Revised

North Branch Bear Creek Watershed TMDL
Butler County, Pennsylvania

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Pennsylvania Department of Environmental Protection

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TABLE OF CONTENTS

TABLES

ATTACHMENTS

Administrative Summary

The North Branch Bear Creek TMDL was produced as a draft for public notice beginning and ending. No comments were received from the public during this period. In addition, a public meeting was held on October 11, 2006, at the USDA Services Center in Butler, PA to discuss the proposed TMDL. The North Branch Bear Creek TMDL received final approval from the U.S. EPA on April 4, 2007.

The Department has a pending permit for a government financed construction contract (GFCC) for an operation in Butler County. The Marrett GFCC is located in the headwaters of an unnamed tributary to North Branch Bear Creek. Historically, the area was surface mined, including mining through the existing stream channel, and subsequently abandoned. As a result, the area includes many abandoned mine land features such as water-filled pits and unvegetated spoils which generate multiple sources of AMD throughout the project area. Remining has been shown to be effective in reducing pollution loads delivered to streams impacted by mine drainage emanating from abandoned mine sites. Thus, it is anticipated that this remining project will create long-term environmental benefits for the unnamed tributary to North Branch Bear Creek by decreasing or eliminating sources of nonpoint source pollution.

In addition to the inclusion of a waste load allocation for the Marrett GFCC, other changes to the document include the updating of calculations of loadings at downstream monitoring points (NB15, NB…), inclusion of attachments addressing coordination of NPDES permits and TMDLs, and updating standard language included in all TMDL reports that has changed since the initial approval of the TMDL.

Guidance to states from U.S. EPA states that changes to existing TMDLs must be subject to re-approval by EPA and an additional public comment period. This document will supersede the document titled “FINAL North Branch Bear Creek Watershed TMDL“ dated March 28, 2007 as the current TMDL directing restoration activities in the North Branch Bear Creek Watershed.

Revised TMDL
North Branch Bear Creek Watershed
Butler County, Pennsylvania

Introduction

This Total Maximum Daily Load (TMDL) calculation has been prepared for segments in the North Branch Bear Creek 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 the one listed segment shown in Table 1. Metals in acidic discharge water from abandoned coalmines causes the impairment. The TMDL addresses the three primary metals associated with acid mine drainage (iron, manganese, aluminum), and pH.

Table 1. 303(d) Sub-List Central Allegheny River

State Water Plan (SWP) Subbasin: 17C

Year	Miles	Segment ID	DEP Stream Code	Stream Name	Desig-nated Use	Data Source	Source	EPA 305(b) Cause Code
1996	2.0	6962	49118	North Branch Bear Creek	CWF	303 (d) List	Resource Extraction	Metals
1998	5.56	6962	49118	North Branch Bear Creek	CWF	SWMP	AMD	Metals
2002	3.3	20010625-1100-JJM	49118	North Branch Bear Creek	CWF	SWMP	AMD	Metals pH
2002	11.2	20000627-1400-JJM	49118	North Branch Bear Creek	CWF	SWMP	AMD	Metals
2004	6.3	20000628-1430-JJM	49118	North Branch Bear Creek	CWF	SWMP	AMD	Metals pH
2004	0.7	20000627-1400-JJM	49118	North Branch Bear Creek	CWF	SWMP	AMD	Metals
2004	2.6	20010625-1000-JJM	49124	Unt.North Fork Bear Creek	CWF	SWMP	AMD	Metals pH
2004	2.44	20010627-1400-JJM	49125	Unt.North Fork Bear Creek	CWF	SWMP	AMD	pH
2004	1.0	20000627-1400-JJM	49127	Unt.North Fork Bear Creek	CWF	SWMP	AMD	pH
2004	0.73	20000627-1400-JJM	49128	Unt.North Fork Bear Creek	CWF	SWMP	AMD	pH
2004	0.5	20000627-1400-JJM	49129	Unt.North Fork Bear Creek	CWF	SWMP	AMD	pH
2004	0.4	20000627-1400-JJM	49130	Unt.North Fork Bear Creek	CWF	SWMP	AMD	pH
2004	1.8	20000627-1400-JJM	49132	Unt.North Fork Bear Creek	CWF	SWMP	AMD	pH
2004	1.1	20000627-1400-JJM	49133	Unt.North Fork Bear Creek	CWF	SWMP	AMD	pH
2004	0.5	20000627-1400-JJM	49134	Unt.North Fork Bear Creek	CWF	SWMP	AMD	pH
2004	0.5	20000627-1400-JJM	49135	Unt.North Fork Bear Creek	CWF	SWMP	AMD	pH

2004	0.4	20000627-1400-JJM	49136	Unt.North Fork Bear Creek	CWF	SWMP	AMD	pH
2004	0.7	2001625-1100-JJM	64604	Unt.North Fork Bear Creek	CWF	SWMP	AMD	Metals pH

Cold Water Fishes=CWF
Surface Water Monitoring Program = SWMP
Abandoned Mine Drainage = AMD

Directions to the North Branch Bear Creek Watershed

The North Branch Bear Creek Watershed is approximately 17 square miles in area and is located in Northeastern Butler County, Pennsylvania. From its headwaters south of the town of Eau Claire, the North Branch Bear Creek flows approximately 6.5 miles in a southeasterly direction to its confluence with Bear Creek, southeast of the town of Parker. A portion of the stream flows through Pennsylvania State Game Lands No. 95. The North Branch Bear Creek can be found on the Eau Claire, Emlenton, Hilliards and Parker 7-1/2 minute quadrangles.

The headwaters of the North Branch Bear Creek can be accessed by taking exit 42 of Interstate 80 (Emlenton Exit/ Route 38). Take a left onto Rt. 38 and travel approximately 0.6 miles and turn left onto Sandy Point Road. Travel for approximately 1.9 miles on Sandy Point Road to the 6 points intersection. Continue to travel straight onto Slater Road (T-840) for approximately 1.6 miles. The headwaters of the North Branch Bear Creek flow under the road at this point. To access the mouth of the North Branch Bear Creek take a left onto Rt. 58 at the 6 points intersection and travel for approximately 0.7 miles. Continue straight onto Parker Pike Road for approximately 3.8 miles to the town of Parker. Turn right onto Rt. 268 and travel for approximately 0.7 miles and the North Branch Bear Creek flows under the road at this point. The mouth of the North Branch Bear Creek is approximately 3600 feet downstream from this point.

Segments addressed in this TMDL

The North Branch Bear Creek Watershed is affected by pollution from AMD. This pollution has caused high levels of metals and low pH in the main stem of North Branch Bear Creek and in a majority of its tributaries. The sources of the AMD are seeps and discharges from areas disturbed by surface mining. Most of the discharges originate from mining on the Lower Kittanning and Clarion coal seams or refuse piles associated with them. These TMDLs will be expressed as long-term, average loadings.

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

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

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

There is one active mining operation in the watershed. All of the remaining discharges in the watershed are from abandoned mines and will be treated as non-point sources. The distinction between non-point and point sources in this case is determined on the basis of whether or not there is a responsible party for the discharge. 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 Attachment D for TMDL calculations.

Clean Water Act Requirements

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

Additionally, the federal Clean Water Act and the U.S. Environmental Protection Agency’s (USEPA) implementing regulations (40 CFR 130) require:

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

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

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

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

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

Despite these requirements, states, territories, authorized tribes, and USEPA have not developed many TMDLs since 1972. Beginning in 1986, organizations in many states filed lawsuits against the USEPA for failing to meet the TMDL requirements contained in the federal Clean Water Act and its implementing regulations. While USEPA 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 USEPA to backstop TMDL development, track TMDL development, review state monitoring programs, and fund studies on issues of concern (e.g., AMD, implementation of nonpoint source Best Management Practices (BMPs), etc.).

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 USEPA, the states have developed methods for assessing the waters within their respective jurisdictions.

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

The assessment method requires selecting representative stream segments based on factors such as surrounding land uses, stream characteristics, surface geology, and point source discharge locations. 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 303(d) list with the documented source and cause. A TMDL must be developed for the stream segment. A TMDL is for only one pollutant. If a stream segment is impaired by two pollutants, two TMDLs must be developed for that stream segment. In order for the process to be more effective, adjoining stream segments with the same source and cause listing are addressed collectively, and on a watershed basis.

Basic Steps for Determining a TMDL

Although all watersheds must be handled on a case-by-case basis when developing TMDLs, 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. Calculate TMDL for the waterbody using USEPA approved methods and computer models;
3. Allocate pollutant loads to various sources;
4. Determine critical and seasonal conditions;
5. Submit draft report for public review and comments; and
6. USEPA approval of the TMDL.

This document will present the information used to develop the North Branch Bear Creek Watershed TMDL.

Watershed History

This AMD TMDL has been revised to include the Marett GFCC. The Marett GFCC is a new discharge and was not captured in the sampling data; the flow adjusted concentration method (explained in Attachment D) was applied to the sampling data from sample points NB15, NB10 and NB05 to reflect changes in water quality that would occur if the Marett GFCC were discharging during the sampling event.

There are limited records available to document mining prior to the 1970s, sometimes referred to as pre-Act mining. Although the date of the earliest mining within this watershed is not known, environmental scars such as unreclaimed pits, spoil piles and post-mining discharges are evidence of a long history of mining in the North Branch Bear Creek watershed.

The more recent mining within the North Branch Bear Creek watershed occurred primarily in the 1970's and 1980's. The last application for a permit to mine coal in this watershed was submitted to the Department of Environmental Protection in 1989. Although the complete files for the mine sites no longer exist, the following information gathered from microfiche records provides a brief outline of the mining permits issued in the watershed:

Big B Mining Company, MDP#3074SM30 (Eldorado Strip Mine): Issued 3/27/1975 for 102.8 acres of which 89.2 acres were to be mined. The coal seams listed for this site include the Upper Freeport and Lower Freeport. Mining was completed and this site was reclaimed. No additional information is available.

Black Fox Mining and Development Corp., SMP#3075SM4 (Hilliards Mine): Issued 4/25/1975 for 215.9 acres of which 170.8 acres were to be mined. The coal seam listed for this site is the Clarion. Mining was completed and this site was reclaimed. No additional information is available.

AH & RS Coal Corp., SMP#3075SM5, (Dean Mine): Issued 7/17/1975 for 328 of which 195 acres were to be mined. The coal seams listed for this site include the Lower Freeport, Upper Kittanning and Middle Kittannning. Mine site was abandoned and bonds were forfeited on 11/26/1979. Several post-mining discharges exist on this site. No additional information is available.

AH & RS Coal Corp., SMP#3075SM13, (Young Mine): Issued 7/26/1977 for 207 acres of which 128 acres were to be mined. The coal seams listed for this site include the Middle Kittanning, Lower Kittanning and Upper Clarion. No additional information is available.

Sunbeam Coal Corporation, MDP#3077SM18 (Christy Mine): Issued 11/2/1977 for 50 acres of which 44 acres were to be mined. The coal seams listed for this site include the Mahoning and Upper Freeport. Mining and reclamation were completed on this site and bonds were released.

Weaver Contracting, Inc., MDP#1079123 (Bennett Mine): Issued 2/21/1978 for 348.5 acres of which 136 acres were to be mined. Coal seam listed is the Middle Kittanning. The operator abandoned this site and approximately 24.6 acres were left unreclaimed. Bonds were forfeited and collected. The Bureau of Abandoned Mine Reclamation has since backfilled and reclaimed the site.

Glacial Minerals, Inc., SMP#10830104 (Hickman Mine): Issued 9/9/1983 to Vendale Coal Company, Inc. and reissued on 1/2/1985 to Glacial Minerals, Inc. 111.2 acres in the permit of which 49.6 are underlain by Middle Kittanning and Upper Kittanning Coal. Site was activated prior to 1/16/1985 and coal removal began on 3/20/1985. Mining and reclamation were completed on this site and bonds were released.

C&K Coal Company, SMP#10860118, (Snyder Sertik/No. 196 Mine): Issued 12/17/1987 for 124 acres of which 96 acres were to be mined. The coal seams listed include the Middle Kittanning and Lower Kittanning. Mining on this site resulted in a post mining discharge that is effectively being treated with a passive system consisting of a bog and polishing pond. The site is sampled and inspected on a quarterly basis by a Knox DMO Surface Mine Compliance Inspector. C&K Coal Company filed for bankruptcy in 2003 and is in the process of an orderly liquidation of their assets. The bonds associated with this site have been forfeited and collected, along with the bonds from several other C&K sites in the State, and have been used to establish a treatment trust fund.

C&K Coal Company, SMP#10890102, (Mine No. 218): Issued 4/10/1989 for 30 acres of which 15 acres were to be mined. The coal seam listed for this site is the Middle Kittanning. Mining and reclamation were completed on this site, bonds were released and the permit was terminated on 5/13/1995.

C&K Coal Company, SMP#10890111, (Mine No. 216): 69-acre permit listing the Middle Kittanning and Lower Kittanning coal seams. This permit was cancelled on 2/23/1990 due to the fact that no mining activity occurred on the site since the permit was issued.

Thomas E. Siegel, SMP#10830119 (Hudson Mine): 23-acre permit listing the Upper Kittanning and Middle Kittanning coal seams. Surface mining was never initiated on this site and the permit was terminated on 12/01/1988.

In October 1975 the Department of Environmental Resources, Office of Resource Management, Ebensburg District Office, completed an investigation on the effects of mining and abandoned oil and gas wells on the water quality of the North Branch Bear Creek. The ensuing report, called the North Branch Bear Creek Operation Scarlift Report, Project SL-199, established water quality sampling stations throughout the watershed near pollution sources an on all major tributaries and the main-stem. The study identified approximately 1400 acres of unreclaimed strip mines in the watershed, all of which are pre-act with no operator responsibility. Several deep mine openings and abandoned discharging oil/gas wells were also identified. Abatement measures were recommended for each of the eight priority areas identified in the watershed.

The Bear Creek Watershed Association (BCWA) was formed in 2002 in part by a Growing Greener Grant received by the Butler County Conservation District. The BCWA was formed in order to restore and maintain the water quality of the Bear Creek Watershed. The BCWA holds meetings at 7:00 pm on the fourth Monday of each month at the Fairview Township Building in the town of Petrolia, Butler County, Pennsylvania.

Hedin Environmental completed the Acid Mine Drainage Restoration Plan for the North Branch of Bear Creek on May 24, 2004 for the Bear Creek Watershed Association (BCWA) and the Butler County Conservation District (BCCD), funded by the PA DEP Growing Greener program. As part of the plan, an assessment of the North Branch Bear Creek Watershed was conducted which established 53 monitoring points consisting of discharges and stream locations that were sampled monthly for one year. Recommendations and cost estimates were provided for 29 discharges identified in the assessment. Seven of the discharges were identified as high priority projects, being the largest contributors of AMD in the watershed, and treatment/abatement options are currently being explored by the BCWA.

