FINAL

BIRCH ISLAND RUN WATERSHED TMDL

Clinton County

For Acid Mine Drainage Affected Segments

Prepared by the Pennsylvania Department of Environmental Protection

September 9, 2004

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ATTACHMENTS

[1]TMDL

Birch Island Run Watershed
Clinton County, Pennsylvania

Table 1. 303(d) Sub-List								
State Water Plan (SWP) Subbasin: 08-D Birch Island Run								
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1996	1.6	7150	25544	Amos Branch	HQ-CWF	305(b) Report	RE	Metals
1998	1.54	7150	25544	Amos Branch	HQ-CWF	SWMP	AMD	Metals
2002	0.5	7150	25544	Amos Branch	HQ-CWF	SWMP	AMD	Metals
1996	6.2	7148	25529	Birch Island Run	HQ-CWF	305(b) Report	RE	Metals
1998	6.16	7148	25529	Birch Island Run	HQ-CWF	SWMP	AMD	Metals
2002	2.1	7148	25529	Birch Island Run	HQ-CWF	SWMP	AMD	Metals
1996	4.3	7149	25530	Little Birch Island Run	HQ-CWF	305(b) Report	RE	Metals
1998	4.21	7149	25530	Little Birch Island Run	HQ-CWF	SWMP	AMD	Metals
2002	1.5	7149	25530	Little Birch Island Run	HQ-CWF	SWMP	AMD	Metals

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

Introduction

This Total Maximum Daily Load (TMDL) calculation has been prepared for segments in the Birch Island Run Watershed **(Attachment A)**. It was done to address the impairments noted on

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

the 1996 Pennsylvania 303(d) list, required under the Clean Water Act, and covers three segments on this list (shown in Table 1). High levels of metals, and in some areas depressed pH, caused these impairments. All impairments resulted from acid drainage from abandoned coalmines. The TMDL addresses the three primary metals associated with acid mine drainage (iron, manganese, aluminum) and pH.

Directions to the Birch Island Run Watershed

The Birch Island Run Watershed is located in North Central Pennsylvania, occupying a southwestern portion of Clinton County within West Keating Township. A very small portion of the watershed stretches into the southeastern portion of Cameron County within Gibson Township. The watershed area is found on United States Geological Survey maps covering Snow Shoe NW and Pottersdale 7.5-Minute Quadrangles.

The Birch Island Run watershed is located in a remote area. The roads leading into the area are gravel and not maintained during the winter months. The watershed can be reached by traveling on the Keating/Pottersdale Road. The road connects the two villages of Keating and Pottersdale. Pottersdale can be reached by traveling one mile west on State Route 879 from Karthaus to the junction of State Routes 879 and 1011. Then by traveling north 1.5 miles on State Route 1011 to the junction of State Routes 1011 and 1018. Then by traveling east on State Route 1011 through the village of Pottersdale where the road eventually becomes the Keating/Pottersdale Road. The road passes over Little Birch Island Run, Birch Island Run and many of the unnamed tributaries to these two streams.

Land use within the watershed is dominated by forestland, including portions of Sproul State Forest. Several abandoned mines are located on the hilltops of the lower section of the watershed. The watershed is sparsely populated. There are approximately five permanent residences located along Keating Road and numerous camps spread across the watershed.

Segments addressed in this TMDL

There are no active mining operations in the watershed. There is one discharge (K5) in the Birch Island Run watershed that will be treated as a point source and will require a WLA, the rest of the 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. Where there is no responsible party the discharge is considered to be a non-point source. Each segment on the Section 303(d) list will be addressed as a separate TMDL. These TMDLs will be expressed as long-term, average loadings. Due to the nature and complexity of mining effects on the watershed, expressing the TMDL as a long-term average gives a better representation of the data used for the calculations. See Attachment C 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 (EPA) implementing regulations (40 CFR Part 130) require:

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

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

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

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

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

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

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

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

Section 303(d) Listing Process

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

The primary method adopted by the Pennsylvania Department of Environmental Protection (DEP) for evaluating waters changed between the publication of the 1996 and 1998 Section 303(d) lists. Prior to 1998, data used to list streams were in a variety of formats, collected under differing protocols. Information also was gathered through the Section 305(b)[2] reporting process. DEP is now using the Statewide Surface Waters Assessment Protocol (SSWAP), a modification of the EPA's 1989 Rapid Bioassessment Protocol II (RBP-II), as the primary mechanism to assess Pennsylvania's waters. The SSWAP provides a more consistent approach to assessing Pennsylvania's streams.

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

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

Basic Steps for Determining a TMDL

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

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

Watershed History

The area within the watershed consists of 15.3 square miles. The Birch Island Run watershed contains an area of 8.7 square miles. The Little Birch Island Run contains 6.6 square miles of

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

area. The upper section of the Birch Island Run drainage also contains Amos Branch. Amos Branch contains 2.3 square miles of area in the Birch Island Run headwaters. The streams in the Birch Island Run watershed flow from the northwest to the southeast. Birch Island Run flows from an elevation of 2000 feet above sea level in the headwaters to an elevation of 800 feet above sea level at its confluence with the West Branch of the Susquehanna River. The Birch Island Run watershed lies within the Appalachian Plateaus Physiographic Province.

Mining has been conducted within the watershed in the past. Several permits were issued for surface mining on the Lower, Middle and Upper Kittanning coal seams. All of these mining operations were left abandoned. The most recent mining took place in the late 1980's. Previous mining effects can be summarized as ungraded spoil and unreclaimed highwall, cuts and mine drainage.

The watershed area is comprised of Pennsylvanian and Mississippian aged rocks, which are divided into the Pottsville and Allegheny Formations of the Pennsylvanian system and Burgoon Sandstone and Huntley Mountain Formation of the Mississippian System. The Clearfield-McIntyre syncline trends in a northeast-southwest direction across the watershed just above the confluence of Birch Island Run and Little Birch Island Run. The Chestnut Ridge-Wellsboro anticline trends in a northeast-southwest direction and is located near the watershed boundary in the headwaters of the watershed.

Older Mississippian rocks of the Huntley Mountain Formation and the Burgoon Sandstone are exposed in the valleys of the watershed and the younger Pennsylvanian rocks of the Pottsville and Allegheny Formations are on the side slopes and hilltops surrounding the watershed. Strata within the watershed are oriented in a northeast-southwest trend and dip to the SE in most of the watershed. The strata below the confluence of Birch Island Run and Little Birch Island Run dip to the NW. Mineable coal seams in the watershed include the Lower, Middle and Upper Kittanning Coals.

Keating Operation

The Hanslovan Keating Operation (SMP 18840101) permit was issued in February of 1985 for the mining of the Middle Kittanning (31 acres), Middle Kittanning rider (15 acres) and Upper Kittanning (10 acres) on 77 acres of permit area. Mining was initiated in April of 1985. Backfilling was completed by September of 1987. The Keating Operation is a hilltop site that involved previous mining.

Although the Keating Operation has been backfilled and revegetated since 1987, the site remains an active site due to the acid mine drainage discharges that have developed on the site. Hanslovan identified several springs as background groundwater sampling and monitoring points, including those designated as K5, K6, K8, K14 and K29. Hanslovan's discharges of acid mine drainage adversely impacted the points previously listed.

As part of the settlement of litigation in Ed Hanslovan Coal Co. v. DEP, Environmental Hearing Board (EHB) Docket No. 95-037-E, Hanslovan agreed to treat passively the discharges at points designated K5, K6, K8, K14 and K29. Hanslovan constructed anoxic limestone drains (ALD's) at each point. The ALD's were designed to collect mine drainage at the discharges and to generate alkalinity in order to meet the applicable effluent limits (25 PA Code 87.102). The ALD's at K5, K8 and K14 failed and the others began to fail.

By Administrative Order issued November 19, 1999, the Department directed Hanslovan to provide interim treatment at discharges K5, K8 and K14; redesign the treatment systems at discharges K5, K8 and K14; and submit a contingency plan to provide for the treatment of all water emanating at points K29 and K6. Hanslovan appealed (11/19/1999 and 1/7/2000) to the EHB and eventually agreed to design and construct treatment systems for discharges K5, K6, K8, K14 and K29.

