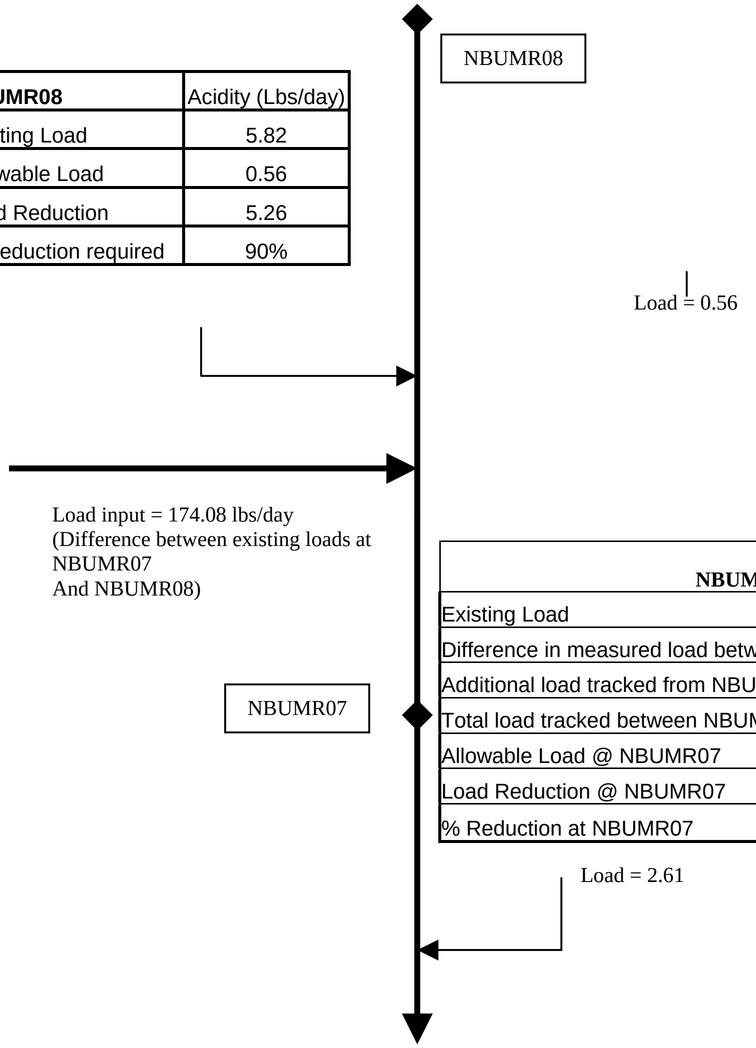
* Total of loads affecting this segment is less than the allowable load calculated at this point, therefore no reduction is necessary. ND = non detection NA = not applicable

In the instance that the allowable load is equal to the measured load (e.g. manganese UMR04, Table 3), the simulation determined that water quality standards are being met instream and therefore 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 eight permitted mine drainage discharges contained in the North Branch Upper Morgan and Upper Morgan Run watersheds. Waste load allocations are calculated using the method to quantify treatment pond pollutant load described in the above section except for the Harbison-Walker discharge, which used measured flow values for waste load calculation. The WLA for the Sky Haven discharge is being evaluated at sample point NBUMR05 on North Branch Upper Morgan Run. Kasubick #4, Moravian, Shuds Tana Rae #2, Shuds #1, River Hill Kasubick and River Hill Betz #3 are all evaluated at UMR06 on Upper Morgan Run. Harbison-Walker discharge is being evaluated at UMR02. No required reductions of permit limits are needed at this time. All necessary reductions are assigned to non-point sources.

Table 4 Waste Load Allocations at Discharges			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Sky Haven			
Al	2	0.044496	0.7
Fe	3	0.044496	1.1
Mn	2	0.044496	0.7
Kasubick #4			
Al	2	0.044496	0.7
Fe	3	0.044496	1.1
Mn	2	0.044496	0.7
Moravian			
Al	2	0.044496	0.7
Fe	3	0.044496	1.1
Mn	2	0.044496	0.7
Shuds Tana Rae #2			
Al	2	0.044496	0.7
Fe	3	0.044496	1.1
Mn	2	0.044496	0.7
Shuds #1			
Al	2	0.044496	0.7
Fe	3	0.044496	1.1
Mn	2	0.044496	0.7
River Hill Kasubick			
Al	2	0.044496	0.7
Fe	3	0.044496	1.1
Mn	2	0.044496	0.7
River Hill Betz #3			
Al	2	0.044496	0.7
Fe	3	0.044496	1.1
Mn	2	0.044496	0.7
Harbison - Walker			
Al	2	0.0029	0.05
Fe	3	0.0029	0.07
Mn	2	0.0029	0.05

On the following page is an example of how the allocations, presented in Table 3, for a stream segment are calculated. For this example, acidity allocations for NBUMR07 of North Branch Upper Morgan Run 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.



NBUMR08	Acidity (Lbs/day)
Existing Load	5.82
Allowable Load	0.56
Load Reduction	5.26
% Reduction required	90%

NBUMR07	Acidity (Lbs/day)
Existing Load	179.90
Difference in measured load between NBUMR07 and NBUMR08	174.08
Additional load tracked from NBUMR08	0.56
Total load tracked between NBUMR07 and NBUMR08	174.64
Allowable Load @ NBUMR07	2.61
Load Reduction @ NBUMR07	172.03
% Reduction at NBUMR07	99%

The allowable load tracked from NBUMR08 was 0.56 lbs/day. The existing load at NBUMR08 was subtracted from the existing load at NBUMR07 to show the actual measured increase of acidity load that has entered the stream between these two sample points (174.08 lbs/day). This value was then added to the allowable load at NBUMR08 to calculate the total load that was tracked between NBUMR07 and NBUMR08 (allowable load @ NBUMR08 + the difference in existing load between NBUMR07 and NBUMR08). The total load tracked was then subtracted from the calculated allowable load at NBUMR07 to determine the amount of load to be reduced at NBUMR07. This value was found to be 174.64 lbs/day; it was 172.03 lbs/day greater then the NBUMR07 allowable load of 2.61 lbs/day. Therefore, a 99% reduction at NBUMR07 is necessary. From this point, the allowable load at NBUMR07 will be tracked to the next downstream point, NBUMR05.

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 Clearfield Creek Watershed Association is an active watershed group focusing on AMD problems within the Clearfield Creek Watershed. The group is currently focusing its efforts on AMD impaired segments in and near the headwaters of Clearfield Creek in an effort to restore a headwaters section of Clearfield Creek. Once the efforts are completed in the headwaters the group may move to other sections of the Clearfield Creek watershed and focus on watersheds such as Upper Morgan Run.

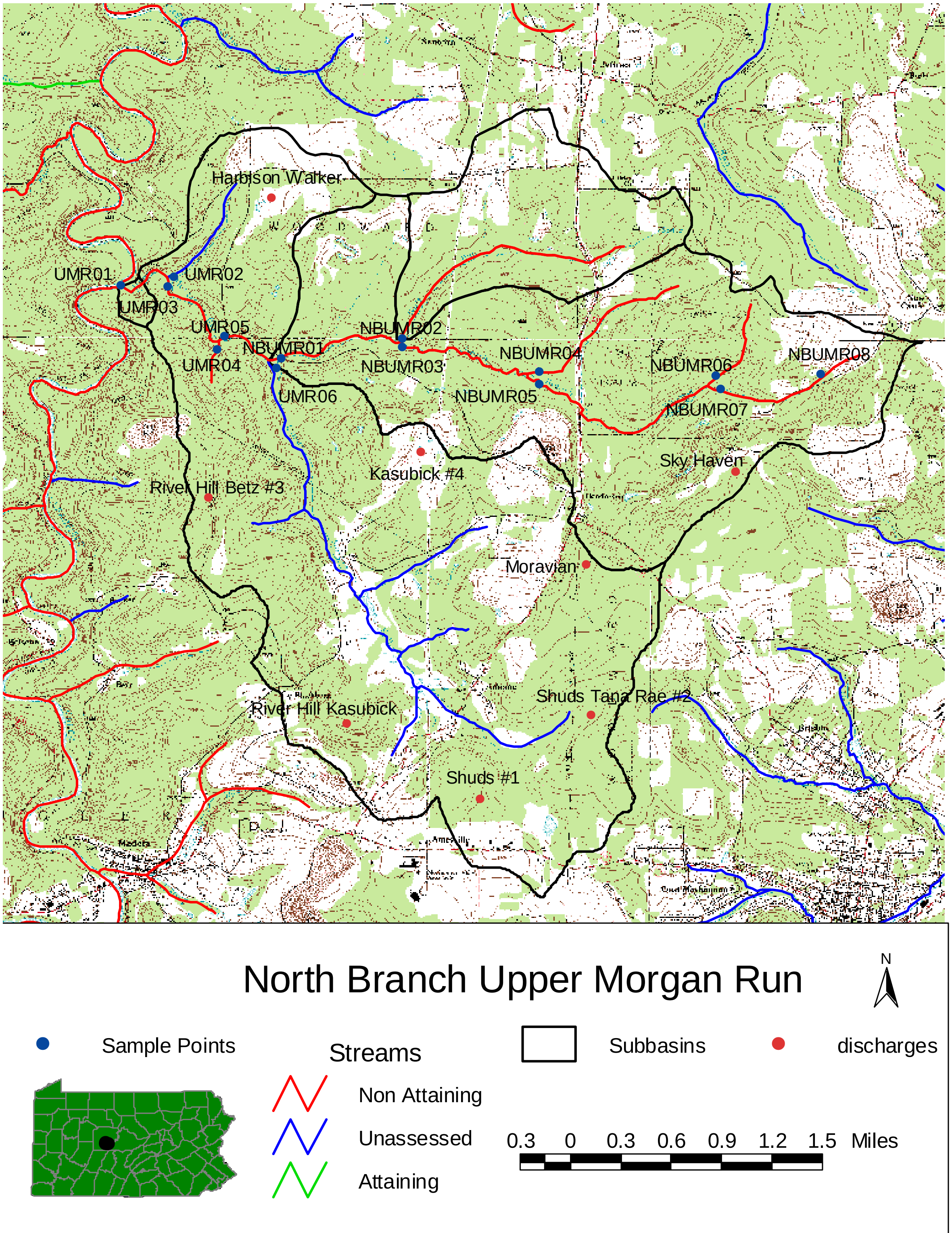
The coal industry, through DEP-promoted remining efforts, can help to eliminate some sources of AMD and conduct some of the remediation identified in the above recommendations through the permitting, mining, and reclamation of abandoned and disturbed mine lands. Special consideration should be given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