AMD Methodology

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

The statistical analysis describes 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 nonpoint 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 nonpoint 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[1] by performing 5,000 iterations to determine the required percent reduction so that the water quality criteria, as defined in the *Pennsylvania Code. Title 25 Environmental Protection, Department of Environmental Protection, Chapter 93, Water Quality Standards,* will be met instream at least 99 percent of the time. For each iteration, the required percent reduction is:

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

PR = required percent reduction for the current iteration

Cc = criterion in mg/l

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

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

Mean = average observed concentration

Standard Deviation = standard deviation of observed data

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

LTA = Mean * (1 – PR99) where (2)

LTA = allowable LTA source concentration in mg/l

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

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

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

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

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 a true reflection of acidity. This method assures that Pennsylvania’s standard for pH is met when the acid concentration reduction is met.

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

TMDL Endpoints

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

Because of the nature of the pollution sources in the watershed, the TMDLs component makeup will be load allocations that are specified above a point in the stream segment. All allocations will be specified as long-term average daily concentrations. These long-term average daily concentrations are expected to meet water quality criteria 99 percent of the time. Pennsylvania Title 25 Chapter 96.3(c) specifies that a minimum 99 percent level of protection is required. All metals criteria evaluated in this TMDL are specified as total recoverable. Pennsylvania does have dissolved criteria for iron; however, the data used for this analysis report iron as total recoverable. Table 2 shows the water quality criteria for the selected parameters.

Table 2 Applicable Water Quality Criteria

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

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

TMDL Elements (WLA, LA, MOS)

A TMDL equation consists of a 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 nonpoint 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).

Allocation Summary

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

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

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

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

Table 3. Summary Table–North Branch Bear Creek Watershed

Station	***Parameter***	***Existing Load (lbs/day)***	***TMDL Allowable Load (lbs/day)***	***WLA (lbs/day)***	***LA (lbs/day)***	***Load Reduction (lbs/day)***	***Percent Reduction %***
NBG20	NBG20 Upstream of NBG01 on Unt 49132						
	Al	5.1	2.2	*1.12*	1.08	2.9	57
	Fe	31.5	9.8	*4.50*	5.3	21.7	69
	Mn	11.0	4.1	*3.00*	1.1	6.9	63
	Acidity	206.4	35.1	-	35.1	171.3	83
NBG01	NBG01 Mouth of Unt 49132 Upstream of Confluence with North Branch Bear Creek						
	Al	47.6	3.3	*1.12*	2.18	41.4	93*
	Fe	130.0	9.1	*4.50*	4.6	99.2	92*
	Mn	19.6	3.9	*3.00*	0.9	8.8	69*
	Acidity	868.0	8.7	-	9.7	688.0	99*
NB41	NB41 Most Upstream Sample Point on North Branch Bear Creek						
	Al	6.4	1.5	*0.56*	0.94	4.9	77
	Fe	25.3	2.5	*2.25*	0.25	22.8	90
	Mn	8.5	1.9	*1.5*	0.4	6.6	78
	Acidity	72.2	14.4	-	14.4	57.8	80
NB40	NB40 Sample Point Downstream of NB41 and NBG01 on North Branch Bear Creek						
	Al	38.8	9.3	*2.24*	7.06	0.0	0*
	Fe	135.4	21.7	*9.00*	12.7	0.0	0*
	Mn	26.0	7.8	*6.00*	1.8	0.0	0*
	Acidity	632.3	50.6	-	50.6	0.0	0*
NB30	NB30 Sample Point Downstream of NB40 on North Branch Bear Creek						
	Al	88.7	12.4	*2.80*	9.6	46.8	79*
	Fe	281.3	33.8	*11.25*	22.55	133.8	80*
	Mn	72.9	14.6	*7.50*	7.1	40.1	73*
	Acidity	2101.1	84.0	-	84.0	1435.4	95*
NBE65	NBE65 Headwaters of Unt 49125						
	Al	0.8	0.6	-	0.6	0.2	25
	Fe	0.3	0.3	-	0.3	0.0	0
	Mn	2.1	1.0	-	1.0	1.1	52
	Acidity	21.5	2.4	-	2.4	19.1	89
NBE66	NBE66 Mouth of Unt 49130 Upstream of Confluence with Unt 49125						
	Al	0.2	0.1	-	0.1	0.1	50
	Fe	0.5	0.3	-	0.3	0.2	40
	Mn	0.5	0.4	-	0.4	0.1	20
	Acidity	47.1	7.1	-	7.1	40.0	85
NBE50	NBE50 Unt 49125 Down stream of Sample Points NBE65 and NBE66						
	Al	7.1	1.3	-	1.3	5.5	80*
	Fe	1.2	1.2	-	1.2	0.0	0*
	Mn	10.4	1.9	-	1.9	7.3	80*
	Acidity	104.6	5.2	-	5.2	40.3	88*
NBE40	NBE40 Mouth of Unt 49128 Upstream of Confluence with Unt 49125						
	Al	0.3	0.3	-	0.3	0.0	0
	Fe	0.7	0.7	-	0.7	0.0	0
	Mn	1.2	1.1	-	1.1	0.1	8
	Acidity	29.9	3.3	-	3.3	26.6	90
NBE20	NBE20 Mouth of Unt 49127 Upstream of the Confluence with Unt 49125						
	Al	48.1	1.9	*0.56*	1.34	46.2	96

Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Reduction %
	Fe	9.3	2.7	*2.25*	0.45	6.6	71
	Mn	53.6	1.6	*1.5*	0.1	52.0	97
	Acidity	507.2	0.0	-	0.0	507.2	100
NBE10	NBE10 Unt 49126 Upstream of the Confluence with Unt 49125						
	Al	5.5	1.9	*0.56*	1.34	3.6	66
	Fe	3.5	3.5	*2.25*	1.25	0.0	0
	Mn	9.2	2.6	*1.5*	1.1	6.6	72
	Acidity	227.3	18.2	-	18.2	209.1	92
NBE01	NBE01 Mouth of Unt 49125Upstream of Confluence with North Branch Bear Creek						
	Al	64.5	9.7	*2.80*	6.9	0.0	0*
	Fe	19.3	15.6	*11.25*	4.35	0.0	0*
	Mn	88.5	13.3	*7.50*	5.8	8.0	38*
	Acidity	1045.7	31.4	-	31.4	172.0	85*
NBF35A	NBF35A Mouth of Unt 4913125Upstream of Confluence with North Branch Bear Creek						
	Al	NA	NA	-	NA	NA	-
	Fe	1.8	1.8	-	1.8	0.0	0
	Mn	0.5	0.5	-	0.5	0.0	0
	Acidity	60.8	10.3	-	10.3	50.5	83
NB20	NB20 North Branch Bear Creek Downstream of Unt 49125						
	Al	140.6	29.5	*2.80*	26.7	0.0	0*
	Fe	147.2	38.3	*11.25*	27.05	0.0	0*
	Mn	161.6	30.7	*7.50*	23.2	0.0	0*
	Acidity	2638.4	79.2	-	79.2	23.9	23*
NB15	NB15 Mouth of Unt 49124 Upstream of Confluence with North Branch Bear Creek						
	Al	46.8	16.4	14.42	1.98	30.4	65
	Fe	130.8	26.2	21.63	4.57	104.6	80
	Mn	59.8	12.0	9.37	2.63	47.8	80
	Acidity	996.3	119.6	-	119.6	876.7	88
NB10	NB10 North Branch Bear Creek Downstream of NB15						
	Al	129.1	25.8	*2.80*	23.0	5.8	18*
	Fe	101.7	44.8	*11.25*	33.55	0.0	0*
	Mn	134.8	29.7	*7.50*	22.2	0.0	0*
	Acidity	1766.3	53.0	-	53.0	44.4	46*
NB05	NB05 Most Downstream Sample Point on North Branch Bear Creek Upstream of Confluence with the Allegheny River						
	Al	143.5	41.6	*2.80*	38.8	0.0	0*
	Fe	110.2	62.8	*11.25*	51.55	0.0	0*
	Mn	169.5	39.0	*7.50*	31.5	25.3	39*
	Acidity	2190.3	131.4	-	131.4	345.6	72*

*Assumes that load reductions have been taken at upstream points.
Numbers in italics are wasteloads that have been reserved for future mining operations.
- indicates temporary wasteload allocation to the Marrett GFCC that functions as a nonpoint source remediation project. The Marrett GFCC is included in this segment of the North Branch Watershed. The WLA for the operation is larger than the downstream allowable load; however, because this operation will be eliminating a non-point source of metals loading to the stream and because of its transient nature (in operation 3 years or less), the load from the GFCC is not included in the waste load allocation summary for this segment of North Branch Bear Creek.

In the instance that the allowable load is equal to the existing load (e.g. iron point NBD35A, Table 3), the simulation determined that water quality standards are being met instream 99% of the time and no TMDL is necessary for the parameter at that point. Although no TMDL is necessary, the loading at the point is considered at the next downstream point. This is denoted as "NA" in the above table.

The waste load allocation for the Marett GFCC was calculated using the pump flow (600 gpm) mentioned in the GFCC permit. Wasteload allocations for the Marett GFCC operation were incorporated into the calculations at NB15. This is the first downstream monitoring point that receives all the potential flow of treated water from the treatment sites.

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

Allowable Aluminum Waste Load Allocation:
600 gal./min. x 2.0 mg/l x 0.01202 = 14.42 lbs./day

Allowable Iron Waste Load Allocation:
600 gal./min. x 3.0 mg/l x 0.01202 = 21.63 lbs./day

Allowable Manganese Waste Load Allocation:
600 gal./min. x 1.3 mg/l x 0.01202 = 9.37 lbs./day

Table 4. Waste Load Allocation of Permitted Discharges

Parameter	Allowable Average Monthly Conc. (mg/l)	Calculated Average Flow (MGD)	WLA (lbs/day)
Marret GFCC			
Al	2.0	0.8646	14.42
Fe	3.0	0.8646	21.63
Mn	1.3	0.8646	9.37

Recommendations

The Bear Creek Watershed Association is currently pursuing AMD remediation projects in the North Branch Bear Creek Watershed, based on the results of the assessment and restoration plan that was completed by Hedin Environmental under a Growing Greener grant.

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

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

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

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

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

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

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

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

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

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

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

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

In addition to the abandoned mine reclamation program, regulatory programs also are assisting in the reclamation and restoration of Pennsylvania's land and water. PADEP has been effective in implementing the NPDES program for mining operations throughout the Commonwealth. This reclamation was done, through the use of remining permits which have the potential for reclaiming abandoned mine lands, at no cost to the Commonwealth or the federal government. Long-term treatment agreements were initialized for facilities/operators who need to assure treatment of post-mining discharges or discharges they degraded which will provide for long-term treatment of discharges. According to OSM, "PADEP is conducting a program where active mining sites are, with very few exceptions, in compliance with the approved regulatory program".

The Commonwealth is exploring all options to address its abandoned mine problem. During 2000-2006, many new approaches to mine reclamation and mine drainage remediation have been explored and projects funded to address problems in innovative ways. These include:

- Project XL - The Pennsylvania Department of Environmental Protection ("PADEP") has proposed this XL Project to explore a new approach to encourage the remining and reclamation of abandoned coal mine sites. The approach would be based on compliance with in-stream pollutant concentration limits and implementation of best management practices ("BMPs"), instead of National Pollutant Discharge Elimination System ("NPDES") numeric effluent limitations measured at individual discharge points. This XL project would provide for a test of this approach in up to eight watersheds with significant acid mine drainage ("AMD") pollution. The project will collect data to compare in-stream pollutant concentrations versus the loading from individual discharge points and provide for the evaluation of the performance of BMPs and this alternate strategy in PADEP's efforts to address AMD.
- Awards of grants for 1) proposals with economic development or industrial application as their primary goal and which rely on recycled mine water and/or a site that has been made suitable for the location of a facility through the elimination of existing Priority 1 or 2 hazards, and 2) new and innovative mine drainage treatment technologies that will provide waters of higher purity that may be needed by a particular industry at costs below conventional treatment costs as in common use today or reduce the costs of water treatment below those of conventional lime treatment plants. Eight contracts totaling $4.075 M were awarded in 2006 under this program.
- Projects using water from mine pools in an innovative fashion, such as the Shannopin Deep Mine Pool (in southwestern Pennsylvania), the Barnes & Tucker Deep Mine Pool (the Susquehanna River Basin Commission into the Upper West Branch Susquehanna River), and the Wadesville Deep Mine Pool (Excelon Generation in Schuylkill County).

Sixteen Problem Areas (PA) have been identified on the National Abandoned Mine Land Information System (NALIS) in the North Branch Bear Creek watershed. The problem areas contain a total of 111 features that have been assessed for remining potential. These features include highwalls, pits, spoil and refuse piles. This information has been put into a BAMR/BDMO shared database and can be used in reclamation project development. BAMR is currently working on a reclamation project on PA7000, located on the headwaters of the North Branch Bear Creek (OSM 10(7000)101.1 – Eau Claire Southeast, Allegheny Township, Butler County). A 1,500 ft long highwall, with an average height of 35 ft, exists on this site along with an associated spoil pile. Slater Road (T-840) runs parallel to the highwall only 15 feet from the road at its closest point, creating a potentially dangerous hazard. The highwall will be backfilled and graded to approximate original contour with the available spoil material, seeded and mulched. The project is currently in the design phase and is expected to be put out to bid during fall of 2006. The estimated cost of this reclamation project is approximately $125,000.00.

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

Public Participation

Public notice of the final TMDL was published in the *Pennsylvania Bulletin* on September 30, 2006 and the Butler Eagle on September 28, 2006 to foster public comment on the allowable loads calculated. A public meeting was held on October 11, 2006 beginning at 2:00 p.m., at USDA Service Center Building in Butler, PA, to discuss the proposed TMDL.

An additional public notice was provided for the revised TMDL. Notice of the revised TMDL and the NPDES permit issued in conjunction with the Marrett GFCC was published in the Pennsylvania Bulletin on July 5, 2008. Public comments will be received until August 5, 2008 on the draft revised TMDL.

Future TMDL Modifications

In the future, the Department may adjust the load and/or wasteload allocations in this TMDL to account for new information or circumstances that are developed or discovered during the implementation of the TMDL when a review of the new information or circumstances indicate that such adjustments are appropriate. Adjustment between the load and wasteload allocation will only be made following an opportunity for public participation. A wasteload allocation adjustment will be made consistent and simultaneous with associated permit(s) revision(s)/reissuances (i.e., permits for revision/reissuance in association with a TMDL revision will be made available for public comment concurrent with the related TMDL's availability for public comment). New information generated during TMDL implementation may include, among other things, monitoring data, BMP effectiveness information, and land use information. All changes in the TMDL will be tallied and once the total changes exceed 1% of the total original TMDL allowable load, the TMDL will be revised. The adjusted TMDL, including its LAs and WLAs, will be set at a level necessary to implement the applicable WQS and any adjustment increasing a WLA will be supported by reasonable assurance demonstration that load allocations will be met. The Department will notify

EPA of any adjustments to the TMDL within 30 days of its adoption and will maintain current tracking mechanisms that contain accurate loading information for TMDL waters.