As of winter 2003, two treatment systems have been constructed to treat four of the discharges onsite. One treatment system treats the K5 discharge. This is the only discharge flowing into the Birch Island Run watershed. This system was completed in the fall of 2000. Another treatment system treats the K6, K8 and K14 discharges. These discharges flow into the Black Stump Run watershed. This system was completed in the fall of 2001. A treatment system for the K29 discharge is currently being proposed.

The two constructed and one proposed treatment systems are vertical flow ponds. Each system consists of or will consist of a primary treatment pond, a secondary treatment pond and a flushing pond. The completed systems have been functioning properly since being built and are still being evaluated at this time.

AMD Methodology

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

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

Allowable loads are determined for each point of interest using Monte Carlo simulation. Monte Carlo simulation is an analytical method meant to imitate real-life systems, especially when other analyses are too mathematically complex or too difficult to reproduce. Monte Carlo simulation calculates multiple scenarios of a model by repeatedly sampling values from the probability distribution of the uncertain variables and using those values to populate a larger data set. Allocations were applied uniformly for the watershed area specified for each allocation point. For each source and pollutant, it was assumed that the observed data were log-normally distributed. Each pollutant source was evaluated separately using @Risk[3] by performing 5,000 iterations to determine the required percent reduction so that the water quality criteria, as defined in the *Pennsylvania Code. Title 25 Environmental Protection, Department of Environmental Protection, Chapter 93, Water Quality Standards*, will be met instream at least 99 percent of the time. For each iteration, the required percent reduction is:

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

PR = required percent reduction for the current iteration

Cc = criterion in mg/l

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

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

Mean = average observed concentration

Standard Deviation = standard deviation of observed data

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

LTA = Mean * (1 – PR99) where (2)

LTA = allowable LTA source concentration in mg/l

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

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

There are two basic rules that are applied in load tracking; rule one is that if the sum of the measured loads that directly affect the downstream sample point is less than the measured load at the downstream sample point it is indicative that there is an increase in load between the points

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

being evaluated, and this amount (the difference between the sum of the upstream and downstream loads) shall be added to the allowable load(s) coming from the upstream points to give a total load that is coming into the downstream point from all sources. The second rule is that if the sum of the measured loads from the upstream points is greater than the measured load at the downstream point this is indicative that there is a loss of instream load between the evaluation points, and the ratio of the decrease shall be applied to the load that is being tracked (allowable load(s)) from the upstream point.

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

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

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

TMDL Endpoints

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

Because all but one of the pollution sources in the watershed are non-point sources, the TMDL is expressed as Load Allocations (LAs) and Waste Load Allocations (WLAs). All allocations will be specified as long-term average daily concentrations. These long-term average concentrations are expected to meet water-quality criteria 99% of the time as required in PA Title 25 Chapter 96.3(c). The following table shows the applicable water-quality criteria for the selected parameters.

Table 2. Applicable Water Quality Criteria

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

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

TMDL Elements (WLA, LA, MOS)

TMDL = WLA + LA + MOS

A TMDL equation consists of a wasteload allocation, load allocation and a margin of safety. The wasteload allocation is the portion of the load assigned to point sources. The load allocation is the portion of the load assigned to non-point sources. The margin of safety is applied to account for uncertainties in the computational process. The margin of safety may be expressed implicitly (documenting conservative processes in the computations) or explicitly (setting aside a portion of the allowable load). The TMDL allocations in this report are based on available data. Other allocation schemes could also meet the TMDL. Table 3 contains the TMDL component summary for each point evaluated in the watershed. Refer to the map in Attachment A.

Allocation Summary

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

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

Each permitted discharge in a segment is assigned a waste load allocation and the total waste load allocation for each segment is included in this table. There is currently one permitted discharge in the Birch Island Run watershed. The difference between the TMDL and the WLA is the load allocation (LA) at the point. The LA at each point includes all loads entering the segment, including those from upstream allocation points. The percent reduction is calculated to show the amount of load that needs to be reduced to the area upstream of the point in order for water quality standards to be met at the point.

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

Table 3. TMDL Component Summary for the Birch Island Run Watershed

Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	% Reduction
LBIR02						
Aluminum (lbs/day)	ND	NA	0	NA	NA	NA
Iron (lbs/day)	ND	NA	0	NA	NA	NA
Manganese(lbs/day)	ND	NA	0	NA	NA	NA
Acidity (lbs/day)	124.9	61.2	0	61.2	63.7	51%
LBIR01						
Aluminum (lbs/day)	26.1	12.5	0	12.5	13.6	52%
Iron (lbs/day)	ND	NA	0	NA	NA	NA
Manganese(lbs/day)	21.2	21.2	0	NA	NA	NA
Acidity (lbs/day)	955.1	200.6	0	200.6	690.9	77%
BIR03						
Aluminum (lbs/day)	ND	NA	0	NA	NA	NA
Iron (lbs/day)	ND	NA	0	NA	NA	NA
Manganese(lbs/day)	ND	NA	0	NA	NA	NA
Acidity (lbs/day)	238.4	35.8	0	35.8	202.7	85%
AB01						
Aluminum (lbs/day)	ND	NA	0	NA	NA	NA
Iron (lbs/day)	ND	NA	0	NA	NA	NA
Manganese(lbs/day)	ND	NA	0	NA	NA	NA
Acidity (lbs/day)	143.8	48.9	0	48.9	94.9	66%
K33						
Aluminum (lbs/day)	ND	NA	0.4	NA	NA	NA
Iron (lbs/day)	ND	NA	0.61	NA	NA	NA
Manganese(lbs/day)	8.1	8.1	0.4	7.7	0.40	5%
Acidity (lbs/day)	367.3	180.0	0.0	180.0	0	0%*
BIR01						
Aluminum (lbs/day)	ND	NA	0	NA	NA	NA
Iron (lbs/day)	ND	NA	0	NA	NA	NA
Manganese(lbs/day)	17.5	17.5	0	17.5	0	0%
Acidity (lbs/day)	948.5	313	0	313	0	0%*
BIR02						
Aluminum (lbs/day)	ND	NA	0	NA	NA	NA
Iron (lbs/day)	ND	NA	0	NA	NA	NA
Manganese(lbs/day)	17.4	17.4	0	17.4	0	0%
Acidity (lbs/day)	1254.7	589.7	0	589.7	29.5	5%

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

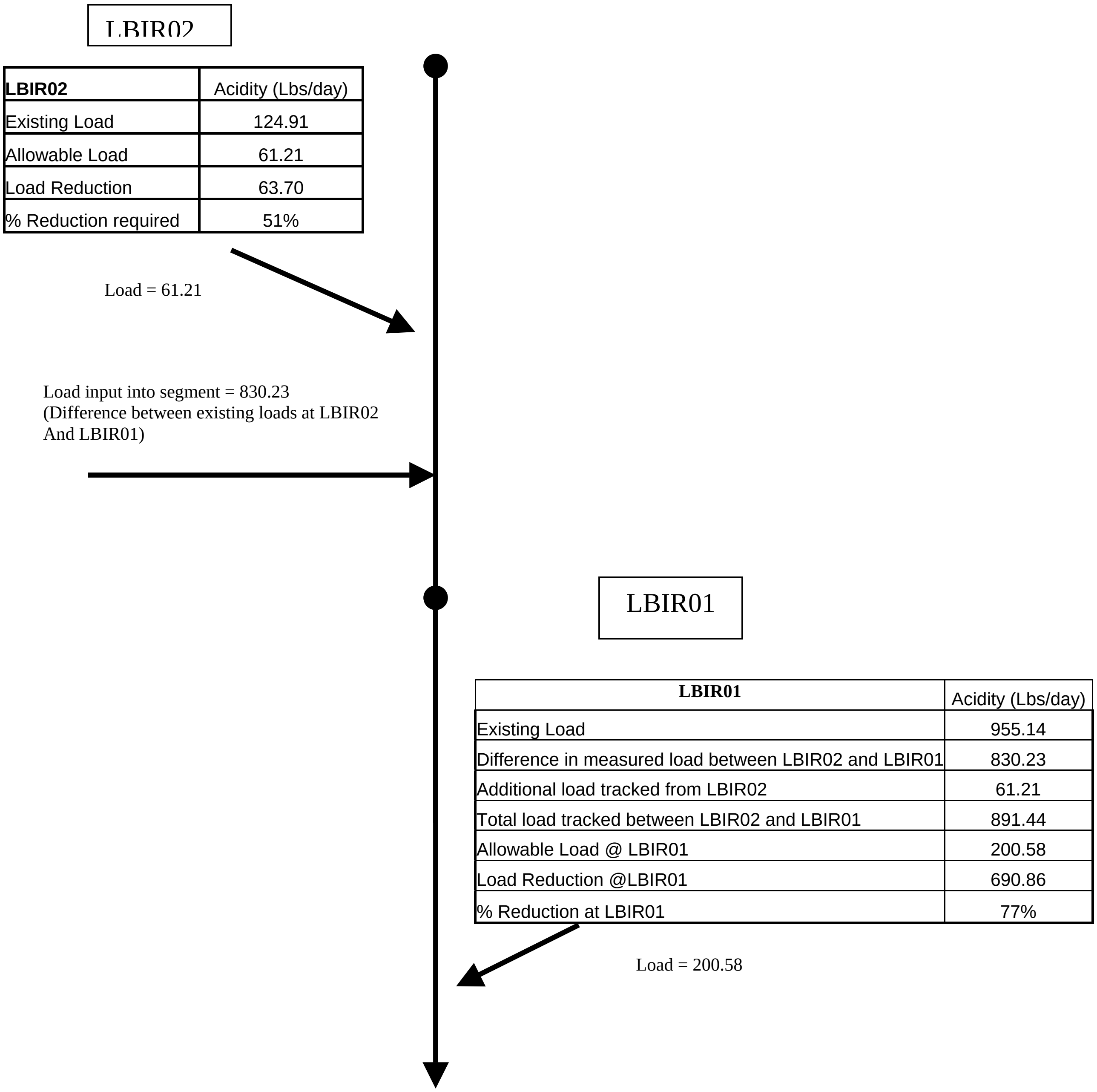
In the instance that the allowable load is equal to the measured load (e.g. manganese BIR01, Table 3), the simulation determined that water quality standards are being met instream and therefore no TMDL is necessary for the parameter at that point. Although no TMDL is necessary, the loading at the point is considered at the next downstream point.