Public Participation

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* and the Progress to foster public comment on the allowable loads calculated. A public meeting was held on Wednesday November 17, 2004, at Clearfield County Multiservice Center in Clearfield, PA, to discuss the proposed TMDL.

Attachment A

North Branch Upper Morgan Run Watershed Maps


Harbison Walker
UMR01
UMR02
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NBUMR05
NBUMR06
NBUMR07
NBUMR08
UMR06
Kasubick #4
River Hill Betz #3
Sky Haven
Moravian
Shuds Tana Rae #2
River Hill Kasubick
Shuds #1
North Branch Upper Morgan Run
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Sample Points
Streams
Non Attaining
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discharges
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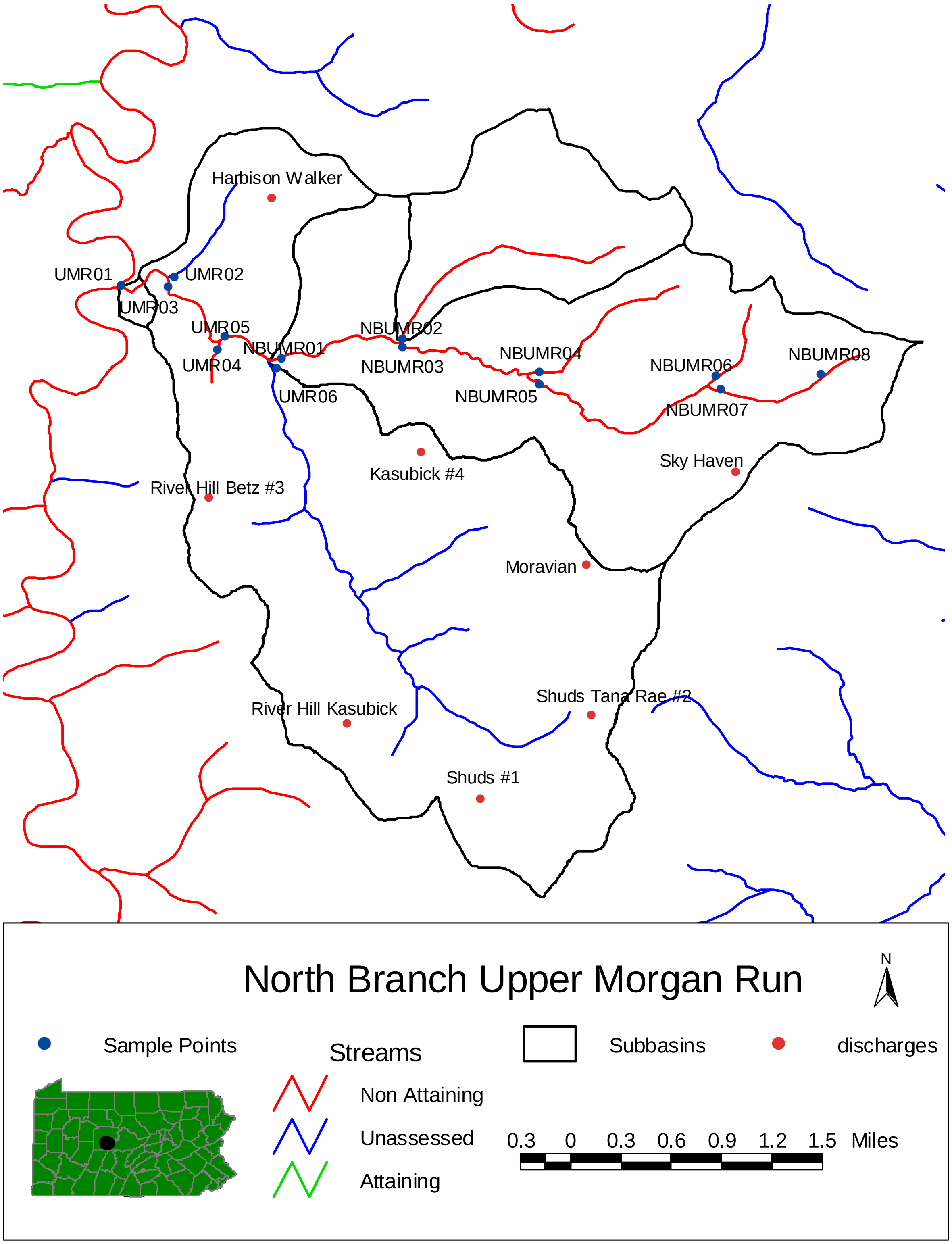
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NBUMR06
NBUMR07
NBUMR08
Kasubick #4
Sky Haven
River Hill Betz #3
Moravian
River Hill Kasubick
Shuds Tana Rae #2
Shuds #1
North Branch Upper Morgan Run
N
Sample Points
Streams
Non Attaining
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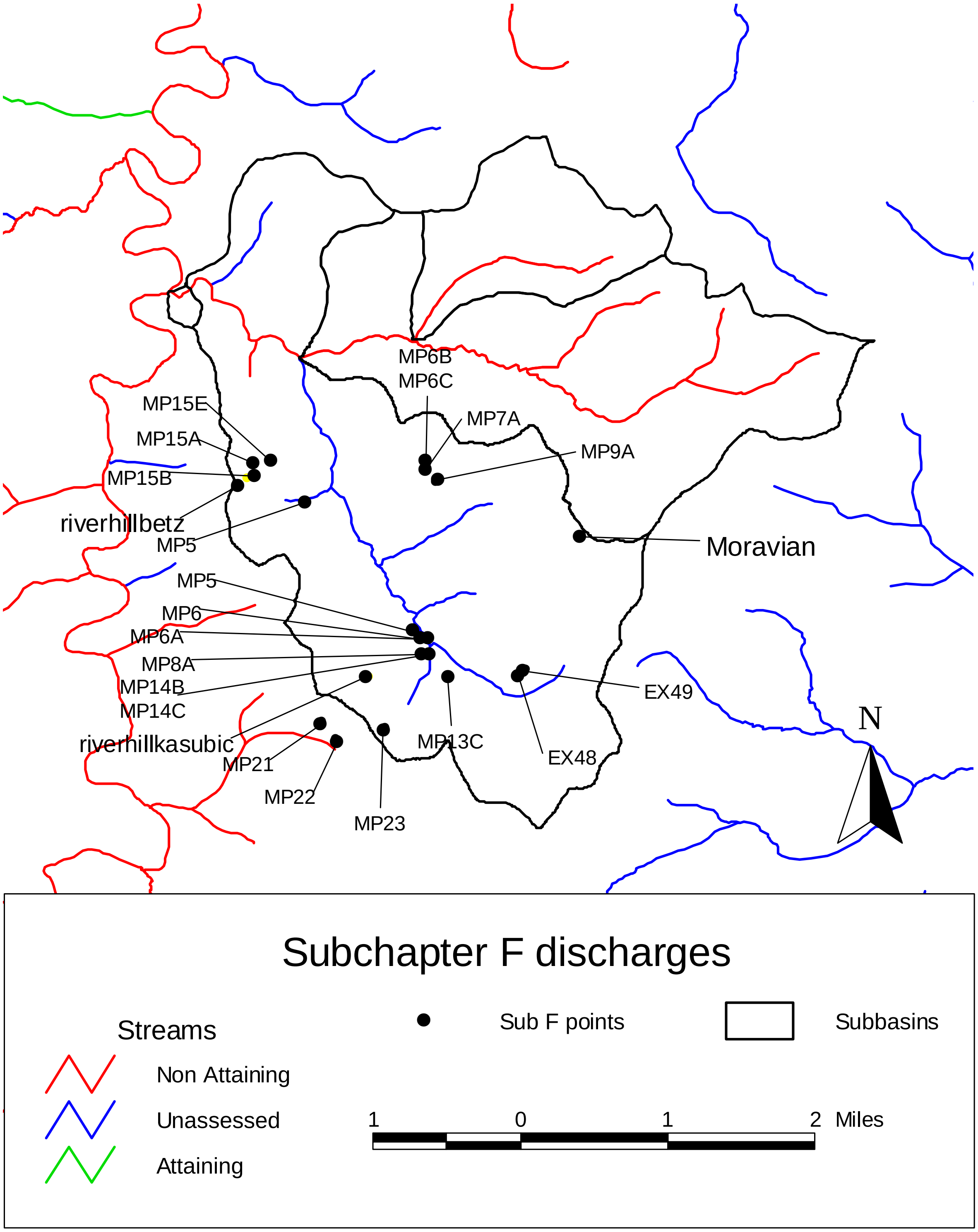
Subbasins
discharges
0.3 0 0.3 0.6 0.9 1.2 1.5 Miles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MP6C
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MP9A
MP15E
MP15A
MP15B
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Moravian
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MP6
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MP14B
MP14C
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Attachment B

