FINAL

ALDER RUN WATERSHED TMDL
Clearfield County

For Acid Mine Drainage Affected Segments

Prepared by:

Pennsylvania Department of Environmental Protection

June 8, 2005

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Clearfield County, Pennsylvania

Table 1. 303(d) Sub-List								
State Water Plan (SWP) Subbasin: 08-C West Branch Susquehannah								
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1996	10.7	7160	25924	Alder Run	CWF	305(b) Report	RE	Metals
1998	10.79	7160	25924	Alder Run	CWF	SWAP	AMD	Metals
2002	25.8	990819-1405-LMS	25924	Alder Run, Browns Run, Flat Run, & Mons Run	CWF	SWAP	AMD	Metals & pH
2004	11.8	990819-1405-LMS	25924	Alder Run	CWF	SWMP	AMD	Metals & pH
2004	0.7	20031022-1200-JCO	25931	Unt Alder Run	CWF	SWAP	AMD	Metals & pH
2004	0.9	20031022-1200-JCO	25932	Unt Alder Run	CWF	SWAP	AMD	Metals & pH
2004	1.5	20030713-1420-JLR	25933	Unt Alder Run	CWF	SWAP	AMD	Metals & pH
2004	0.7	20030713-1420-JLR	25934	Unt Alder Run	CWF	SWAP	AMD	Metals & pH
2004	0.6	20031022-1300-JCO	25942	Unt Alder Run	CWF	SWAP	AMD	Metals & pH
2004	0.5	20031022-1300-JCO	25943	Unt Alder Run	CWF	SWAP	AMD	Metals & pH
2004	0.5	990819-1405-LMS	64553	Unt Alder Run	CWF	SWAP	AMD	Metals & pH
2004	0.5	990819-1405-LMS	64554	Unt Alder Run	CWF	SWAP	AMD	Metals & pH

Resource Extraction=RE
Cold Water Fishes = CWF
Abandoned Mine Drainage = AMD
Surface Water Assessment Program = SWAP

See Attachment E, *Excerpts Justifying Changes Between the 1996, 1998, 2002 and 2004 Section 303(d) Lists.*
The use designations for the stream segments in this TMDL can be found in PA Title 25 Chapter 93.

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

Introduction

This report presents the Total Maximum Daily Loads (TMDLs) developed for segments in the Alder Run Watershed (Attachments A). These were done to address the impairments noted on the 1996 Pennsylvania Section 303(d) list of impaired waters, required under the Clean Water Act, and covers one segment on this list and one additional non-listed segment (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 Alder Run Watershed

The Alder Run Watershed is located in North Central Pennsylvania, occupying a northeastern portion of Clearfield County in Copper, Graham and Morris Townships. The watershed area is found on United States Geological Survey maps covering Philipsburg, Frenchville 7.5-Minute Quadrangle.

The center of the watershed is located near Kylertown. Kylertown can be reached by traveling north seven miles on State Route 53 from Philipsburg or east thirteen miles on Interstate 80 from Clearfield. State and township roads easily access the headwaters streams, but the lower reaches of the watershed can only be accessed by foot or canoe.

Hydrology of Alder Run Watershed

The area within the watershed consists of approximately twenty-four square miles. The watershed is irregularly shaped with a maximum length of nine miles and a maximum width of five miles. Named tributaries of Alder Run are Browns Run, Mons Run, Flat Run, Kettle Spring Run and Hubler Run. Alder Run flows from an elevation of 1720 feet above sea level in its headwaters near Morrisdale to an elevation of 940 feet above sea level at its confluence with the West Branch of the Susquehanna River. Alder Run flows from the southwest to the northeast.

Geology of Alder Run Watershed

The Alder Run watershed lies within the Appalachian Plateaus Physiographic Province.
The watershed area is comprised of Pennsylvanian and Mississippian aged rocks. The Laurel Hill anticline trends in a northeast-southwest direction just west of the watershed area. Mining in the Alder Run watershed has been confined to the southeast limb of the Laurel Hill Anticline.

Older Mississippian rocks of the Pocono Formation are exposed in the valleys of the watershed and the younger Pennsylvanian aged rocks of the Pottsville and Allegheny Groups are on the hilltops and ridges surrounding the watershed. Coal seams mined within the watershed include Clarion/Brookville, Lower Kittanning, Middle Kittanning, Upper Kittanning, Lower Freeport and Upper Freeport seams. Strata in the watershed are oriented in a NW to SE trend and dip to the NE in the lower reaches of the watershed and are oriented in a NE to SW trend and dip to the SE in the headwaters of the watershed. Much of the deformation in the watershed area is caused by faulting which has resulted in a departure from the normal attitude of the bedding.

Segments addressed in this TMDL

There is one active mining permit (EnerCorp, Inc. SMP17663136) located in the Alder Run watershed. Sky Haven Coal, Inc.'s, (SMP#17813091) Albert #1 remains active today due to a discharge that resulted from mining. A chemical treatment system has been placed onsite to treat this discharge. The remaining discharges in the watershed that 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 Environmental Protection Agency's (EPA) implementing regulations (40 CFR Part 130) require:

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

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

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

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

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

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

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

These TMDLs were developed in partial fulfillment of the 1997 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA.*

Section 303(d) Listing Process

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

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

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

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

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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.

Basic Steps for Determining a TMDL

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

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

Alder Run Watershed History

Alder Run is severely polluted by mine drainage almost entirely emanating from abandoned surface and deep mines. The pollution extends from its headwaters to its mouth and affects almost all of its tributaries. This pollution has been documented since 1949 by extensive water sampling. Mining was initially begun in the southern portion of the watershed. The Lower Kittanning or "B" seam was extensively deep mined because of its high quality, persistent thickness and lateral continuity. Clearfield Bituminous Coal Company; Morrisdale, Maxton and Cunard; Pennsylvania Coal and coke; and Peale, Peacock, and Kerr were the major operators and established an extensive subterranean system which underlies the southern portion of the watershed as well as the region to the south and east. The deep mining in the region ceased during World War II.

At present, strip mining is the mining method used throughout the watershed. Many of the mining operations today include portions of sites previously deep mined and/or strip mined. Many of these sites benefit from reclamation that would not be done if it were not for the mining company remining the sites that were left abandoned in the past.

The most recent mining in the Alder Run watershed includes the following:

<u>Graham Township Mining</u>

The Clair McGovern Coal Company, Mcgovern #1 (Mine Drainage Permit No.3266BSM68), was issued on June 13, 1968. This issuance was a continuation of mining previous mining in the area that commenced in the mid to late 1940's. The coal seams mined were the Clarion (236 acres) and the Lower Kittanning (295.0 acres) with a total of 423.0 acres affected. The permit was updated on November 3, 1980. The update modified the Lower Kittanning (229.0 acres) coal seam mining and the total (479.0 acres) number of acres affected. Mine Drainage Permit No. 3266BSM68 was issued as SMP#17663136 on July 23, 1984 for a permit area of 202.0 acres with 144.5 to be affected. This permit was then transferred from Clair McGovern Coal

Company to EnerCorp Inc. on January 11, 1991. This permit has been renewed several times since the transfer and currently expires on July 23, 2009.

Sky Haven Coal, Inc.'s, (SMP#17813091) Albert #1 was issued on August 9, 1984. The coal seams mined were the Middle Kittanning (126.3 acres) and the Lower Kittanning (196.3 acres). The total permit area was 196.3 acres with 196.3 acres affected and 196.3 surface acres of coal removed. Mining was completed and the site backfilled during the winter of 1989. The site remains active today due to a discharge that resulted from this mining. The permit expires on August 9, 2009. A chemical treatment system has been placed onsite to treat this discharge. The discharge is treated with lime and then passes through two settling ponds prior to being pumped for discharging. The discharge has a flow rate that varies from season to season. Discharge limits are covered under Part C of the NPDES Permit.

EnerCorp, Inc.'s, Albert Operation (SMP#17840115) was issued on April 8, 1985. The coal seams mined were the Lower Kittanning #1 (15.0 acres), Lower Kittanning #2 (6.0 acres), Lower Kittanning #3 (6.0 acres), and Lower Kittanning #4 (6.0acres). The total permit area was 36.0 acres with 15.0 acres affected and 15.0 surface acres of coal removed. Mining was completed and the site backfilled in the spring of 1994. This permit area lies just west of where Alder Run passes under the Allport Cutoff.

The Larson Enterprises, Inc., Graham Operation (SMP17950107), was issued on October 26, 1995. The coal seam mined was the Middle Kittanning #3. The total permit area was 20.5 acres with 20.5 acres affected and 11.0 surface acres of coal removed. Mining was completed and the site was backfilled in the spring of 1999. This permit area also lies to the west of Kylertown on the hilltop in the headwaters of Flat and Mons Runs.

EnerCorp, Inc.'s, Forcey Operation (SMP#17970102) was issued on November 25, 1997. The coal seams mined were the Lower Kittanning (32.5 acres) and the Lower Kittanning rider (0.5 acres). The total permit area was 58.9 acres with 58.9 acres affected and 32.5 surface acres of coal removed. This permit also reclaimed 9.9 acres of abandoned mine land and daylighted 5.0 acres of underground mines. Mining was completed and the site backfilled in the fall of 2002. The site is located on the hilltop just above the confluence of Flat/Alder Runs.

The Larson Enterprises, Inc., Graham #2 Operation (SMP#17980114) was issued on November 18, 1998. The coal seams mined were the Middle Kittanning #2 (7.2 acres), Middle Kittanning #1 (12.1 acres), Lower Kittanning #4 (27.9 acres) and the Lower Kittanning #3 (7.4 acres). In addition to the coal seams the Lower Kittanning #4 clay (6.0 acres) and Lower Kittanning #4 sandstone were also mined. The total permit area is 52 acres with 51 acres affected and 41.3 surface acres of coal removed. This permit also reclaimed 5.0 acres of abandoned mine lands and daylighted 7.4 acres of underground mines. Mining was completed and the site was backfilled and planted in the fall of 2002. This permit area also lies to the west of Kylertown on the hilltop in the headwaters of Flat and Mons Runs.

Larry Baumgardner Coal's, Gasline Operation (GFCC 17-02-02) reclamation site is in the process of reclaiming an abandoned highwall (approximately 500 feet) and spoil (8.3 acres). This site is a Government Financed Construction Contract (GFCC) and will require a strip of

Lower Kittanning (2.4 acres) crop coal, approximately 40 feet wide, to be removed during the reclamation process in order to obtain material to properly reclaim the site. The reclamation process began December 4, 2003 and is to be completed by the fall of 2006. This site is located off of Deer Creek Road in the headwaters of an unnamed tributary to Alder Run.

EnerCorp, Inc.'s, (GFCC 17-01-03) Bumbarger #2 Operation reclamation site is in the process of reclaiming an abandoned Lower Kittanning highwall (approximately 350 feet) and spoil (11.4 acres). This site is a Government Financed Construction Contract (GFCC) and will require a strip of Lower Kittanning (3.1 acres) crop coal, approximately 50 feet wide, to be removed during the reclamation process in order to obtain material to properly reclaim the site. The reclamation process began October 18, 2002 and is to be completed by the fall of 2005. The site is located just above the Flat Run/Alder Run confluence on Alder Run.

Cooper Township Mining

E. M. Brown, Inc.'s, (SMP#17820146) Pleasant Hill Operation was issued on June 7, 1984. The coal seams mined were the Upper Kittanning (24.6 acres), Middle Kittanning (54.8 acres) and the Lower Kittanning rider (43.5 acres). The total permit area was 137.8 acres with 137.8 acres affected and 90.3 surface acres of coal removed. Mining was completed and the site backfilled in the fall of 1993. This mine site is located in the headwaters of Browns Run.

Larson Enterprises, Inc.'s, (SMP#17960120) Krasinski Operation was issued on February 12, 1997. The coal seam mined was the Middle Kittanning (5.2 acres). The total permit area wa 10.2 acres with 10.2 acres affected and 5.2 surface acres of coal removed. This permit also reclaimed 3.3 acres of abandoned mine lands. Mining was completed and the site backfilled in the spring of 2001. A small portion of this site lies within the Alder Run watershed in the headwaters of an unnamed tributary to Browns Run.

E. M. Brown, Inc.'s, (SMP#17970104) Kendrick Operation was issued on October 8, 1997. The coal seam mined was the Upper Kittanning (21.0 acres). The total permit area was 34.0 acres with 29 acres affected and 21 surface acres of coal removed. Mining was completed and the site backfilled in the summer of 2000. This mine site is located in the headwaters of Browns Run.

Morris Township Mining

King Coal Sales, Inc.'s, (SMP#17940117) Queen Operation was issued on March 13, 1995. The coal seams mined were the Middle Kittanning (18.0 acres), Middle Kittanning rider #2 (7.0 acres), Upper Kittanning (62.0 acres) and the Lower Freeport (6.0 acres). The total permit area was 141 acres with 140 acres affected and 107 surface acres of coal removed. This permit also reclaimed 63 acres of abandoned mine lands during the mining process. Mining was completed and the site backfilled in the spring of 1998.

Larson Enterprises, Inc.'s, (SMP#17950115) Swamp Poodle Operation was issued on February 7, 1996. The coal seams mined were the Middle Kittanning #1 (10.7 acres), Middle Kittanning #2 (5.6 acres), Middle Kittanning #3 (3.7 acres), Lower Kittanning #3 (27.9 acres) and the Lower Kittanning #4 (32.9 acres). The total permit area was 50.1 acres with 50.1 acres affected and

40.0 surface acres of coal removed. This permit also reclaimed 8.6 acres of abandoned mine lands and daylighted 27.9 acres of underground mines. Mining was completed and the site backfilled in the spring of 1999.

AMD Methodology

Two approaches are used for the TMDL analysis of AMD-affected stream segments. Both of these approaches use the same statistical method for determining the instream allowable loading rate at the point of interest. The difference between the two is based on whether the pollution sources are defined as permitted discharges or have a responsible party, which are considered point sources. Nonpoint 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 a 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.