A waste load allocation was assigned to one permitted mine drainage treatment poind contained on the Ed Hanslovan Coal Company SMP No. 18840101, NPDES permit No. PA 0610976, site. Waste load allocations are calculated using the average flow and monthly average permit limits for aluminum, iron and manganese. The WLA for K5 is being evaluated at sample point K33. No required reductions of permit limits are needed at this time. All necessary reductions are assigned to non-point sources.

Table 4. Waste Load Allocation Summary for the Birch Island Run Watershed

. Waste Load Allocations at Discharge K5			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Discharge K5			
Al	2	0.0243	0.4
Fe	3	0.0243	0.61
Mn	2	0.0243	0.4

Following is an example of how the allocations, presented in Table 3, for a stream segment are calculated. For this example, acidity allocations for LBIR01 of Little Birch Island Run are shown. As demonstrated in the example, all upstream contributing loads are accounted for at each point. Attachment C contains the TMDLs by segment analysis for each allocation point in a detailed discussion. These analyses follow the example. Attachment A contains maps of the sampling point locations for reference.



LBIR02	Acidity (Lbs/day)
Existing Load	124.91
Allowable Load	61.21
Load Reduction	63.70
% Reduction required	51%

LBIR01	Acidity (Lbs/day)
Existing Load	955.14
Difference in measured load between LBIR02 and LBIR01	830.23
Additional load tracked from LBIR02	61.21
Total load tracked between LBIR02 and LBIR01	891.44
Allowable Load @ LBIR01	200.58
Load Reduction @LBIR01	690.86
% Reduction at LBIR01	77%

The allowable load tracked from LBIR02 was 61.21 lbs/day. The existing load at LBIR02 was subtracted from the existing load at LBIR01 to show the actual measured increase of acidic load that has entered the stream between these two sample points. This value was then added to the allowable load at LBIR02 to calculate the total load that was tracked between LBIR02 and LBIR01 (allowable load @ LBIR02 + the difference in existing load between LBIR01 and LBIR02). The total load tracked was then subtracted from the calculated allowable load at LBIR01 to determine the amount of load to be reduced at LBIR01. This value was found to be 891.44 lbs/day, it was 690.86 lbs/day greater then the LBIR01 allowable load of 200.58 lbs/day.

Therefore, a 77% reduction at LBIR01 is necessary. From this point, the allowable load at LBIR01 will be tracked to the next downstream point, BIR01.

Recommendations

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

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

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

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

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

- To encourage private and public participation in abandoned mine reclamation efforts
- To improve reclamation efficiency through better communication between reclamation partners
- To increase reclamation by reducing remining risks

- To maximize reclamation funding by expanding existing sources and exploring new sources.

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

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

There is currently no watershed group focused on the Birch Island Run Watershed area. It is recommended that agencies work with local interests to form a watershed organization. This watershed organization could then work to implement projects to achieve the reductions recommended in this TMDL document.

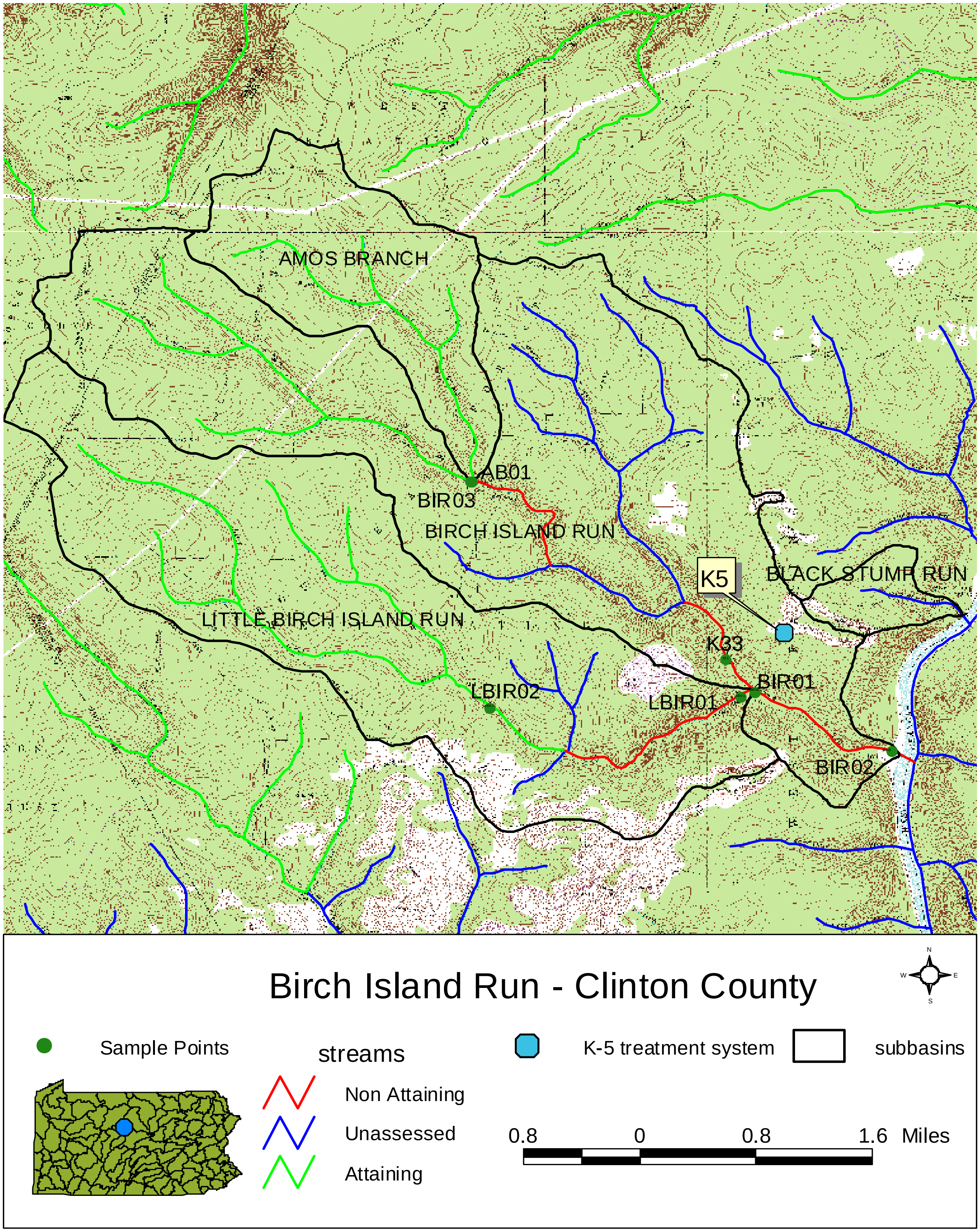
Currently, Hanslovan has constructed a passive treatment system to address the AMD problems reporting to the Birch Island Run Watershed. This system is currently being evaluated at this time. One other passive treatment system has been built and another system is to be built to address additional AMD problems created by the mining on the Hanslovan site. These two treatment systems will treat AMD water that will not flow into the Birch Island Run watershed.