Method for Addressing Section 303(d) Listings for pH and *Surface Mining Control and Reclamation Act*

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 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.*

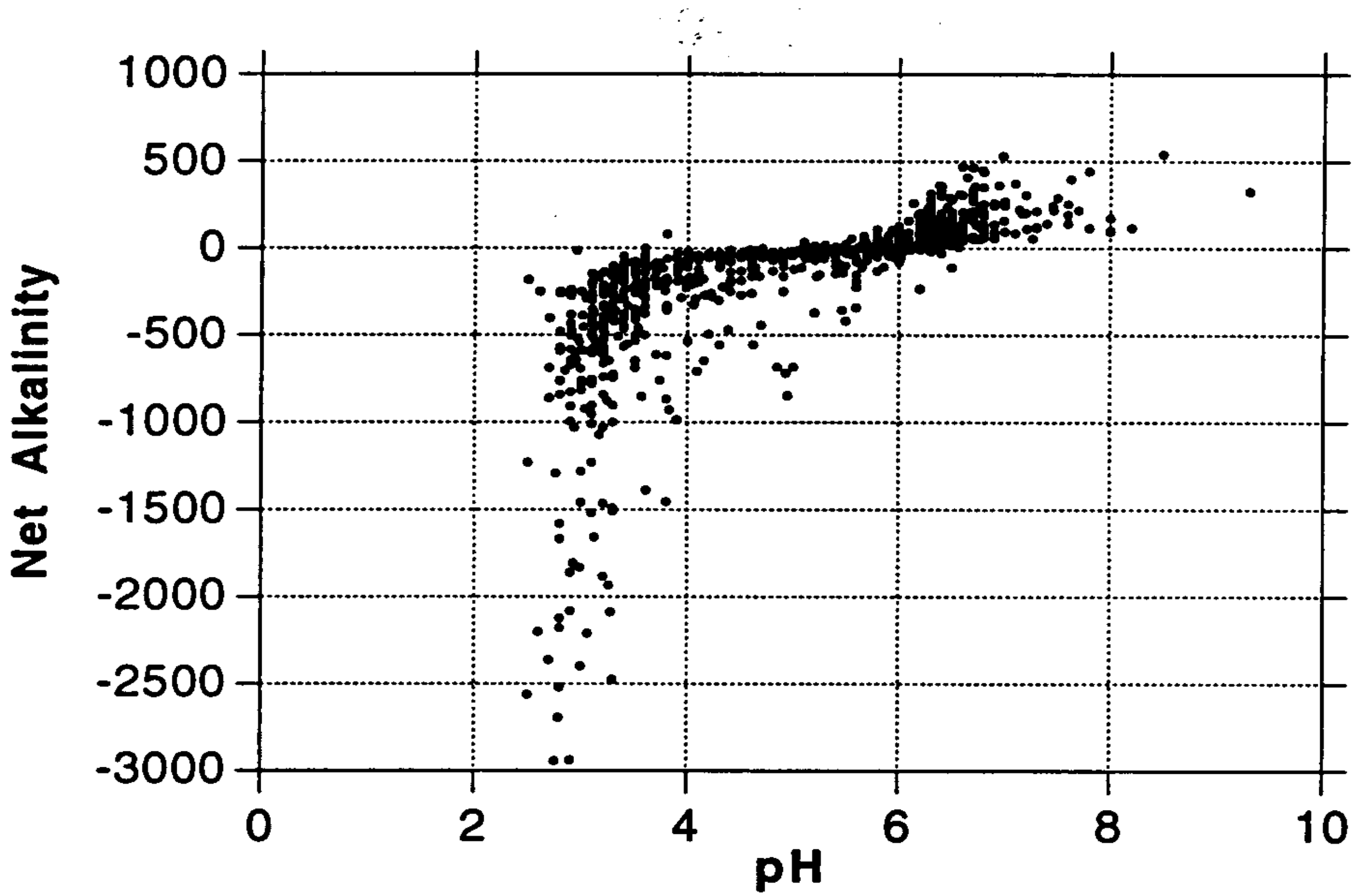


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

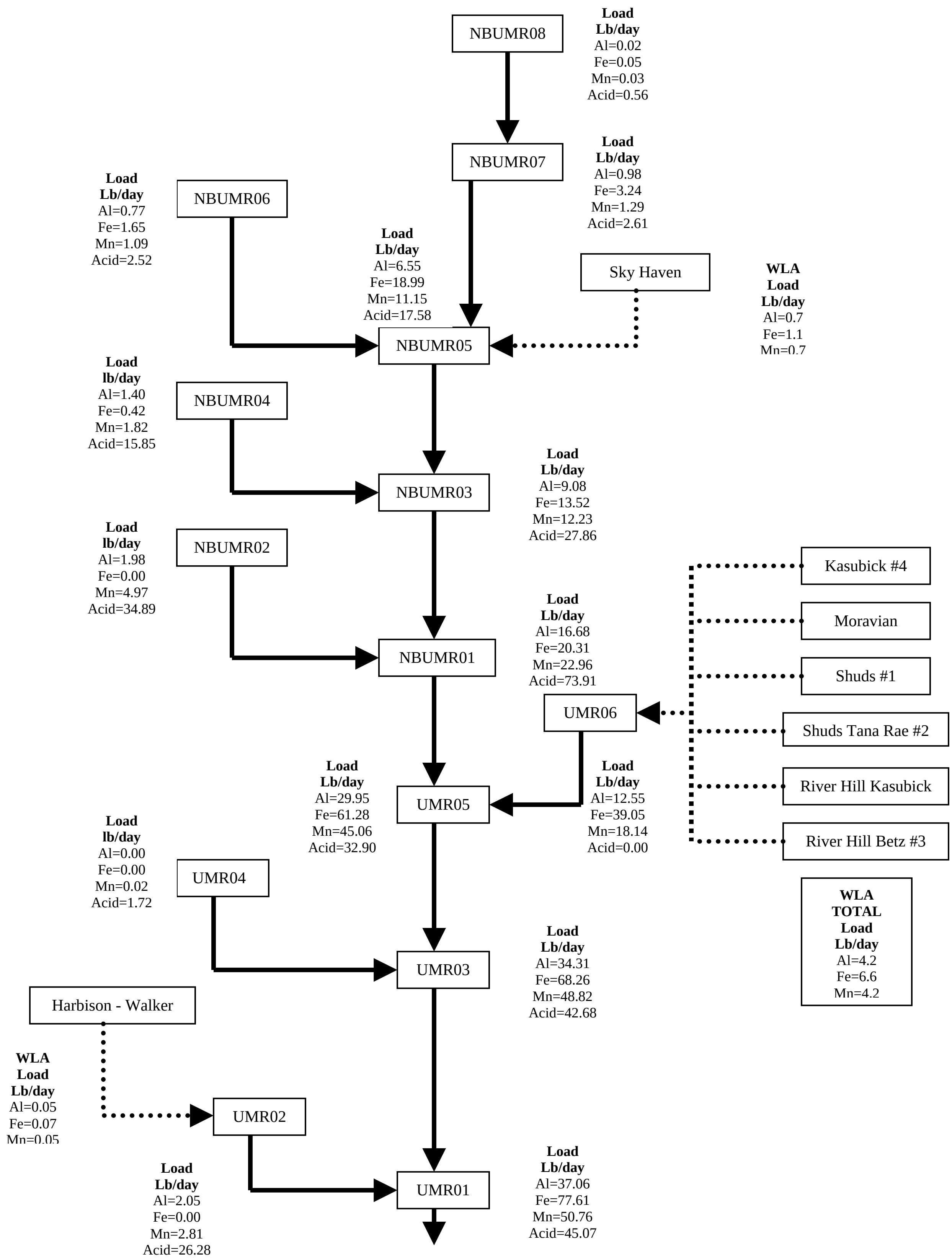
Attachment C
TMDLs By Segment

North Branch Upper Morgan Run

The TMDL for North Branch Upper Morgan Run consists of load allocations to five sampling sites along the stream (NBUMR08, NBUMR07, NBUMR05, NBUMR03 and NBUMR01), three sites on tributaries of North Branch Upper Morgan Run (NBUMR06, NBUMR04 and NBUMR02), four sampling sites on Upper Morgan Run (UMR06, UMR05, UMR03 and UMR01) and two sites on tributaries of Upper Morgan Run (UMR04 and UMR02). Data sets include 4 samples taken roughly on the same days for each sample point. All sample points are shown on the maps included in Attachment A as well as on the loading schematic drawn on the following page.

North Branch Upper Morgan Run is listed on the 1996 PA Section 303(d) list for metals from AMD as being the cause of the degradation to the stream. Although this TMDL will focus primarily on metals analysis to the North Branch Upper Morgan Run watershed, pH and reduced acid loading will be performed as well. 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 lognormally 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.