Changes in TMDLs That May Require EPA Approval

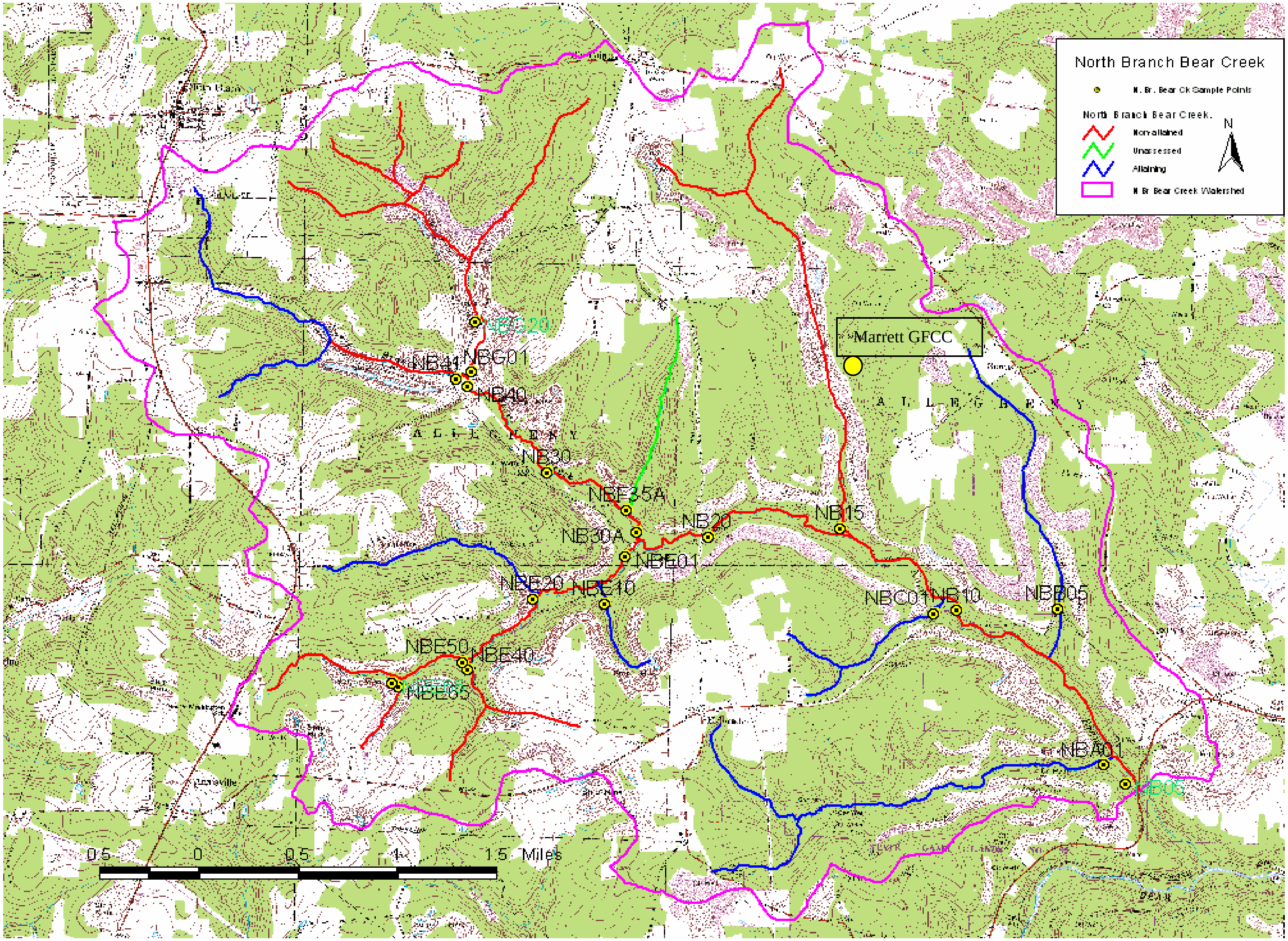
- Increase in total load capacity.
- Transfer of load between point (WLA) and nonpoint (LA) sources.
- Modification of the margin of safety (MOS).
- Change in water quality standards (WQS).
- Non-attainment of WQS with implementation of the TMDL.
- Allocations in trading programs.

Changes in TMDLs That May Not Require EPA Approval

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

Attachment A

North Branch Bear Creek Watershed Maps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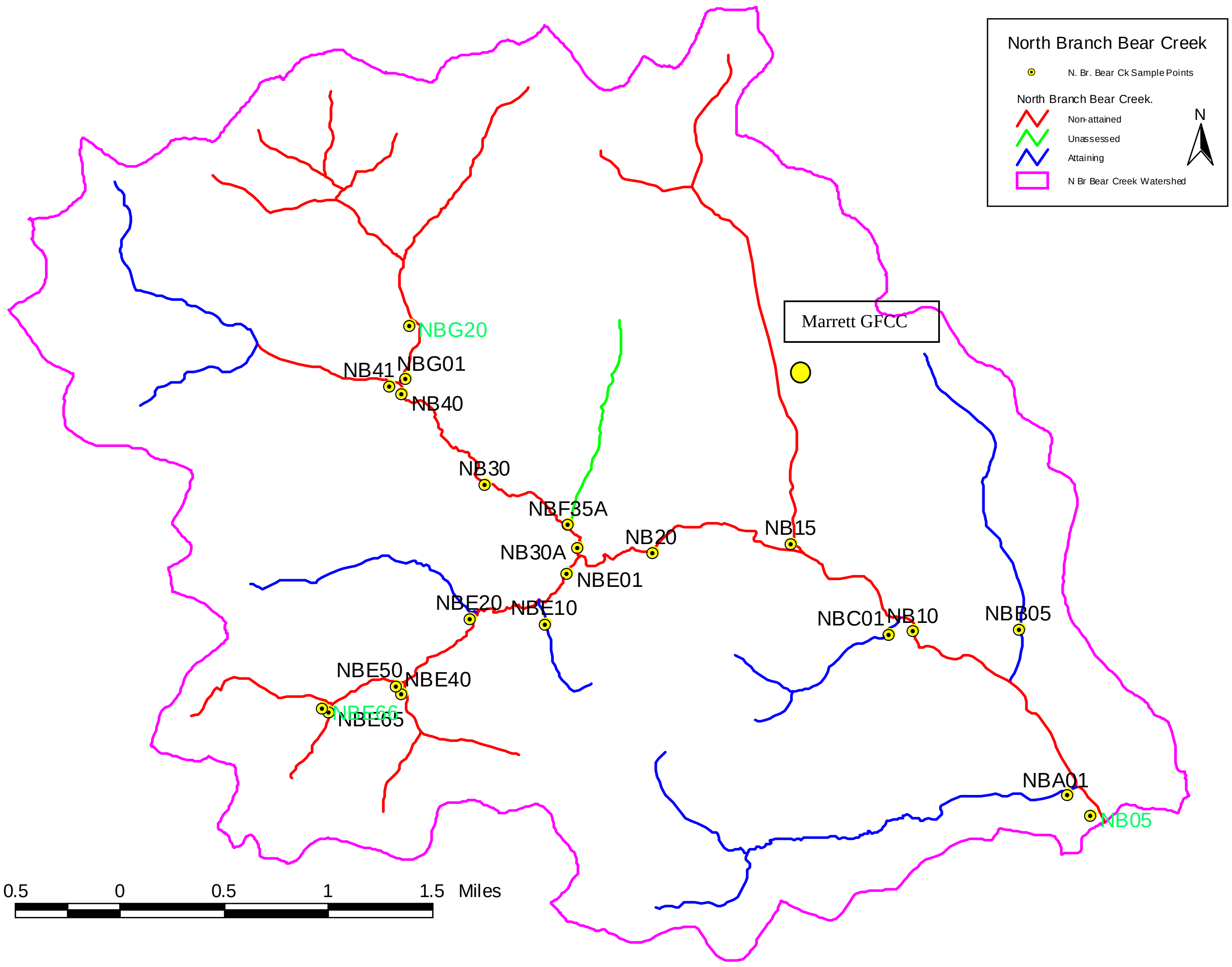
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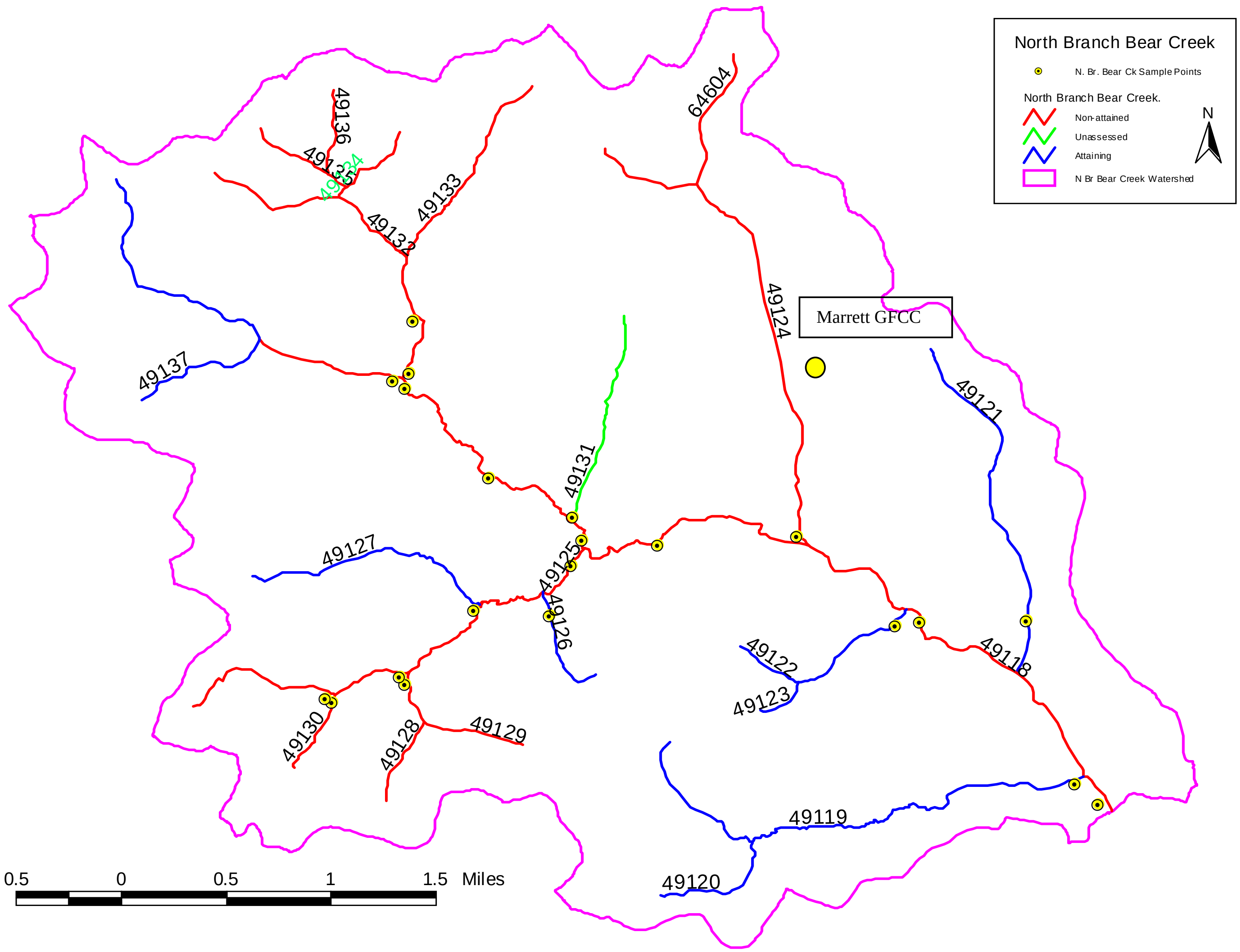
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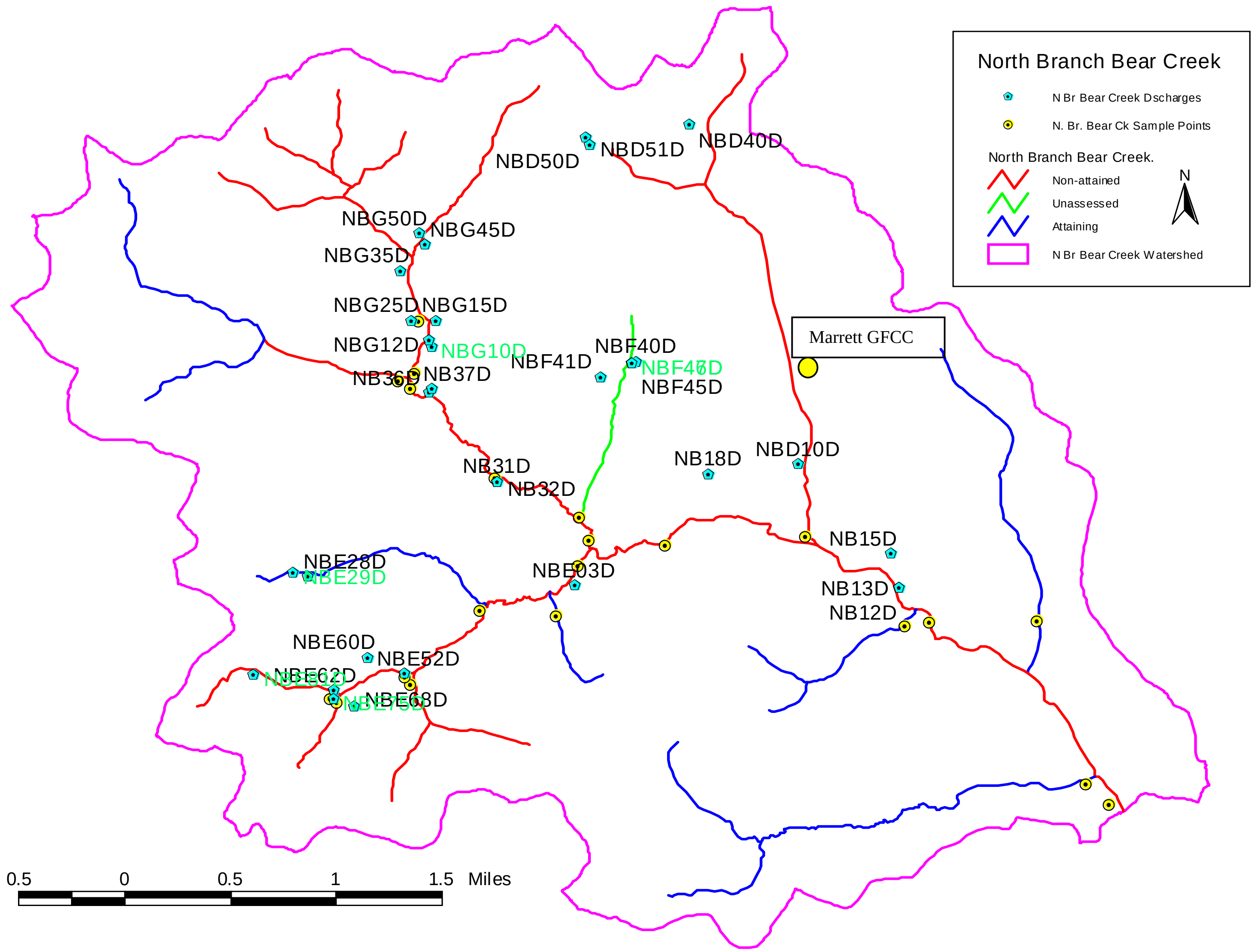
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Attachment B

Method for Addressing Section 303(d) Listings for pH

Method for Addressing 303(d) Listings for pH

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

The pH, a measurement of hydrogen ion acidity presented as a negative logarithm, is not conducive to standard statistics. Additionally, pH does not measure latent acidity. For this reason, and based on the above information, Pennsylvania is using the following approach to address the stream impairments noted on the 303(d) list due to pH. The concentration of acidity in a stream is at least partially chemically dependent upon metals. For this reason, it is extremely difficult to predict the exact pH values, which would result from treatment of abandoned mine drainage. 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.