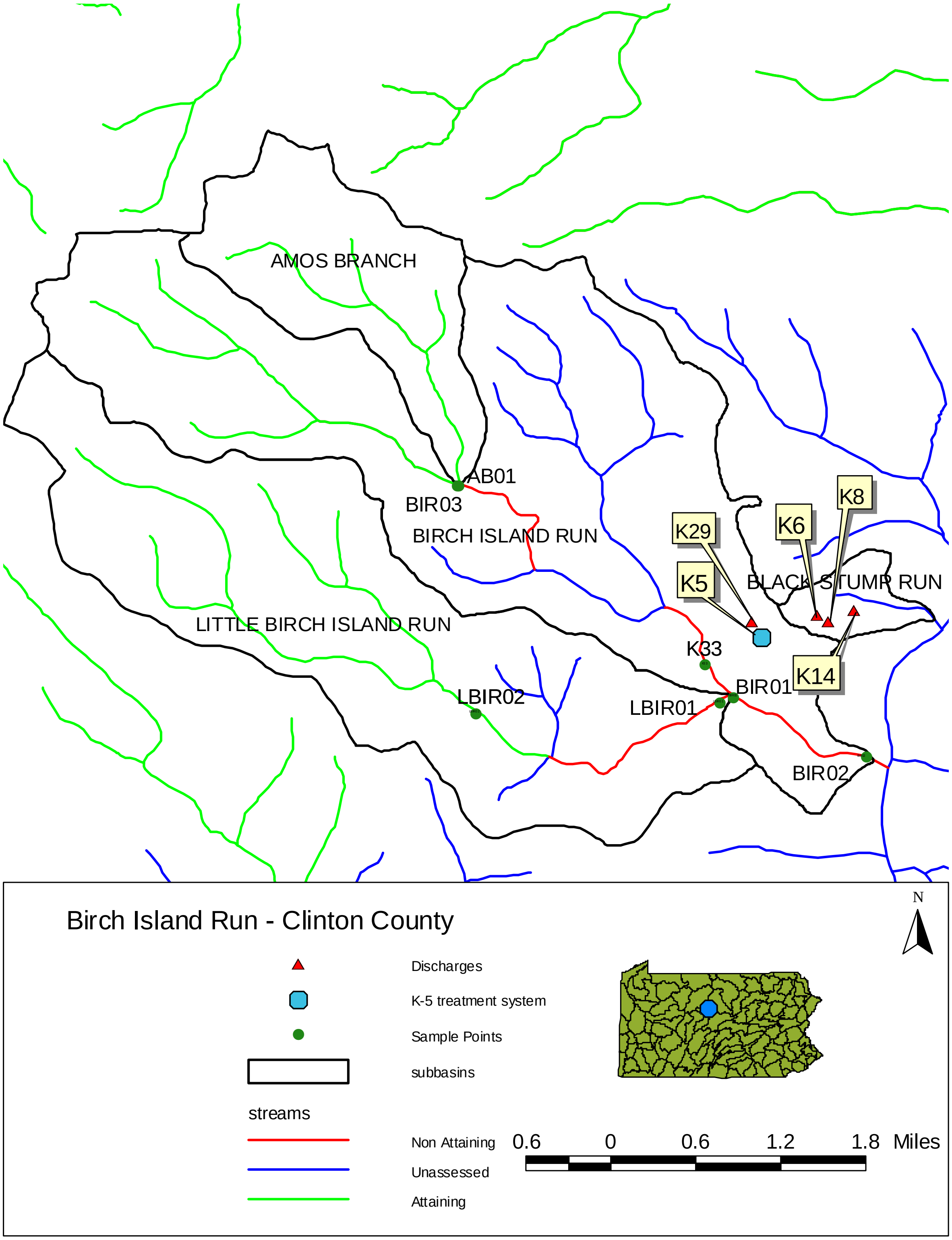
Public Participation

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* and the Clearfield Progress to foster public comment on the allowable loads calculated. A public meeting was held on July 14, 2004, at the Multiservice center in Clearfield, to discuss the proposed TMDL.

Attachment A

Birch Island Run Watershed Map


AMOS BRANCH
AB01
BIR03
BIRCH ISLAND RUN
K5
BLACK STUMP RUN
LITTLE BIRCH ISLAND RUN
K33
BIR01
LBIR02
LBIR01
BIR02
Birch Island Run - Clinton County
Sample Points
streams
Non Attaining
Unassessed
Attaining
K-5 treatment system
subbasins
0.8
0
0.8
1.6
Miles


AMOS BRANCH
AB01
BIR03
BIRCH ISLAND RUN
K29
K6
K8
K5
BLACK STUMP RUN
LITTLE BIRCH ISLAND RUN
K33
BIR01
K14
LBIR02
LBIR01
BIR02
Birch Island Run - Clinton County
N
Discharges
K-5 treatment system
Sample Points
subbasins
streams
Non Attaining
Unassessed
Attaining
0.6 0 0.6 1.2 1.8 Miles

Attachment B

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

Method for Addressing Section 303(d) Listings for pH

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

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

Each sample point used in the analysis of pH by this method must have measurements for total alkalinity and total acidity. Net alkalinity is alkalinity minus acidity, both being in units of milligrams per liter (mg/l) $CaCO_3$. The same statistical procedures that have been described for use in the evaluation of the metals is applied, using the average value for total alkalinity at that point as the target to specify a reduction in the acid concentration. By maintaining a net alkaline stream, the pH value will be in the range between six and eight. This method negates the need to specifically compute the pH value, which for mine waters is not a true reflection of acidity. This method assures that Pennsylvania's standard for pH is met when the acid concentration reduction is met.