NBUMR08
Load Lb/day Al=0.02 Fe=0.05 Mn=0.03 Acid=0.56
NBUMR07
Load Lb/day Al=0.98 Fe=3.24 Mn=1.29 Acid=2.61
NBUMR06
Load Lb/day Al=0.77 Fe=1.65 Mn=1.09 Acid=2.52
Load Lb/day Al=6.55 Fe=18.99 Mn=11.15 Acid=17.58
Sky Haven
WLA Load Lb/day Al=0.7 Fe=1.1 Mn=0.7
NBUMR05
NBUMR04
Load lb/day Al=1.40 Fe=0.42 Mn=1.82 Acid=15.85
NBUMR03
Load Lb/day Al=9.08 Fe=13.52 Mn=12.23 Acid=27.86
NBUMR02
Load lb/day Al=1.98 Fe=0.00 Mn=4.97 Acid=34.89
Kasubick #4
Moravian
Shuds #1
Shuds Tana Rae #2
River Hill Kasubick
River Hill Betz #3
NBUMR01
Load Lb/day Al=16.68 Fe=20.31 Mn=22.96 Acid=73.91
UMR06
UMR05
Load Lb/day Al=29.95 Fe=61.28 Mn=45.06 Acid=32.90
Load Lb/day Al=12.55 Fe=39.05 Mn=18.14 Acid=0.00
WLA TOTAL Load Lb/day Al=4.2 Fe=6.6 Mn=4.2
UMR04
Load lb/day Al=0.00 Fe=0.00 Mn=0.02 Acid=1.72
UMR03
Load Lb/day Al=34.31 Fe=68.26 Mn=48.82 Acid=42.68
Harbison - Walker
WLA Load Lb/day Al=0.05 Fe=0.07 Mn=0.05
UMR02
Load Lb/day Al=2.05 Fe=0.00 Mn=2.81 Acid=26.28
UMR01
Load Lb/day Al=37.06 Fe=77.61 Mn=50.76 Acid=45.07

TMDL calculations- NBUMR08-Headwaters segment of North Branch Upper Morgan Run

The TMDL for sample point NBUMR08 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this headwaters segment was computed using water-quality sample data collected at point NBUMR08. The average flow, measured at the sampling point NBUMR08 (0.02 MGD), is used for these computations. Because this is the most upstream point of this segment, the allowable load allocations calculated at NBUMR08 is equal to the actual load that will directly affect the downstream point NBUMR07.

Sample data at point NBUMR08 shows that the headwaters of North Branch Upper Morgan Run have a pH ranging between 4.9 and 5.1. Because of the high pH values, there currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for aluminum, iron, manganese and acidity at NBUMR08 have been calculated. Table C1 shows the measured and allowable concentrations and loads at NBUMR08. Table C2 shows percent reductions for aluminum, iron, manganese and acidity required at this point.

Table C1		Measured		Allowable	
Flow (gpm)=	14.25	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.37	0.1	0.13	0.02
	Iron	1.70	0.3	0.27	0.1
	Manganese	4.01	0.7	0.20	0.03
	Acidity	34.00	5.8	3.30	0.6
	Alkalinity	10.25	1.8		

Table C2. Allocations NBUMR08				
NBUMR08	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ NBUMR08	0.06	0.29	0.69	5.82
Allowable Load @ NBUMR08	0.02	0.05	0.03	0.56
Load Reduction @ NBUMR08	0.04	0.24	0.66	5.26
% Reduction required @ NBUMR08	67%	83%	96%	90%

TMDL calculations- NBUMR07 Above confluence with unnamed tributary near headwaters

The TMDL for sampling point NBUMR07 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 was computed using water-quality sample data collected at point NBUMR07. The average flow, measured at the sampling point NBUMR07 (0.32 MGD), is used for these computations. The loads calculated at NBUMR07 will directly affect the downstream point NBUMR05.

Sample data at point NBUMR07 shows pH ranging between 3.8 and 4.7; 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 NBUMR07 for aluminum, 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 point NBUMR08 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between point NBUMR07 and NBUMR08 to determine a total load tracked for the segment of stream between NBUMR08 and NBUMR07. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at NBUMR07.

A TMDL for aluminum, manganese and acidity at NBUMR07 have been calculated. The measured sample data at iron was above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for this parameter isn't necessary and is not calculated. In this case, the accounting for upstream loads

Table C3 shows the measured and allowable concentrations and loads at NBUMR07. Table C4 shows the percent reduction needed for aluminum, manganese and acidity at this point.

Table C3		Measured		Allowable	
Flow (gpm)=	224.75	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	4.59	12.4	0.36	1.0
	Iron	1.20	3.2	1.20	3.2
	Manganese	18.10	48.9	0.48	1.3
ND = non detection	Acidity	66.65	179.9	0.97	2.6
NA = not applicable	Alkalinity	2.00	5.4		

Table C4. Allocations NBUMR07			
NBUMR07	Al (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ NBUMR07	12.39	48.85	179.90
Difference in measured Loads between the loads that enter and existing NBUMR07	12.33	48.16	174.08
Additional load tracked from above samples	0.02	0.03	0.56
Total load tracked between NBUMR08 and NBUMR07	12.35	48.19	174.64
Allowable Load @ NBUMR07	0.98	1.29	2.61
Load Reduction @ NBUMR07	11.37	46.90	172.03
% Reduction required at NBUMR07	92%	97%	99%

The percent reduction required for aluminum at M2 was calculated at 92%. The upstream existing load for aluminum from NBUMR08 was found to be 12.33 lbs/day less than the existing load at sample point NBUMR07. The total aluminum load tracked was 11.37 lbs/day greater than the calculated allowable load of 0.98 lbs/day. The total manganese load tracked between

NBUMR08 and NBUMR07 was 46.90 lbs/day greater than the calculated allowable manganese load of 1.29 lbs/day. This resulted in a required 97% manganese reduction. The total acidic load measured at NBUMR07 required a 99% reduction or 172.03 lbs/day to reach the calculated allowable acidic load of 2.61 lbs/day.

TMDL calculations- NBUMR06-unnamed tributary to North Branch Upper Morgan Run

The TMDL for sample point NBUMR06 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this unnamed tributary segment was computed using water-quality sample data collected at point NBUMR06. The average flow, measured at the sampling point NBUMR06 (0.33 MGD), is used for these computations. Because this is the most upstream point of this segment, the allowable load allocations calculated at NBUMR06 is equal to the actual load that will directly affect the downstream point NBUMR05.

Sample data at point NBUMR06 shows that this unnamed tributary to North Branch Upper Morgan Run has a pH ranging between 3.7 and 4.1. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for aluminum, manganese and acidity at NBUMR06 has been calculated. The measured sample data at iron was above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for this parameter isn't necessary and is not calculated.

Table C5 shows the measured and allowable concentrations and loads at NBUMR06. Table C6 shows percent reductions for aluminum, manganese and acidity required at this point.

Table C5		Measured		Allowable	
Flow (gpm)=	230.25	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	6.11	16.9	0.28	0.8
	Iron	0.60	1.7	0.60	1.7
	Manganese	10.57	29.2	0.39	1.1
	Acidity	87.30	241.4	0.91	2.5
	Alkalinity	1.50	4.2		

Table C6. Allocations NBUMR06			
NBUMR06	Al (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ NBUMR06	16.88	29.23	241.40
Allowable Load @ NBUMR06	0.77	1.09	2.52
Load Reduction @ NBUMR06	16.11	28.14	238.88
% Reduction required @ NBUMR06	95%	96%	99%

Waste Load Allocation – Sky Haven Coal Co., Erickson Operation

The Sky Haven Coal, Inc., SMP 17930124, NPDES permit no. PA 0219649 has a permitted discharge that is evaluated in the calculated allowable loads at NBUMR05. Waste load allocations are calculated using a method to quantify treatment pond pollutant loads for aluminum, iron and manganese. The following table shows the waste load allocation for this discharge.

Table C7. Waste Load Allocations at Sky Haven

Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Sky Haven Coal, Inc.			
Al	2	0.044496	0.7
Fe	3	0.044496	1.1
Mn	2	0.044496	0.7

TMDL calculations- NBUMR05 North Branch Upper Morgan Run above tributary along SR153

The TMDL for sampling point NBUMR05 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 was computed using water-quality sample data collected at point NBUMR05. The average flow, measured at the sampling point NBUMR05 (2.23 MGD), is used for these computations. The loads calculated at NBUMR05 will directly affect the downstream point NBUMR03.

Sample data at point NBUMR05 shows pH ranging between 3.6 and 4.1; 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 NBUMR05 for aluminum, 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 loads from point NBUMR06 and NBUMR07 show the total load that was permitted from upstream sources. This value was added to the difference in existing loads between point NBUMR05 and NBUMR06/ NBUMR07 to determine a total load tracked for the segment of stream between NBUMR05 and NBUMR06/ NBUMR07. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at NBUMR05.

A TMDL for aluminum, manganese and acidity at NBUMR05 have been calculated. The measured sample data at iron was above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for this parameter isn’t necessary and is not calculated.

Table C8 shows the measured and allowable concentrations and loads at NBUMR05. Table C9 shows the percent reduction needed for aluminum, manganese and acidity at this point.