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.*

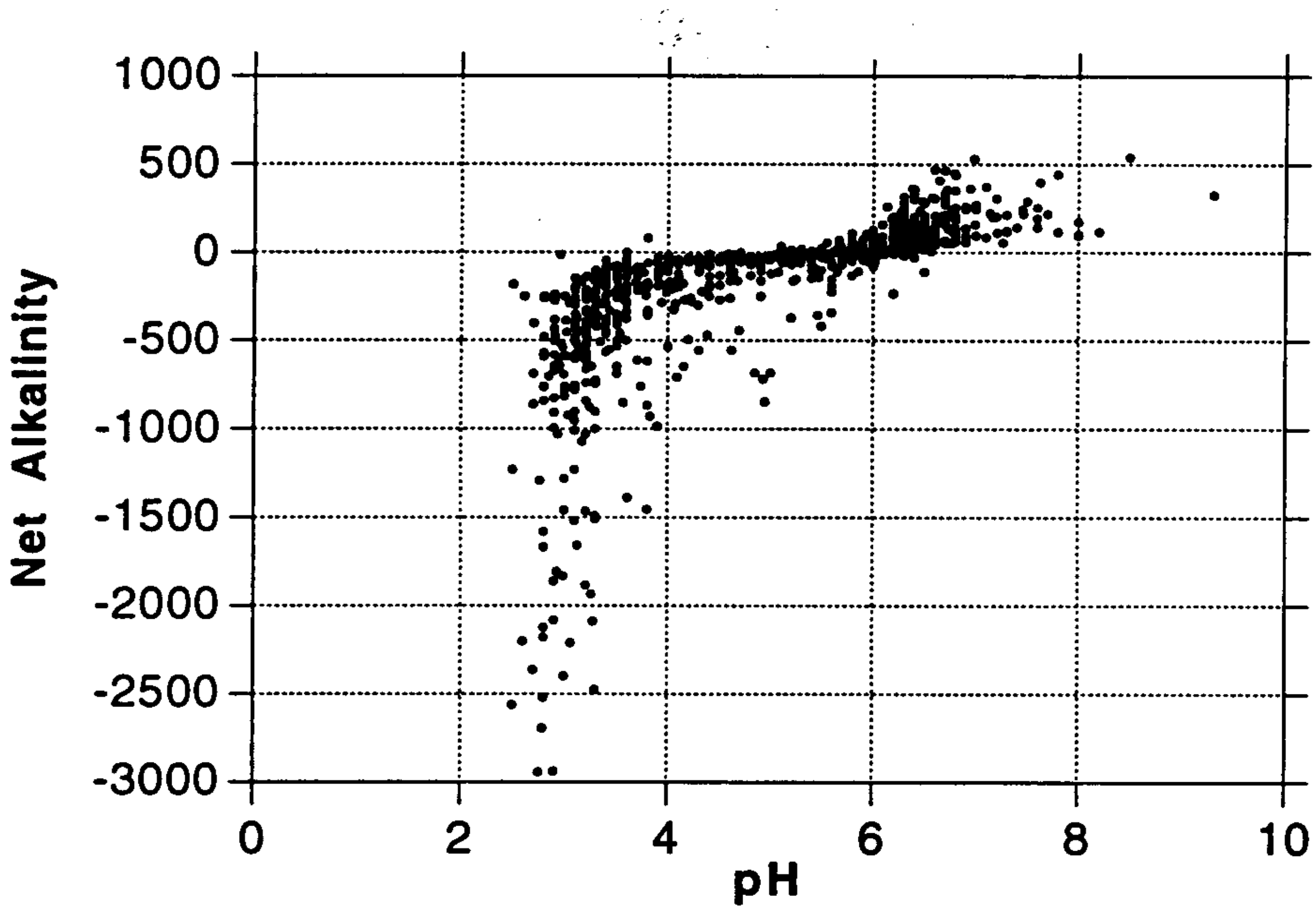


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

Attachment C

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

Method to Quantify Treatment Pond Pollutant Load

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

The end product of the TMDL report is to develop Waste Load Allocations (WLA) and Load Allocations (LA) that represent the amount of pollution the stream can assimilate while still achieving 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

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 0.75 mg/l x 0.01202 = 0.3 lbs./day

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

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

Also, it is the goal of 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.

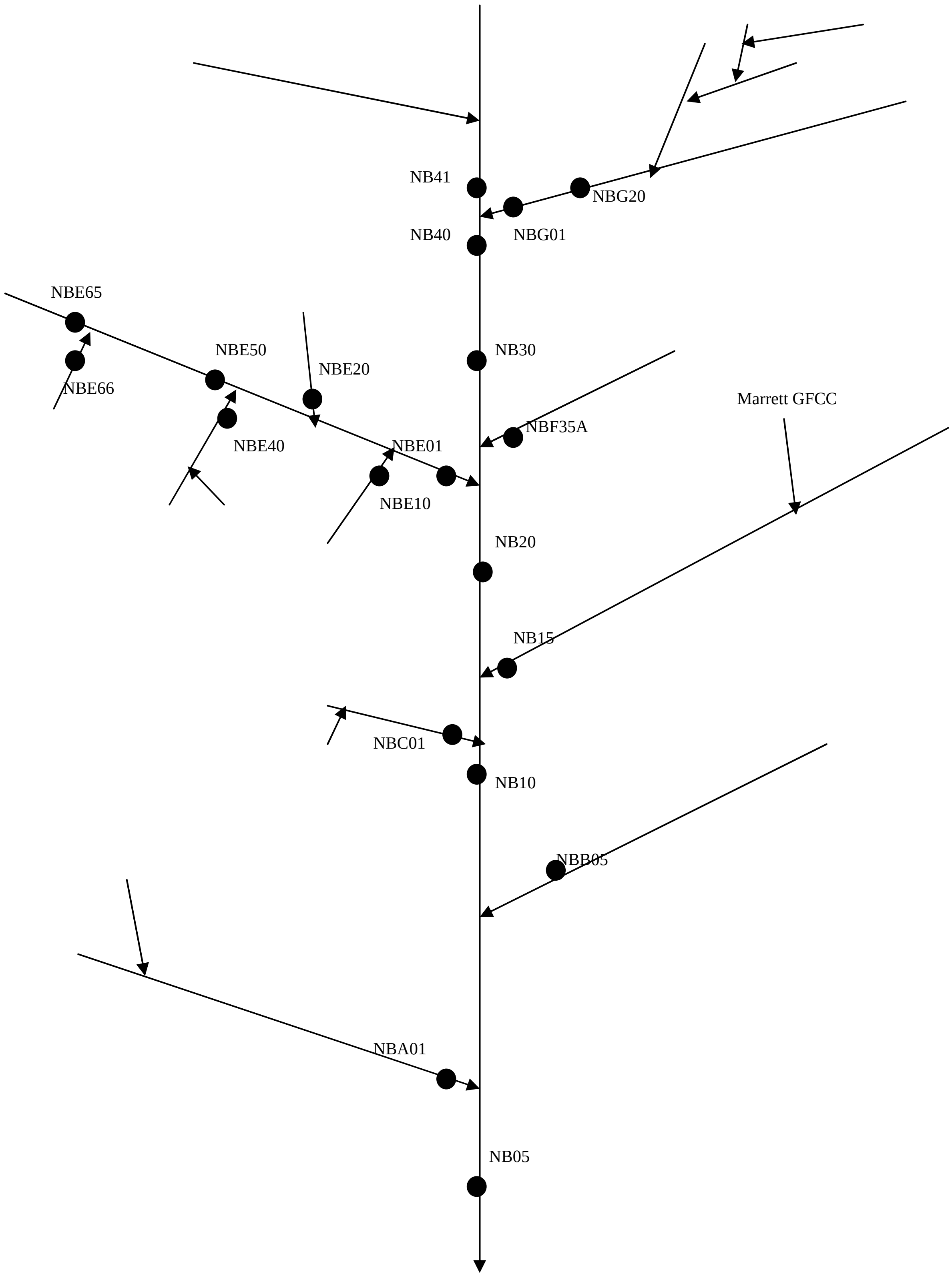
The allowable load for the stream segment is determined by modeling of flow and water quality data. The allowable load has a potential Waste Load Allocation (WLA) component if there is active mining or anticipated future mining and a Load Allocation (LA). So, the sum of the Load Allocation and the Waste 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 may be greater than the current level of mining activity, an additional WLA amount may be included in the allowed load to allow for future mining.

Attachment D

TMDLs By Segment



NB41
NBG20
NB40
NBG01
NBE65
NB30
NBE50
NBE20
NBE66
Marrett GFCC
NBF35A
NBE40
NBE01
NBE10
NB20
NB15
NBC01
NB10
NBB05
NBA01
NB05

North Branch Bear Creek

The TMDL for North Branch Bear Creek consists of load allocations for seventeen sampling sites along North Branch Bear Creek and various unnamed tributaries.

North Branch Bear Creek is listed for pH and metals from AMD as being the cause of the degradation to the stream. The method and rationale for addressing pH is contained in Attachment B.

An allowable long-term average in-stream concentration was determined at the points below for aluminum, iron, manganese 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.

A waste load allocation for future mining was included for this segment of North Branch Bear Creek, NBG01, allowing for two operations with two active pits (1500' x 300') to be permitted in the future on this segment (see page 11 for the method used to quantify treatment pond load).

Table C1. Waste Load Allocations for future mining operations

Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

NBG20 Upstream of NBG01 on Unt 49132

The TMDL for this sample point on North Branch Bear Creek consists of a load allocation to the segment upstream. The load allocation for this segment was computed using water-quality sample data collected at point NBG20. The average flow, measured at the sampling point NBG20 (1.42 MGD), is used for these computations.

There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point NBG20 shows pH ranging between 4.7 and 6.6; pH will be addressed in this TMDL because of the mining impacts. 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.

Table C2. Load Allocations for Point NBG20

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Al	0.43	5.1	0.19	2.2
Fe	2.66	31.5	0.82	9.8
Mn	0.93	11.0	0.34	4.1
Acid	17.43	206.4	2.96	35.1
Alk	9.90	117.2		

Table C3. Calculation of Load Reductions Necessary at Point NBG20

	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	5.1	31.5	11.0	206.4
Allowable Load = TMDL	2.2	9.8	4.1	35.1
Load Reduction	2.9	21.7	6.9	171.3
% Reduction Segment	57	69	63	83

A waste load allocation for future mining was included for this segment of North Branch Bear Creek, NBG01, allowing for two operations with two active pits (1500’ x 300’) to be permitted in the future on this segment (see page 11 for the method used to quantify treatment pond load).

Table C4. Waste Load Allocations for future mining operations

Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

NBG01 Mouth of Unt 49132 Upstream of Confluence with North Branch Bear Creek

The TMDL for this sample point on North Branch Bear Creek consists of a load allocation to all of the area between sample points NBG20 and NBG01. The load allocation for this segment was computed using water-quality sample data collected at point NBG01. The average flow, measured at the sampling point NBG01 (1.62 MGD), is used for these computations.

There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point NBG01 shows pH ranging between 3.5 and 4.8, pH will be addressed in this TMDL because of the mining impacts. 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.

Table C5. Load Allocations for Point NBG01

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Al	3.52	47.6	0.25	3.3
Fe	9.61	130.0	0.67	9.1
Mn	1.45	19.6	0.29	3.9
Acid	64.18	868.0	0.64	8.7
Alk	2.39	32.4		

The calculated load reductions for all the loads that enter point NBG01 must be accounted for in the calculated reductions at sample point NBG01 shown in Table C6. A comparison of measured loads between points NBG20 and NBG01 shows that there is additional loading entering the segment for aluminum, iron, manganese and acidity. The total segment aluminum, iron, manganese and acidity loads are the sum of the upstream allocated loads and any additional loading within the segment.

Table C6. Calculation of Load Reduction at Point NBG01				
	Al	Fe	Mn	Acidity
Existing Load	47.6	130.0	19.6	868.0
Difference in Existing Load between NBG20 & NBG01	42.5	98.5	8.6	661.6
Load tracked from NBG20	2.2	9.8	4.1	35.1
Percent loss due to instream process	-	-	-	-
Percent load tracked from NBG20	-	-	-	-
Total Load tracked from NBG20	44.7	108.3	12.7	696.7
Allowable Load at NBG01	3.3	9.1	3.9	8.7
Load Reduction at NBG01	41.4	99.2	8.8	688.0
% Reduction required at NBG01	93	92	69	99

A waste load allocation for future mining was included for this segment of North Branch Bear Creek, NB41, allowing for one operations with two active pits (1500' x 300') to be permitted in the future on this segment (see page 11 for the method used to quantify treatment pond load).

Table C7. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

NB41 Most Upstream Sample Point on North Branch Bear Creek

The TMDL for this sample point on North Branch Bear Creek consists of a load allocation to the segment upstream. The load allocation for this segment was computed using water-quality sample data collected at point NB41. The average flow, measured at the sampling point NB41 (0.94 MGD), is used for these computations.

There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point NB41 shows pH ranging between 4.8 and 6.6, pH will be addressed in this TMDL because of the mining impacts. 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.

Table C8. Load Allocations for Point NB41				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Al	0.82	6.4	0.20	1.5
Fe	3.23	25.3	0.32	2.5
Mn	1.08	8.5	0.25	1.9
Acid	9.20	72.2	1.84	14.4
Alk	15.56	122.0		

Table C9. Calculation of Load Reduction Necessary at Point NB41				
	Al	Fe	Mn	Acidity
	(#/day)	(#/day)	(#/day)	(#/day)
Existing Load	6.4	25.3	8.5	72.2
Allowable Load=TMDL	1.5	2.5	1.9	14.4
Load Reduction	4.9	22.8	6.6	57.8
Total % Reduction	77	90	78	80

A waste load allocation for future mining was included for this segment of North Branch Bear Creek, NB40, allowing for four operations with two active pits (1500’ x 300’) to be permitted in the future on this segment (see page 11 for the method used to quantify treatment pond load).

Table C10. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 3			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 4			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

NB40 Sample Point Downstream of NB41 and NBG01 on North Branch Bear Creek

The TMDL for this unnamed tributary of North Branch Bear Creek consists of a load allocation to the watershed area between sample points NBG01/NB41 and NB40. The load allocation for this segment was computed using water-quality sample data collected at point NB40. The average flow, measured at the sampling point NB40 (2.81 MGD), is used for these computations.