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

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

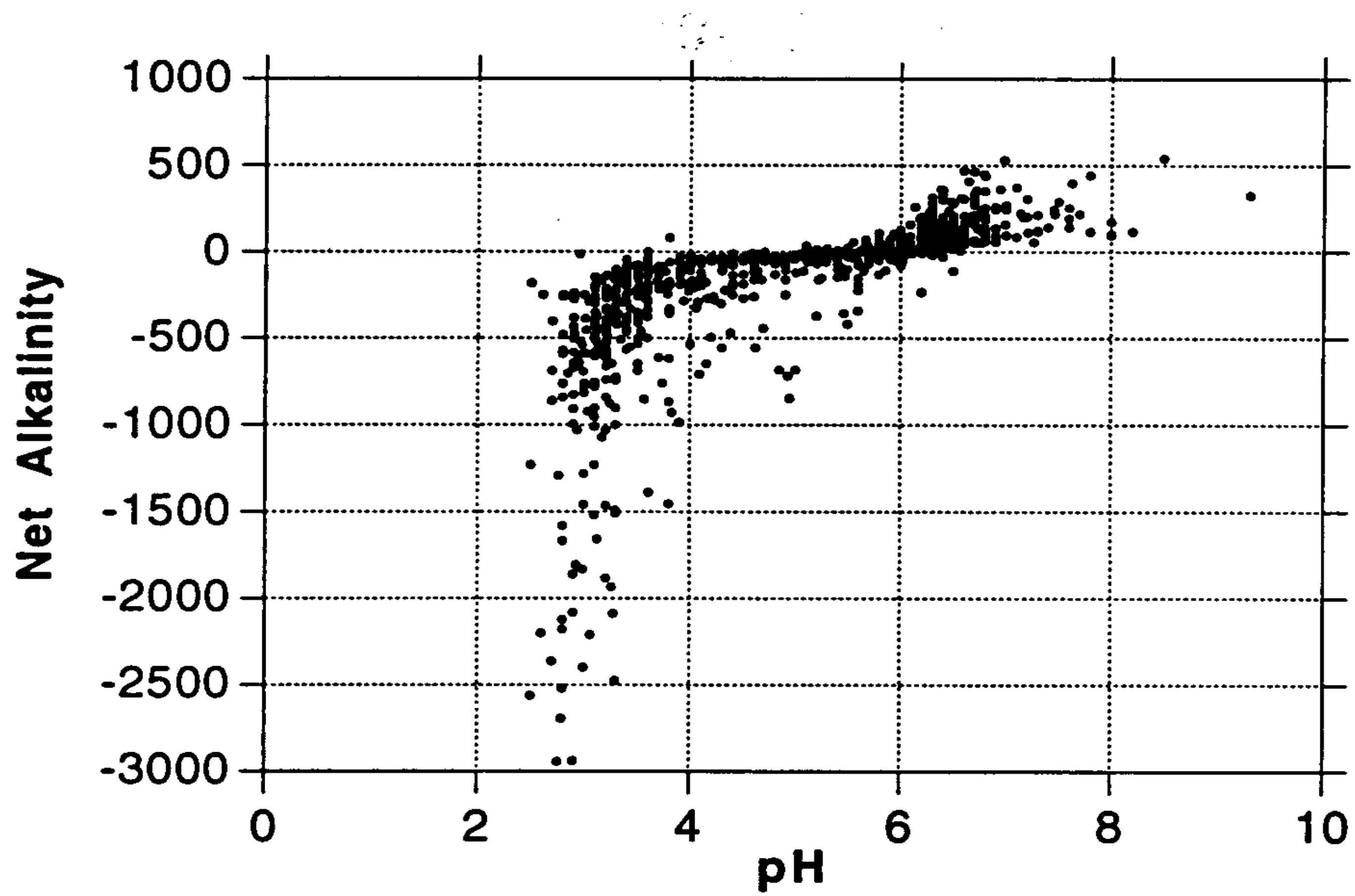


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

Surface Mining Control and Reclamation Act

The Surface Mining Control and Reclamation Act of 1977 (SMCRA, Public Law 95-87) and its subsequent revisions were enacted to established a nationwide program to, among other things, protect the beneficial uses of land or water resources, and pubic health and safety from the adverse effects of current surface coal mining operations, as well as promote the reclamation of mined areas left without adequate reclamation prior to August 3, 1977. SMCRA requires a permit for the development of new, previously mined, or abandoned sites for the purpose of surface mining. Permittees are required to post a performance bond that will be sufficient to ensure the completion of reclamation requirements by the regulatory authority in the event that the applicant forfeits. Mines that ceased operating by the effective date of SMCRA, (often called "pre-law" mines) are not subject to the requirements of SMCRA.

Title IV of the Act is designed to provide assistance for reclamation and restoration of abandoned mines, while Title V states that any surface coal mining operations shall be required to meet all applicable performance standards. Some general performance standards include:

- Restoring the affected land to a condition capable of supporting the uses which it was capable of supporting prior to any mining,

- Backfilling and compacting (to insure stability or to prevent leaching of toxic materials) in order to restore the approximate original contour of the land with all highwalls being eliminated, and topsoil replaced to allow revegetation, and

- Minimizing the disturbances to the hydrologic balance and to the quality and quantity of water in surface and ground water systems both during and after surface coal mining operations and during reclamation by avoiding acid or other toxic mine drainage.

For purposes of these TMDLs, point sources are identified as NPDES-permitted discharge points, and non-point sources include discharges from abandoned mine lands, including but not limited to, tunnel discharges, seeps, and surface runoff. Abandoned and reclaimed mine lands were treated in the allocations as non-point sources because there are no NPDES permits associated with these areas. In the absence of an NPDES permit, the discharges associated with these land uses were assigned load allocations.

The decision to assign load allocations to abandoned and reclaimed mine lands does not reflect any determination by EPA as to whether there are, in fact, unpermitted point source discharges within these land uses. In addition, by establishing these TMDLs with mine drainage discharges treated as load allocations, EPA is not determining that these discharges are exempt from NPDES permitting requirements.

Related Definitions

Pre-Act (Pre-Law) – Mines that ceased operating by the effective date of SMCRA and are not subject to the requirements of SMCRA.
Bond – An instrument by which a permittee assures faithful performance of the requirements of the acts, this chapter, Chapters 87-90 and the requirements of the permit and reclamation plan.

Postmining pollution discharge – A discharge of mine drainage emanating from or hydrologically connected to the permit area, which may remain after coal mining activities have been completed, and which does not comply with the applicable effluent requirements described in Chapters 87.102, 88.92, 88.187, 88.292, 89.52 or 90.102. The term includes minimal-impact postmining discharges, as defined in Section of the Surface Mining Conservation and Reclamation Act.

Forfeited Bond – Bond money collected by the regulatory authority to complete the reclamation of a mine site when a permittee defaults on his reclamation requirements.

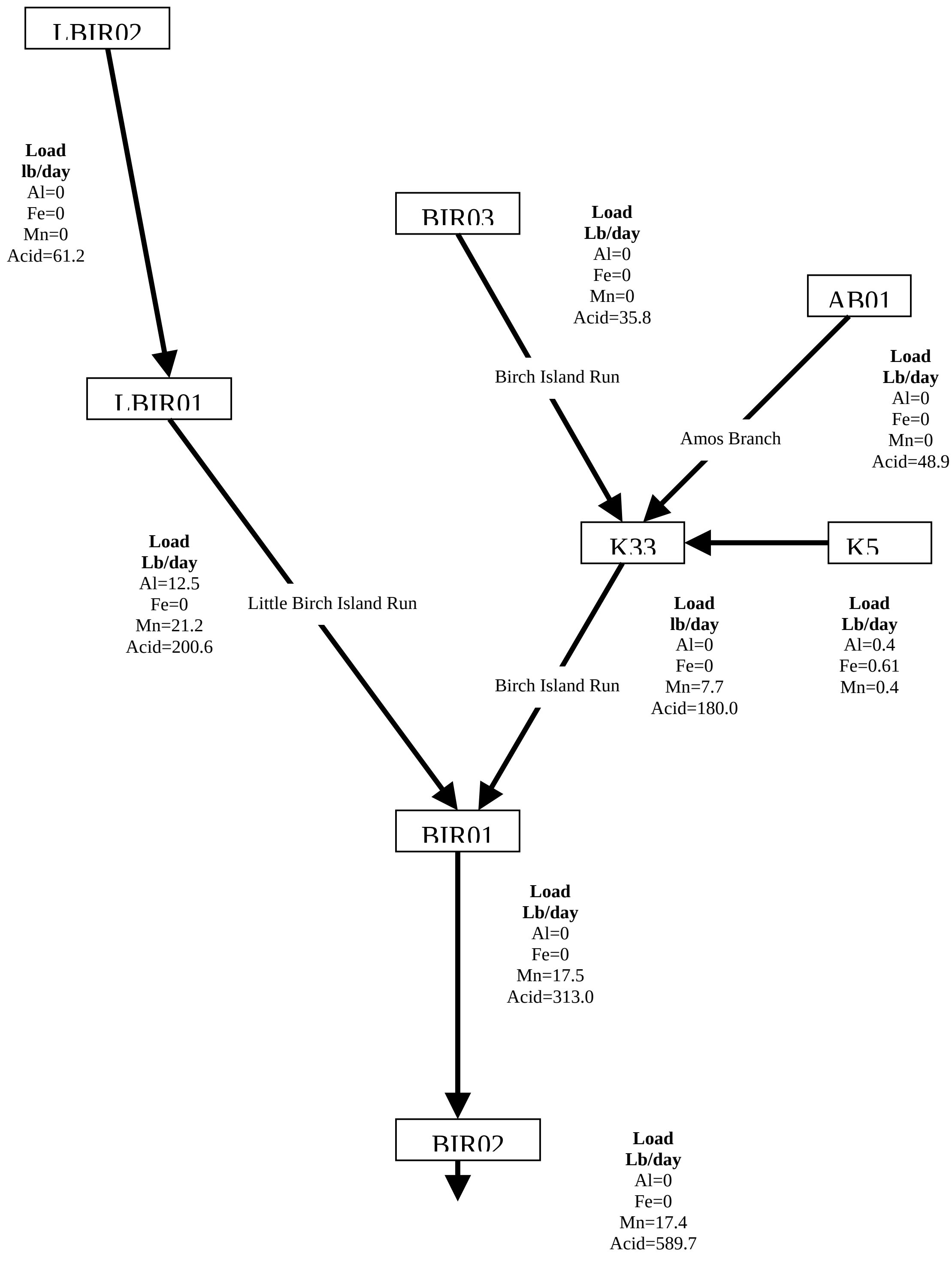
Attachment C
TMDLs By Segment

Birch Island Run

The TMDL for Birch Island Run consists of load allocations to four sampling sites along the Birch Island Run (BIR03, K33, BIR01 and BIR02), two sampling sites on Little Birch Island Run (LBIR02 and LBIR01), one site on Amos Branch (AB01) and a point source discharge (K5). Following is an explanation of the TMDL for each allocation point. Data sets include between 7 and 10 samples taken for each sample point in the Birch Island Run watershed. All sample points are shown on the maps included in Attachment A. Calculated allowable load values that affect downstream points for each sample point are shown on the schematic on the next page.