Table C8		Measured		Allowable	
Flow (gpm)=	1550.25	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	4.70	87.4	0.35	6.6
	Iron	1.02	19.0	1.02	19.0
	Manganese	10.16	189.1	0.60	11.2
	Acidity	64.65	1203.7	0.94	17.6
	Alkalinity	1.85	34.4		

Table C9. Allocations NBUMR05			
NBUMR05	Al (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ NBUMR05	87.41	189.06	1203.65
Difference in measured Loads between the loads that enter and existing NBUMR05	58.14	110.98	782.35
Additional load tracked from above samples	1.75	2.38	5.13
Total load tracked between NBUMR07/NBUMR06 and NBUMR05	59.89	113.36	787.48
Allowable Load @ NBUMR05	6.55	11.15	17.58
Load Reduction @ NBUMR05	53.34	102.21	769.90
% Reduction required at NBUMR05	89%	90%	98%

The total aluminum load tracked at NBUMR05 was found to be 53.34 lbs/day greater than the calculated aluminum load of 6.55 lbs/day. This resulted in a 89% aluminum reduction required at NBUMR05. Upstream manganese loads totaled 113.36 lbs/day, which was 102.21 lbs/day greater than the calculated manganese allowable load of 11.15 lbs/day, requiring a 90% reduction. The acidic loading at NBUMR05 needed a 98% reduction from the total load tracked at this point to achieve the calculated allowable acidic load or 17.58 lbs/day.

TMDL calculations- NBUMR04 unnamed tributary to North Branch Upper Morgan Run along SR153

The TMDL for sample point NBUMR04 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this tributary segment was computed using water-quality sample data collected at point NBUMR04. The average flow, measured at the sampling point NBUMR04 (0.35 MGD), is used for these computations. The allowable load calculated at NBUMR04 will directly affect the downstream point NBUMR03.

Sample data at point NBUMR04 shows pH ranging between 4.6 and 5.0; 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.

A TMDL for aluminum, manganese and acidity at NBUMR04 has been calculated. The measured sample data for iron was above detection limits for one sample and below detection limits for the remaining three samples. All iron samples fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for this parameter isn't necessary and is not calculated.

Table C10 shows the measured and allowable concentrations and loads at NBUMR04. Table C11 shows the percent reduction for all parameters required at this point.

Table C10		Measured		Allowable	
Flow (gpm)=	244.25	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	1.65	4.9	0.48	1.4
	Iron	0.14	0.4	0.14	0.4
	Manganese	2.69	7.9	0.62	1.8
	Acidity	50.65	148.6	5.40	15.9
	Alkalinity	7.05	20.7		

Table C11. Allocations NBUMR04			
NBUMR04	Al (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ NBUMR04	4.85	7.88	148.57
Allowable Load @ NBUMR04	1.40	1.82	15.85
Load Reduction @ NBUMR04	3.45	6.06	132.72
% Reduction required @ NBUMR04	71%	77%	89%

TMDL Calculation –NBUMR03 above confluence with Wolf Run(tributary) to North Branch Upper Morgan Run

The TMDL for sampling point NBUMR03 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 was computed using water-quality sample data collected at point NBUMR03. The average flow, measured at the sampling point NBUMR03 (2.97 MGD), is used for these computations. The loads calculated at NBUMR03 will directly affect the downstream point NBUMR01.

Sample data at point NBUMR03 shows pH ranging between 3.8 and 4.3; 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 NBUMR03 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 loads from point NBUMR05 and NBUMR04 show the total load that was permitted from upstream sources. This value was added to the difference in existing loads between point NBUMR03 and NBUMR05/ NBUMR04 to determine a total load tracked for the segment of stream between NBUMR03 and NBUMR05/ NBUMR04. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at NBUMR03.

A TMDL for aluminum, iron, manganese and acidity at NBUMR03 have been calculated. Table C12 shows the measured and allowable concentrations and loads at NBUMR03. Table C13 shows the percent reduction needed for aluminum, iron, manganese and acidity at this point.

Table C12		Measured		Allowable	
Flow (gpm)=	2060.00	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	3.70	91.5	0.37	9.1
	Iron	0.81	20.1	0.55	13.5
	Manganese	7.88	194.9	0.49	12.2
	Acidity	71.65	1772.6	1.13	27.9
	Alkalinity	2.15	53.2		

Table C13. Allocations NBUMR03				
NBUMR03	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ NBUMR03	91.48	20.06	194.89	1772.60
Difference in measured Loads between the loads that enter and existing NBUMR03	-0.78	0.65	-2.05	420.38
Percent loss due calculated at NBUMR03	1%	NA	1%	NA
Additional load tracked from above samples	7.95	19.41	12.97	33.43
Percentage of upstream loads that reach the NBUMR03	99%	NA	99%	NA
Total load tracked between NBUMR05/NBUMR04 and NBUMR03	7.88	20.06	12.84	453.81
Allowable Load @ NBUMR03	9.08	13.52	12.23	27.86
Load Reduction @ NBUMR03	-1.20	6.54	0.60	425.95
% Reduction required at NBUMR03	0%	33%	5%	94%

The percent reduction for aluminum at NBUMR03 was calculated at 0. The upstream existing aluminum loads from NBUMR04 and NBUMR05 were summed and found to be greater than the existing aluminum load at sample point NBUMR03. The percent of upstream load that actually reaches sample point NBUMR03 was calculated resulting in a value for percent loss of upstream load that occurs before the aluminum load reaches this sample point. Therefore this loss is considered in the reductions at NBUMR03. A loss of 0.78 lbs/day of aluminum between upstream points and NBUMR03 results in a 1% loss in this segment of stream. This loss can be attributed to instream processes. The same can be shown for manganese at NBUMR03. The sum of the upstream sources was 2.05 lbs/day greater than the existing manganese load at NBUMR03. 1% of the manganese load has been lost to instream processes, resulting in no reduction necessary at NBUMR03. The iron loading at NBUMR03 was calculated at 20.06 lbs/day, 0.65 lbs/day greater than the entering loads.. The calculated allowable load was found to be 13.52 lbs/day, resulting in a required iron reduction of 6.54 lbs/day or 33%. The acidic value tracked was 425.95 lbs/day greater than the allowable acidic load at NBUMR03 calculating a 94% reduction.

TMDL calculations- NBUMR02 Wolf Run before confluence with North Branch Upper Morgan Run

The TMDL for sample point NBUMR02 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this tributary was computed using water-quality sample data collected at point NBUMR02. The average flow, measured at the sampling point NBUMR02 (1.14 MGD), is used for these computations. The allowable load calculated at NBUMR02 will directly affect the downstream point NBUMR01.

Sample data at point NBUMR02 shows pH ranging between 4.6 and 5.0; 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.

A TMDL for aluminum, manganese and acidity at NBUMR02 has been calculated. All measured sample data for iron fell below detection limits. Because water quality standards are met, a TMDL for iron isn't necessary and is not calculated. Iron's existing load values at NBUMR02 in Table C14 will be denoted as "NA".

Table C14 shows the measured and allowable concentrations and loads at NBUMR02. Table C15 shows the percent reductions for aluminum, manganese and acidity that are calculated at NBUMR02.

Table C14		Measured		Allowable	
Flow (gpm)=	790.50	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.52	4.9	0.21	2.0
	Iron	ND	NA		
	Manganese	1.77	16.8	0.52	5.0
ND = non detection	Acidity	30.90	293.4	3.68	34.9
NA = not applicable	Alkalinity	6.75	64.1		

Table C15. Allocations NBUMR02			
NBUMR02	Al (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ NBUMR02	4.90	16.76	293.35
Allowable Load @ NBUMR02	1.98	4.97	34.89
Load Reduction @ NBUMR02	2.92	11.79	258.46
% Reduction required @ NBUMR02	60%	70%	88%

TMDL Calculation –NBUMR01 North Branch Upper Morgan Run before confluence with Upper Morgan Run

The TMDL for sampling point NBUMR01 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this most downstream segment on North Branch Upper Morgan Run was computed using water-quality sample data collected at point NBUMR01. The average flow, measured at the sampling point NBUMR01 (5.44 MGD), is used for these computations. The existing load allocations calculated at NBUMR01 will directly affect the downstream point UMR05.

Sample data at point NBUMR01 shows pH ranging between 3.9 and 4.3; 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 NBUMR01 for all parameters 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 allowable loads already specified from upstream sources. The existing load from points NBUMR03 and NBUMR02 show the total load that was permitted from upstream sources. This value, for each parameter, was subtracted from the actual load at point NBUMR01 to determine a remaining allowable load for the segment of stream between NBUMR03 – NBUMR02 and NBUMR01. This remaining load will determine if further reductions are needed to meet the calculated TMDL at NBUMR01.

A TMDL for aluminum, manganese and acidity at NBUMR01 has been calculated. The measured sample data at iron was above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for iron isn't necessary and is not calculated.

Table C16 shows the measured and allowable concentrations and loads at NBUMR01. Table C17 shows the percent reduction for acidity needed at NBUMR01.

Table C16		Measured		Allowable	
Flow (gpm)=	3775.00	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	2.81	127.2	0.37	16.7
	Iron	0.45	20.3	0.45	20.3
	Manganese	6.28	284.7	0.51	23.0
	Acidity	67.55	3062.5	1.63	73.9
	Alkalinity	2.45	111.1		

Table C17. Allocations NBUMR01			
NBUMR01	Al (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ NBUMR01	127.17	284.71	3062.46
Difference in measured Loads between the loads that enter and existing NBUMR01	30.79	73.06	996.51
Additional load tracked from above samples	11.06	17.20	62.75
Total load tracked between NBUMR03/NBUMR02 and NBUMR01	41.85	90.26	1059.26
Allowable Load @ NBUMR01	16.68	22.96	73.91
Load Reduction @ NBUMR01	25.17	67.30	985.35
% Reduction required at NBUMR01	60%	75%	93%

The total aluminum load tracked at NBUMR01 was 41.85 lbs/day. This was 25.17 lbs/day greater than the calculated aluminum allowable load of 16.68 lbs/day, resulting in a 60% reduction. The manganese total tracked load was 67.30 lbs/day greater than the calculated allowable load of 22.96 lb/day, requiring a 75% reduction. A 93% reduction from the tracked acidic load of 1059.26 lbs/day was needed to lower the acidic load to the calculated allowable load of 73.91 lbs/day.