TMDLs and load allocations for each pollutant were determined using Monte Carlo simulation. 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 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:

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

LTA = Mean * (1 – PR99) where (2)
LTA = allowable LTA source concentration in mg/l

Once the required percent reduction for each pollutant source was determined, a second series of Monte Carlo simulations were performed to determine if the cumulative loads from multiple sources allow instream water quality criteria to be met at all points at least 99 percent of the time. The second series of simulations combined the flows and loads from individual sources in a step-wise fashion, so that the level of attainment could be determined immediately downstream of each source. Where available data allowed, pollutant-source flows used were the average flows. Where data were insufficient to determine a source flow frequency distribution, the average flow derived from linear regression was used.

In general, these cumulative impact evaluations indicate that, if the percent reductions determined during the first step of the analysis are achieved, water quality criteria will be achieved at all upstream points, and no further reduction in source loadings is required.

Where a stream segment is listed on the Section 303(d) list for pH impairment, the evaluation is the same as that discussed above; the pH method is fully explained in Attachment B. Information for the TMDL analysis performed using the methodology described above is contained in the TMDLs by segment section of this report in Attachment C.

Method to Quantify Treatment Pond Pollutant Load

Surface Coal Mines 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 are 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 revegated. 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 instream limits to be exceeded.

Standard Treatment Pond Effluent Limits:
Alkalinity > Acidity
6.0 <= pH <= 9.0
Al < 2.0 mg/l
Fe < 3.0mg/l
Mn < 2.0

When a treatment plant has an NPDES permit a Waste Load Allocation (WLA) must be calculated. When there is flow data available this is used along with the permit Best Available

Technology (BAT) limits for one or more of the following: aluminum, iron, and manganese. The following formula is used:

Flow (MGD) X BAT limit (mg/l) X 8.34 = lbs/day

When site specific flow data is unavailable to determine a waste load allocation for an active mining operation, an average flow rate must be determined. This is done by investigating and quantifying the hydrology of a surface mine site. 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 when site specific flow data is unavailable.

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 40 inches of precipitation per year. A maximum pit dimension without special permit approval is 1500 feet long by 300 feet wide. Assuming 100 percent runoff of the precipitation to be pumped to the treatment ponds results in the following equation and average flow rates for the pit area.

40 in. precip./yr x 1 ft/12/in. x 1500'x 300'/pit x 7.48 gal/ft3 x 1yr/365days x 1day/24hr. x 1hr/60mins. =

21.3 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. DEP compliance efforts encourage that backfilling, topsoiling, and revegetation be as prompt and concurrent as mining conditions and weather conditions allow. Generally the revegatation follows about three pit widths behind the active mining area.

In the case of roughly backfilled land highly porous spoil; there is very little surface runoff. It is estimated that 80 percent of precipitation on the roughly regraded mine spoil infiltrates, 5 percent evaporates, and 15 percent may run off to the pit for pumping and potential treatment. The following equation represents the average flow reporting to the pit from the unregraded and unrevegatated spoil area.

40 in. precip./yr x 3 pit areas x 1 ft/12/in. x 1500'x 300'/pit x 7.48 gal/ft3 x 1yr/365days x 1day/24hr. x 1hr/60mins. x 15 in. runoff/100 in. precipitation =

= 9.6 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 = 21.3 gal./min. + 9.6 gal./min. = 30.9 gal./min.

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

Allowable Iron Waste Load Allocation:
30.9 gal./min. x 3 mg/l x 0.01202 = 1.1 lbs./day

Allowable Manganese Waste Load Allocation:
30.9 gal./min. x 2 mg/l x 0.01202 = 0.7 lbs./day

Allowable Aluminum Waste Load Allocation:
30.9 gal./min. x 2 mg/l x 0.01202 = 0.7 lbs./day

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

Field experience shows that the average flow rate of 30.9 gal./min. is excessively high. 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 enviroment. As a step to insure that a mine site does not produce acid drainage, it is common to require the addition of alkaline materials (limestone, alkaline shale or other rocks) may produce alkaline pit water with very low metals concentrations that does not require treatment. Also, while most mining operations are permitted 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 that the standard size is present, the calculations to define the potential pollution load are adjusted accordingly. Hence, the above calculated Waste Load Allocation is very generous and likely high compared to actual conditions that are generally encountered.

TMDL Endpoints

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

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

Table 2. Applicable Water Quality Criteria

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

*The pH values shown will be used when applicable. In the case of freestone streams with little or no buffering capacity, the TMDL endpoint for pH will be the natural background water quality.

TMDL Elements (WLA, LA, MOS)

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). The TMLD allocations in this report are based on available data. Other allocation schemes could also meet the TMDL.

TMDL Allocations Summary

Analyses of data for metals for point AR11 indicate that there is no single critical flow condition for pollutant sources, and further, that there was no significant correlation between source flows and pollutant concentrations (Table 3). The other points in this TMDL did not have enough paired flow/parameter data to calculate correlations (fewer than 15 paired observations).

Table 3 Correlation Between Metals and Flow for Selected Points

Point Identification	*Flow vs.*			*Number of Samples*
	Iron	*Manganese*	*Aluminum*	
AR11	0.085	0.074	0.043	17

Allocation Summary

These TMDLs will focus remediation efforts on the identified numerical reduction targets for each watershed. As changes occur in the watershed, the TMDLs may be re-evaluated to reflect current conditions. Table 3 presents the estimated reductions identified for all points in the watershed. Attachment C gives detailed TMDLs by segment analysis for each allocation point.

Table 4. Summary Table–Alder Run Watershed

Station	***Parameter***	***Existing Load (lb/day)***	***TMDL Allowable Load (lb/day)***	***WLA (lb/day)***	***LA (lb/day)***	***Load Reduction (lb/day)***	***Percent Reduction %***
AR14	Headwaters of Alder Run						
	Al	162.2	1.7	0.00	1.7	160.5	99
	Fe	89.6	1.8	0.00	1.8	87.8	98
	Mn	237.2	2.5	0.00	2.5	234.7	99
	Acidity	1716.3	1.0	0.00	1.0	1715.3	99.9
AR13	Unnamed Tributary (64553) to Alder Run Downstream of AR14						
	Al	128.2	55.5	3.00	52.5	72.7	57
	Fe	40.1	40.1	4.50	35.6	0.0	0
	Mn	207.8	51.3	3.00	48.3	156.5	75
	Acidity	2618.8	763.1	0.00	763.1	1855.7	71
AR11	Alder Run Upstream of Unnamed Tributary 25945						
	Al	78.8	1.6	0.00	1.6	13.9	90
	Fe	29.5	1.2	0.00	1.2	8.3	87
	Mn	110.2	1.7	0.00	1.7	11.6	87
	Acidity	877.7	0.7	0.00	0.7	154.0	100
AR12	Unnamed Tributary (25945) to Alder Run						
	Al	ND	ND	NA	NA	-	0
	Fe	0.08	0.03	0.00	0.03	0.05	57
	Mn	0.02	0.02	0.00	0.2	0.0	0
	Acidity	ND	ND	NA	NA	-	0
AR09	Unnamed Tributary (25942) to Alder Run Upstream of AR08						
	Al	2.4	0.8	0.00	0.8	1.6	68
	Fe	0.9	0.9	0.00	0.9	0.0	0
	Mn	4.4	2.0	0.00	2.0	2.4	55
	Acidity	140.4	15.4	0.00	15.4	125.0	89
AR08	Alder Run						
	Al	175.4	4.3	0.00	4.3	92.3	96
	Fe	38.9	4.9	0.00	4.9	5.6	53
	Mn	237.8	6.1	0.00	6.1	120.8	95
	Acidity	2248.8	13.9	0.00	13.9	1232.8	99
AR07	Alder Run Upstream of Confluence with Flat Run						
	Al	262.6	7.5	0.00	7.5	84.0	92
	Fe	59.2	15.7	0.00	15.7	9.5	38
	Mn	274.5	13.7	0.00	13.7	29.1	68
	Acidity	3438.9	7.2	0.00	7.2	1196.8	99
AR06	Unnamed Tributary (25940) to Alder Run Downstream of Flat Run						
	Al	ND	ND	NA	NA	-	0
	Fe	ND	ND	NA	NA	-	0
	Mn	0.2	0.2	0.00	0.2	0.0	0

Station	*Parameter*	*Existing Load (lb/day)*	*TMDL Allowable Load (lb/day)*	*WLA (lb/day)*	*LA (lb/day)*	*Load Reduction (lb/day)*	*Percent Reduction %*
	Acidity	19.7	5.0	0.00	5.0	14.7	75
FR01	Flat Run Upstream of Confluence with Alder Run						
	Al	233.1	2.8	0.24**	2.56	230.3	99
	Fe	49.4	5.0	0.36**	4.64	44.4	90
	Mn	74.9	5.4	0.24**	5.16	69.5	93
	Acidity	1503.3	0.0	0.00	0.0	1503.3	100
AR05	Alder Run Upstream of Hubler and Mons Runs						
	Al	224.2	11.0	0.00	11.0	0.0	0
	Fe	35.6	19.8	0.00	19.8	0.0	0
	Mn	193.9	15.2	0.00	15.2	0.0	0
	Acidity	2477.9	20.3	0.00	20.3	0.0	0
HR03	Headwaters of Hubler Run (25938)						
	Al	14.5	1.4	0.00	1.4	13.1	91
	Fe	2.8	2.8	0.00	2.8	0.0	0
	Mn	26.0	2.2	0.00	2.2	23.8	91
	Acidity	314.8	14.9	0.00	14.9	299.9	95
HR02	Unnamed Tributary (25939) to Hubler Rub						
	Al	1.1	0.14	0.00	0.14	0.96	87
	Fe	1.8	0.36	0.00	0.36	1.44	80
	Mn	0.5	0.38	0.00	0.38	0.12	30
	Acidity	12.0	4.1	0.00	4.1	7.9	66
HR01	Hubler Run Upstream of Confluence with Alder Run						
	Al	8.3	1.4	0.00	1.4	0.0	0
	Fe	ND	ND	NA	NA	-	0
	Mn	18.7	2.6	0.00	2.6	0.0	0
	Acidity	229.8	21.1	0.00	21.1	0.0	0
MR05	Unnamed Tributary (25937) to Unnamed Tributary (25936)						
	Al	1.3	0.05	0.24**	0.05	1.25	96
	Fe	0.4	0.09	0.36**	0.09	0.31	78
	Mn	0.9	0.11	0.24**	0.11	0.79	88
	Acidity	14.4	0.0	0.00	0.0	14.4	100
MR04	Unnamed Tributary (25936) to Mons Run						
	Al	27.1	0.7	0.00	0.7	26.4	98
	Fe	0.9	0.7	0.00	0.7	0.2	26
	Mn	8.4	0.9	0.00	0.9	7.5	89
	Acidity	277.2	1.2	0.00	1.2	276.0	99.6
MR03	Unnamed Tributary (25936) to Unnamed Tributary (25935)						
	Al	27.9	0.8	0.00	0.8	0.0	0
	Fe	1.7	0.9	0.00	0.9	0.3	23
	Mn	9.5	1.1	0.00	1.1	0.2	14
	Acidity	281.1	0.5	0.00	0.5	0.7	57

Station	***Parameter***	***Existing Load (lb/day)***	***TMDL Allowable Load (lb/day)***	***WLA (lb/day)***	***LA (lb/day)***	***Load Reduction (lb/day)***	***Percent Reduction %***
MR02	Mons Run Upstream of MR03						
	Al	166.6	1.0	0.24**	0.74	165.6	99
	Fe	422.4	1.7	0.36**	1.34	420.7	99.6
	Mn	66.5	1.3	0.24**	1.06	65.2	98
	Acidity	2595.6	0.0	0.00	0.0	2595.6	100
MR01	Mons Run Upstream of Confluence with Alder Run						
	Al	248.0	3.1	0.00	3.1	52.2	94
	Fe	465.6	5.2	0.00	5.2	29.9	85
	Mn	101.6	3.7	0.00	3.7	24.3	87
	Acidity	3536.5	0.0	0.00	0.0	660.3	100
AR04	Unnamed Tributary (25933) to Alder Run						
	Al	131.2	1.9	0.00	1.9	129.3	99
	Fe	45.5	2.9	0.00	2.9	42.6	94
	Mn	55.4	2.6	0.00	2.6	52.8	95
	Acidity	1240.3	0.0	0.00	0.0	1240.3	100
AR03	Unnamed Tributary (25931) to Alder Run						
	Al	12.0	1.8	0.00	1.8	10.2	85
	Fe	ND	ND	NA	NA	-	0
	Mn	7.5	2.0	0.00	2.0	5.5	74
	Acidity	215.3	9.4	0.00	9.4	205.9	96
AR02	Alder Run Upstream of Confluence with Browns Run						
	Al	819.5	32.5	0.00	32.5	182.6	85
	Fe	1624.2	33.3	0.00	33.3	1081.0	97
	Mn	584.0	33.6	0.00	33.6	199.4	86
	Acidity	12153.8	0.0	0.00	0.00	4504.8	100
BR06	Unnamed Tributary (25930) to Browns Run						
	Al	103.2	1.6	0.00	1.6	101.6	98
	Fe	232.1	3.0	0.00	3.0	229.1	99
	Mn	14.2	2.6	0.00	2.6	11.6	82
	Acidity	1730.3	0.0	0.00	0.0	1730.3	100
BR05	Browns Run Upstream of BR06						
	Al	81.5	2.3	0.00	2.3	79.2	97
	Fe	175.3	4.2	0.00	4.2	171.1	98
	Mn	9.0	3.7	0.00	3.7	5.3	58
	Acidity	1471.6	0.0	0.00	0.0	1471.6	100
BR07	Unnamed Tributary (64240) to Browns Run						
	Al	42.3	0.9	0.00	0.9	41.4	98
	Fe	49.0	1.7	0.00	1.7	47.3	96
	Mn	13.8	2.1	0.00	2.1	11.7	85
	Acidity	660.3	0.0	0.00	0.0	660.3	100
BR02	Browns Run						