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

An allowable long-term average in-stream concentration was determined at each sample point for acidity, and for some metals when determined necessary. The analysis is designed to produce an average value that, when met, will be protective of the water-quality criterion for that parameter 99% of the time. An analysis was performed using Monte Carlo simulation to determine the necessary long-term average concentration needed to attain water-quality criteria 99% of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and standard deviation of the data set, 5000 iterations of sampling were completed, and compared against the water-quality criterion for that parameter. For each sampling event a percent reduction was calculated, if necessary, to meet water-quality criteria. A second simulation that multiplied the percent reduction times the sampled value was run to insure that criteria were met 99% of the time. The mean value from this data set represents the long-term average concentration that needs to be met to achieve water-quality standards. Following is an explanation of the TMDL for each allocation point.



LBIR02
Load
lb/day
Al=0
Fe=0
Mn=0
Acid=61.2
BIR03
Load
Lb/day
Al=0
Fe=0
Mn=0
Acid=35.8
AB01
Load
Lb/day
Al=0
Fe=0
Mn=0
Acid=48.9
Birch Island Run
Amos Branch
LBIR01
Load
Lb/day
Al=12.5
Fe=0
Mn=21.2
Acid=200.6
Little Birch Island Run
K33
K5
Load
lb/day
Al=0
Fe=0
Mn=7.7
Acid=180.0
Load
Lb/day
Al=0.4
Fe=0.61
Mn=0.4
Birch Island Run
BIR01
Load
Lb/day
Al=0
Fe=0
Mn=17.5
Acid=313.0
BIR02
Load
Lb/day
Al=0
Fe=0
Mn=17.4
Acid=589.7

TMDL calculations- LBIR02 Little Birch Island Run at Keating Road (in headwaters)

The TMDL for sample point LBIR02 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this headwaters segment was computed using water-quality sample data collected at point LBIR02. The average flow, measured at the sampling point LBIR02 (1.61 MGD), is used for these computations. Because this is the most upstream point of this segment, the allowable load calculated at LBIR02 is equal to the actual load and will directly affect the downstream point LBIR01.

Sample data at point LBIR02 shows that the headwaters of Little Birch Island Run have a pH ranging between 4.9 and 6.0. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for acidity at LBIR02 has been calculated. All measured sample data for aluminum, iron and manganese fell below the detection limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated.

Table C1 shows the measured and allowable concentrations and loads at LBIR02. Table C2 shows percent reductions for all parameters required at this point.

Table C1		Measured		Allowable	
Flow (gpm)=	1116.67	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA		
	Iron	ND	NA		
	Manganese	ND	NA		
ND = non detection	Acidity	9.31	124.9	4.56	61.2
NA = not applicable	Alkalinity	8.43	113.0		

Table C2 LBIR02	
LBIR02	Acidity (Lbs/day)
Existing Load @ LBIR02	124.91
Allowable Load @ LBIR02	61.21
Load Reduction @ LBIR02	63.70
% Reduction required @ LBIR02	51%

TMDL Calculation –LBIR01- Little Birch Island Run before confluence with Birch Island Run

The TMDL for sampling point LBIR01 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point LBIR01. The average flow, measured at the sampling point LBIR01 (6.03 MGD), is used for these computations. The acidic load calculated at LBIR01 will directly affect the downstream point BIR01.

Sample data at point LBIR01 shows pH ranging between 4.5 and 5.1; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point LBIR01 for aluminum and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from point LBIR02 shows the total load that was permitted from upstream sources. This value was added to the difference in loads between point LBIR02 and LBIR01 to determine a total load tracked for the segment of stream between LBIR02 and LBIR01. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at LBIR01.

A TMDL for aluminum and acidity at LBIR01 has been calculated. All measured sample data for iron fell below the detection limits. The measured sample data at manganese was above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. The iron existing and allowable load values at LBIR01 in Table C3 will be denoted as "NA".

Table C3 shows the measured and allowable concentrations and loads at LBIR01. Table C4 shows the percent reduction required for aluminum and acidity at this point.

Table C3		Measured		Allowable	
Flow (gpm)=	4185.88	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.52	26.1	0.25	12.5
	Iron	ND	NA		
	Manganese	0.42	21.2	0.42	21.2
ND = non detection	Acidity	19.00	955.1	3.99	200.6
NA = not applicable	Alkalinity	7.69	386.5		

Table C4 LBIR01		
LBIR01	Al (Lbs/day)	Acidity (Lbs/day)
Existing Load @ LBIR01	26.13	955.14
Difference in measured load between LBIR02 and LBIR01	26.13	830.23
Additional load tracked from LBIR01	0.00	61.21
Total load tracked between LBIR02 and LBIR01	26.13	891.44
Allowable Load @ LBIR01	12.54	200.58
Load Reduction @ LBIR01	13.59	690.86
% Reduction at LBIR01	52%	77%

TMDL calculations- BIR03- Birch Island Run above confluence with Amos Branch

The TMDL for sample point BIR03 consists of a load allocation to all of the area at and above this point shown in Attachment A. This sample point takes into account for the headwaters of Birch Island Run. The load allocation for this segment was computed using water-quality sample data collected at point BIR03. The average flow, measured at the sampling point BIR03 (2.23 MGD), is used for these computations. The allowable load calculated at BIR03 will directly affect the downstream point K33.

Sample data at point BIR03 shows pH ranging between 4.9 and 6.2; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

A TMDL for acidity at BIR03 has been calculated. All measured sample data for aluminum, iron and manganese fell below the detection limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. Their existing and allowable load values at BIR03 in Table C5 will be denoted as "NA".

Table C5 shows the measured and allowable concentrations and loads at BIR03. Table C6 shows the percent reduction for acidity required at this point.

Table C5		Measured		Allowable	
Flow (gpm)=	1548.00	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA		
	Iron	ND	NA		
	Manganese	ND	NA		
ND = non detection	Acidity	12.83	238.4	1.92	35.8
NA = not applicable	Alkalinity	8.70	161.7		

Table C6 BIR03	
BIR03	Acidity (Lbs/day)
Existing Load @ BIR03	238.43
Allowable Load @ BIR03	35.76
Load Reduction @ BIR03	202.67
% Reduction required @ BIR03	85%

TMDL calculations- AB01- Amos Branch above confluence w/ Birch Island Run

The TMDL for sample point AB01 consists of a load allocation to all of the area at and above this point shown in Attachment A. This sample point takes into account for the Amos Branch, a tributary of Big Run. The load allocation for this segment was computed using water-quality sample data collected at point AB01. The average flow, measured at the sampling point AB01 (1.77 MGD), is used for these computations. The allowable load calculated at AB01 will directly affect the downstream point K33.

Sample data at point AB01 shows pH ranging between 4.8 and 5.8; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

A TMDL for acidity at AB01 has been calculated. All measured sample data for aluminum, iron and manganese fell below the detection limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. Their existing and allowable load values at AB01 in Table C7 will be denoted as "NA".

Table C7 shows the measured and allowable concentrations and loads at AB01. Table C8 shows the percent reduction for acidity required at this point.