Waste Load Allocations in the Upper Morgan Run Watershed

Six permitted discharges exist in the Upper Morgan Run watershed that will be evaluated and calculated in the allowable load at sample point UMR06. Waste load allocations are calculated using a method to quantify treatment pond pollutant loads for aluminum, iron and manganese. Table C18 shows the waste load allocation for each discharge. Table C19 shows the total waste load allocations integrated into the allowable load at UMR06.

Table C18. Waste Load Allocation Calculations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Al	2	0.044496	0.7
Fe	3	0.044496	1.1
Mn	2	0.044496	0.7

The following coal mining operations have permits in the Upper Morgan Run Watershed:

The Kasubick Brothers Coal Company, Kasubick #4 Operation (SMP17820129) NPDES PA 0610623
The Shud's Coal Hounds, Inc., Tana Rae #2 Operation (SMP17000107) NPDES 0242951
The Moravian Run Reclamation Company, Inc., Excelsior Operation (SMP 17000107) NPDES 0243086
The River Hill Coal Company, Inc., Betz #3 Operation (SMP17010110) NPDES 0243132
The River Hill Coal Company, Inc., Kasubick Operation (SMP17990103) NPDES 0238244
The Shud's Coal Hounds, Inc., Shud #1 Operation (SMP17000905) NPDES 0242951

These mining operations are shown in the North Branch Upper Morgan Watershed maps in Attachment A and can also be found in the schematic drawing on page 31 of Attachment C.

Table C19. Total Waste Load Allocation Calculations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow	Allowable Load
		(MGD)	(lbs/day)
Al	2	0.044496	4.2
Fe	3	0.044496	6.6
Mn	2	0.044496	4.2

TMDL calculations- UMR06 On Upper Morgan Run before confluence with North Branch Upper Morgan Run

The TMDL for sample point UMR06 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 was computed using water-quality sample data collected at point UMR06. The average flow, measured at the sampling point UMR06 (4.27 MGD), is used for these computations. The allowable load calculated at UMR06 will directly affect the downstream point UMR05.

Sample data at point UMR06 shows pH ranging between 3.2 and 3.8; 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.

Table C20 shows the measured and allowable concentrations and loads at UMR06. Table C21 shows the percent reductions for all parameters that are required at UMR06.

Table C20		Measured		Allowable	
Flow (gpm)=	2962.50	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	4.04	143.7	0.35	12.6
	Iron	2.02	72.0	1.10	39.1
	Manganese	7.40	263.2	0.51	18.1
	Acidity	64.20	2284.1	0.00	0.0
	Alkalinity	0.00	0.0		

Table C21. Allocations UMR06				
UMR06	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ UMR06	143.74	71.96	263.19	2284.14
Allowable Load @ UMR06	12.55	39.05	18.14	0.00
Load Reduction @ UMR06	131.19	32.91	245.05	2284.14
% Reduction required @ UMR06	91%	46%	93%	100%

TMDL Calculation – UMR05 Upper Morgan Run above unnamed tributary from the South

The TMDL for sampling point UMR05 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 was computed using water-quality sample data collected at point UMR05. The average flow, measured at the sampling point UMR05 (9.85 MGD), is used for these computations. The loads calculated at UMR05 will directly affect the downstream point UMR03.

Sample data at point UMR05shows pH ranging between 3.5 and 4.1; 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 UMR05 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 loads from point NBUMR01 and UMR06 show the total load that was permitted from upstream sources. This value was added to the difference in existing loads between point UMR05 and NBUMR01/ UMR06 to determine a total load tracked for the segment of stream between UMR05 and NBUMR01/UMR06. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at UMR05.

A TMDL for aluminum, iron, manganese and acidity at UMR05 have been calculated. Table C22 shows the measured and allowable concentrations and loads at UMR05. Table C23 shows the percent reduction needed for aluminum, iron, manganese and acidity at this point.

Table C22		Measured		Allowable	
Flow (gpm)=	6837.75	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	3.00	246.4	0.36	30.00
	Iron	1.99	163.2	0.75	61.3
	Manganese	6.28	515.3	0.55	45.1
	Acidity	59.00	4845.0	0.40	32.9
	Alkalinity	0.90	73.9		

Table C23. Allocations UMR05				
UMR05	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ UMR05	246.36	163.21	515.29	4845.00
Difference in measured Loads between the loads that enter and existing UMR05	-24.55	70.94	-32.61	-501.60
Percent loss due calculated at UMR05	9%	NA	6%	9%
Additional load tracked from above samples	29.23	59.36	41.10	73.91
Percentage of upstream loads that reach the UMR05	90.9%	NA	94.0%	90.6%
Total load tracked between NBUMR01/UMR06 and UMR05	26.58	130.30	38.65	66.98
Allowable Load @ UMR05	29.95	61.28	45.06	32.90
Load Reduction @ UMR05	-3.37	69.02	-6.41	34.08
% Reduction required at UMR05	0%	53%	0%	51%

The percent reduction for aluminum at UMR05 was calculated at 0. The upstream existing aluminum loads from NBUMR01 and UMR06 were summed and found to be greater than the existing aluminum load at sample point UMR05. The percent of upstream load that actually reaches sample point UMR05 was calculated resulting in a value for percent loss of upstream load that occurs before the aluminum load reaches this sample point. Therefore this loss is considered in the reductions at UMR05. A loss of 24.55 lbs/day of aluminum between upstream points and UMR05 results in a 9% loss in this segment of stream. This loss can be attributed to instream processes. The same can be shown for manganese at UMR05. The sum of the upstream sources was 32.61 lbs/day greater than the existing manganese load at UMR05. 6% of the manganese load has been lost to instream processes, resulting in no reduction necessary at UMR05. The total iron loading tracked at UMR05 was calculated at 130.30 lbs/day. The calculated allowable load was found to be 61.28 lbs/day, resulting in a required iron reduction of 69.02 lbs/day or 53%. The acidic value tracked was 34.08 lbs/day greater than the allowable acidic load at UMR05 calculating a 51% reduction.

<u>TMDL calculations- UMR04 unnamed tributary to Upper Morgan Run from the south</u>

The TMDL for sample point UMR04 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 was computed using water-quality sample data collected at point UMR04. The average flow, measured at the sampling point UMR04 (0.06 MGD), is used for these computations. The allowable load calculated at UMR04 will directly affect the downstream point UMR03.

Sample data at point UMR04 shows a pH value of 5.2; 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.

All sample data for aluminum and iron fell below detection limits. The measured sample data at manganese was above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. The existing load values for aluminum and iron at UMR04 in Table C24 will be denoted as "NA".

Table C24 shows the measured and allowable concentrations and loads at UMR04. Table C25 shows the percent reductions for all parameters that are required at UMR04.

Table C24		Measured		Allowable	
Flow (gpm)=	39.75	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
ND = non detection	Aluminum	ND	NA		
NA = not applicable	Iron	ND	NA		
	Manganese	0.04	0.02	0.04	0.02
	Acidity	18.30	8.7	3.60	1.7
	Alkalinity	6.85	3.3		

Table C25. Allocations UMR04	
UMR04	Acidity (Lbs/day)
Existing Load @ UMR04	8.74
Allowable Load @ UMR04	1.72
Load Reduction @ UMR04	7.02
% Reduction required @ UMR04	80%

TMDL Calculation – UMR03 Upper Morgan Run above unnamed tributary that originates along Kellytown Road

The TMDL for sampling point UMR03 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 was computed using water-quality sample data collected at point UMR03. The average flow, measured at the sampling point UMR03 (10.97 MGD), is used for these computations. The loads calculated at UMR03 will directly affect the downstream point UMR01.

Sample data at point UMR03 shows pH ranging between 3.5 and 4.1; 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 UMR03 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 loads from point UMR05 and UMR04 show the total load that was permitted from upstream sources. This value was added to the difference in existing loads between point UMR03 and UMR05/ UMR04 to determine a total load tracked for the segment of stream between UMR03 and UMR05/UMR04. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at UMR03.

A TMDL for aluminum, iron, manganese and acidity at UMR03 have been calculated. Table C26 shows the measured and allowable concentrations and loads at UMR03. Table C27 shows the percent reduction needed for aluminum, iron, manganese and acidity at this point.