Station	***Parameter***	***Existing Load (lb/day)***	***TMDL Allowable Load (lb/day)***	***WLA (lb/day)***	***LA (lb/day)***	***Load Reduction (lb/day)***	***Percent Reduction %***
	Al	696.8	20.3	0.00	20.3	360.9	95
	Fe	1321.7	43.7	0.00	43.7	634.5	94
	Mn	143.9	25.2	0.00	25.2	75.0	75
	Acidity	11887.1	0.0	0.00	0.0	6492.3	100
BR04	Unnamed Tributary (25929) to Browns Run						
	Al	95.2	1.8	0.00	1.8	93.4	98
	Fe	199.2	3.2	0.00	3.2	196.0	98
	Mn	18.3	3.2	0.00	3.2	15.0	82
	Acidity	1532.6	0.0	0.00	0.0	1532.6	100
BR03	Unnamed Tributary (25928) to Browns Run						
	Al	81.4	1.2	0.00	1.2	80.2	99
	Fe	36.1	1.9	0.00	1.9	34.2	95
	Mn	22.2	1.7	0.00	1.7	20.5	92
	Acidity	790.8	0.0	0.00	0.0	790.8	100
BR01	Browns Run Upstream of Confluence with Alder Run						
	Al	868.0	25.9	0.00	25.9	85.4	77
	Fe	1336.4	58.9	0.00	58.9	0.0	0
	Mn	209.8	34.0	0.00	34.0	36.6	52
	Acidity	13977.7	0.0	0.00	0.00	1299.8	100
AR01A	Alder Run						
	Al	2142.2	58.1	0.00	58.1	455.0	89
	Fe	3245.7	118.8	0.00	118.8	285.5	69
	Mn	738.9	91.7	0.00	91.7	0.0	0
	Acidity	32788.0	0.0	0.00	0.0	6656.5	100
AR01	Alder Run at Confluence with the West Branch Susquehanna River						
	Al	2091.2	110.0	0.00	110.0	0.0	0
	Fe	4505.4	149.1	0.00	149.1	1229.4	89
	Mn	1067.4	100.4	0.00	100.4	319.8	76
	Acidity	38433.6	0.0	0.00	0.0	5645.6	100

**This is one WLA. As mining moves around the permitted area one of the treatment systems is online providing treatment while those previously used are no longer used and are removed. As the mining proceeds the WLA affects FR01, MR05 and MR02.

A waste load allocation is being assigned to the following permitted discharges for iron manganese and aluminum for the EnerCorp, Inc Company site SMP 17663136 and a post mining discharge treated by the Sky Haven Coal Co. under Permit No. 17813091. The waste load allocations are based on estimated flow data and the permit limits, which are Best Available Technology (BAT) limits. The flows were estimated because no field data exist for either permit. The EnerCorp permit lists five treatment systems but, as mining progresses a new treatment system goes online as the previously one used goes off line. So there is only one treatment system discharging at anytime. The discharge is into a sump that is periodically pumped and treated. The post mining discharge treatment system on the Sky Haven permit is being constructed and thus no discharge flow data is available. No required reduction of these permits is necessary at this time because there are non-point contributions upstream of the treatment systems that when reduced will satisfy the TMDL or there is available assimilation capacity. All necessary reductions are assigned to the two permits and the nonpoint sources. Table 4 contains the waste load allocations for the permitted discharges.

Table 4. Waste Load Allocation of Permitted Discharges

Parameter	Allowable Average Monthly Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
EnerCorp, Inc. Permit No. 17663136			
Opperting Discharge			
Al	2.0	0.0144	0.24
Fe	3.0	0.0144	0.36
Mn	2.0	0.0144	0.24
Sky Haven Coal, Inc. Permit 17813091			
Discharge 001			
Al	5.0	0.072	3.0
Fe	7.0	0.072	4.5
Mn	5.0	0.072	3.0

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; 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.

To date one passive treatment system has been constructed in order to address the affects of abandoned mines and abandoned mine lands in the watershed. The treatment system is located in the headwaters of Hubler Run. Hubler Run is a tributary that flows to Alder Run near the West Branch Sportsmen Club just above the Mons Run/Alder Run confluence. Hubler Run is impacted by seeps emanating from mine spoil. The area had been surfaced mined in the 1960's. The seeps are divided into two distinct discharges that flow to Hubler Run and an unnamed tributary to Hubler Run. As a result of these seeps Hubler Run has been degraded which also contributes to the pollutional loading of Alder Run.

The treatment system consists of two independent open limestone cells for the addtion of alkalinity. One cell is a channel and the other is a pond. Both cells are a 25 year design and consist of 3-foot deep beds of limestone (each cell contains approximately 770 tons of limestone). Each limestone cell contains a dosing siphon within a manhole. The system operates in fill and drain cycles: AMD enters the limestone cell and fills up the channel or pond until it reaches a level where the dosing siphon activates and a siphon is started, draining AMD through the underdrain and siphon into the first of two wetland cells for the settling of metals. Fill times are estimated to be between 42 an 46 hours and drain times are around 50 minutes.

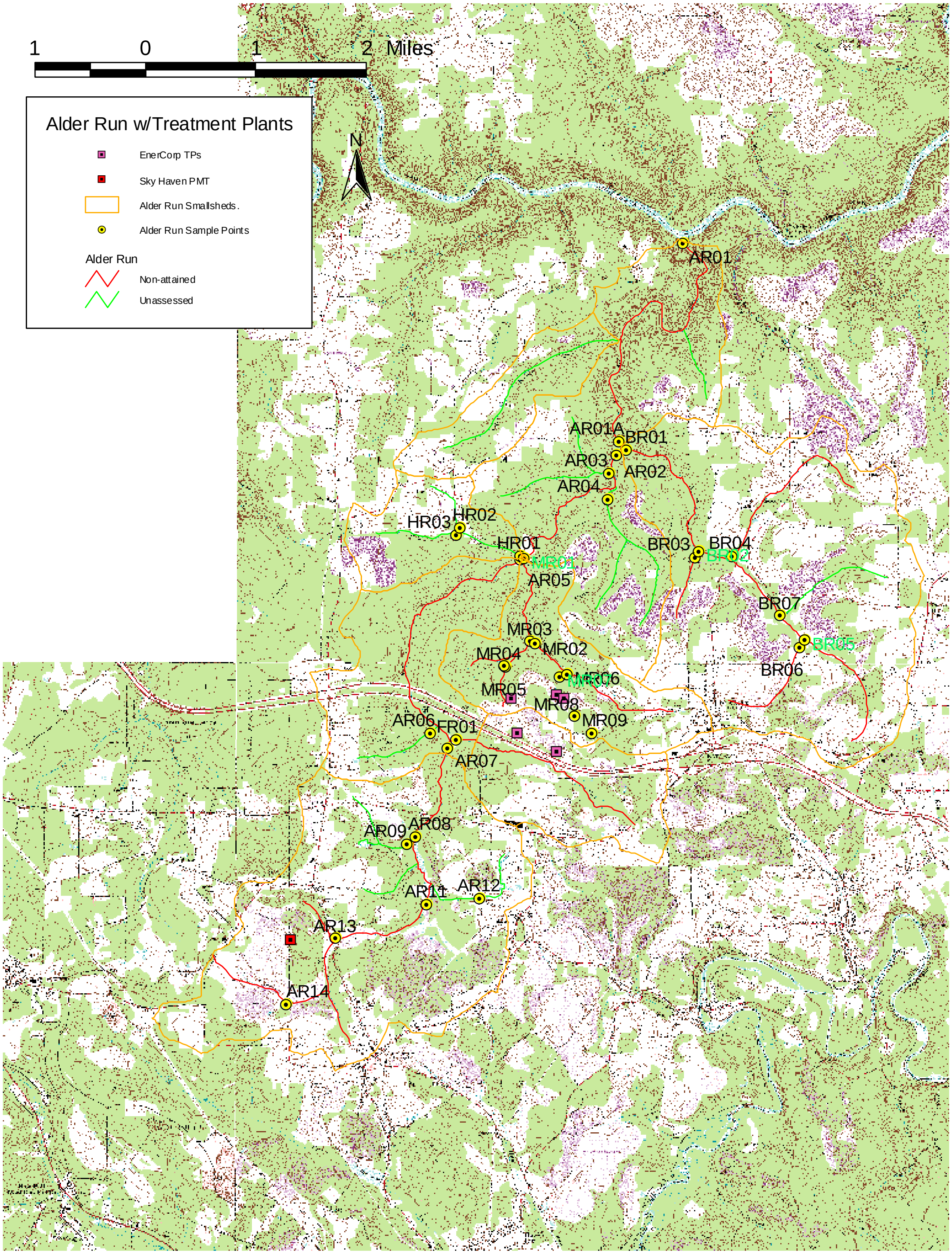
Currently there is a watershed group actively working in the watershed. At the present time a watershed assessment is underway for the Alder Run watershed. All of the tributaries and sources of acid mine drainage will be mapped, evaluated and prioritized based on their severity and flow. The watershed group for Alder Run will then focus its attention on the top priorities for the watershed.

Public Participation

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* on April 1, 2006 and the The Progress, Philipsburg, PA, May 3 and 10, 2006 to foster public comment on the allowable loads calculated. The public comment period on this TMDL was open from April 1, 2006 to May 31, 2006. A public meeting was held on May 17, 2006 at the Moshannon Dirtrict Office, Philipsburg, Pennsylvania, to discuss the proposed TMDL.

Attachment A

Alder Run Watershed Map



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Alder Run w/Treatment Plants
EnerCorp TPs
Sky Haven PMT
Alder Run Smallsheds.
Alder Run Sample Points
Alder Run
Non-attained
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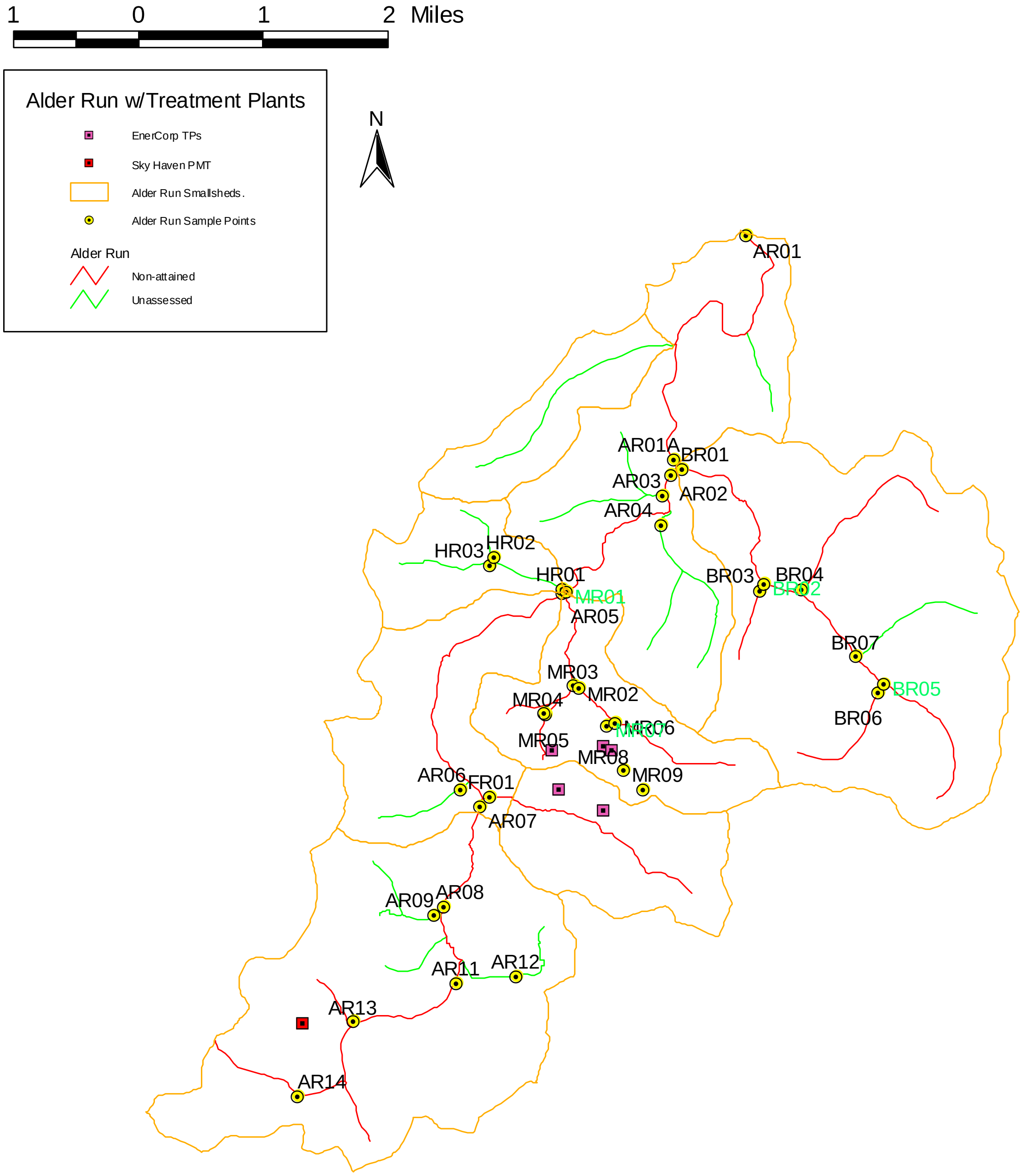