There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point NB40 shows pH ranging between 4.9 and 6.2; pH will be addressed in this TMDL because of the mining impacts. 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.

Table C11. Load Allocations at Point NB40				
	Measured Sample Data		**Allowable**	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	1.65	38.8	0.40	9.3
Fe	5.77	135.4	0.92	21.7
Mn	1.11	26.0	0.33	7.8
Acid	26.94	632.3	2.16	50.6
Alk	7.75	181.9		

The calculated load reductions for all the loads that enter point NB40 must be accounted for in the calculated reductions at sample point NB40 shown in Table C12. A comparison of measured loads between points NBG01/NB41 and NB40 shows that there is no additional loading entering the segment for aluminum, iron, manganese and acidity. For aluminum, iron, manganese and acidity the percent decrease in existing loads are applied to the allowable upstream loads entering the segment.

Table C12. Calculation of Load Reduction at Point NB40				
	Al	Fe	Mn	Acidity
Existing Load	38.8	135.4	26.0	632.3
Difference in Existing Load between NBG01, NB41 & NB40	-15.2	-19.9	-2.1	-307.9
Load tracked from NBG01 &NB41	4.8	11.6	5.8	23.1
Percent loss due to instream process	28	13	7	33
Percent load tracked from NBG01 & NB41	72	87	93	67
Total Load tracked from NBG01 & NB41	3.5	10.1	5.4	15.5
Allowable Load at NB40	9.3	21.7	7.8	50.6
Load Reduction at NB40	0.0	0.0	0.0	0.0
% Reduction required at NB40	0	0	0	0

A waste load allocation for future mining was included for this segment of North Branch Bear Creek, NB30, allowing for five operations with two active pits (1500’ x 300’) to be permitted in the future on this segment (see page 11 for the method used to quantify treatment pond load).

Table C13. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 3			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 4			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 5			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

NB30 Sample Point Downstream of NB40 on North Branch Bear Creek

The TMDL for sampling point NB30 consists of a load allocation to the area upstream of point NB30. The load allocation for this tributary was computed using water-quality sample data collected at point NB30. The average flow, measured at the sampling point NB30 (6.23 MGD), is used for these computations.

There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point NB30 shows pH ranging between 3.6 and 4.9; pH will be addressed in this TMDL because of the mining impacts. 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.

Table C14. Load Allocations at Point NB30				
	Measured Sample Data		**Allowable**	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	1.71	88.7	0.24	12.4
Fe	5.41	281.3	0.65	33.8
Mn	1.40	72.9	0.28	14.6
Acid	40.44	2101.1	1.62	84.0
Alk	3.57	185.4		

The calculated load reductions for all the loads that enter point NB40 must be accounted for in the calculated reductions at sample point NB40 shown in Table C15. A comparison of measured loads between points NB40 and NB30 shows that there is additional loading entering the segment for aluminum, iron, manganese and acidity. The total segment aluminum, iron, manganese and acidity loads are the sum of the upstream allocated loads and any additional loading within the segment.

Table C15. Calculation of Load Reduction at Point NB30				
	Al	Fe	Mn	Acidity
Existing Load	88.7	281.3	72.9	2101.1
Difference in Existing Load between NB40 & NB30	49.9	145.9	46.9	1468.8
Load tracked from NB40	9.3	21.7	7.8	50.6
Percent loss due to instream process	-	-	-	-
Percent load tracked from NB40	-	-	-	-
Total Load tracked from NB40	59.2	167.6	54.7	1519.4
Allowable Load at NB30	12.4	33.8	14.6	84.0
Load Reduction at NB30	46.8	133.8	40.1	1435.4
% Reduction required at NB30	79	80	73	95

NBE65 Headwaters of Unt 49125

The TMDL for sampling point NBE65 consists of a load allocation to all of the area upstream of point NBE65. The load allocation for this tributary was computed using water-quality sample data collected at point NBE65. The average flow, measured at the sampling point NBE65 (0.26 MGD), is used for these computations.

There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point NBE65 shows pH ranging between 5.2 and 6.1; pH will be addressed in this TMDL because of the mining impacts. 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.

Table C16. Load Allocations at Point NBE65				
	Measured Sample Data		**Allowable**	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.38	0.8	0.26	0.6
Fe	0.14	0.3	0.14	0.3
Mn	0.97	2.1	0.47	1.0
Acid	9.91	21.5	1.09	2.4
Alk	3.91	8.5		

Table C17 Calculation of Load Reduction Necessary at Point NBE65				
	Al	Fe	Mn	Acidity
	(#/day)	(#/day)	(#/day)	(#/day)
Existing Load	0.8	0.3	2.1	21.5
Allowable Load=TMDL	0.6	0.3	1.0	2.4
Load Reduction	0.2	0.0	1.1	19.1
Total % Reduction	25	0	52	89

NBE66 Mouth of Unt 49130 Upstream of Confluence with Unt 49125

The TMDL for sampling point NBE66 consists of a load allocation to the all of the area upstream of point NBE66. The load allocation for this tributary was computed using water-quality sample data collected at point NBE66. The average flow, measured at the sampling point NBE66 (0.13 MGD), is used for these computations.

There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point NBE66 shows pH ranging between 6.1 and 6.4; pH will be addressed in this TMDL because of the mining impacts. 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.

Table C18. Load Allocations at Point NBE66				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.18	0.2	0.10	0.1
Fe	0.46	0.5	0.32	0.3
Mn	0.48	0.5	0.40	0.4
Acid	43.87	47.1	6.58	7.1
Alk	12.80	13.7		

Table C19. Calculation of Load Reduction Necessary at Point NBE66				
	Al	Fe	Mn	Acidity
	(#/day)	(#/day)	(#/day)	(#/day)
Existing Load	0.2	0.5	0.5	47.1
Allowable Load=TMDL	0.1	0.3	0.4	7.1
Load Reduction	0.1	0.2	0.1	40.0
Total % Reduction	50	40	20	85

NBE50 Unt 49125 Downstream of Sample Points NBE65 and NBE66

The TMDL for this segment of North Branch Bear Creek consists of a load allocation to the area between sample points NBE65/NBE66 and NBE50. The load allocation for this segment was computed using water-quality sample data collected at point NBE50. The average flow, measured at the sampling point NBE50 (0.49 MGD), is used for these computations.

There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point NBE50 shows pH ranging between 4.7 and 6.1; pH will be addressed in this TMDL because of the mining impacts. 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.

Table C20. Load Allocations for Point NBE50				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	1.72	7.1	0.33	1.3
Fe	0.28	1.2	0.28	1.2
Mn	2.53	10.4	0.46	1.9
Acid	25.41	104.6	1.27	5.2
Alk	3.60	14.8		

The calculated load reductions for all the loads that enter point NBE50 must be accounted for in the calculated reductions at sample point NBE50 shown in Table C21. A comparison of measured loads between points NBE65/NBE66 and NBE50 shows that there is no additional loading entering the segment for iron. For iron the percent decrease in existing loads are applied to the allowable upstream loads entering the segment. There is additional loading entering the segment for aluminum, manganese and acidity. The total segment aluminum, manganese and acidity loads are the sum of the upstream allocated loads and any additional loading within the segment.

Table C21. Calculation of Load Reduction at Point NBE50				
	Al	Fe	Mn	Acidity
Existing Load	7.1	1.2	10.4	104.6
Difference in Existing Load between NBE65/NBE66 & NBE50	6.1	0.4	7.8	36.0
Load tracked from NBE65 &NBE66	0.7	0.6	1.4	9.5
Percent loss due to instream process	-	-	-	-
Percent load tracked from NBE65 & NBE66	-	-	-	-
Total Load tracked from NBE65 & NBE66	6.8	1.0	9.2	45.5
Allowable Load at NBE50	1.3	1.2	1.9	5.2
Load Reduction at NBE50	5.5	0.0	7.3	40.3
% Reduction required at NBE50	81	0	80	89

NBE40 Mouth of Unt 49128 Upstream of Confluence with Unt 49125

The TMDL for this segment of North Branch Bear Creek consists of a load allocation to the area upstream of sample point NBE40. The load allocation for this segment was computed using water-quality sample data collected at point NBE40. The average flow, measured at the sampling point NBE40 (0.34 MGD), is used for these computations.

There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point NBE40 shows pH ranging between 5.8 and 6.6; pH will be addressed in this TMDL because of mining impacts. 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.

Table C22. Load Allocations for Point NBE40

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.13	0.3	0.13	0.3
Fe	0.23	0.7	0.23	0.7
Mn	0.41	1.2	0.40	1.1
Acid	10.68	29.9	1.17	3.3
Alk	7.62	21.3		

Table C23. Calculation of Load Reduction Necessary at Point NBE40

	Al	Fe	Mn	Acidity
	(#/day)	(#/day)	(#/day)	(#/day)
Existing Load	0.3	0.7	1.2	29.9
Allowable Load=TMDL	0.3	0.7	1.1	3.3
Load Reduction	0.0	0.0	0.1	26.6
Total % Reduction	0	0	8	90

A waste load allocation for future mining was included for this segment of North Branch Bear Creek, NBE20, allowing for one operation with two active pits (1500’ x 300’) to be permitted in the future on this segment (see page 11 for the method used to quantify treatment pond load).

Table C24. Waste Load Allocations for future mining operations

Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

NBE20 Mouth of Unt 49127 Upstream of Confluence with Unt 49125

The TMDL for this segment of North Branch Bear Creek consists of a load allocation to the area upstream of sample point NBE20. The load allocation for this segment was computed using water-quality sample data collected at point NBE20. The average flow, measured at the sampling point NBE20 (0.55 MGD), is used for these computations.

There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point NBE20 shows pH ranging between 3.4 and 4.1; pH will be addressed in this TMDL because of mining impacts. 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.

Table C25. Load Allocations for Point NBE20

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	10.52	48.1	0.42	1.9
Fe	2.03	9.3	0.59	2.7
Mn	11.74	53.6	0.35	1.6
Acid	111.00	507.2	0.00	0.0
Alk	0.00	0.0		

Table C26. Calculation of Load Reduction Necessary at Point NBE20

	Al	Fe	Mn	Acidity
	(#/day)	(#/day)	(#/day)	(#/day)
Existing Load	48.1	9.3	53.6	507.2
Allowable Load=TMDL	1.9	2.7	1.6	0.0
Load Reduction	46.2	6.6	52.0	507.2
Total % Reduction	96	71	97	100

A waste load allocation for future mining was included for this segment of North Branch Bear Creek, NBE10, allowing for one operation with two active pits (1500’ x 300’) to be permitted in the future on this segment (see page 11 for the method used to quantify treatment pond load).

Table C27. Waste Load Allocations for future mining operations

Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

NBE10 Mouth of Unt 49126 Upstream of Confluence with Unt 49125

The TMDL for this segment of North Branch Bear Creek consists of a load allocation to the area upstream of sample point NBE10. The load allocation for this segment was computed using water-quality sample data collected at point NBE10. The average flow, measured at the sampling point NBE10 (2.20 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point NBE10 shows pH ranging between 4.9 and 6.7; pH will be addressed in this TMDL because of mining impacts. 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.

Table C28. Load Allocations for Point NBE10

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.30	5.5	0.10	1.9
Fe	0.19	3.5	0.19	3.5
Mn	0.50	9.2	0.14	2.6
Acid	12.40	227.3	0.99	18.2
Alk	7.33	134.3		

Table C29. Calculation of Load Reduction Necessary at Point NBE10

	Al	Fe	Mn	Acidity
	(#/day)	(#/day)	(#/day)	(#/day)
Existing Load	5.5	3.5	9.2	227.3
Allowable Load=TMDL	1.9	3.5	2.6	18.2
Load Reduction	3.6	0.0	6.6	209.1
Total % Reduction	66	0	72	92

A waste load allocation for future mining was included for this segment of North Branch Bear Creek, NBE01, allowing for five operations with two active pits (1500’ x 300’) to be permitted in the future on this segment (see page 11 for the method used to quantify treatment pond load).

Table C30. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 3			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 4			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 5			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

NBE01 Mouth of Unt 49125 Upstream of Confluence with North Branch Bear Creek

The TMDL for this segment of North Branch Bear Creek consists of a load allocation to the area between NBE50/NBE40/NBE20/NBE10 and sample point NBE01. The load allocation for this segment was computed using water-quality sample data collected at point NBE01. The average flow, measured at the sampling point NBE01 (3.18 MGD), is used for these computations.

There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point NBE01 shows pH ranging between 4.3 and 4.7; pH will be addressed in this TMDL because of mining impacts. 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.

Table C31. Load Allocations for Point NBE01				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	2.43	64.5	0.36	9.7
Fe	0.73	19.3	0.59	15.6
Mn	3.34	88.5	0.50	13.3
Acid	39.45	1045.7	1.18	31.4
Alk	2.46	65.2		

The calculated load reductions for all the loads that enter point NBE01 must be accounted for in the calculated reductions at sample point NBE01 shown in Table C32. A comparison of measured loads between points NBE50/NBE40/NBE20/NBE10 and NBE01 shows that there is no additional loading entering the segment for aluminum and iron. For aluminum and iron the percent decrease in existing loads are applied to the allowable upstream loads entering the segment. There is additional loading entering the segment for manganese and acidity. The total segment manganese and acidity loads are the sum of the upstream allocated loads and any additional loading within the segment.

Table C32. Calculation of Load Reduction at Point NBE01				
	Al	Fe	Mn	Acidity
Existing Load	64.5	19.3	88.5	1045.7
Difference in Existing Load between NBE50, NBE40 NBE20, NBE10 & NBE01	3.5	4.6	14.1	176.7
Load tracked from NBE50, NBE40, NBE20 &NBE10	5.4	8.1	7.2	26.7
Percent loss due to instream process	-	-	-	-
Percent load tracked from NBE50, NBE40, NBE20 & NBE10	-	-	-	-
Total Load tracked from NBE50, NBE40, NBE20 & NBE10	8.9	12.7	21.3	203.4
Allowable Load at NBE01	9.7	15.6	13.3	31.4
Load Reduction at NBE01	0.0	0.0	8.0	172.0
% Reduction required at NBE01	0	0	38	85

NBF35A Mouth of Unt 49131 Upstream of Confluence with North Branch Bear Run

The TMDL for this unnamed tributary of North Branch Bear Creek consists of a load allocation to all of the watershed area upstream of sample point NBF35A. The load allocation for this segment was computed using water-quality sample data collected at point NBF35A. The average flow, measured at the sampling point NBG35A (0.69 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point NBF35A shows pH ranging between 6.5 and 6.7; pH will be addressed in this TMDL because of mining impacts. 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.

Allocations were not calculated for aluminum and iron because all of the aluminum samples were less than detection and the iron samples were less than detection or below criteria.