Table C7		Measured		Allowable	
Flow (gpm)=		Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA		
	Iron	ND	NA		
	Manganese	ND	NA		
ND = non detection	Acidity	9.73	143.8	3.31	48.9
NA = not applicable	Alkalinity	8.53	126.1		

Table C8 AB01	
AB01	Acidity (Lbs/day)
Existing Load @ AB01	143.84
Allowable Load @ AB01	48.91
Load Reduction @ AB01	94.93
% Reduction required @ AB01	66%

Waste Load Allocation – Discharge K5, Ed Hanslovan Coal Company

The Ed Hanslovan Coal Company SMP No. 18840101, NPDES permit No. PA 0610976 has one permitted treatment discharge. The waste load allocation for the discharge is calculated from measured flow data and the monthly average permit limits for aluminum, iron and manganese. The following table shows the waste load allocations for the discharge.

Table C9. Waste Load Allocations at Discharge K5			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Discharge K5			
Al	2	0.0243	0.4
Fe	3	0.0243	0.61
Mn	2	0.0243	0.4

TMDL calculations- K33 Birch Island Run Downstream (before confluence with Little Birch Island Run)

The TMDL for sampling point K33 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point K33. The average flow, measured at the sampling point K33 (6.45 MGD), is used for these computations. The allowable load calculated at K33 will directly affect the downstream point BIR01.

There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH. Sample data at point K33 shows pH ranging between 5.2 and 6.2; pH will be addressed as part of this TMDL.

The measured and allowable loading for point K33 for acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The load from points BIR03, the waste load discharge K5 and AB01 show the total load that was permitted from upstream sources. This value, was subtracted from the existing loads at point K33 to determine a remaining existing load for the segment of stream between BIR03, K33 – AB01 and K33. This remaining load will determine if further reductions are needed to meet the calculated TMDL at K33.

A TMDL for acidity at K33 has been calculated. All measured sample data for aluminum, and iron fell below detection limits. The measured sample data at manganese was above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn’t necessary and is not calculated. Their existing and allowable load values at K33 in Table C10 will be denoted as “NA”. In this case, the accounting for upstream loads (BIR03, K5 and AB01) is not carried through to the next downstream point (K33), for aluminum, iron and manganese. The small instream metals contribution from the waste load allocation K5 is not enough to necessitate reductions at K33, since sampling data showed that metals at K33 were at or below detection limits.

Table C10 shows the measured and allowable concentrations and loads at K33. Table C11 shows the percent reduction for acidity required at K33.

Table C10		Measured		Allowable	
Flow (gpm)=	5014.25	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA		
	Iron	ND	NA		
	Manganese	0.13	8.1	0.13	7.7 (0.4) WLA
ND = non detection	Acidity	6.10	367.3	2.99	180.0
NA = not applicable	Alkalinity	9.14	550.4		

Table C11. K33		
K33	Mn(Lbs/day)	Acidity (Lbs/day)
Existing Load @ K33	8.12	367.34
Difference in measured Loads between the loads that enter and existing K33	8.12	-14.93
Percent loss due calculated at K33	NA	4%
Additional load tracked from above samples	0.00	84.67
Percentage of upstream loads that reach the K33	NA	96%
Total load tracked between BIR03/AB01 and K33	8.12	81.36
Allowable Load @ K33	7.72	179.99
Load Reduction @ K33	0.40	-98.63
% Reduction required at K33	5%	0%

The upstream, acidic loads from AB01 and BIR03 were summed (K5 values are not included in acidic analysis, waste load allocations calculate metal loads) and found to be greater than the existing load at sample point K33. The percent of upstream loads that actually reach sample point K33 was calculated resulting in a value for percent loss of upstream loads that occurs before the loads reach this sample point. Therefore this loss is considered in the reductions at K33. A loss of 14.93 lbs between upstream points and K33 results in a 4% loss of acidic load in this segment of stream. The total load tracked was 98.63 lbs/day less than the calculated allowable load at K33. Therefore no acidic reduction was needed at this sample point. The existing manganese load was 8.12 lbs/day. There was no manganese loading from upstream sample points BIR03 or AB01, therefore the allowable manganese load was equal to the calculated allowable load at K33 – WLA (8.12 – 0.40 = 7.72 lbs/day). A 5% manganese reduction is necessary at K33.

TMDL calculations- BIR01- Birch Island 100 yds below confluence with Little Birch Island Run

The TMDL for sampling point BIR01 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point BIR01. The average flow, measured at the sampling point BIR01 (8.47 MGD), is used for these computations. The allowable load calculated at BIR01 will directly affect the downstream point BIR02.

Sample data at point BIR01 shows pH ranging between 4.7 and 5.7; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point BIR01 for all parameters was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The load from points LBIR01 and K33 show the total load that was permitted from upstream sources. This value, for acidity, was subtracted from the existing acidic load at point BIR01 to determine a remaining load for the segment of stream between LBIR01-K33 and BIR01. This remaining load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at BIR01.

A TMDL for acidity at BIR01 has been calculated. All measured sample data for aluminum and iron fell below the detection limits. The measured sample data at manganese was above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. Their existing and allowable load values at BIR01 in Table C12 will be denoted as "NA".

Table C12 shows the measured and allowable concentrations and loads at BIR01. Table C13 shows the percent reduction for acidity required at BIR01.

Table C12		Measured		Allowable	
Flow (gpm)=	5881.43	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA		
	Iron	ND	NA		
	Manganese	0.25	17.5	0.25	17.5
ND = non detection	Acidity	13.43	948.5	4.43	313.0
NA = not applicable	Alkalinity	8.23	581.2		

Table C13 BIR01	
BIR01	Acidity (Lbs/day)
Existing Load @ BIR01	948.51
Difference in measured Loads between the loads that enter and existing BIR01	-373.97
Percent loss due calculated at BIR01	28%
Additional load tracked from above samples	380.57
Percentage of upstream loads that reach the BIR01	72%
Total load tracked between LBIR01/K33 and BIR01	272.95
Allowable Load @ BIR01	313.01

Load Reduction @ BIR01	-40.06
% Reduction required at BIR01	0%

The calculated allowable load at BIR01 is greater than the total load tracked to BIR01 explaining why no percent reduction is necessary for acidity.

TMDL calculations- BIR02 Birch Island Run before confluence with West Branch Susquehanna River at a railroad bridge

The TMDL for sampling point BIR02 on Birch Island Run consists of a load allocation of the entire watershed area above point BIR02 as shown in Attachment A. The load allocation for this mouth segment was computed using water-quality sample data collected at point BIR02. The average flow, measured at the sampling point BIR02 (13.34 MGD), is used for these computations.

There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point BIR02 shows pH ranging between 4.8 and 5.5, pH will be addressed as part of this TMDL.

The measured and allowable loading for point BIR02 for all parameters was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any allowable loads already specified from upstream sources. The load from point BIR01 shows the total load that was permitted from upstream sources. This value, for acidity, was subtracted from the existing load at point BIR02 to determine a remaining load for the segment of stream between BIR01 and BIR02. This remaining load will determine if further reductions are needed to meet the calculated TMDL at BIR02.

A TMDL for acidity at BIR02 has been calculated. All measured sample data for aluminum and iron fell below detection limits. The measured sample data at manganese was above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters aren't necessary and are not calculated. Their existing and allowable load values for aluminum, iron and manganese at BIR02 in Table C14 will be denoted as "NA".

Table C14 shows the measured and allowable concentrations and loads at BIR02. Table C15 shows the percent reductions required for acidity at sample point BIR02.

Table C14		Measured		Allowable	
Flow (gpm)=	9266.00	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA		
	Iron	ND	NA		
	Manganese	0.16	17.4	0.16	17.4

ND = non detection	Acidity	11.28	1254.7	5.30	589.7
NA = not applicable	Alkalinity	7.98	887.5		

Table C15 BIR02	
BIR02	Acidity (Lbs/day)
Existing Load @ BIR02	1254.69
Difference in measured load between upstream loads and existing BIR02	306.18
Additional load tracked from BIR01	313.01
Total load tracked between BIR01 and BIR02	619.19
Allowable Load @ BIR02	589.71
Load Reduction @BIR02	29.48
% Reduction at BIR02	5%

The difference in measured loads between BIR01 and BIR02 was added to the allowable load tracked from the upstream point BIR01. This total load value was then compared to the allowable load at BIR02 to determine if a reduction is necessary at this downstream point. The acidic reduction needed is 5% or 29.48 lbs/day.

Margin of Safety

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

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

- A MOS is also the fact that the calculations were performed with a daily Iron average instead of the 30-day average.