1 0 1 2 Miles
Alder Run w/Treatment Plants
EnerCorp TPs
Sky Haven PMT
Alder Run Smallsheds.
Alder Run Sample Points
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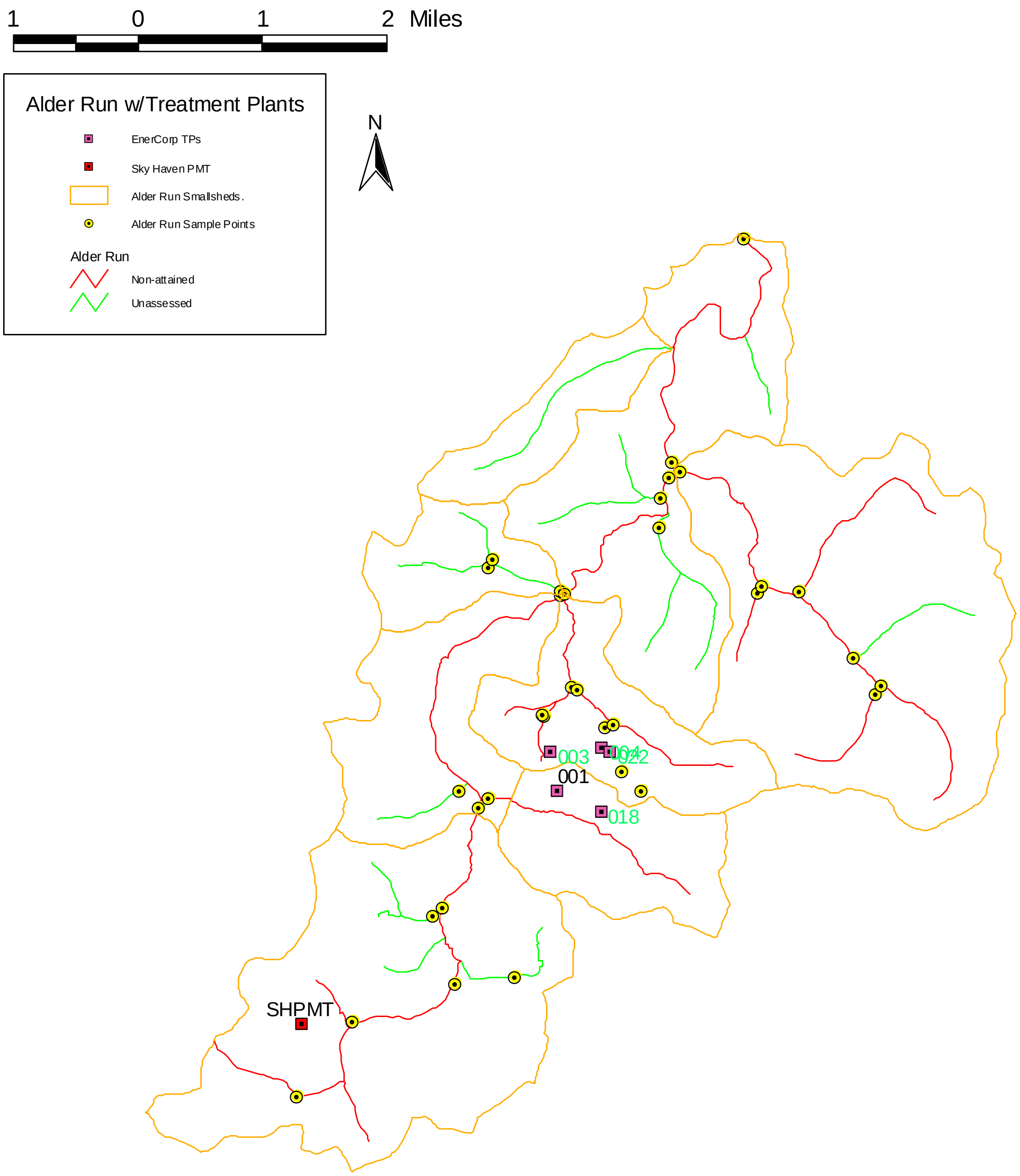
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Sky Haven PMT
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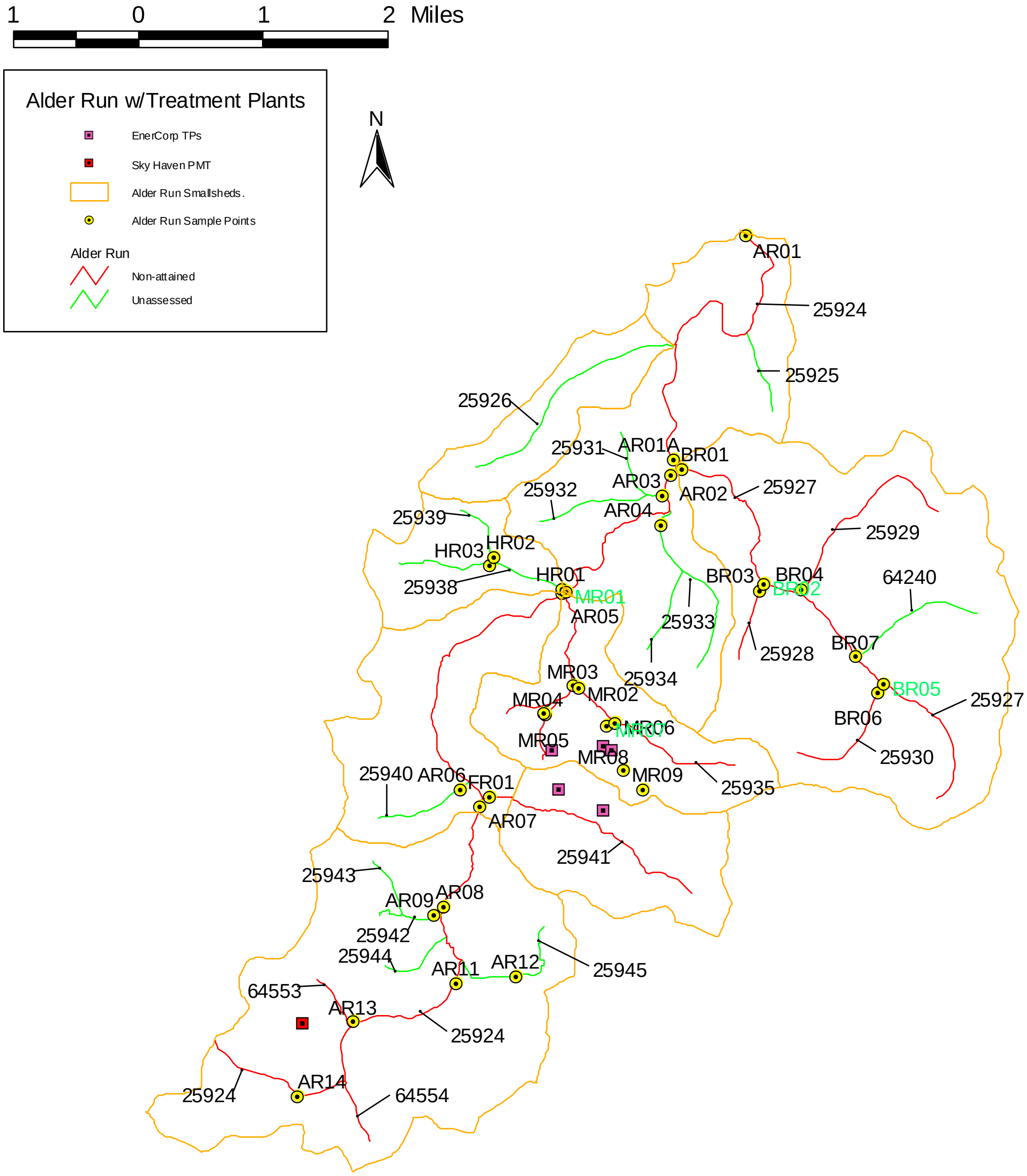
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Alder Run w/Treatment Plants
EnerCorp TPs
Sky Haven PMT
Alder Run Smallsheds.
Alder Run Sample Points
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Attachment B

Method for Addressing Section 303(d) Listings for pH

Method for Addressing Section 303(d) Listings for pH

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

The pH, a measurement of hydrogen ion acidity presented as a negative logarithm, is not conducive to standard statistics. Additionally, pH does not measure latent acidity. For this reason, and based on the above information, Pennsylvania is using the following approach to address the stream impairments noted on the 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.

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

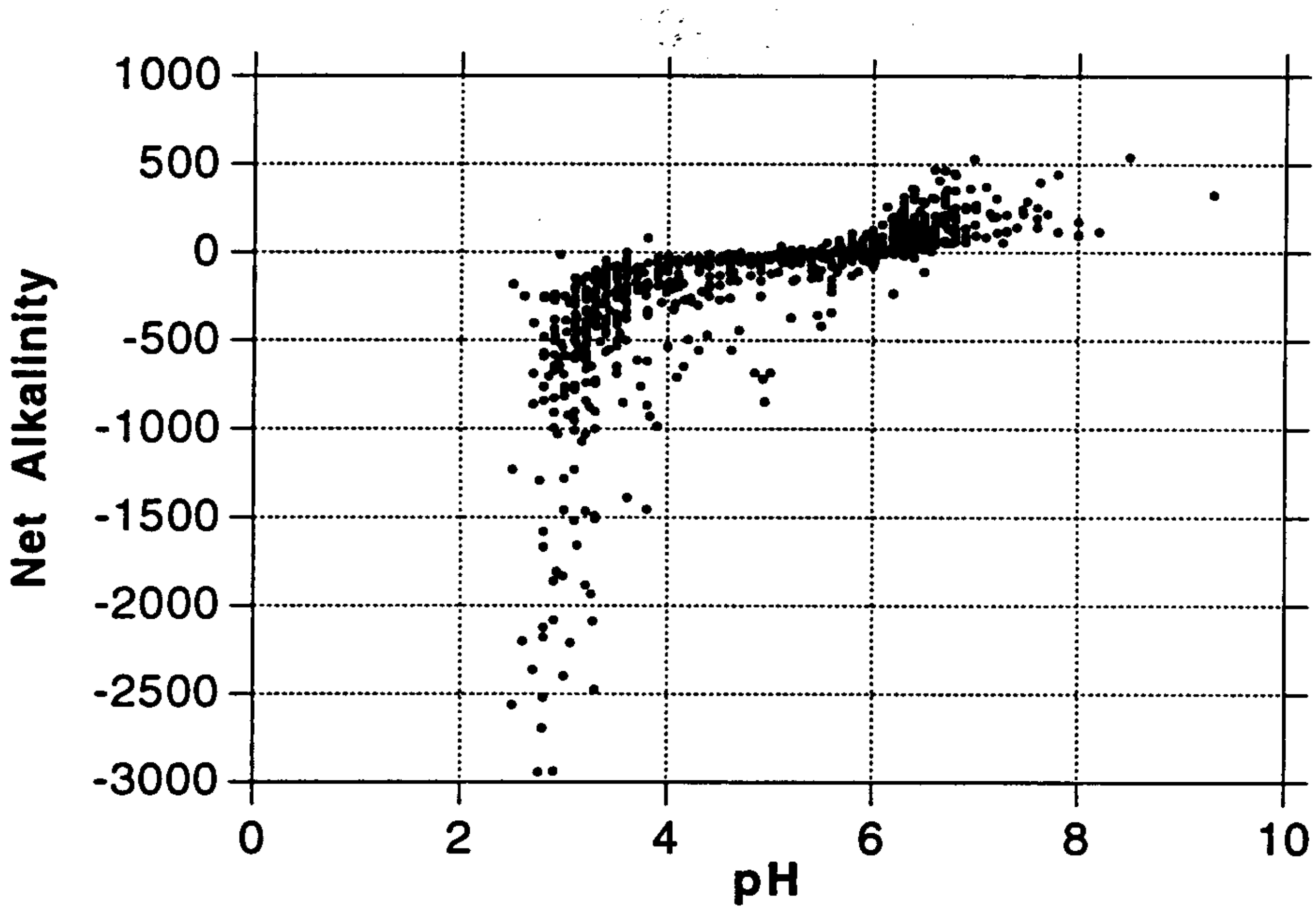

Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

Attachment C
TMDLs By Segment

Alder Run

The TMDL for Alder Run consists of load allocations for twenty-nine sampling sites along Alder Run and various unnamed tributaries.

Alder Run is listed for 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.

AR14 Headwaters of Alder Run

The TMDL for this sample point on Alder Run 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 AR14. The average flow, measured at the sampling point AR14 (0.75 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 AR14 shows pH ranging between 3.1 and 4.6, 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 C1. Load Allocations for Point AR14				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Aluminum	25.77	162.2	0.27	1.7
Iron	14.23	89.6	0.29	1.8
Manganese	37.67	237.2	0.40	2.5
Acidity	272.64	1716.3	0.16	1.0
Alkalinity	0.40	10.2		

Table C2. Calculation of Load Reductions Necessary at Point AR14				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	162.2	89.6	237.2	1716.3
Allowable Load = TMDL	1.7	1.8	2.5	1.0
Load Reduction	160.5	87.8	234.7	1715.3
% Reduction Segment	99%	98%	99%	99.9%

Waste Load Allocation – Sky Haven Coal, Inc.

The Sky Haven Coal, Permit17813091 has a post mining treatment facility, SHPMT, is located upstream of Sample Point AR13. The waste load allocation was calculated as described in the Method to Quantify Treatment Pond Pollutant Loading section of the report and is incorporated into the calculations at AR13. This is the first downstream monitoring point that receives all the potential flow of treated water. The following table shows the waste load allocation.