Table C33. Load Allocations at Point NBF35A

	Measured Sample Data		**Allowable**	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	ND	ND	NA	NA
Fe	0.31	1.8	0.31	1.8
Mn	0.09	0.5	0.09	0.5
Acid	10.50	60.8	1.79	10.3
Alk	11.50	66.6		

Table C34. Calculation of Load Reduction Necessary at Point NBF35A

	Al	Fe	Mn	Acidity
	(#/day)	(#/day)	(#/day)	(#/day)
Existing Load	ND	1.8	0.5	60.8
Allowable Load=TMDL	NA	1.8	0.5	10.3
Load Reduction	0.0	0.0	0.0	50.5
Total % Reduction	0	0	0	83

A waste load allocation for future mining was included for this segment of North Branch Bear Creek, NB20, allowing for five operations with two active pits (1500’ x 300’) to be permitted in the future on this segment (see page 11 for the method used to quantify treatment pond load).

Table C35. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 3			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 4			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 5			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

NB20 North Branch Bear Creek Downstream of Unt 49125

The TMDL for sampling point NB20 consists of a load allocation of the area between sample points NBE01/NB30/NBF35A and NB20. The load allocation for this tributary was computed using water-quality sample data collected at point NB20. The average flow, measured at the sampling point NB20 (8.83 MGD), is used for these computations.

There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point NB20 shows pH ranging between 3.8 and 4.8; pH will be addressed in this TMDL because of the mining impacts. 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.

Table C36. Load Allocations for Point NB20				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	1.91	140.6	0.40	29.5
Fe	2.00	147.2	0.52	38.3
Mn	2.19	161.6	0.42	30.7
Acid	35.81	2638.4	1.07	79.2
Alk	2.20	162.4		

The calculated load reductions for all the loads that enter point NB20 must be accounted for in the calculated reductions at sample point NB20 shown in Table C37. A comparison of measured loads between points NBE01/NB30/NBF25A and NB20 shows that there is no additional loading entering the segment for aluminum, iron and manganese. For aluminum, iron and manganese the percent decrease in existing loads are applied to the allowable upstream loads entering the segment. There is additional loading entering the segment for acidity. The total segment acidity load is the sum of the upstream allocated load and any additional loading within the segment.

Table C37. Calculation of Load Reduction at Point NB20				
	Al	Fe	Mn	Acidity
Existing Load	140.6	147.2	161.6	2638.4
Difference in Existing Load between NBE01, NB30, NBF35A & NB20	-12.6	-155.2	-0.3	-569.2
Load tracked from NBE01, NB30 &NBF35A	22.1	51.2	28.4	125.7
Percent loss due to instream process	9	51	<0.01	18
Percent load tracked from NBE01, NB30 & NBF35A	91	49	>99.9	82
Total Load tracked from NBE01, NB30 & NBF35A	20.1	25.1	28.4	103.1
Allowable Load at NB20	29.5	38.3	30.7	79.2
Load Reduction at NB20	0.0	0.0	0.0	23.9
% Reduction required at NB20	0	0	0	23

Wasteload allocations for the Marett GFCC operation were incorporated into the calculations at NB15. This is the first downstream monitoring point that receives all the potential flow of treated water from the treatment sites.

Table C38. Waste Load Allocation of Permitted Discharges

Parameter	Allowable Average Monthly Conc. (mg/l)	Calculated Average Flow (MGD)	WLA (lbs/day)
Marrett GFCC			
Al	2.0	0.8646	14.42
Fe	3.0	0.8646	21.63
Mn	1.3	0.8646	9.37

NB15 Mouth of Unt 49124 Upstream of Confluence with North Branch Bear Creek

The TMDL for this segment of North Branch Bear Creek consists of a load allocation to all of the watershed area upstream of sample point NB15. The load allocation for this segment was computed using water-quality sample data collected at point NB15 that had been adjusted using the flow adjusted concentration method described in Attachment E to better characterize the effects of the Marrett GFCC discharge on NB15 and other downstream points. . The average adjusted flow, calculated at the sampling point NB15 (3.59 MGD), is used for these computations.

There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point NB15 shows pH ranging between 4.9 and 6.1; pH will be addressed in this TMDL because of the mining impacts. 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.

Table C39. Load Allocations for Point NB15

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	1.56	46.8	0.55	16.4
Fe	4.37	130.8	0.87	26.2
Mn	2.00	59.8	0.40	12.0
Acid	48.90	996.3	5.87	119.6
Alk	8.55	174.2		

Table C40. Calculation of Load Reduction Necessary at Point NB15				
	Al	Fe	Mn	Acidity
	(#/day)	(#/day)	(#/day)	(#/day)
Existing Load	46.8	130.8	59.8	996.3
Allowable Load=TMDL	16.4	26.2	12.0	119.6
Load Reduction	30.4	104.6	47.8	876.7
Total % Reduction	65	80	80	88

NBC01 Mouth of Unt 49123 Upstream of the Confluence with North Branch Bear Creek

No load allocations were calculated for this sample point because the two samples collected were significantly less than criteria or not detected and this segment is net alkaline.

A waste load allocation for future mining was included for this segment of North Branch Bear Creek, NB10, allowing for five operations with two active pits (1500’ x 300’) to be permitted in the future on this segment (see page 11 for the method used to quantify treatment pond load).

Table C41. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 3			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 4			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 5			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

NB10 North Branch Bear Creek Downstream of NB15

The TMDL for this segment of North Branch Bear Creek consists of a load allocation to all of the watershed area between sample points NB20/NB15 and NB10. The load allocation for this segment was computed using water-quality sample data collected at point NB10 that had been adjusted using the flow adjusted concentration method described in Attachment E to better characterize the effects of the Marrett GFCC discharge on other downstream points. The average adjusted flow, calculated at the sampling point NB10 (7.74 MGD), is used for these computations.

There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point NB10 shows pH ranging between 3.8 and 4.9; pH will be addressed in this TMDL because of the mining impacts. 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.

Table C42 Load Allocations for Point NB10

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	2.00	129.1	0.40	25.8
Fe	1.58	101.7	0.69	44.8
Mn	2.09	134.8	0.46	29.7
Acid	32.13	1766.3	0.96	53.0
Alk	2.07	114.0		

The calculated load reductions for all the loads that enter point NB10 must be accounted for in the calculated reductions at sample point NB10 shown in Table C43. A comparison of measured loads between points NB20/NB15 and NB10 shows that there is no additional loading entering the segment for iron. For iron the percent decrease in existing loads are applied to the allowable upstream loads entering the segment. There is additional loading entering the segment for aluminum, manganese and acidity. The total segment aluminum, manganese and acidity load is the sum of the upstream allocated load and any additional loading within the segment.

Table C43. Calculation of Load Reduction at Point NB10				
	Al	Fe	Mn	Acidity
Existing Load	129.1	101.7	134.8	1766.3
Difference in Existing Load between NB20, NB15 & NB10	-58.3	-176.3	-86.6	-1868.4
Load tracked from NB20 & NB15	45.9	64.4	42.7	198.7
Percent loss due to instream process	25	63	39	51
Percent load tracked from NB20 & NB15	75	37	61	49
Total Load tracked from NB20 & NB15	34.4	23.8	26.0	97.4
Allowable Load at NB10	25.8	44.8	29.7	53.0
Load Reduction at NB10	8.6	0.0	0.0	44.4
% Reduction required at NB10	25	0	0	46

NBB05 Mouth of Unt 49121 Upstream of the Confluence with North Branch Bear Creek

No load allocations were calculated for this sample point because the two samples collected were significantly less than criteria or not detected and this segment is net alkaline.

NBA01 Mouth of Unt 49121 Upstream of the Confluence with North Branch Bear Creek

No load allocations were calculated for this sample point because the two samples collected were significantly less than criteria or not detected and this segment is net alkaline.

A waste load allocation for future mining was included for this segment of North Branch Bear Creek, NB05, allowing for five operations with two active pits (1500’ x 300’) to be permitted in the future on this segment (see page 11 for the method used to quantify treatment pond load).

Table C44. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 3			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 4			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 5			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

NB05 Most Downstream Sample Point on North Branch Bear Creek Upstream of Confluence with the Allegheny River

The TMDL for this segment of North Branch Bear Creek consists of a load allocation to all of the watershed area between sample points NB10 and NB15. The load allocation for this segment was computed using water-quality sample data collected at point NB05 that had been adjusted using the flow adjusted concentration method described in Attachment E to better characterize the effects of the Marrett GFCC discharge on NB05. The average adjusted flow, calculated at the sampling point NB05 (11.90 MGD), is used for these computations.

There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point NB05 shows pH ranging between 4.8 and 6.0; pH will be addressed in this TMDL because of the mining impacts. 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.

Table C45. Load Allocations for Point NB05				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	1.45	143.5	0.42	41.6
Fe	1.11	110.2	0.63	62.8
Mn	1.71	169.5	0.39	39.0
Acid	24.43	2190.3	1.47	131.4
Alk	5.13	459.7		

The calculated load reductions for all the loads that enter point NB05 must be accounted for in the calculated reductions at sample point NB05 shown in Table C46. A comparison of measured loads between points NB10 and NB05 shows that there is no additional loading entering the segment for aluminum, iron, manganese and acidity. For aluminum, iron, manganese and acidity the percent decrease in existing loads are applied to the allowable upstream loads entering the segment.

Table C46. Calculation of Load Reduction at Point NB05				
	Al	Fe	Mn	Acidity
Existing Load	143.5	110.2	169.5	2190.3
Difference in Existing Load between NB10 & NB05	14.4	8.5	34.7	424.0
Load tracked from NB10	25.8	44.8	29.7	53.0
Percent loss due to instream process	-	-	-	-
Percent load tracked from NB10	-	-	-	-
Total Load tracked from NB10	40.2	52.3	64.3	477.0
Allowable Load at NB05	41.6	62.8	39.0	131.4
Load Reduction at NB05	0.0	0.0	25.3	345.6
% Reduction required at NB05	0	0	39	72

Margin of Safety (MOS)

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 added when the calculations were performed with a daily iron average instead of the 30-day average.

Seasonal Variation

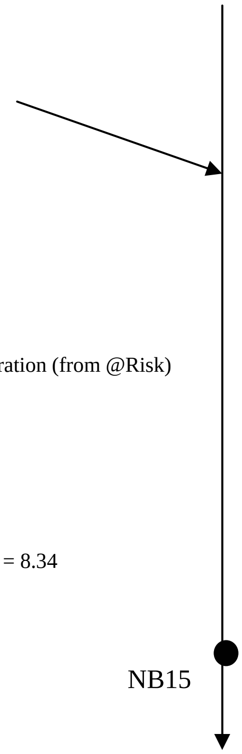
Seasonal variation is implicitly accounted for in these TMDLs because the data used represent all seasons.

Critical Conditions

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

Attachment E

Flow Adjusted Concentration Method



NB15

Adjusted Available Concentration (from @Risk)

Aluminum: 0.55 mg/l
Iron: 0.87 mg/l
Manganese: 0.40 mg/l

Average flow: 3.592 MGD

Conversion factor to lbs/day = 8.34

Adjusted Alowable Load

Alluminum: 16.4 lbs/day
Iron: 26.2 lbs/day
Manganese: 12.0 lbs/day

Marett GFCC Load Allocation

Effluent Limits:
Aluminum: 2.0 mg/l
Iron: 3.0 mg/l
Manganese: 1.3 mg/l

Average Flow: 0.8646 MGD

WLA = effluent limit * average flow* 8.34

Aluminum: 14.42 lbs/day
Iron: 21.63 lbs/day
Manganese: 9.37 lbs/day

Flow adjusted mass balance method

Total flow = 1.152 MGD (Marett GFCC) + 2.44 MGD (Instream flow measured at NB15) = 3.592 MGD

Flow ratio total:

Marett GFCC 1.152/3.592 = 0.32 NB15 2.44/3.592 = 0.68

For every sample point at NB15

Flow adjusted iron concentration at NB15 (10/29/2003) = (flow ratio Marett * iron limit at Marett) + (flow ratio NB15 * iron concentration NB15) = (0.32 * 3) + (0.68 * 4.19) = 3.8 mg/l

Flow adjusted total allowable iron load at NB15 = allowable iron concentration from @Risk simulation using average flow adjusted iron concentration at NB15 * total flow * 8.34 = 0.87 * 3.592 * 8.34 = 26.2 lbs/day

TMDL = waste load allocation + load allocation + margin of safety (implicit in model)

LA at NB15 = TMDL – actual WLA = 26.2 – 21.63 = 4.57

Attachment F

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

The following are excerpts from the Pennsylvania DEP Section 303(d) narratives that justify changes in listings between the 1996, 1998, 2002, 2004 and 2006 303(d) Lists and Integrated Report/List (2006). The Section 303(d) listing process has undergone an evolution in Pennsylvania since the development of the 1996 list.

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

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

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

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

Migration to National Hydrography Data (NHD)

New to the 2006 report is use of the 1/24,000 National Hydrography Data (NHD) streams GIS layer. Up until 2006 the Department relied upon its own internally developed stream layer. Subsequently, the United States Geologic Survey (USGS) developed 1/24,000 NHD streams layer for the Commonwealth based upon national geodatabase standards. In 2005, DEP contracted with USGS to add missing streams and correct any errors in the NHD. A GIS contractor transferred the old DEP stream assessment information to the improved NHD and the old DEP streams layer was archived. Overall, this marked an improvement in the quality of the streams layer and made the stream assessment data compatible with national standards but it necessitated a change in the Integrated Listing format. The NHD is not attributed with the old DEP five digit stream codes so segments can no longer be listed by stream code but rather only by stream name or a fixed combination of NHD fields known as reachcode and ComID. The NHD is aggregated by Hydrologic Unit Code (HUC) watersheds so HUCs rather than the old

State Water Plan (SWP) watersheds are now used to group streams together. The map in Appendix E illustrates the relationship between the old SWP and new HUC watershed delineations. A more basic change was the shift in data management philosophy from one of "dynamic segmentation" to "fixed segments". The dynamic segmentation records were proving too difficult to mange from an historical tracking perspective. The fixed segment methods will remedy that problem. The stream assessment data management has gone through many changes over the years as system requirements and software changed. It is hoped that with the shift to the NHD and OIT's (Office of Information Technology) fulltime staff to manage and maintain SLIMS the systems and formats will now remain stable over many Integrated Listing cycles.