Table C26		Measured		Allowable	
Flow (gpm)=	7619.25	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	2.86	261.9	0.37	34.3
	Iron	1.67	152.8	0.75	68.3
	Manganese	5.86	535.8	0.53	48.8
	Acidity	62.80	5746.5	0.47	42.7
	Alkalinity	0.85	77.8		

Table C27. Allocations UMR03				
UMR03	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ UMR03	261.93	152.81	535.76	5746.46
Difference in measured Loads between the loads that enter and existing UMR03	15.57	-10.40	20.47	892.72
Percent loss due calculated at UMR03	NA	6%	NA	NA
Additional load tracked from above samples	29.95	61.28	45.08	34.62
Percentage of upstream loads that reach the UMR03	NA	93.6%	NA	NA
Total load tracked between UMR05/UMR04 and UMR03	45.52	57.38	65.53	927.34
Allowable Load @ UMR03	34.31	68.26	48.82	42.68
Load Reduction @ UMR03	11.21	-10.88	16.71	884.66
% Reduction required at UMR03	25%	0%	25%	95%

The upstream existing iron loads from UMR05 and UMR04 were summed and found to be greater than the existing iron load at sample point UMR03. The percent of upstream load that actually reaches sample point UMR03 was calculated resulting in a value for percent loss of upstream load that occurs before the iron load reaches this sample point. Therefore this loss is considered in the reductions at UMR03. A loss of 10.40 lbs/day of iron between upstream points and UMR03 results in a 6% loss in this segment of stream. This loss can be attributed to instream processes. The total iron load calculated was 10.88 lbs/day less than the calculated allowable load at UMR03. Therefore no iron reduction is necessary at this sample point. The total aluminum loading tracked at UMR03 was calculated at 45.52 lbs/day. The calculated allowable load was found to be 34.31 lbs/day, resulting in a required aluminum reduction of 11.21 lbs/day or 25%. The total manganese load tracked at UMR03 was found to be 65.53 lbs/day. A 25% reduction was necessary to attain the calculated allowable manganese load of 48.82 lbs/day. The acidic value tracked was 34.08 lbs/day greater than the allowable acidic load at UMR05 calculating a 51% reduction.

Waste Load Allocation – Harbison-Walker Refactories, Sanborne Strip Operation

The Harbison-Walker Refactories, Sanborne Strip Operation, MDP4475SM10 has a permitted discharge that is evaluated in the allowable loads at UMR02. The waste load allocation is determined from measured flow data and the monthly average permit limits for iron and manganese. The following table shows the waste load allocation for this discharge.
The Harbison-Walker Refractories has the Sanborne Mine operation upstream of this tributary to Upper Morgan Run. This Industrial Minerals Surface Mine is not permitted for metals, but is an active treatment facility that incorporates batch treatments using lime addition. The location of the Harbison-Walker site can be seen on the maps included in Attachment A. This site was an active mine site at one time. In addition to the coal, clay associated with the coal was also removed for brick making. At one time it was permitted for metals, therefore a WLA has been calculated.

Table C28. Waste Load Allocations at Harbison-Walker			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Harbison-Walker			
Al	2	0.0029	0.05
Fe	3	0.0029	0.07
Mn	2	0.0029	0.05

TMDL calculations- UMR02 unnamed tributary that originates along Kellytown Road

The TMDL for sample point UMR02 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 was computed using water-quality sample data collected at point UMR02. The average flow, measured at the sampling point UMR02 (0.56 MGD), is used for these computations. The allowable load calculated at UMR02 will directly affect the downstream point M6.

Sample data at point UMR02 shows pH ranging between 4.4 and 4.9; 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.

A TMDL for aluminum, manganese and acidity at UMR02 has been calculated. All measured sample data for iron fell below detection limits. Because water quality standards are met, a TMDL for iron isn't necessary and is not calculated. Iron's existing load values at UMR02 in Table C28 will be denoted as "NA".

Table C29 shows the measured and allowable concentrations and loads at UMR02. Table C30 shows the percent reductions for all parameters that are required at UMR02.

Table C29		Measured		Allowable	
Flow (gpm)=	390.00	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.97	4.6	0.44	2.1
	Iron	ND	NA		
ND = non detection	Manganese	1.49	7.0	0.60	2.8
NA = not applicable	Acidity	43.87	205.5	5.61	26.3
	Alkalinity	6.33	29.7		

Table C30. Allocations UMR02			
UMR02	Al (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ UMR02	4.56	6.98	205.46
Allowable Load @ UMR02	2.05	2.81	26.28
Load Reduction @ UMR02	2.51	4.17	179.18
% Reduction required @ UMR02	55%	60%	87%

TMDL Calculation – UMR01 Upper Morgan Run at confluence with Clearfield Creek

The TMDL for sampling point UMR01 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this most downstream segment of Upper Morgan Run was computed using water-quality sample data collected at point UMR01. The average flow, measured at the sampling point UMR01 (11.58 MGD), is used for these computations.

Sample data at point UMR01 shows pH ranging between 3.5 and 4.1; 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 UMR01 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 loads from point UMR03 and UMR02 show the total load that was permitted from upstream sources. This value was added to the difference in existing loads between point UMR01 and UMR03/ UMR02 to determine a total load tracked for the segment of stream between UMR01 and UMR03/UMR02. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at UMR01.

A TMDL for aluminum, iron, manganese and acidity at UMR01 have been calculated. Table C31 shows the measured and allowable concentrations and loads at UMR01. Table C32 shows the percent reduction needed for aluminum, iron, manganese and acidity at this point.

Table C31		Measured		Allowable	
Flow (gpm)=	8041.50	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	2.72	262.9	0.38	37.1
	Iron	1.50	144.6	0.80	77.6
	Manganese	5.59	539.9	0.53	50.8
	Acidity	63.00	6084.2	0.47	45.1
	Alkalinity	0.95	91.8		

Table 32. Allocations UMR01				
UMR01	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ UMR01	262.93	144.62	539.86	6084.24
Difference in measured Loads between the loads that enter and existing UMR01	-3.56	-8.19	-2.88	132.32
Percent loss due calculated at UMR01	1%	5%	1%	NA
Additional load tracked from above samples	36.36	68.26	51.63	68.96
Percentage of upstream loads that reach the UMR01	98.7%	94.6%	99.5%	NA
Total load tracked between UMR03/UMR02 and UMR01	35.87	64.60	51.36	201.28
Allowable Load @ UMR01	37.06	77.61	50.76	45.07
Load Reduction @ UMR01	-1.19	-13.01	0.60	156.21
% Reduction required at UMR01	0%	0%	1%	78%

The upstream existing aluminum loads from UMR03 and UMR02 were summed and found to be greater than the existing iron load at sample point UMR01. The percent of upstream load that actually reaches sample point UMR01 was calculated resulting in a value for percent loss of upstream load that occurs before the aluminum load reaches this sample point. Therefore this loss is considered in the reductions at UMR01. A loss of 3.56 lbs/day of aluminum between upstream points and UMR01 results in a 1% loss in this segment of stream. This loss can be attributed to instream processes. The total aluminum load calculated was 1.19 lbs/day less than the calculated allowable load at UMR01. Therefore no aluminum reduction is necessary at this sample point. Due to instream processes, 8.19 lbs/day of iron, or 5 % has fallen out of the stream by the time it reaches sample point UMR01. The total iron load tracked was 13.01 lbs/day less than the calculated iron allowable load. Since total load tracked is less than the allowable load, no iron reduction is necessary at this point. The existing manganese load at UMR01 was measured to be 2.88 lbs/day less than the summed existing manganese loads from sample points UMR03 and UMR02. The total manganese load tracked to this sample point was found to be 0.60 lbs/day greater than the calculated allowable load of 50.76 lbs/day, resulting in a 1% reduction. The total acidic load tracked at UMR01 was 201.28 lbs/day, which was 156.21 lbs/day greater than the calculated allowable acidic load of 45.07 lb/day. To achieve this calculated allowable load value, the total acidic load needs to be reduced by 78%.

Margin of Safety

PADEP used an implicit MOS in these TMDLs derived from the Monte Carlo statistical analysis. The Water Quality standard states that water quality criteria must be met at least 99% of the time. All of the @Risk analyses results surpass the minimum 99% level of protection. Another margin of safety used for this TMDL analysis results from:

- 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.

- A MOS is also the fact that the calculations were performed with a daily Iron 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 and 2002 Section 303(d) Lists

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

In the 1996 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 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 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

DEP Data **NBUMR08**

	pH*	Alkalinity^	Acidity	Sulfate	Iron	Manganese	Aluminum
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
5/7/2003	5.0	10.0	27.4	262.0	0.40	3.51	0.55
7/2/2003	5.1	15.4	45.20	437.7	2.07	9.89	0.91
10/29/2003	4.9	7.8	54.80	242.5	4.35	2.31	0.00
3/23/2004	5.1	7.8	8.60	246.5	0.00	0.34	0.00
average	5.0	10.3	34.0	297.2	1.7	4.0	0.4
st deviation	0.1	3.6	20.4	94.1	2.0	4.1	0.4

DEP Data **NBUMR07**

	pH*	Alkalinity^	Acidity	Sulfate	Iron	Manganese	Aluminum
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
5/7/2003	3.9	0	72.6	804.1	1.12	20.60	5.78
7/2/2003	3.8	0.0	96.00	1060.0	1.20	25.60	6.08
10/29/2003	4.3	0.0	55.20	699.4	1.17	15.30	3.63
3/23/2004	4.7	8.0	42.80	582.4	1.31	10.90	2.87
average	4.2	2.0	66.7	786.5	1.2	18.1	4.6
st deviation	0.4	4.0	23.1	203.6	0.1	6.4	1.6

DEP Data **NBUMR06**

	pH*	Alkalinity^	Acidity	Sulfate	Iron	Manganese	Aluminum
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
5/7/2003	3.8	0	98.00	419.8	0.65	14.00	8.60
7/2/2003	3.7	0.0	109.80	445.9	0.71	15.60	8.90
10/29/2003	4.0	1.4	74.60	219.0	0.56	6.92	3.40
3/23/2004	4.2	4.6	66.80	243.0	0.46	5.76	3.52
average	3.9	1.5	87.3	331.9	0.6	10.6	6.1
st deviation	0.2	2.2	20.0	117.4	0.1	5.0	3.1