Table 3. Waste Load Allocation			
Parameter	Allowable Average Monthly Conc. (mg/l)	Calculated Average Flow (MGD)	WLA (lbs/day)
SMM2			
Al	5.0	0.072	3.0
Fe	7.0	0.072	4.5
Mn	5.0	0.072	3.0

AR13 Unnamed Tributary (64553) to Alder Run Downstream of AR14

The TMDL for this unnamed tributary of Alder Run consists of a load allocation to all of the watershed area upstream of sample point AR13. The load allocation for this segment was computed using water-quality sample data collected at point AR13. The average flow, measured at the sampling point AR13 (0.03 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 AR13 shows pH ranging between 4.2 and 5.6, 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 C4. Load Allocations at Point AR13

	Measured Sample Data		**Allowable**	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Aluminum	0.68	128.2	0.30	55.5
Iron	0.21	40.1	0.21	40.1
Manganese	1.11	207.8	0.27	51.3
Acidity	13.96	2618.8	4.07	763.1
Alkalinity	15.91	96.9		

Table C5 Calculation of Load Reductions Necessary at Point AR13

	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	128.2	40.1	207.8	2618.8
Allowable Load = TMDL	55.5	40.1	51.3	763.1
Load Reduction	72.7	0.0	156.5	1855.7
% Reduction Segment	57%	0%	75%	71%

AR11 Alder Run Upstream of Unnamed Tributary 25945

The TMDL for sampling point AR11 consists of a load allocation to the area between points AR14, AR13 and AR11. The load allocation for this tributary was computed using water-quality sample data collected at point AR11. The average flow, measured at the sampling point AR11 (0.57 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 AR11 shows pH ranging between 3.0 and 4.6, 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 C6. Load Allocations at Point AR11				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Aluminum	16.70	78.8	0.33	1.6
Iron	6.26	29.5	0.26	1.2
Manganese	23.36	110.2	0.35	1.7
Acidity	186.00	877.7	0.15	0.7
Alkalinity	0.35	1.7		

The calculated load reductions for all the loads that enter point AR11 must be accounted for in the calculated reductions at sample point AR11 shown in Table C7. A comparison of measured loads between points AR14, AR13, and AR11 shows that there is additional loading entering the segment for aluminum, iron, manganese and acidity. The total segment loading for aluminum, iron. manganese, and acidity is the sum on the upstream allocated loads and any additional loading within the segment.

Table C7. Calculation of Load Reductions Necessary at Point AR11				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	78.8	29.5	110.2	877.7
Difference in Existing Load between AR14, AR13 & AR11	-211.6	-100.2	-334.8	-3457.4
Load tracked from AR14 & AR13 (Upstream Loads)	57.2	41.9	53.8	764.1
Percent lost due to instream process	73	77	75	80
Percent load tracked from AR14 & AR13	27	23	25	20
Total Load tracked between points AR14, AR13 & AR11	15.5	9.5	13.3	154.7
Allowable Load = TMDL	1.6	1.2	1.7	0.7
Load Reduction	13.9	8.3	11.6	154.0
% Reduction Segment	90%	87%	87%	100%

AR12 Unnamed Tributary (25945) to Alder Run

The TMDL for sampling point AR12 consists of a load allocation to the area upstream of point AR12. The load allocation for this tributary was computed using water-quality sample data collected at point AR12. The average flow, measured at the sampling point AR12 (0.01 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 AR12 shows pH ranging between 6.5 and 6.7, 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.

Allocations were not calculated for aluminum and acidity because they were not detected in this unnamed Tributary to Alder Run. Water quality analysis determined that the measured and allowable manganese loads are equal. Because water quality standards are met, TMDLs are not necessary for aluminum and acidity.

Table C8. Load Allocations at Point AR12

	Measured Sample Data		**Allowable**	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	ND	ND	NA	NA
Fe	0.99	0.08	0.43	0.03
Mn	0.24	0.02	0.24	0.02
Acidity	ND	ND	NA	NA
Alkalinity	18.25	1.4		

Table C9. Calculation of Load Reductions Necessary at Point AR12

	Al (lbs/day)	Fe (lbs/ day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	ND	0.08	0.02	ND
Allowable Load = TMDL	NA	0.03	0.02	NA
Load Reduction	0.0	0.05	0.0	0.0
% Reduction Segment	0%	57%	0%	0%

AR09 Unnamed Tributary (25942) to Alder Run Upstream of AR08

The TMDL for this unnamed tributary of Alder Run consists of a load allocation to all of the watershed area upstream of sample point AR09. The load allocation for this segment was computed using water-quality sample data collected at point AR09. The average flow, measured at the sampling point AR09 (0.43 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 AR09 shows pH ranging between 4.8 and 5.9, 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.

An allocation was not calculated for iron because it meets water quality standards in this segment of Alder Run. Water quality analysis determined that the measured and allowable manganese loads are equal. Because water quality standards are met, a TMDL is not necessary for iron.

Table C10. Load Allocations at Point AR09

	Measured Sample Data		**Allowable**	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Aluminum	0.67	2.4	0.22	0.8
Iron	0.26	0.9	0.26	0.9
Manganese	1.24	4.4	0.55	2.0
Acidity	39.25	140.4	4.29	15.4
Alkalinity	8.15	29.1		

Table C11. Calculation of Load Reductions Necessary at Point AR09

	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	2.4	0.9	4.4	140.4
Allowable Load = TMDL	0.8	0.9	2.0	15.4
Load Reduction	1.6	0.0	2.4	125.0
% Reduction Segment	68%	0%	55%	89%

AR08 Alder Run

The TMDL for this segment of Alder Run consists of a load allocation to the area between sample points AR11, AR12, AR09 and AR08. The load allocation for this segment was computed using water-quality sample data collected at point AR08. The average flow, measured at the sampling point AR08 (2.25 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 AR08 shows pH ranging between 3.3 and 4.4, 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 C12. Load Allocations for Point AR08				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Aluminum	9.35	175.4	0.23	4.3
Iron	2.07	38.9	0.26	4.9
Manganese	12.67	237.8	0.32	6.1
Acidity	119.80	2248.8	0.74	13.9
Alkalinity	1.55	29.1		

The calculated load reductions for all the loads that enter point AR08 must be accounted for in the calculated reductions at sample point AR08 shown in Table C13. A comparison of measured loads between points AR11, AR12, AR09, and AR08 shows that there is additional loading entering the segment for aluminum, iron, manganese and acidity. The total segment load for aluminum, iron, manganese and acidity is the sum of the upstream allocated loads and any additional loading within the segment.

Table C13. Calculation of Load Reductions Necessary at Point AR08				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	175.4	38.9	237.8	2248.8
Difference in Existing Load between AR11, AR12, AR09 & AR08	94.2	8.4	123.2	1230.7
Load tracked from AR11 AR12 & AR09 (Upstream Loads)	2.4	2.1	3.7	16.1
Total Load tracked between points AR11, AR12, AR09 & AR08	96.6	10.6	126.9	1246.8
Allowable Load = TMDL	4.3	4.9	6.1	13.9
Load Reduction	92.3	5.6	120.8	1232.8
% Reduction Segment	96%	53%	95%	99%

AR07 Alder Run Upstream of Confluence with Flat Run

The TMDL for this segment of Alder Run consists of a load allocation to the area between sample points AR08 and AR07. The load allocation for this segment was computed using water-quality sample data collected at point AR07. The average flow, measured at the sampling point AR07 (3.64 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 AR07 shows pH ranging between 3.6 and 4.6, 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 C14. Load Allocations for Point AR07

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	8.66	262.6	0.25	7.5
Fe	1.95	59.2	0.52	15.7
Mn	9.05	274.5	0.45	13.7
Acidity	113.43	3438.9	0.24	7.2
Alkalinity	0.43	12.9		

The calculated load reductions for all the loads that enter point AR07 must be accounted for in the calculated reductions at sample point AR07 shown in Table C15. A comparison of measured loads between points AR08 and AR07 shows that there is additional loading entering the segment for aluminum, iron, manganese and acidity. The total segment load for aluminum, iron, manganese and acidity is the sum on the upstream allocated loads and any additional loading within the segment.

Table C15. Calculation of Load Reductions Necessary at Point AR07

	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	262.6	59.2	274.5	3438.9
Difference in Existing Load between AR08 & AR07	87.2	20.3	36.7	1190.1
Load tracked from AR08 (Upstream Loads)	4.3	4.9	6.1	13.9
Total Load tracked between points AR08 & AR07	91.5	25.2	42.8	1204.0
Allowable Load = TMDL	7.5	15.7	13.7	7.2
Load Reduction	84.0	9.5	29.1	1196.8
% Reduction Segment	92%	38%	68%	99%

AR06 Unnamed Tributary (25940) to Alder Run Downstream of Flat Run

The TMDL for this sample point on Alder Run 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 AR06. The average flow, measured at the sampling point AR06 (0.23 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 AR06 shows pH ranging between 6.0 and 6.5, 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.

No allocations were calculated for aluminum and iron because neither was detected at this sample point.

Table C16. Load Allocations for Point AR06

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Al	ND	ND	NA	NA
Fe	ND	ND	NA	NA
Mn	0.10	0.2	0.10	0.2
Acidity	10.35	19.7	2.60	5.0
Alkalinity	9.90	18.9		

Table C17. Calculation of Load Reductions Necessary at Point AR06

	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	ND	ND	0.2	19.7
Allowable Load = TMDL	NA	NA	0.2	5.0
Load Reduction	0.0	0.0	0.0	14.7
% Reduction Segment	0%	0%	0%	75%

Waste Load Allocation – ENERCORP, Inc.

The ENERCORP Inc., Permit 17663136 has two permitted treatment facilities that will, in turn, operate. The waste load allocation was calculated as described in the Method to Quantify Treatment Pond Pollutant Loading section of the report and is incorporated into the calculations at FR01. This is the first downstream monitoring point that receives all the potential flow of treated water. The following table shows the waste load allocation.

Table C18. Waste Load Allocation			
Parameter	Allowable Average Monthly Conc. (mg/l)	Calculated Average Flow (MGD)	WLA (lbs/day)
SMM2			
Al	2.0	0.0144	0.24
Fe	3.0	0.0144	0.36
Mn	2.0	0.0144	0.24

FR01 Flat Run Upstream of Confluence with Alder Run

The TMDL for this sample point on Flat Run 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 FR01. The average flow, measured at the sampling point FR01 (1.84 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 FR01 shows pH ranging between 3.5 and 4.2, 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 C19. Load Allocations for Point FR01				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Aluminum	15.17	233.1	0.18	2.8
Iron	3.21	49.4	0.33	5.0
Manganese	4.87	74.9	0.35	5.4
Acidity	97.85	1503.3	0.00	0.0
Alkalinity	0.00	0.0		

Table C20. Calculation of Load Reductions Necessary at Point FR01				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	233.1	49.4	74.9	1503.3
Allowable Load = TMDL	2.8	5.0	5.4	0.0
Load Reduction	230.3	44.4	69.5	1503.3
% Reduction Segment	99%	90%	93%	100%

AR05 Alder Run Upstream of Huber and Mons Runs

The TMDL for this segment of Little Mill Creek consists of a load allocation to the area between sample points AR06, AR07, FR01 and AR05. The load allocation for this segment was computed using water-quality sample data collected at point AR05. The average flow, measured at the sampling point AR05 (3.40 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 AR05 shows pH ranging between 3.5 and 4.0, 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 C21. Load Allocations for Point AR05				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Aluminum	7.91	224.2	0.39	11.0
Iron	1.25	35.6	0.70	19.8
Manganese	6.84	193.9	0.54	15.2
Acidity	87.40	2477.9	0.72	20.3
Alkalinity	1.10	31.2		

The calculated load reductions for all the loads that enter point AR05 must be accounted for in the calculated reductions at sample point AR05 shown in Table C22. A comparison of measured loads between points AR06, AR07, FR01, and AR05 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 load is applied to the allowable upstream load entering the segment.

Table C22. Calculation of Load Reductions Necessary at Point AR05				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	224.2	35.6	193.9	2477.9
Difference in Existing Load between AR06, AR07, FR01 & AR05	-271.5	-73.0	-155.7	-2484.0
Load tracked from AR06, AR07 & FR01 (Upstream Loads)	10.3	20.8	19.3	12.2
Percent lost due to instream process	55	67	45	50
Percent load tracked from AR06, AR07 & FR01	45	33	55	50
Total Load tracked between points AR06. AR07, FR01 & AR05	4.7	6.8	10.7	6.1
Allowable Load = TMDL	11.0	19.8	15.2	20.3
Load Reduction	0.0	0.0	0.0	0.0
% Reduction Segment	0%	0%	0%	0%

HR03 Headwaters of Huber Run (25938)

The TMDL for this sample point on Hubler Run 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 HR03. The average flow, measured at the sampling point HR03 (0.59 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 HR03 shows pH ranging between 4.1 and 4.7, 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.

An allocation was not calculated for iron because it meets water quality standards in this segment of Alder Run. Water quality analysis determined that the measured and allowable manganese loads are equal. Because water quality standards are met, a TMDL is not necessary for iron.

Table C23. Load Allocations for Point HR03				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Aluminum	2.96	14.5	0.27	1.4
Iron	0.58	2.8	0.58	2.8
Manganese	5.29	26.0	0.45	2.2
Acidity	64.05	314.8	3.03	14.9
Alkalinity	5.10	25.1		

Table C24. Calculation of Load Reductions Necessary at Point HR03				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	14.5	2.8	26.0	314.8
Allowable Load = TMDL	1.4	2.8	2.2	14.9
Load Reduction	13.1	0.0	23.8	299.9
% Reduction Segment	91%	0%	91%	95%

HR02 Unnamed Tributary (25939) to Huber Rub

The TMDL for this sample point on Huber Run 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 HR02. The average flow, measured at the sampling point HR02 (0.15 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 HR02 shows pH ranging between 6.3 and 6.7, 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 C25. Load Allocations for Point HR02				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Aluminum	0.82	1.1	0.11	0.1
Iron	1.37	1.8	0.28	0.4
Manganese	0.43	0.5	0.30	0.4
Acidity	9.30	12.0	3.17	4.1
Alkalinity	17.60	22.7		

Table C26. Calculation of Load Reductions Necessary at Point HR02				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	1.1	1.8	0.5	12.0
Allowable Load = TMDL	0.1	0.4	0.4	4.1
Load Reduction	1.0	1.4	0.1	7.9
% Reduction Segment	87%	80%	30%	66%

HR01 Huber Run Upstream of Confluence with Alder Run

The TMDL for this segment of Huber Run consists of a load allocation to the area between sample points HR03, HR02 and HR01. The load allocation for this segment was computed using water-quality sample data collected at point HR01. The average flow, measured at the sampling point HR01 (0.66 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 HR01 shows pH ranging between 4.6 and 5.1, 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.