Attachment G

Marrett Reclamation Project

Project Necessity and Benefits

The Marrett government financed construction contract (GFCC #10-06-02) is located in the headwaters of the NB15 unnamed tributary to North Branch Bear Creek (Figure 1). Historically, the area was surface mined, including mining through the existing stream channel, and subsequently abandoned. As a result, the area includes many abandoned mine land features such as water-filled pits and unvegetated spoils which generate multiple sources of AMD throughout the project area. The project will have many environmental benefits to the unnamed tributary to North Branch Bear Creek and possibly downstream on the mainstem of the North Branch Bear Creek. These benefits include:

- Reclamation of over 7,000 linear feet of abandoned open highwall
- Reconstruction of 4,300 feet of previously affected stream channel
- Regrading and revegetation of over 66 acres of abandoned spoil banks that were cast into the previously existing stream valley prior to modern mining regulation
- Elimination of twelve existing discharges that emanate either from the central spoil bank or the unreclaimed highwalls, and which contribute some of the highest concentrations of metals (up to 30.31 mg/l iron and 15.31 mg/l manganese) found in background samples to the stream
- Stabilization of the stream channel which will decrease the existing suspended sediment load currently elevated by accelerated erosion in soft spoil, further reducing metals loading in the stream

Implementation of reclamation using remining techniques has been shown to be effective in reducing pollution loads delivered to streams impacted by mine drainage emanating from abandoned mine sites. A study of Pennsylvania's remining program evaluated pre and post-mining water quality characteristics at 231 sites (U.S. EPA 2000). Overall, 91.9% of sites improved or showed no significant difference in acidity after remining; 91% of sites improved or showed no significant different in manganese; 94.7% of sites improved or showed no significant difference in iron; 96.6% of sites improved or showed no significant difference in aluminum; and 94.4% of sites improved or showed no significant difference in flow volume (U.S. EPA 2000). The most significant influence of remining on loading is due to flow reduction, largely through the BMPs of regrading and revegetation (Smith 1988 and Hawkins 1995). Thus, it is anticipated that this remining project will create long-term environmental benefits for the unnamed tributary to North Branch Bear Creek by decreasing or eliminating sources of nonpoint source pollution.

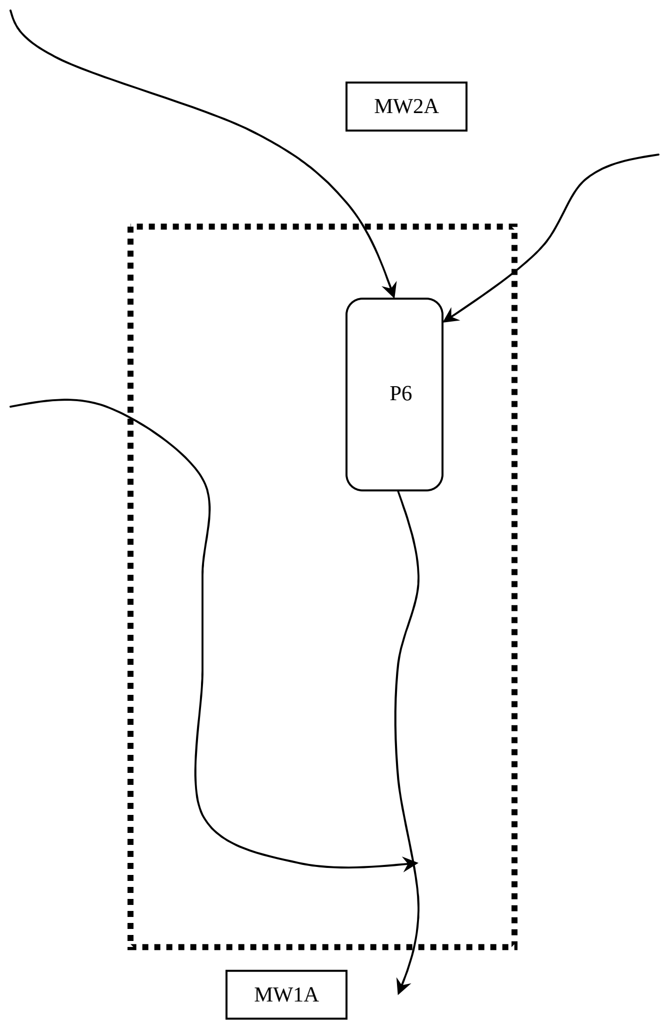


Figure 1. Site diagram of proposed Marrett GFCC project; dashed lines signify project boundaries

Existing Water Quality Characteristics

Site water quality is highly influenced by groundwater contamination which increases along a north/south gradient. Water quality of samples drawn from MW-2A, the upradient Clarion coal seam monitoring well (representative of uncontaminated groundwater at the site), show little effects of mining. Levels of metals are low (average only 0.55 mg/l iron and 0.09 mg/l manganese) and net alkaline (Table 1). However, water samples drawn from MW-1A, the downgradient monitoring well (representative of quality characteristics throughout the site of contaminated groundwater delivered to the surface as mine drainage), contain average metals concentrations of 11.34 mg/l iron and 3.47 mg/l manganese[2] and, while net alkaline, are three times less alkaline than water from MW-1A (Table 2). Two mine drainage discharges (D20 and D24) that emanate from the existing unreclaimed Clarion seam highwall should be representative of the flow component derived from the active pit highwalls. These discharges contain water of intermediate quality between that found in the downgradient and upgradient monitoring wells. Because of this, site water quality during mining can be expected to increase as mining progresses from the south to the north of the site.

Table 1. Discharge quality of upgradient monitoring well (MW-2A)			
	Acid	Iron	Manganese
Avg. Concentration (mg/l)	0	0.47	0.10
800 GPM load (lbs/day)	0	4.52	0.96

Table 2. Discharge quality of downgradient monitoring well (MW-1A)			
	Acid	Iron	Manganese
Avg. Concentration (mg/l)	0	11.34	3.47
800 GPM load (lbs/day)	0	109.05	33.37

Project Tasks and Timeline

1. Dewatering of existing pond (P6)

An initial discharge will derive from dewatering Pond P6 (Figure 2A). This is more accurately described as the transfer of surface flow from the existing stream channel on the east side of the central spoil bank (Figure 2B) to the other channel on the west side, with no additional impact from proposed mining. The operator intends to divert incoming stream flow from this impoundment and commence dewatering as soon as possible in order to utilize the exposed abandoned highwall pit for initial spoil placement.

[2] It must be considered that these samples do not include water quality from the overlying 70' of overburden that was sealed off in piezometer construction, which will provide much of the contribution to the pumped discharge from an active pit and is assumed to be of better quality. Therefore, this quality is considered to be the "worst case" scenario for contaminated groundwater to be encountered during the mining process.

Figure 2A. Abandoned surface mine pit filled with water to be drained (P6).
Figure 2B. Stream channel downstream of P6 that will be reconstructed.

It is anticipated that this dewatering should be completed within the first month of operations, prior to the necessity for active pit water pumping and treatment. Pumping will be conducted with a 4” portable pump rated at 600 GPM (0.8646 MGD), and will be sustained for 24 hours per day. However, to be conservative in modeling impacts from the discharge on the unnamed tributary to Bear Creek, a discharge rate of 800 GPM (1.1528 MGD) was used.

Water quality sampled at P6 shows two samples (taken on 9/7/06 and 4/4/07) that contain excess alkalinity, no acidity, iron ranging from 0.17 to 0.30 mg/l and manganese ranging from 0.05 to 0.24 mg/l. This quality would be compliant with existing applicable TMDL concentration limits (0.75 mg/l Fe, 0.33 mg/l Mn, 5.87 mg/l Acid) established for this stream tributary of North Branch designated as unnamed tributary 49124. Sampling history also includes one sample (taken on 3/6/07) that exceeded these limits in acidity and manganese. Suspended solids concentration comparison and observed extreme diversity in other analyses suggest that the non-compliant sample may be due either to poor sampling technique or erroneous sampling location by a new lab sampler unfamiliar with the site. In order to prevent similar influences on the discharge, the operator has agreed to float the pump intake well offshore and slightly beneath the water surface, thus insuring minimal chance of adverse effects from increased sediment in the discharge (leading to increased concentrations of total metals in the water column). Thus, the initial discharge from the dewatering of P6 is estimated to be 2.89 lbs/day iron, 2.31 lbs/day manganese, 0 lbs/day acidity and pH between 6 and 9.

2. Active mining and contemporaneous reclamation

Approximately contemporaneous with the completion of pond dewatering, the initial coal removal pit will be excavated and water pumping of the active mining pit floor will begin. Based on past experience, the operator believes that this will not exceed the capacity of the 4” 800 GPM (1.153 MGD) pump previously referenced.

The average water quality of this treated discharge over the life of the project is less easily predicted, although it certainly should be much better than the best available technology (B.A.T.) effluent standards usually applied to permitted mining-related discharges. These discharges contain water of intermediate quality between that found in the downgradient (MW-1A) and upgradient (MW-2A) monitoring wells, supporting the projection that average discharge quality over the life of the project will range between standards when operations are at the southern end of the project and the upgradient water quality found in MW-2A when operations are at the northern end. However, to determine limits that would be protective of instream water quality, water quality-based effluent limits (WQBELs) were calculated for the discharge from the mine drainage treatment facilities used to treat pit water from active mining. Mass balance water quality modeling conducted by the Knox District Mining Office determined that WQBELs for the discharge from the permit should be 3.0 mg/L for total iron, 2.0 mg/L for total aluminum, and 1.3 mg/L for total manganese (Table 3).

Table 3. Water Quality-Based Effluent Limits[3]			
	Total Iron	Total Aluminum	Total Manganese
30-day average concentration (mg/L)	3.0[4]	2.0	1.3[5]
800 GPM load (lbs/day) – used in modelling	28.84	19.23	12.50
600 GPM load (lbs/day) – actual discharge rate	21.63	14.42	9.37

Surface reclamation of the site will also be conducted through the project. These activities will include reclamation of over 7,000 linear feet of highwall; reconstruction of 4,300 feet of stream channel and stabilization of eroding streambanks; regarding and revegetation of 66 acres of spoils. These actions will improve the ambient geochemistry of surface and ground water, as well as reducing the present stream sediment loading which results from accelerated erosion of loose spoil that forms the stream banks. During the process of reclamation, a significant portion of surface water flow will be diverted from interacting with the existing adverse influences and approximately 170,000 tons of 100% calcium carbonate equivalent excess alkalinity will be added to the site, further improving the geochemistry of the local hydrologic system.

Waste Load Allocation Justification

Since there were no active permitted point source discharges within the North Branch Bear Creek Watershed when TMDL limits were established, no waste load allocations were assigned to any of the stream tributaries. Typical WLAs for permitted sources may involve time frames of many decades for an operating industrial plant, but the reclamation project outlined in this application has a finite time span of just five years. As a necessary part of the proposed beneficial reclamation operation temporary point source discharges to the receiving stream must occur, some of which may derive from non-compliant sources that must be treated. The existing average daily loading calculated for Unt 49124 at downstream sample point NB15 includes 102.1 lbs/day iron, 47.4 lbs/day manganese and 996.3 lbs/day acid, based on observed long term average concentrations and an average flow rate of 2.44 MGD (1.694 GPM). The allowable loading at NB15 under the EPA-approved TMDL is 15.3 lbs/day iron, 6.6 lbs/day manganese, and 119.6 lbs/day acid, a reduction of between 85% and 88%. The proposed reclamation project will generate a short-term increase in metals loading in the stream at the discharge outfall point due to increased total flow volume. But by contributing higher levels of excess alkalinity into the stream it actually may reduce the levels of metals that

[3] Additional limits for other parameters also apply to the discharge. These include alkalinity greater than acidity, pH between 6.0 and 9.0, and a 30-day average concentration of total suspended solids (TSS) of 35 mg/L.

[4] Applicant anticipates, based on pre-mining site chemistry, that an average concentration over the life of the project will be 1.74 mg/L.

[5] Applicant anticipates, based on pre-mining site chemistry, that the average concentration over the life of the project will be 1.05 mg/L.

Figures 3A & 3B. Areas of streambank erosion and stream bottom sedimentation that will be restored via reclamation of original stream channel, surface contouring, and revegetation.

ultimately arrive at downstream TMDL point NB15 via increased rates of geochemical cycling kinetics. However, the post-project loading from the site to the unnamed tributary to the North

Branch Bear Creek will be reduced permanently. When this project has been completed the improvements to existing surface and subsurface conditions will provide permanent benefit to the quality of water that migrates through the site and should greatly reduce in-stream metals loading while eliminating acidic contribution altogether. Pennsylvania's remining permit study evaluated pre and post-mining water quality characteristics at 231 sites. Overall, 91.9% of sites improved or showed no significant difference in acidity after remining; 91% of sites improved or showed no significant different in manganese; 94.7% of sites improved or showed no significant difference in iron; 96.6% of sites improved or showed no significant difference in aluminum; and 94.4% of sites improved or showed no significant difference in flow volume (U.S. EPA 2000). The most significant influence of remining on loading is due to flow reduction, largely through the BMPs of regarding and revegetation (Smith 1988 and Hawkins 1995). Due to these anticipated environmental benefits and permanent reductions in nonpoint source pollution load (LA), the Department feels issuance of this permit is justified to meet the goals of both the TMDL and the Clean Water Act.

References

Hawkins, J.W. 1995. Characterization and effectiveness of remining abandoned coal mines in Pennsylvania. U.S. Bureau of Mines, Report of Investigations – 9562, 37 p.

Smith, M.W. 1998. Establishing baseline pollution load from pre-existing pollutional discharges for remining in Pennsylvania. U.S. Bureau of Mines IC 9184, p. 311-318.

U.S. Environmental Protection Agency. March 2000. Coal Remining Best Management Practices Guidance Manual. Office of Water, Office of Science and Technology, Engineering and Analysis Division, U. S. Environmental Protection Agency, Washington, DC: EPA 821-R-00-007.