Seasonal Variation

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

Critical Conditions

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

Attachment D

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

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

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

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

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

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

Attachment E
Water Quality Data Used In TMDL Calculations

LBIR02

	pH*	Alkalinity^	Acidity	Flow	Iron	Manganese	Aluminum
Date	**Lab**	**mg/l**	**mg/l**	**gpm**	**mg/l**	**mg/l**	**mg/l**
4/9/2002	5.1	9.2	6.60		ND	ND	ND
4/29/2002	4.9	10.4	8.00	2000	ND	ND	ND
5/14/2002	4.9	7.2	8.40	2000	ND	0.087	ND
6/6/2002	5.0	8.6	8.40	2000	ND	ND	ND
7/11/2002	4.9	6.8	13.40	500	ND	ND	ND
9/18/2002	5.5	8.4	12.80	100	ND	ND	ND
10/9/2002	6.0	8.4	7.60	100	ND	ND	ND
average	5.2	8.4	9.3	1116.7	NA	NA	NA
st dev	0.4	1.2	2.7	978.6	NA	NA	NA

LBIR01

	pH*	Alkalinity^	Acidity	Flow	Iron	Manganese	Aluminum
Date	**Lab**	**mg/l**	**mg/l**	**gpm**	**mg/l**	**mg/l**	**mg/l**
11/15/2001	5.1	7.2	10.6		ND	0.338	ND
4/2/2002	4.7	9.4	29.80	10830	ND	0.347	0.779
4/9/2002	4.7	9.0	18.20	5140	ND	0.361	0.653
4/29/2002	4.6	9.2	19.40	5000	ND	0.376	0.564
5/14/2002	4.6	6.2	16.40	5000	ND	0.217	ND
6/7/2002	4.5	5.2	23.20	6000	ND	0.484	0.639
7/10/2002	4.7	6.8	13.40	1150	ND	0.554	0.639
9/18/2002	4.8	8.8	24.60	172	ND	0.561	0.615
10/9/2002	4.8	7.4	15.40	195	ND	0.548	0.789
average	4.7	7.7	19.0	4185.9	NA	0.4	0.7
st dev	0.2	1.5	6.0	3604.1	NA	0.1	0.1

BIR03

	pH*	Alkalinity^	Acidity	FLOW	Iron	Manganese	Aluminum
Date	**Lab**	**mg/l**	**mg/l**	**gpm**	**mg/l**	**mg/l**	**mg/l**
4/1/2002	5.5	8.4	11.20		ND	ND	0.597
4/9/2002	5.2	9.6	3.20	2620	ND	ND	ND
4/29/2002	4.9	10.6	40.00	2500	ND	ND	ND
5/14/2002	4.9	7.0	5.20	2500	ND	0.063	ND
6/6/2002	4.9	8.4	9.20	2500	ND	ND	ND
7/11/2002	5.3	7.2	15.40	505	ND	ND	ND
9/18/2002	5.7	9.4	11.20	88	ND	ND	ND
10/9/2002	6.2	9.0	7.20	123	ND	ND	ND
average	5.3	8.7	12.8	1548.0	NA	NA	NA
st dev	0.5	1.2	11.6	1232.8	NA	NA	NA

AB01

AB01	pH*	Alkalinity^	Acidity	FLOW	Iron	Manganese	Aluminum
Date	Lab	mg/l	mg/l	gpm	mg/l	mg/l	mg/l
4/2/2002	5.3	10.2	12.00		ND	ND	ND
4/9/2002	5.0	9.2	3.40	2175	ND	ND	ND
4/29/2002	4.9	10.4	6.00	2000	ND	ND	ND
5/14/2002	4.8	7.2	8.40	2000	ND	0.069	ND
6/6/2002	4.8	8.0	9.00	2000	ND	ND	ND
7/11/2002	5.0	7.0	17.80	345	ND	ND	ND
9/18/2002	5.2	8.0	14.00	38	ND	ND	ND
10/9/2002	5.8	8.2	7.20	63	ND	ND	ND
average	5.1	8.5	9.7	1231.6	NA	NA	NA
st dev	0.3	1.3	4.6	1019.6	NA	NA	NA

K33

MINING	Flow	Lab	Temp	Alkalinity	Acidity	Iron	Manganese
Date	gpm	Lab	C	mg/l	mg/l	mg/l	mg/l
5/25/1999	N/M	4.2	16	2	12	0.04	0.27
9/28/1999	185	5.8	16	6	6	0.08	0.03
11/19/1999	N/M	6.1	9	8	0	0.52	0.09
3/9/2000	N/M	6.0	7	6	2	0.12	0.03
6/23/2000	N/M	5.2	15	6	6	0.10	0.07
9/8/2000	N/M	6.1	17	6	4	0.10	0.04
10/20/2000	N/M	6.7	10	12	0	0.03	0.07
3/16/2001	N/M	5.3	6	6	4	0.07	0.03
6/1/2001	N/M	5.5	16	6	6	0.11	0.03
9/19/2001	500+	6.5	16	10	0	0.06	0.04

DEP	pH*	Alkalinity^	Acidity	FLOW	Iron	Manganese	Aluminum
Date	Lab	mg/l	mg/l	gpm	mg/l	mg/l	mg/l
3/13/2000	5.6	8.2	1.00		0.029	0.203	0.284
11/15/2001	6.0	9.0	2.60		ND	0.209	ND
4/2/2002	5.7	9.2	10.40	7500	ND	0.062	ND
4/9/2002	5.3	9.8	2.40	7783	ND	0.114	ND
4/29/2002	5.3	10.2	7.80	7500	ND	0.071	ND
5/14/2002	5.2	7.0	4.40	7500	ND	0.085	ND
6/7/2002	5.7	7.6	4.60	8000	ND	0.098	ND
7/10/2002	5.8	8.4	7.80	1500	ND	0.06	ND
9/18/2002	6.2	12.0	11.60	155	ND	0.058	ND
10/9/2002	6.2	10.0	8.40	176	ND	0.388	ND
average	5.7	8.0	5.1	5014.3	NA	0.1	NA
st dev	0.6	2.4	3.7	3674.0	NA	3.9	NA

BIR01

BIR01	pH*	Alkalinity^	Acidity	Flow	Iron	Manganese	Aluminum
Date	Lab	mg/l	mg/l	gpm	mg/l	mg/l	mg/l
4/2/2002	4.8	9.6	17.20	10,000	ND	0.208	ND
4/29/2002	4.8	10.2	11.00	10,000	ND	0.228	ND
5/14/2002	4.7	6.6	17.40	10,000	ND	0.184	ND
6/7/2002	4.9	6.6	11.20	8000	ND	0.312	ND
7/11/2002	5.2	7.2	12.00	2500	ND	0.259	ND
9/18/2002	5.7	9.4	17.20	300	ND	0.201	ND
10/9/2002	5.6	8.0	8.00	370	ND	0.339	ND
average	5.1	8.2	13.4	5881.4	NA	0.2	NA
st dev	0.4	1.5	3.8	4624.9	NA	0.1	NA

BIR02

	pH*	Alkalinity^	Acidity	Flow	Iron	Manganese	Aluminum
Date	Lab	mg/l	mg/l	gpm	mg/l	mg/l	mg/l
4/2/2002	5.0	9.6	16.00		ND	0.177	ND
4/9/2002	4.9	9.4	10.40	15155	ND	0.157	ND
4/29/2002	4.8	9.8	9.40	15000	ND	0.178	ND
5/14/2002	4.9	6.8	11.60	15000	ND	0.156	ND
6/7/2002	5.0	6.6	9.60	16000	ND	0.243	ND
7/10/2002	5.2	6.8	10.80	2745	ND	0.125	ND
9/18/2002	5.1	6.8	11.20	500	ND	0.058	ND
10/9/2002	5.5	8.0	11.20	462	ND	ND	ND
average	5.1	8.0	11.3	9266.0	NA	0.2	NA
st dev	0.2	1.4	2.1	7557.1	NA	0.1	NA

ND = Non Detection

	Date	Flow (gpm)
K5	4/24/2003	15
	3/25/2003	40
	10/3/2002	0
	7/25/2002	8
	6/13/2002	30
	4/11/2002	15
	2/26/2002	10
	Average	16.857
	St Dev	13.692

Attachment F

Comment and Response

No official comments were received during the final comment period.