There was no allocation calculated for iron because there was no iron present or detected at this sample point.

Table C27. Load Allocations for Point HR01				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Aluminum	1.50	8.3	0.25	1.4
Iron	ND	ND	NA	NA
Manganese	3.40	18.7	0.47	2.6
Acidity	41.65	229.8	3.82	21.1
Alkalinity	7.45	41.1		

The calculated load reductions for all the loads that enter point HR01 must be accounted for in the calculated reductions at sample point HR01 shown in Table C28. A comparison of measured loads between points HR03, HR02, and HR01 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 load is applied to the allowable upstream load entering the segment.

Table C28. Calculation of Load Reductions Necessary at Point HR01				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	8.3	0	18.7	229.8
Difference in Existing Load between HR03, HR02, & HR01	-7.3	-4.6	-7.8	-97.0
Load tracked from HR03, & HR02 (Upstream Loads)	1.5	3.2	2.6	19.0
Percent lost due to instream process	47	100	29	30
Percent load tracked from HR03, HR02 & HR01	53	0	71	70
Total Load tracked between points HR03. HR02, & HR01	0.8	0.0	1.8	13.4
Allowable Load = TMDL	1.4	0	2.6	21.1
Load Reduction	0.0	0.0	0.0	0.0
% Reduction Segment	0%	0%	0%	0%

Waste Load Allocation – ENERCORP, Inc.

The ENERCORP Inc., Permit 17663136 has one permitted treatment facility that will operate. The waste load allocation was calculated as described in the Method to Quantify Treatment Pond Pollutant Loading section of the report and is incorporated into the calculations at MR05. This is the first downstream monitoring point that receives all the potential flow of treated water. The following table shows the waste load allocation.

Table C29. Waste Load Allocation			
Parameter	Allowable Average Monthly Conc. (mg/l)	Calculated Average Flow (MGD)	WLA (lbs/day)
SMM2			
Al	2.0	0.0144	0.24
Fe	3.0	0.0144	0.36
Mn	2.0	0.0144	0.24

MR05 Unnamed Tributary (25937) to Unnamed Tributary (25936)

The TMDL for this sample point on Mons Run 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 MR05. The average flow, measured at the sampling point MR05 (0.02 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 MR05 shows pH ranging between 3.2 and 3.4, 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 C30. Load Allocations for Point MR05				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Aluminum	9.94	1.3	0.39	0.05
Iron	3.18	0.4	0.70	0.09
Manganese	6.63	0.9	0.80	0.11
Acidity	107.95	14.4	0.00	0.00
Alkalinity	0.00	0.0		

Table C31. Calculation of Load Reductions Necessary at Point MR05				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	1.3	0.4	0.9	14.4
Allowable Load = TMDL	0.05	0.09	0.11	0.0
Load Reduction	1.25	0.31	0.79	14.4
% Reduction Segment	96%	78%	88%	100%

MR04 Unnamed Tributary (25936) to Mons Run

The TMDL for this sample point on Mons Run 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 MR04. The average flow, measured at the sampling point MR04 (0.30 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 MR04 shows pH ranging between 3.7 and 4.1, 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 C32. Load Allocations for Point MR04				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Al	10.89	27.1	0.27	0.7
Fe	0.36	0.9	0.27	0.7
Mn	3.39	8.4	0.36	0.9
Acidity	111.25	277.2	0.49	1.2
Alkalinity	1.15	2.9		

Table C33. Calculation of Load Reductions Necessary at Point MR04				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	27.1	0.9	8.4	277.2
Allowable Load = TMDL	0.7	0.7	0.9	1.2
Load Reduction	26.4	0.2	7.5	276.0
% Reduction Segment	98%	26%	89%	99.6%

MR03 Unnamed Tributary (25936) to Unnamed Tributary (25935)

The TMDL for this segment of Mons Run consists of a load allocation to the area between sample points MR05, MR04 and MR03. The load allocation for this segment was computed using water-quality sample data collected at point MR03. The average flow, measured at the sampling point MR03 (0.32 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 MR03 shows pH ranging between 3.6 and 3.9, 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 C34. Load Allocations for Point MR03

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Aluminum	10.57	27.9	0.30	0.8
Iron	0.66	1.7	0.34	0.9
Manganese	3.58	9.5	0.40	1.1
Acidity	106.50	281.1	0.19	0.5
Alkalinity	0.35	0.9		

The calculated load reductions for all the loads that enter point MR03 must be accounted for in the calculated reductions at sample point MR03 shown in Table C35. A comparison of measured loads between points MR05, MR04, and MR03 shows that there is no additional loading entering the segment for aluminum. For aluminum the percent decrease in existing load is applied to the allowable upstream load entering the segment. There is an increase in iron, manganese and acidity loading within the segment. The total segment load for iron, manganese and acidity is the sum on the upstream allocated loads and any additional loading within the segment.

Table C35. Calculation of Load Reductions Necessary at Point MR03				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	27.9	1.7	9.50	281.1
Difference in Existing Load between MR05, MR04, & MR03	-0.5	0.4	0.2	-10.5
Load tracked from MR05, & MR04 (Upstream Loads)	0.72	0.8	1.0	1.22
Percent lost due to instream process	2	-	-	4
Percent load tracked from MR04 & MR04	98	-	-	96
Total Load tracked between points MR05. MR04, & MR03	0.7	1.2	1.2	1.2
Allowable Load = TMDL	0.8	0.9	1.1	0.5
Load Reduction	0.0	0.3	0.1	0.7
% Reduction Segment	0%	23%	14%	57%

Waste Load Allocation – ENERCORP, Inc.

The ENERCORP Inc., Permit 17663136 has two permitted treatment facilities that will, in turn, operate. The waste load allocation was calculated as described in the Method to Quantify Treatment Pond Pollutant Loading section of the report and is incorporated into the calculations at MR02. This is the first downstream monitoring point that receives all the potential flow of treated water. The following table shows the waste load allocation.

Table C36. Waste Load Allocation			
Parameter	Allowable Average Monthly Conc. (mg/l)	Calculated Average Flow (MGD)	WLA (lbs/day)
SMM2			
Al	2.0	0.0144	0.24
Fe	3.0	0.0144	0.36
Mn	2.0	0.0144	0.24

MR02 Mons Run Upstream of MR03

The TMDL for this sample point on Mons Run 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 MR02. The average flow, measured at the sampling point MR02 (0.50 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 MR02 shows pH ranging between 2.7 and 3.8, 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 C37. Load Allocations for Point MR02

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Aluminum	39.93	166.6	0.25	1.0
Iron	101.22	422.4	0.40	1.7
Manganese	15.94	66.5	0.31	1.3
Acidity	621.95	2595.6	0.00	0.0
Alkalinity	0.00	0.0		

Table C38. Calculation of Load Reductions Necessary at Point MR02

	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	166.6	422.4	66.5	2595.6
Allowable Load = TMDL	1.0	1.7	1.3	0.0
Load Reduction	165.6	420.7	65.2	2595.6
% Reduction Segment	99%	99.6%	98%	100%

MR01 Mons Run Upstream of Confluence with Alder Run

The TMDL for this segment of Mons Run consists of a load allocation to the area between sample points MR03, MR02 and MR01. The load allocation for this segment was computed using water-quality sample data collected at point MR01. The average flow, measured at the sampling point MR01 (1.13 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 MR01 shows pH ranging between 2.6 and 3.1, 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 MR01				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	26.28	248.0	0.33	3.1
Fe	49.33	465.6	0.55	5.2
Mn	10.76	101.6	0.39	3.7
Acidity	374.65	3536.5	0.00	0.0
Alkalinity	0.00	0.0		

The calculated load reductions for all the loads that enter point MR01 must be accounted for in the calculated reductions at sample point MR01 shown in Table C40. A comparison of measured loads between points MR03, MR02, and MR01 shows that there is an increase in aluminum, iron, manganese and acidity loading within the segment. The total segment load for aluminum, iron, manganese and acidity is the sum on the upstream allocated loads and any additional loading within the segment.

Table C40. Calculation of Load Reductions Necessary at Point MR01				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	248.0	465.6	101.6	3536.5
Difference in Existing Load between MR03, MR02, & MR01	53.5	32.5	25.6	659.8
Load tracked from MR03, & MR02 (Upstream Loads)	1.8	2.6	2.4	0.5
Total Load tracked between points MR03, MR02 & MR01	55.3	35.1	28.0	660.3
Allowable Load = TMDL	3.1	5.2	3.7	0.0
Load Reduction	52.2	29.9	24.3	660.3
% Reduction Segment	94%	85%	87%	100%

AR04 Unnamed Tributary (25933) to Alder Run

The TMDL for this sample point on Alder Run 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 AR04. The average flow, measured at the sampling point AR04 (0.84 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 AR04 shows pH ranging between 3.1 and 3.6, 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 C41. Load Allocations for Point AR04				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Aluminum	18.78	131.2	0.26	1.9
Iron	6.51	45.5	0.41	2.9
Manganese	7.92	55.4	0.38	2.6
Acidity	177.45	1240.3	0.00	0.0
Alkalinity	0.00	0.0		

Table C42. Calculation of Load Reductions Necessary at Point AR04				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	131.2	45.5	55.4	1240.3
Allowable Load = TMDL	1.9	2.9	2.6	0.0
Load Reduction	129.3	42.6	52.8	1240.3
% Reduction Segment	99%	94%	95%	100%

AR03 Unnamed Tributary (25931) to Alder Run

The TMDL for this sample point on Alder Run 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 AR03. The average flow, measured at the sampling point AR03 (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 AR03 shows pH ranging between 4.1 and 4.5, 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.

An allocation was not calculated for iron because iron was not present.

Table C43. Load Allocations for Point AR03				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Al	2.92	12.0	0.45	1.8
Fe	ND	ND	NA	NA
Mn	1.83	7.5	0.48	2.0
Acidity	52.50	215.3	2.30	9.4
Alkalinity	4.45	18.3		

Table C44. Calculation of Load Reductions Necessary at Point AR03				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	12.0	ND	7.5	215.3
Allowable Load = TMDL	1.8	NA	2.0	9.4
Load Reduction	10.2	0.0	5.5	205.9
% Reduction Segment	85%	0%	74%	96%

AR02 Alder Run Upstream of Confluence with Browns Run

The TMDL for this segment of Mons Run consists of a load allocation to the area between sample points AR04, AR03 and AR02. The load allocation for this segment was computed using water-quality sample data collected at point AR02. The average flow, measured at the sampling point AR02 (10.92 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 AR02 shows pH ranging between 3.2 and 3.8, 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 C45. Load Allocations for Point AR02				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	9.00	819.5	0.36	32.5
Fe	17.83	1624.2	0.37	33.3
Mn	6.41	584.0	0.37	33.6
Acidity	133.40	12153.8	0.00	0.00
Alkalinity	0.00	0.0		

The calculated load reductions for all the loads that enter point AR02 must be accounted for in the calculated reductions at sample point AR02 shown in Table C46. A comparison of measured loads between points AR05, MR01, HR01, AR04, AR03 and AR02 shows that there is additional loading entering the segment for aluminum, iron, manganese and acidity loading within the segment. The total segment load for aluminum, iron, manganese and acidity is the sum on the upstream allocated loads and any additional loading within the segment.

Table C46. Calculation of Load Reductions Necessary at Point AR02				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	819.5	1624.2	584.0	12153.8
Difference in Existing Load between AR05, MR01, HR01, AR04, AR03, & AR02	195.8	1086.5	206.9	4454.0
Load tracked from AR05, MR01, HR01, AR04, & AR03 (Upstream Loads)	19.2	27.8	26.1	50.8
Total Load tracked between points AR05, MR01, HR01, AR04, & AR02	215.0	1114.3	233.0	4504.8
Allowable Load = TMDL	32.5	33.3	33.6	0.0
Load Reduction	182.6	1081.0	199.4	4504.8
% Reduction Segment	85%	97%	86%	100%

BR06 Unnamed Tributary (25930) to Browns Run

The TMDL for this sample point on Alder Run 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 BR06. The average flow, measured at the sampling point BR06 (0.56 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 BR06 shows pH ranging between 2.6 and 3.1, 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 C47. Load Allocations for Point BR06				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Aluminum	22.26	103.2	0.34	1.6
Iron	50.08	232.1	0.65	3.0
Manganese	3.07	14.2	0.56	2.6
Acidity	373.25	1730.3	0.00	0.0
Alkalinity	0.00	0.0		

Table C48. Calculation of Load Reductions Necessary at Point BR06				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	103.2	232.1	14.2	1730.3
Allowable Load = TMDL	1.6	3.0	2.6	0.0
Load Reduction	101.6	229.1	11.6	1730.3
% Reduction Segment	98%	99%	82%	100%

BR05 Browns Run Upstream of Unnamed Tributary 64240

The TMDL for this sample point on Browns Run 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 BR05. The average flow, measured at the sampling point BR05 (0.63 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 BR05 shows pH ranging between 2.7 and 3.1, 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 C49. Load Allocations for Point BR05				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Aluminum	15.60	81.5	0.44	2.3
Iron	33.58	175.3	0.81	4.2
Manganese	1.72	9.0	0.72	3.7
Acidity	281.85	1471.6	0.00	0.0
Alkalinity	0.00	0.0		

Table C50. Calculation of Load Reductions Necessary at Point BR05				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	81.5	175.3	9.0	1471.6
Allowable Load = TMDL	2.3	4.2	3.7	0.0
Load Reduction	79.2	171.1	5.3	1471.6
% Reduction Segment	97%	98%	58%	100%