DEP Data **NBUMR05**

	pH*	Alkalinity^	Acidity	Sulfate	Iron	Manganese	Aluminum
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
5/7/2003	3.7	0	69.8	668.6	1.06	11.90	5.77
7/2/2003	3.6	0.0	91.40	722.3	0.95	12.50	6.52
10/29/2003	4.1	3.4	51.80	509.9	1.04	8.51	3.13
3/23/2004	4.1	4.0	45.60	404.2	1.03	7.71	3.36
average	3.9	1.9	64.7	576.3	1.0	10.2	4.7
st deviation	0.3	2.2	20.6	145.9	0.0	2.4	1.7

DEP Data **NBUMR04**

	pH*	Alkalinity^	Acidity	Sulfate	Iron	Manganese	Aluminum
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
5/7/2003	4.6	6.2	49.20	108.1	0	2.67	2.06
7/2/2003	4.6	7.4	42.80	131.6	0.57	3.46	1.47
10/29/2003	5.0	7.0	55.60	91.0	0.00	2.57	1.29

3/23/2004	4.9	7.6	55.00	84.7	0.00	2.04	1.79
average	4.8	7.1	50.7	103.9	0.1	2.7	1.7
st deviation	0.2	0.6	6.0	21.0	0.3	0.6	0.3

DEP Data **NBUMR03**

	pH*	Alkalinity^	Acidity	Sulfate	Iron	Manganese	Aluminum
Date	**Lab**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
5/7/2003	3.9	0	76.4	463.6	0.58	8.53	4.39
7/2/2003	3.8	0.0	99.80	560.2	1.43	11.30	5.12
10/29/2003	4.2	3.6	61.20	294.3	0.54	6.30	2.54
3/23/2004	4.3	5.0	49.20	357.4	0.70	5.38	2.74
average	4.1	2.2	71.7	418.9	0.8	7.9	3.7
st deviation	0.2	2.5	21.8	117.3	0.4	2.6	1.3

DEP Data **NBUMR02**

	pH*	Alkalinity^	Acidity	Sulfate	Iron	Manganese	Aluminum
Date	**Lab**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
5/7/2003	4.6	5.6	22.8	75.5	0	2.42	0.80
7/2/2003	4.7	7.6	24.40	270.1	0.00	1.85	0.75
10/29/2003	5.0	6.6	35.40	61.2	0.00	1.68	0.51
3/23/2004	5.0	7.2	41.00	55.6	0.00	1.11	0.00
average	4.8	6.8	30.9	115.6	0.0	1.8	0.5
st deviation	0.2	0.9	8.8	103.3	0.0	0.5	0.4

DEP Data **NBUMR01**

	pH*	Alkalinity^	Acidity	Sulfate	Iron	Manganese	Aluminum
Date	**Lab**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
5/7/2003	3.9	0	69.20	287.4	0.42	7.44	3.50
7/2/2003	3.9	0.0	84.20	434.9	0.45	8.49	3.75
10/28/2003	4.3	4.2	61.20	230.3	0.43	5.00	1.93
3/23/2004	4.3	5.6	55.60	231.2	0.50	4.19	2.04
average	4.1	2.5	67.6	296.0	0.4	6.3	2.8
st deviation	0.2	2.9	12.4	96.4	0.0	2.0	1.0

DEP Data **UMR06**

	pH*	Alkalinity^	Acidity	Sulfate	Iron	Manganese	Aluminum
Date	**Lab**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
5/7/2003	3.3	0	77.00	434.7	2.40	9.13	5.33
7/2/2003	3.2	0.0	88.40	534.1	2.06	9.67	5.28
10/29/2003	3.7	0.0	47.00	283.0	1.75	5.90	2.68
3/23/2004	3.8	0.0	44.40	269.0	1.88	4.89	2.87
average	3.5	0.0	64.2	380.2	2.0	7.4	4.0
st deviation	0.3	0.0	21.9	127.1	0.3	2.4	1.5

DEP Data **UMR05**

	pH*	Alkalinity^	Acidity	Sulfate	Iron	Manganese	Aluminum
Date	**Lab**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
5/6/2003	3.6	0.0	87.4	312.9	2.42	7.93	4.08
7/1/2003	3.5	0.0	68.60	458.0	2.67	7.53	3.68
10/28/2003	3.9	0.4	41.20	255.4	1.55	5.40	2.00
3/23/2004	4.1	3.2	38.80	231.2	1.31	4.24	2.24
average	3.8	0.9	59.0	314.4	2.0	6.3	3.0
st deviation	0.3	1.5	23.3	101.7	0.7	1.8	1.0

DEP Data **UMR04**

	pH*	Alkalinity^	Acidity	Sulfate	Iron	Manganese	Aluminum
Date	**Lab**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
5/6/2003	5.2	7.4	18.20	28.6	0	0.06	0.00
7/1/2003	5.2	6.4	16.60	50.4	0.00	0.05	0.00
10/28/2003	5.2	6.4	12.60	55.0	0.00	0.06	0.00
3/23/2004	5.2	7.2	25.80	37.9	0.00	0.00	0.00
average	5.2	6.9	18.3	43.0	0.0	0.0	0.0
st deviation	0.0	0.5	5.5	12.0	0.0	0.0	0.0

DEP Data **UMR03**

	pH*	Alkalinity^	Acidity	Sulfate	Iron	Manganese	Aluminum
Date	**Lab**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
5/6/2003	3.6	0.0	85.40	319.8	2.22	7.73	3.99
7/1/2003	3.5	0.0	65.20	407.2	2.07	6.79	3.29
10/28/2003	3.9	0.0	43.40	250.1	1.24	5.00	2.12
3/23/2004	4.1	3.4	57.20	228.6	1.15	3.90	2.05
average	3.8	0.9	62.8	301.4	1.7	5.9	2.9
st deviation	0.3	1.7	17.6	80.5	0.6	1.7	0.9

DEP Data **UMR02**

	pH*	Alkalinity^	Acidity	Sulfate	Iron	Manganese	Aluminum
Date	**Lab**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
5/6/2003	4.6	5.4	41.80	67.8	0	1.52	1.21
7/1/2003	4.4	5.4	41.40	103.7	0.00	1.73	1.24
10/28/2003	4.8	6.0	44.20	85.3	0.00	1.65	0.76
3/23/2004	4.9	7.6	46.00	64.9	0.00	1.09	0.92
average	4.7	6.3	43.9	84.6	0.0	1.5	1.0
st deviation	0.3	1.1	2.3	19.4	0.0	0.3	0.2

DEP Data **UMR01**

	pH*	Alkalinity^	Acidity	Sulfate	Iron	Manganese	Aluminum
Date	**Lab**	**mg/l**	**mg/l**	**mg/l**	**ug/l**	**ug/l**	**ug/l**
5/6/2003	3.6	0.0	92.20	287.6	1.91	7.29	3.65
7/1/2003	3.5	0.0	63.00	451.4	1.84	6.69	3.26

10/28/2003	3.9	0.2	42.00	239.8	1.16	4.71	2.01
3/23/2004	4.1	3.6	54.80	171.5	1.08	3.67	1.97
average	3.8	1.0	63.0	287.6	1.5	5.6	2.7
st deviation	0.3	1.8	21.3	119.2	0.4	1.7	0.9

Non detections are calculated as zeros in data sets.

Attachment F

Comment and Response

Comments/Responses on Middle Branch Big Run TMDL

EPA Region III comments:

Comment:
In the *Active Mining* section eight active mining permits are described, however, only seven wasteload allocations (WLAs) are calculated. The Sanborn Strip Operation (MDP4475SM10) was issued a compliance order in 1984 to treat a new mining related discharge. The report states that treatment continues today and there have been no recent violations at the site. If the treatment is pursuant to a permit or a compliance order enforcing a permit, a WLA is required. If the treatment is being done by the State under one of its programs, then no WLA is required, and the treated discharge is part of the LA. Please identify the party treating the discharge.

Reponse:
The Sanborne Strip Operation WLA has been added to the TMDL report for North Branch Upper Morgan Run.

Comment:
We still believe that the use of a zero concentration for ND samples is inappropriate for naturally occurring substances. We have provided arguments to this effect previously. Another argument for <ins>not</ins> using <DL = 0 is demonstrated in DEP's @RISK spreadsheet. DEP's data was used for the @RISK analysis and iron results <0.3 mg/l were used as zero for Sample Point UMR02. Apparently the Mining Company used an analytical method capable of lower detection levels and iron levels of 0.22, 0.11, and 0.2 mg/l were measured, together with levels > 0.3 mg/l, DEP's detection level demonstrating that the concentration of naturally occurring constituents, iron, is not zero. It is unclear why the mining data was not used which would increase the power of the analysis. The mining data appears similar to PADEP's data. It would be helpful to identify on the spreadsheet why mining data was not used.

Response:
As previously agreed upon, the Department's position is to set less than detection limits equal to zero. The DEP lab reported data at less than detection limits; therefore zero was used in this analysis. The Department's analytical method does not allow lower measurements then those reported in the Department's data. It was determined that mining data would not be used because of the relatively few sample sites that had mining data available compared to the total number of sample sites (only 3 out of 14 sites had available mining data).