Attachment H

Water Quality Data Used In TMDL Calculations

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NBG20		1/13/2003		5.37	3.43	18.8	3.8	0.77	0.74
NBG20		3/19/2003	3257	4.69	1.01	13.74	2.2	0.5	0.7
NBG20		6/19/2002	1004	5.86	3.42	8.45	3.66	0.85	0.77
NBG20		5/21/2002		5.3	2.6	10.51	2.73	0.49	0.76
NBG20		10/9/2002		6.45	15.84	1	3.12	2.13	0.38
NBG20	4251 773	10/29/2003	768	6.3	12.4	25.2	2.21	0.703	<.5
NBG20	4251 993	5/013/04	417	6.4	12.2	40.2	1.76	0.866	0.537
NBG20	4251 180	8/18/2004	127	6.6	20.8	22.4	2.56	1.38	<.5
NBG20	4251 316	11/9/2004	343	6.6	17.4	16.6	1.88	0.691	<.5
		avg=	986.00	5.95	9.90	17.43	2.66	0.93	0.65
		stdev=				11.28	0.74	0.52	0.16

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NBG01		6/19/2002	1290	4.17	0	44.29	9.32	1.14	3.27
NBG01		5/21/2002		4.16	0	38.32	6.94	0.79	2.8
NBG01		10/9/2002		3.46	0	114.6	11.51	3.81	7.55
NBG01		1/14/2003		4.04	0	110.2	15.72	1.31	5.22
NBG01		3/19/2003		4.56	0.33	21.41	5.34	0.63	1.84
NBG01	4251 784	11/6/2003	1039	4.8	7.2	57.4	7.16	1.02	1.96
NBG01	4251 002	5/18/2004	2635	4.7	6.8	58.4	5	0.783	1.84
NBG01	4251 183	8/18/2004	172	3.9	0	84.6	15.1	2.21	4.49
NBG01	4251 319	11/10/2005	495	4.8	7.2	48.4	10.4	1.36	2.7
		avg=	1126.20	4.29	2.39	64.18	9.61	1.45	3.52
		stdev=				32.21	3.94	1.00	1.92

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NB41		5/21/2002		6.53	10.17	0	0.86	0.31	0.47
NB41		6/19/2002	985.6	6.34	10.49	0	1.48	0.51	0.37
NB41		7/9/2002		6.32	20.44	0	3.45	1.88	1.31
NB41		8/7/2002		6.31	21.53	0	4	2.02	1.22
NB41		9/3/2002		5.86	15.16	2.4	4.52	2.47	1.73
NB41		10/9/2002		4.81	1.93	49.2	13.79	2.96	2.05
NB41		11/8/2002		6.49	22.37	0	3.14	0.86	0.36
NB41		12/16/2002		6.62	11.56	0	0.63	0.19	0.26
NB41		1/14/2003		6.56	17.52	0	1.57	0.53	0.47
NB41		2/5/2003		6.56	15.72	0	1.06	0.35	0.33
NB41		3/19/2003		5.99	6.96	0.2	0.5	0.21	0.36
NB41		4/15/2003		6.54	15.49	0	2.12	0.63	0.79
NB41	4251 772	10/29/2003	870	6.6	21	0	2.59	0.706	<.5
NB41	4251 994	5/13/2004	678	6.1	14.2	53.2	3.49	1.22	1.17
NB41	4251 181	8/18/2004	264	6.1	18.4	32	5.65	1.6	1.58
NB41	4251 317	11/9/2004	468	6.6	26	10.2	2.78	0.819	0.677

		avg=	653.12	6.27	15.56	9.20	3.23	1.08	0.88
		stdev=				18.31	3.18	0.86	0.59

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NB40		5/20/2002		5.23	2.55	16.48	3.22	0.5	1.2
NB40		6/18/2002	3109	5.79	3.72	10.3	4.04	0.72	1.22
NB40		10/9/2002		6.16	22.04	1.6	5.09	2.3	1.84
NB40		1/14/2003		5.13	2.98	26.6	7.61	1.06	1.93
NB40		3/19/2003		5.11	2.45	11.11	3.02	0.5	1.03
NB40	4251 783	11/6/2003	1689	5.8	10.4	44.4	5.64	0.908	1.38
NB40	4251 003	5/18/2004	3458	5.6	9	40.2	4.6	0.794	1.65
NB40	4251 182	8/18/2004	545	4.9	8.4	53.8	10.7	1.94	2.64
NB40	4251 318	11/10/2004	970	5.3	8.2	38	8.02	1.25	1.99
		avg=	1954.20	5.45	7.75	26.94	5.77	1.11	1.65
		stdev=				18.04	2.54	0.63	0.51

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NB30		5/21/2002		4.4	0	32.96	4.55	0.83	2.19
NB30		6/18/2002	4283	4.56	0.53	26.78	4.77	1.05	1.96
NB30		10/9/2002		3.58	0	63.2	8.42	3.74	3.14
NB30		1/14/2003		4.46	0	42.6	8.8	1.73	3
NB30		3/19/2003	8332	4.64	0.98	17.78	3.16	0.68	1.43
NB30	4251 781	11/4/2003	1740	4.5	5.4	53.4	5.89	1.67	1.64
NB30	4251 001	5/18/2004	5218	5	7.4	57.6	3.09	0.953	0.551
NB30	4251 188	8/24/2004	4928	6	9.6	23.2	2.73	0.589	<.5
NB30	4251 323	11/10/2004	1459	4.9	8.2	46.4	7.31	1.39	1.45
		avg=	4326.67	4.67	3.57	40.44	5.41	1.40	1.92
		stdev=				16.10	2.32	0.97	0.86

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NBE65		5/21/2002		5.63	2.68	10.09	0.15	0.82	0.5
NBE65		6/19/2002		5.54	2.44	5.15	0.3	0.77	0.34
NBE65		10/8/2002		5.22	2.31	10.8	0.06	1.69	0.57
NBE65		1/14/2003		5.45	3.33	8.4	0.08	0.9	0.48
NBE65		3/18/2003		5.66	3.49	2.83	0.22	0.87	0.36
NBE65	4251 787	11/6/2003	181	6.1	9.2	22.2	<.3	0.789	<.5
		avg=	181.00	5.60	3.91	9.91	0.16	0.97	0.45
		stdev=				6.74	0.10	0.35	0.10

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NBE66	4251 326	11/10/2004	33	6.3	13	36	<.3	<.05	<.5
NBE66	4251 788	11/6/2003	79	6.4	13	35.2	0.512	0.596	<.5
NBE66	4251 005	5/18/2004	156	6.1	12.4	60.4	0.857	0.831	0.547
		avg=	89.33	6.27	12.80	43.87	0.68	0.71	0.55
		stdev=				14.32	0.24	0.17	#DIV/0!

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NBE50		6/19/2002	573	4.7	1.45	24.51	0.32	2.81	2.61
NBE50		7/10/2002		4.8	1.72	16.93	0.22	3.53	2.02
NBE50		8/8/2002		4.85	1.76	15.55	0.25	2.89	1.51
NBE50		9/4/2002		4.75	1.36	18.8	0.28	3.39	1.51
NBE50		10/8/2002		4.97	2.09	17.4	0.28	3.7	1.65
NBE50		11/8/2002		4.75	1.31	12.87	0.22	3.4	1.9
NBE50		12/16/2002		4.85	1.69	14.13	0.13	2.31	1.55
NBE50		2/6/2003		4.74	1.46	24.6	0.35	2.72	2.46
NBE50		3/18/2003		4.69	1.4	18.38	0.46	2.27	2.39
NBE50		4/15/2003		4.67	1.1	19.39	0.25	2.64	2.55
NBE50	4251 786	11/6/2003	222	4.8	7.4	50.4	<.3	2.41	1.58
NBE50	4251 004	5/18/2004	515	4.8	7.6	57.2	0.366	2	1.69
NBE50	4251 189	8/24/2004	308	6.1	10.2	41.8	0.809	0.773	0.6
NBE50	4251 325	11/10/2004	96	6.1	9.8	23.8	<.3	0.611	<.5
		avg=	342.80	4.97	3.60	25.41	0.33	2.53	1.85
		stdev=				14.02	0.17	0.93	0.56

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NBE40		6/19/2002	372	6.58	7.64	0	0.25	0.24	0.12
NBE40		5/21/2002		6.43	5.6	2.06	0.24	0.34	0.25
NBE40		10/8/2002		6.39	7.02	1.8	0.04	0.23	0.1
NBE40		3/18/2003		5.83	3.84	3.43	0.36	0.38	0.28
NBE40	4251 788	11/6/2003	79	6.4	13	35.2	0.512	0.596	<.5
NBE40	4251 190	8/24/2004	248	6	8.6	21.6	<.3	0.692	<.5
		avg=	233.00	6.27	7.62	10.68	0.28	0.41	0.19
		stdev				14.42	0.17	0.19	0.09

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NBE20		5/21/2002		3.92	0	86.52	1.07	7.44	8.72
NBE20		6/19/2002		3.49	0	170.98	1.94	11.85	14.48
NBE20		7/10/2002		3.44	0	145.25	3.07	17.7	15.61
NBE20		8/8/2002		3.42	0	151.3	3.29	14.7	11.95
NBE20		9/4/2002		3.37	0	182.4	3.53	21.98	15.91
NBE20		10/8/2002		3.46	0	166.4	3.44	20.29	13.7
NBE20		11/8/2002		3.45	0	107.32	2.71	15.92	12.16
NBE20		12/16/2002		3.79	0	52.74	1.33	6.63	6.41
NBE20		2/6/2003		3.76	0	99.8	2.04	10.45	10.98
NBE20		3/18/2003		4.07	0	35.96	0.76	3.98	5.11
NBE20		4/15/2003		3.82	0	79.79	1.14	9.83	9.87
NBE20	4251 777	11/4/2003	276	3.6	0	95.8	1.1	9.62	9.05
NBE20	4251 997	5/18/2004	912	3.9	0	86.2	1.09	4.85	4.87
NBE20	4251 184	8/18/2004	116	3.5	0	118.4	1.39	12.4	11
NBE20	4251 324	11/10/2004	218	3.8	0	86.2	2.53	8.42	8.05
		avg=	380.50	3.65	0.00	111.00	2.03	11.74	10.52
		stdev=				43.77	0.99	5.43	3.54

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NBE10		5/20/2002		6.7	5.68	0	0.18	0.16	0.16
NBE10		10/9/2002		5.87	4.64	6	0.04	0.09	0.04
NBE10	4251 776	11/4/2003	150	6.7	12	0	<.3	0.084	<.5
NBE10	4251 187	8/24/2004	2902	4.9	7	43.6	0.538	1.68	0.999
		avg=	1526.00	6.04	7.33	12.40	0.25	0.50	0.40
		stdev=				20.99	0.26	0.79	0.52

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NBE01		6/18/2002	2705	4.25	0	46.35	0.63	4.16	3.78
NBE01		5/20/2002		4.52	0.26	28.02	0.45	2.72	2.81
NBE01		10/9/2002		4.57	0.42	25.2	1.5	5.6	1.6
NBE01		1/14/2003		4.65	0.96	30.8	0.54	3.56	3.51
NBE01		3/19/2003		4.56	0.44	19.39	0.5	2.3	2.45
NBE01	4251 778	11/4/2003	1039	4.4	4.8	49	0.599	3.4	2.11
NBE01	4251 998	5/18/2004	4034	4.5	6.2	68	0.908	2.5	1.78
NBE01	4251 322	11/10/2004	1052	4.6	6.6	48.8	0.688	2.47	1.41
		avg=	2207.50	4.51	2.46	39.45	0.73	3.34	2.43
		stdev=				16.27	0.34	1.12	0.88

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NBF35A	4251 782	11/4/2003	244	6.7	12.2	0	<.3	0.053	<.5
NBF35A	4251 999	5/18/2004	720	6.5	10.8	21	0.612	0.122	<.5
		avg=	482.00	6.60	11.50	10.50	0.61	0.09	#DIV/0!
		stdev=				14.85	#DIV/0!	0.05	#DIV/0!

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NB20		5/20/2002		4.53	0.28	21.63	2	1.34	2.07
NB20		6/18/2002	9766	4.35	0	25.13	1.71	1.96	2.31
NB20		10/9/2002		3.82	0	31.2	1.32	4.29	2.14
NB20		1/14/2003		4.57	0.53	36	4.47	2.45	2.89
NB20		3/19/2003		4.56	0.43	14.14	1.36	1.27	1.68
NB20	4251 780	11/4/2003	3376	4.2	3.6	46	1.64	2.26	1.63
NB20	4251 996	5/18/2004	13142	4.6	6.4	53.6	1.97	1.52	1.21
NB20	4251 186	8/18/2004	1609	4	1.6	56.6	0.615	2.97	2.04
NB20	4251 321	11/10/2004	2780	4.8	7	38	2.9	1.68	1.21
		avg=	6134.60	4.38	2.20	35.81	2.00	2.19	1.91
		stdev=				14.42	1.11	0.96	0.54

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NB15	4251 771	10/29/2003	853	5.4	7.2	47.2	4.19	2.35	1.28
NB15	4251 995	5/18/2004	5022	6.1	9.2	56.6	3.77	0.878	1.36
NB15	4251 185	8/18/2004	306	4.9	9	53.2	7.43	4.08	1.8
NB15	4251 320	11/10/2004	605	5.8	8.8	38.6	4.66	1.99	0.988
		avg=	1696.50	5.55	8.55	48.90	5.01	2.32	1.36
		stdev=				7.89	1.65	1.33	0.34

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NBC01		5/20/2002		7.09	13.58	0	0.24	0.03	0.11
NBC01	4251 789	11/6/2003	334	7.3	29.8	0	0.352	<.05	<.5

Point	ID	Date	GPM	pH Units	mg/l	mg/l	mg/l	mg/l	mg/l
NB10		5/20/2002		4.88	1.96	16.27	1.51	1.24	1.82
NB10		6/18/2002		4.56	0.56	23.48	1.44	1.78	2.05
NB10		7/10/2002		3.76	0	38.56	0.81	4.13	3.56
NB10		8/7/2002		3.87	0	37.17	0.62	3.63	2.42
NB10		9/4/2002		3.79	0	42.2	0.65	4.45	2.81
NB10		10/8/2002		3.99	0	34.2	0.95	4.3	2.33
NB10		11/8/2002		4.03	0	21.58	0.9	2.9	1.84
NB10		12/16/2002		4.81	1.42	14.53	1.2	1.14	1.02
NB10		1/13/2003		4.89	2.34	33.2	2.97	2	2.58
NB10		2/6/2003		4.8	1.81	22	2.59	1.86	1.82
NB10		3/18/2003		4.83	1.89	10.5	1.1	0.95	1.23
NB10		4/15/2003		4.41	0	18.99	1.66	2.15	2.5
NB10	4251 790	11/6/2003	6501	4.5	6	53.6	1.37	1.96	1.17
NB10	4251 992	5/13/2004	5156	4.3	4.8	47.8	0.831	2.22	1.98
NB10	4251 179	8/18/2004	2199	4.1	3.6	58.2	0.726	2.9	1.79
NB10	4251 315	11/9/2004	4454	4.9	8.8	41.8	1.86	1.77	1.07
		avg=	4577.50	4.40	2.07	32.13	1.32	2.46	2.00
		stdev=				14.48	0.68	1.13	0.69

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NBB05		5/20/2002		6.95	11.59	0	0.23	0.22	0.2
NBB05	4251 791	11/6/2003	460	7	23.4	0	<.3	0.243	<.5

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NBA01	4251 792	11/6/2003	1367	7.1	22.6	0	<.3	0.06	<.5
NBA01	4251 991	5/13/2004	346	7.4	28.2	9.4	0.345	0.066	<.5

Monitoring Point	Collector ID	Date	Flow GPM	pH pH Units	Alkalinity mg/l	Acidity mg/l	Iron mg/l	Manganese mg/l	Aluminum mg/l
NB05		6/19/2002	13350	4.97	2	10.92	0.93	1.5	1.67
NB05		5/20/2002		5.15	2.2	10.71	1.06	0.98	1.48
NB05		10/8/2002		4.81	1.68	16.6	0.23	3.73	1.92
NB05		1/13/2003		5.25	2.71	12	1.94	1.5	1.71
NB05		3/18/2003		5.27	2.56	6.06	0.85	0.76	0.93
NB05	4251 771	10/29/2003	8997	5.8	6.6	31.4	1.22	1.53	0.859
NB05	4251 990	5/13/2004	6679	5	7.4	60.2	0.415	1.9	1.68
NB05	4251 178	8/17/2004	2365	5.1	10.8	42.8	0.355	2.53	1.48
NB05	4251 314	11/9/2004	5933	6	10.2	29.2	1.1	1.35	0.731
		avg=	7464.80	5.26	5.13	24.43	0.90	1.75	1.38
		stdev=				18.07	0.53	0.90	0.43

Attachment I

TMDLs and NPDES Permitting Coordination

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

Load Tracking Mechanisms

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

Options for Permittees in TMDL Watersheds

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

Options identified

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

Other possible options

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

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

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

Attachment J

Comment and Response

No comments received on the final North Branch Bear Creek Watershed TMDL during the public comment period (held in 2006).