BR07 Unnamed Tributary (64240) to Browns Run

The TMDL for this sample point on Alder Run 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 BR07. The average flow, measured at the sampling point BR07 (0.32 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 BR07 shows pH ranging between 2.6 and 3.3, 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 C51. Load Allocations for Point BR07				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Al	15.83	42.3	0.35	0.9
Fe	18.34	49.0	0.65	1.7
Mn	5.18	13.8	0.77	2.1
Acidity	247.10	660.3	0.00	0.0
Alkalinity	0.00	0.0		

Table C52. Calculation of Load Reductions Necessary at Point BR07				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	42.3	49.0	13.8	660.3
Allowable Load = TMDL	0.9	1.7	2.1	0.0
Load Reduction	41.4	47.3	11.7	660.3
% Reduction Segment	98%	96%	85%	100%

BR04 Unnamed Tributary (25929) to Browns Run

The TMDL for this sample point on Alder Run 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 BR04. The average flow, measured at the sampling point BR04 (0.60 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 BR04 shows pH ranging between 2.7 and 3.4, 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 C53. Load Allocations for Point BR04				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Aluminum	19.10	95.2	0.36	1.8
Iron	39.98	199.2	0.64	3.2
Manganese	3.68	18.3	0.65	3.2
Acidity	307.50	1532.6	0.00	0.0
Alkalinity	0.00	0.0		

Table C54. Calculation of Load Reductions Necessary at Point BR04				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	95.2	199.2	18.3	1532.6
Allowable Load = TMDL	1.8	3.2	3.2	0.0
Load Reduction	93.4	196.0	15.1	1532.6
% Reduction Segment	98%	98%	82%	100%

BR02 Browns Run

The TMDL for this segment of Browns Run consists of a load allocation to the area between sample points BR06, BR05, BR07, BR04 and BR02. The load allocation for this segment was computed using water-quality sample data collected at point BR02. The average flow, measured at the sampling point BR02 (4.59 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 BR02 shows pH ranging between 2.7 and 2.8, 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 C55. Load Allocations for Point BR02				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	18.20	696.8	0.53	20.3
Fe	34.53	1321.7	1.14	43.7
Mn	3.76	143.9	0.66	25.2
Acidity	310.50	11887.1	0.00	0.0
Alkalinity	0.00	0.0		

The calculated load reductions for all the loads that enter point BR02 must be accounted for in the calculated reductions at sample point BR02 shown in Table C56. A comparison of measured loads between points BR06, BR05, BR07, BR04 and BR02 shows that there is additional loading entering the segment for aluminum, iron, manganese and acidity loading within the segment. The total segment load for aluminum, iron, manganese and acidity is the sum on the upstream allocated loads and any additional loading within the segment.

Table C56. Calculation of Load Reductions Necessary at Point BR02				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	696.8	1321.7	143.9	11887.1
Difference in Existing Load between BR06, BR05, BR07, BR04 & BR02	374.6	666.1	88.6	6492.3
Load tracked from BR06, BR05, BR07, BR04 & BR02 (Upstream Loads)	6.6	12.1	11.6	0.0
Total Load tracked between points BR06, BR05, BR07, BR04 & BR02	381.2	678.2	100.2	6492.3
Allowable Load = TMDL	20.3	43.7	25.2	0.0
Load Reduction	360.9	634.5	75.0	6492.3
% Reduction Segment	95%	94%	75%	100%

BR03 Unnamed Tributary (25928) to Browns Run

The TMDL for this sample point on the unnamed tributary to Browns Run 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 BR03. The average flow, measured at the sampling point BR03 (0.35 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 BR03 shows pH ranging between 2.8 and 3.3, 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 C57. Load Allocations for Point BR03				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Al	27.68	81.4	0.40	1.2
Fe	12.26	36.1	0.66	1.9
Mn	7.56	22.2	0.59	1.7
Acidity	268.75	790.8	0.00	0.0
Alkalinity	0.00	0.0		

Table C58. Calculation of Load Reductions Necessary at Point BR03				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	81.4	36.1	22.2	790.8
Allowable Load = TMDL	1.2	1.9	1.7	0.0
Load Reduction	80.2	34.2	20.5	790.8
% Reduction Segment	99%	95%	92%	100%

BR01 Browns Run

The TMDL for this segment of Browns Run consists of a load allocation to the area between sample points BR02, BR03, and BR01. The load allocation for this segment was computed using water-quality sample data collected at point BR01. The average flow, measured at the sampling point BR01 (6.75 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 BR01 shows pH ranging between 2.7 and 3.0, 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 C59. Load Allocations for Point BR01				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Aluminum	15.43	868.0	0.46	25.9
Iron	23.75	1336.4	1.05	58.9
Manganese	3.73	209.8	0.60	34.0
Acidity	248.40	13977.7	0.00	0.0
Alkalinity	0.00	0.0		

The calculated load reductions for all the loads that enter point BR01 must be accounted for in the calculated reductions at sample point BR01 shown in Table C60. A comparison of measured loads between points BR02, BR03, and BR01 shows that there is no additional loading entering the segment for iron. For iron the percent decrease in existing load is applied to the allowable upstream load entering the segment. There is an increase in aluminum, manganese and acidity loading within the segment. The total segment load for aluminum, manganese and acidity is the sum on the upstream allocated loads and any additional loading within the segment.

Table C60. Calculation of Load Reductions Necessary at Point BR01				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	868.0	1336.4	209.8	13977.7
Difference in Existing Load between BR02, BR03, & BR01	89.8	-21.4	43.7	1299.8
Load tracked from BR02, BR03, & BR01 (Upstream Loads)	21.5	45.6	26.9	0.0
Percent lost due to instream process	-	2	-	-
Percent load tracked from BR02 & BR03	-	98	-	-
Total Load tracked between points BR02, BR03, & BR01	111.3	44.9	70.6	1299.8
Allowable Load = TMDL	25.9	58.9	34.0	0.0
Load Reduction	85.4	0.0	36.6	1299.8
% Reduction Segment	77%	0%	52%	100%

AR01A Alder Run

The TMDL for this segment of Browns Run consists of a load allocation to the area between sample points AR02, BR01, and AR01A. The load allocation for this segment was computed using water-quality sample data collected at point AR01A. The average flow, measured at the sampling point AR01A (19.83 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 AR01A shows pH ranging between 2.8 and 3.2, 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 C61. Load Allocations for Point AR01A

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Aluminum	12.95	2142.2	0.35	58.0
Iron	19.63	3245.7	0.72	118.8
Manganese	4.47	738.9	0.55	91.7
Acidity	198.25	32788.0	0.00	0.00
Alkalinity	0.00	0.0		

The calculated load reductions for all the loads that enter point AR01A must be accounted for in the calculated reductions at sample point AR01A shown in Table C62. A comparison of measured loads between points AR02, BR01, and AR01A 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 load is applied to the allowable upstream load entering the segment.

Table C62. Calculation of Load Reductions Necessary at Point AR01A

	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	2142.2	3245.7	738.9	32788
Difference in Existing Load between AR02, BR01, & AR01A	454.7	285.1	-54.9	6656.5
Load tracked fromAR02, BR01, & AR01A (Upstream Loads)	58.3	92.2	67.6	0.0
Percent lost due to instream process	-	-	7	-
Percent load tracked from AR02 & BR01	-	-	93	-
Total Load tracked between points AR02, BR01, & AR01A	513.0	377.3	62.9	6656.5
Allowable Load = TMDL	58.0	118.8	91.7	0.0
Load Reduction	455.0	258.5	0.0	6656.5
% Reduction Segment	89%	69%	0%	100%

AR01 Alder Run at Confluence with the West Branch Susquehanna River

The TMDL for this segment of Browns Run consists of a load allocation to the area between sample points AR01A, and AR01. The load allocation for this segment was computed using water-quality sample data collected at point AR01. The average flow, measured at the sampling point AR01 (25.82 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 AR01 shows pH ranging between 3.0 and 3.3, 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 C63. Load Allocations for Point AR01

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	9.71	2091.2	0.51	110.0
Fe	20.93	4505.4	0.69	149.1
Mn	4.96	1067.4	0.47	100.4
Acidity	178.50	38433.6	0.00	0.0
Alkalinity	0.00	0.0		

The calculated load reductions for all the loads that enter point AR01 must be accounted for in the calculated reductions at sample point AR01 shown in Table C64. A comparison of measured loads between points AR02, BR01, and AR01A shows that there is no additional loading entering the segment for aluminum. For aluminum the percent decrease in existing load is applied to the allowable upstream load entering the segment. There is an increase in iron, manganese and acidity loading within the segment. The total segment load for iron, manganese and acidity is the sum on the upstream allocated loads and any additional loading within the segment

Table C64. Calculation of Load Reductions Necessary at Point AR01				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	2091.2	4505.4	1067.4	38433.6
Difference in Existing Load between AR01A, & AR01	-51.0	1259.7	328.5	5645.6
Load tracked from AR01A (Upstream Loads)	58.1	118.8	91.7	0.0
Percent lost due to instream process	2	-	-	-
Percent load tracked from AR01A	98	-	-	-
Total Load tracked between points AR01A, & AR01	56.7	1378.5	420.2	5645.6
Allowable Load = TMDL	110.0	149.13	100.4	0.0
Load Reduction	0.0	1229.4	319.8	5645.6
% Reduction Segment	0%	89%	76%	100%

Margin of Safety

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

- Effluent variability plays a major role in determining the average value that will meet water-quality criteria over the long-term. The value that provides this variability in our analysis is the standard deviation of the dataset. The simulation results are based on this variability and the existing stream conditions (an uncontrolled system). The general assumption can be made that a controlled system (one that is controlling and stabilizing the pollution load) would be less variable than an uncontrolled system. This implicitly builds in a margin of safety.
- An additional MOS is provided because the calculations were done with a daily Fe average instead of the 30-day average

Seasonal Variation

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

Critical Conditions

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

Attachment D

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

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

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

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

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

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

Attachment E

Water Quality Data Used In TMDL Calculations

AR14	**Flow**	**pH**		**Conductivity**	**Temp**	**Alkalinity**	**Acidity**	**Iron**	**Manganese**	**Aluminum**
Date	**gpm**	**Field**	**Lab**	**umhos/c**	**C**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
3/14/2002	54	3.4	3.2	3800	6	0	398	47.3	60.7	
5/21/2002	410	4.6	3.4	1800	9	0	162	7.71	27.8	
9/9/2002	34	3.1	3	3200	24	0	514	32.9	69.4	
11/9/2002	70	3.2	3.1	1900	11	0	284	27.1	48.4	
3/24/2003	1082	3.3	3.4	1300	15	0	163	4.28	25.2	
5/28/2003	839	3.5	3.4	100	14	0	173	5.04	23.7	
9/18/2003	727	3.5	3.4	2200	16	0	244	3.05	36.8	
5/21/2003	600		3.5			0	311	4.8	27.6	21.6
7/21/2003	200		3.3			0.0	400.2	15.8	46.1	39.0
10/14/2003	250		3.5			0.0	275.2	4.9	38.1	34.1
3/2/2004	1500		4.2			4.4	74.6	3.5	10.6	8.3
mean=	524.1	3.5	3.4		13.5	0.4	272.6	14.2	37.6	25.7
stdev=							128.872	14.9	17.3	13.7

AR13	**Flow**	**pH**		**Conductivity**	**Temp**	**Alkalinity**	**Acidity**	**Iron**	**Manganese**	**Aluminum**
Date	**gpm**	**Field**	**Lab**	**umhos/c**	**C**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
3/14/2002	3	4.4	4.6	340	11	8	24	0.38	1.62	
5/21/2002	28	5.6	4.8	320	9	14	8	0	0.95	
9/9/2002	dry									
11/9/2002	<1	4.8	4.9	370	12	9	32	0	1.86	
3/23/2003	28	4.3	4.5	260	15	14	14	0	1.02	
5/28/2003	11	5.4	6.4	240	14	19	12	0.07	1.09	
9/18/2003	5	4.2	4.4	280	17	8	25	0.73	2.56	
5/21/2003	25		6.2			14.4	2.8	0	0.05	0.5
7/21/2003										
10/14/2003	5		5.8			13.0	7.8	0.00	0.22	0.50
3/2/2004	75		6.7			43.8	0.0	0.74	0.60	1.05
mean=	22.5	4.7	5.3		13.0	15.9	13.9	0.2	1.107	0.683
stdev=							10.8	0.3	0.80	0.32

AR11	Flow	pH		Conductivity	Temp	Alkalinity	Acidity	Iron	Manganese	Aluminum
Date	**gpm**	**Field**	**Lab**	**umhos/c**	**C**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
9/30/2000	70		3.2	2900		0	360	18.72	59.31	32.19
12/30/2000	50		3	2340		0	276	27.95	38.85	22.67
3/31/2001	125		3.4	1310		0	130	5.07	17.96	11.73
6/24/2001	90		3.2	2400		0	236	5.49	33.65	20.29
9/29/2001	80		3.2	2570		0	308	13.7	30.8	20.1
12/31/2001	55		3.4	1630		0	170	6.66	18.2	11.6
3/21/2002	120		3.3	1420		0	158	5.15	15.5	11
6/5/2002	250		4.6	725		6	34	0.08	7.24	4.08
9/27/2002	60		3.3	2000		0	218	8.92	25	18.9
12/31/2002	150		3.6	1190		0	92	1.09	12.8	10.3
3/31/2002	125		3.6	1520		0	144	1.61	16.2	15.5
6/20/2003	130		3.5	1510		0	147	1.3	17.9	16.6
9/30/2003	135		3.7	1480		0	137	1.58	17	16
5/21/2003	989		3.6			0.0	177.6	1.60	19.60	16.90
7/21/2003	550		3.2			0.0	272.2	4.13	30.40	23.60
10/14/2003	564		3.5			0.0	209.8	2.23	25.20	22.00
3/10/2004	3137		3.9			0.0	92.4	1.06	11.50	10.40
mean=	392.9		3.4			0.3	186.0	6.2	23.3	16.6
stdev=							84.9	7.4	12.5	6.6

AR12	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum
Date	**Lab**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
5/21/2003	6.5	15.4	0.00	0.81	0.38	0.00
7/21/2003	6.6	17.8	0.00	1.95	0.21	0.00
10/16/2003	6.6	23.8	0.00	0.89	0.26	0.00
3/9/2004	6.7	16.0	0.00	0.33	0.12	0.00
mean=	6.6	18.2	0.0	0.9	0.2	0.000
stdev=			0.0	0.7	0.1	0.0

AR09	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	**Lab**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**gpm**
5/20/2003	4.8	6.8	32.2	0	1.18	0.865	200
7/21/2003	5.0	9.4	55.60	0.45	1.58	1.02	75
10/14/2003	5.1	7.4	40.00	0.59	1.41	0.78	175
3/10/2004	5.9	9.0	29.20	0.00	0.79	0.00	741
mean=	5.2	8.2	39.3	0.3	1.2	0.7	297.8
stdev=			11.8	0.3	0.3	0.5	

AR08	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/20/2003	3.6	0.0	144.8	1.06	16.80	13.40	476
7/21/2003	3.3	0.0	138.60	5.77	16.60	9.20	476
10/14/2003	3.7	0.0	138.40	0.97	15.90	13.80	800
3/10/2004	4.4	6.2	57.40	0.50	1.37	0.98	4500
mean=	3.8	1.6	119.8	2.1	12.7	9.3	1563.0
stdev=			41.71	2.48	7.54	5.95	

AR07	Flow	pH		Conductivity	Temp	Alkalinity	Acidity	Iron	Manganese	Aluminum
Date	gpm	Field	Lab	umhos/c	C	mg/l	mg/l	mg/l	mg/l	mg/l
4/24/2001	NM	3.6	3.6	828	17	0	78	0.92	10.28	9.57
9/17/2001	40		3.4	927		0	140	2.19	3.54	
10/19/2001	20	3.7	3.5	662		0	104	3.87	7.12	
1/15/2002	40	4.6	3.7	723	4	0	80	2.15	7.37	
5/20/2003	1040		3.6			0	126.4	1.82	12.70	12.30
7/17/2003	420		3.3			0.0	155.40	2.84	13.00	9.64
10/8/2003	1167		3.7			0.0	136.80	1.29	12.20	11.80
3/10/2004	14945		4.1			3.4	86.80	0.55	6.21	0.00
mean=	2524.5	3.9	3.6		10.5	0.425	113.425	1.9	9.0	8.662
stdev=							30.13	1.07	3.49	5.00

AR06	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/20/2003	6.0	8.6	14.00	0	0.09	0	150
7/17/2003	6.5	12.6	0.00	0	0.06	0	35
10/9/2003	6.4	9.6	9.20	0	0.09	0	79
3/10/2004	6.1	8.8	18.20	0	0.14	0	371
mean=	6.3	9.9	10.4	0.0	0.10	0.0	158.8
stdev=			7.82	0.00	0.04	0.00	

FR01	Flow	pH		Conductivity	Temp	Alkalinity	Acidity	Iron	Manganese	Aluminum
Date	gpm	Field	Lab	umhos/c	C	mg/l	mg/l	mg/l	mg/l	mg/l
4/24/2001	NM	3.7	3.8	603	17	0	42	1.01	2.02	3.77
9/17/2001	15		3.5	828		0	52	2.34	8.61	
10/19/2001	100	3.5	3.7	771		0	46	2.16	3.13	
1/15/2002	40	4.2	3.8	653	2	0	46	1.43	2.49	
5/20/2003	456		3.5			0	95.8	1.64	3.58	10.20
7/17/2003	126		3.3			0.0	123.20	4.05	5.20	8.92
10/8/2003	274		3.2			0.0	287.20	9.86	9.09	37.80
3/10/2004	7944		3.9			0.0	90.60			
mean=	1279.2	3.8	3.5		9.5	0	97.85	3.27	4.8	15.1
stdev=							82.07	3.09	2.90	15.34

AR05	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	ug/l	ug/l	ug/l	gpm
5/19/2003	4.0	2.4	78.4	0.66	4.54	5.16	3462
7/16/2003	3.5	0.0	105.00	1.52	9.35	7.89	598
10/7/2003	3.8	0.0	97.60	1.71	7.13	11.10	2888
3/1/2004	4.0	2.0	68.60	1.13	6.34	7.48	2495
mean=	3.8	1.1	87.4	1.3	6.8	7.9	2360.8
stdev=			16.82	0.46	1.99	2.44	

HR03	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/20/2003	4.4	5.4	62.6	0.33	3.87	2.17	783
7/17/2003	4.1	2.6	78.40	0.50	7.27	2.46	102
10/7/2003	4.3	5.2	72.00	0.54	6.81	5.21	316
3/2/2004	4.7	7.2	43.20	0.94	3.20	1.98	436
mean=	4.4	5.1	64.1	0.6	5.3	3.0	409.3
stdev=			15.34	0.26	2.05	1.52	

HR02	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/20/2003	6.3	14.2	19.6	0.51	0.19	0.00	75
7/17/2003	6.5	21.6	0.00	1.50	0.33	0.63	50
10/7/2003	6.7	16.2	0.00	0.00	0.83	0.00	60
3/2/2004	6.4	18.4	17.60	3.48	0.37	2.64	244
mean=	6.5	17.6	9.3	1.4	0.4	0.8	107.3
stdev=			10.77	1.54	0.28	1.25	

HR01	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/19/2003	5.1	8.0	33.6	0	2.29	1.02	717
7/16/2003	4.6	7.0	50.40	0	4.64	1.28	224
10/7/2003	4.8	7.6	55.00	0	4.23	2.75	499
3/1/2004	5.1	7.2	27.60	0	2.42	0.96	398
mean=	4.9	7.5	41.7	0.0	3.4	1.5	459.5
stdev=			13.13	0.00	1.21	0.84	

MR05	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/19/2003	3.3	0.0	104.6	1.68	6.25	10.70	30
7/16/2003	3.2	0.0	98.20	4.51	5.99	5.74	7.5
10/9/2003	3.3	0.0	110.00	3.45	6.82	10.20	5
3/1/2004	3.4	0.0	119.00	3.07	7.44	13.10	2
mean=	3.30	0.00	107.95	3.18	6.63	9.94	11.13
stdev=			8.8	1.2	0.6	3.1	

MR04	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/19/2003	3.9	2.0	74.6	0	1.81	5.86	466
7/16/2003	3.7	0.0	167.80	0.68	5.44	17.00	25
10/9/2003	3.8	0.0	132.80	0.76	4.24	14.50	164
3/1/2004	4.1	2.6	69.80	0.00	2.06	6.19	175
mean=	3.9	1.2	111.3	0.4	3.4	10.9	207.5
stdev=			47.34	0.42	1.75	5.71	

MR03	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/19/2003	3.9	0.0	86.8	0.00	2.01	6.03	496
7/16/2003	3.6	0.0	140.40	1.32	5.50	15.40	35
10/9/2003	3.7	0.0	120.80	0.98	4.42	14.20	170
1/4/1900		1.4	78.00	0.35	2.40	6.65	178
mean=	3.7	0.4	106.5	0.7	3.6	10.6	219.8
stdev=			29.18	0.60	1.66	4.92	

MR02	p	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/19/2003	2.7	0	744.00	127.00	18.80	49.60	396
7/16/2003	2.6	0.0	1093.40	181.00	26.50	61.60	261
10/9/2003	2.8	0.0	586.20	95.50	15.80	41.20	291
3/1/2004	3.8	0.0	64.20	1.37	2.65	7.31	442
mean=	3.0	0.0	622.0	101.2	15.9	39.9	347.5
stdev=			427.99	75.35	9.94	23.30	

MR01	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/19/2003	3.0	0.0	237.4	29.40	6.92	18.60	1555
7/16/2003	2.6	0.0	663.40	86.70	18.30	41.70	265
10/7/2003	3.0	0.0	320.60	39.20	8.90	24.60	645
3/1/2004	3.1	0.0	277.20	42.00	8.92	20.20	679
mean=	2.9	0.0	374.7	49.3	10.8	26.3	786.0
stdev=			195.48	25.50	5.11	10.59	

AR04	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/14/2003	3.4	0.0	126.0	3.5	6.0	14.0	500
7/15/2003	3.1	0.0	315.80	13.10	13.10	32.20	150
10/9/2003	3.3	0.0	180.00	6.50	8.60	20.20	428
3/9/2004	3.6	0.0	88.00	2.97	4.00	8.71	1250
mean=	3.4	0.0	177.5	6.5	7.9	18.8	582.0
stdev=			99.66	4.66	3.93	10.11	

AR03	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/14/2003	4.2	5.4	39.6	0	1.62	3.04	300
7/15/2003	4.1	2.8	73.20	0.00	2.48	3.14	40
10/9/2003	4.2	4.0	58.00	0.00	2.18	3.55	276
3/9/2004	4.5	5.6	39.20	0.00	1.03	1.93	750
mean=	4.3	4.5	52.5	0.0	1.8	2.9	341.5
stdev=			16.35	0.00	0.64	0.69	

AR02	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/14/2003	3.5	0.0	97.40	10.80	4.77	7.73	8345
7/15/2003	3.2	0.0	230.20	38.70	10.40	11.20	1545
10/9/2003	3.4	0.0	142.80	16.60	7.50	12.00	2170
3/9/2004	3.8	0.0	63.20	5.21	2.97	5.05	18285
mean=	3.5	0.0	133.4	17.8	6.4	9.0	7586.3
stdev=			72.30	14.67	3.25	3.22	

BR06	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/15/2003	2.7	0	416.00	57.50	3.40	26.30	250
7/16/2003	2.7	0.0	484.00	65.20	3.44	27.90	203
10/14/2003	2.6	0.0	438.80	57.80	3.63	25.10	334
3/2/2004	3.1	0.0	154.20	19.80	1.82	9.74	757
mean=	2.8	0.0	373.3	50.1	3.1	22.3	386.0
stdev=			148.74	20.50	0.84	8.43	

BR05	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/15/2003	2.7	0	327.00	40.20	1.85	18.50	454
7/16/2003	2.8	0.0	333.20	41.70	1.99	18.00	310
10/14/2003	2.7	0.0	295.00	31.90	1.65	15.60	503
3/2/2004	3.1	0.0	172.20	20.50	1.40	10.30	472
mean=	2.8	0.0	281.9	33.6	1.7	15.6	434.8
stdev=			74.99	9.72	0.26	3.75	

BR07	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/15/2003	2.8	0.0	256.00	18.50	5.09	17.30	250
7/15/2003	2.6	0.0	340.00	21.80	5.93	19.30	40
10/14/2003	2.8	0.0	302.60	25.20	5.23	19.40	100
3/2/2004	3.3	0.0	89.80	7.84	4.46	7.32	500
mean=	2.9	0.0	247.1	18.3	5.2	15.8	222.5
stdev=			110.35	7.51	0.60	5.76	

BR04	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/15/2003	2.8	0.0	336.4	42.20	3.94	22.70	287
7/15/2003	2.7	0.0	444.80	52.40	4.15	24.30	60
10/14/2003	2.9	0.0	347.60	50.90	4.06	21.60	307
3/2/2004	3.4	0.0	101.20	14.40	2.55	7.78	1006
mean=	3.0	0.0	307.5	40.0	3.7	19.1	415.0
stdev=			145.89	17.63	0.75	7.62	

BR02	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/15/2003	2.8	0.0	301.00	33.60	4.07	19.10	1892
7/15/2003	2.7	0.0	381.60	38.10	4.22	20.90	1122
10/14/2003	2.7	0.0	321.40	38.10	4.16	19.20	1629
3/9/2004	2.8	0.0	238.00	28.30	2.58	13.60	8108
mean=	2.8	0.0	310.5	34.5	3.8	18.2	3187.8
stdev=			59.22	4.66	0.79	3.18	

BR03	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/15/2003	3.1	0.0	235.60	8.88	7.24	26.30	263
7/15/2003	2.8	0.0	412.40	19.90	9.69	39.10	88
10/14/2003	3.0	0.0	272.20	13.00	8.23	28.80	160
3/9/2004	3.3	0.0	154.80	7.24	5.08	16.50	469
mean=	3.1	0.0	268.8	12.3	7.6	27.7	245.0
stdev=			107.60	5.64	1.94	9.28	

BR01	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/14/2003	3	0.0	209.0	20.10	3.99	14.80	2986
7/15/2003	2.7	0.0	336.20	26.20	4.50	19.70	1441
10/9/2003	2.9	0.0	254.80	27.80	3.93	15.90	2610
3/9/2004	3.0	0.0	193.60	20.90	2.49	11.30	11705
mean=	2.9	0.0	248.4	23.8	3.7	15.4	4685.5
stdev=			64.04	3.82	0.86	3.46	

AR01A	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum	Flow
Date	Lab	mg/l	mg/l	mg/l	mg/l	mg/l	gpm
5/14/2003	3.2	0.0	132.8	13.7	4.6	9.9	11331
7/15/2003	2.8	0.0	314.00	28.30	5.34	19.30	2986
10/9/2003	3.0	0.0	210.00	22.10	5.23	13.80	4780
3/9/2004	3.2	0.0	136.20	14.40	2.69	8.78	35988
mean=	3.1	0.0	198.3	19.6	4.5	13.0	13771.3
stdev=			84.99	6.92	1.23	4.75	

AR01	**pH**	**Alkalinity**	**Acidity**	**Iron**	**Manganese**	**Aluminum**	**Flow**
Date	**Lab**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**gpm**
5/14/2003	3.3	0.0	120.60	14.50	4.42	8.07	14377
7/14/2003	3.0	0.0	253.20	33.20	6.92	10.10	3642
10/8/2003	3.1	0.0	204.00	21.60	5.80	11.90	8710
3/9/2004	3.2	0.0	136.20	14.40	2.69	8.78	44985
mean=	3.2	0.0	178.5	20.9	5.0	9.7	17928.5
stdev=			61.57	8.85	1.82	1.68	

Attachment F
Comment and Response

No comments received.