CURLEYS RUN WATERSHED TMDL
Clearfield County

Prepared for:

Pennsylvania Department of Environmental Protection

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INTRODUCTION

This report presents the Total Maximum Daily Load (TMDL) developed for stream segments in the Curleys Run Watershed (Attachment A). This was done to address impairments noted on the 1996, 1998, 2002, and 2004 Pennsylvania Section 303(d) lists required under the Clean Water Act and covers one segment on this list (Table 1). High levels of metals and siltation caused these impairments. All impairments resulted from acid drainage from abandoned coal mines. The TMDL addresses the three primary metals (iron, manganese, aluminum) associated with acid mine drainage (AMD) and pH.

Table 1. Curleys Run Segment Addressed

State Water Plan (SWP) Subbasin: 08-D Susquehanna River								
Year	Miles	Segment ID	DEP Stream Code	Stream Name	Designated Use	Data Source	Source	EPA 305(b) Cause Code
1996	1.2	7153	25628	Curleys Run	HQ-CWF	305(b) Report	RE	Metals
1998	1.25	7153	25628	Curleys Run	HQ-CWF	SWMP	AMD	Metals
2002	1.2	7153	25628	Curleys Run	HQ-CWF	SWMP	AMD	Metals
2004	1.2	20020627-1315-TAS	25628	Curleys Run	HQ-CWF	SWMP	AMD	Metals, Siltation

See Attachment B, 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.

HQ-CWF = High Quality Cold Water Fishes
RE = Resource Extraction
AMD = Abandoned Mine Drainage
SWMP = Surface Water Monitoring Program

LOCATION

The Curleys Run Watershed is approximately 0.93 square miles in area. It is located about 0.5 miles west of Karthaus, Clearfield County, Pennsylvania. Curleys Run flows 1.25 miles northeast from its headwaters near Keewaydin, Covington Township, Clearfield County, to its confluence with Mosquito Creek. Curleys Run Watershed can be accessed by traveling east on State Route 879 for about 10 miles from the Clearfield exit of I 80. The watershed is on the right just outside of Karthaus.

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[1] Pennsylvania's 1996, 1998, 2002, and 2004 Section 303(d) lists were approved by the Environmental Protection Agency (USEPA). The 1996 Section 303(d) list provides the basis for measuring progress under the 1996 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA.*

SEGMENTS ADDRESSED IN THIS TMDL

The Curleys Run Watershed is affected by pollution from AMD. This pollution has caused high levels of metals and siltation throughout the entire stream. The upper two thirds of the watershed is highly disturbed from surface mines. The upper portion of Curleys Run has been buried by coal spoil piles that were piled next to the stream and have since flowed into the stream channel.

CLEAN WATER ACT REQUIREMENTS

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

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

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

Despite these requirements, states, territories, authorized tribes, and USEPA have not developed many TMDLs since 1972. Beginning in 1986, organizations in many states filed lawsuits against the USEPA for failing to meet the TMDL requirements contained in the federal Clean Water Act and its implementing regulations. While USEPA has entered into consent agreements with the plaintiffs in several states, many lawsuits still are pending across the country.

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

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

SECTION 303(D) LISTING PROCESS

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

The primary method adopted by the Pennsylvania Department of Environmental Protection (PADEP) 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. PADEP is now using the Unassessed Waters Protocol (UWP), a modification of the USEPA Rapid Bioassessment Protocol II (RPB-II), as the primary mechanism to assess Pennsylvania's waters. The UWP provides a more consistent approach to assessing Pennsylvania's streams.

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

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

BASIC STEPS FOR DETERMINING A TMDL

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

1. Collection and summarization of pre-existing data (watershed characterization, inventory contaminant sources, determination of pollutant loads, etc.);

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

2. Calculate TMDL for the waterbody using USEPA approved methods and computer models;
3. Allocate pollutant loads to various sources;
4. Determine critical and seasonal conditions;
5. Submit draft report for public review and comments; and
6. USEPA approval of the TMDL.

This document will present the information used to develop the Curleys Run Watershed TMDL.

WATERSHED BACKGROUND

The Curleys Run Watershed lies within the Pittsburgh Low Plateau Section of the Appalachian Plateau Province. There is a vertical drop in the watershed of about 500 feet from its headwaters to the mouth. The average annual precipitation is 42 inches. The region is characterized by warm summers and long, cold winters. Temperatures change frequently and sometimes rapidly.

The watershed is dominated primarily by disturbed and forested land uses. Disturbed and poorly reclaimed land make up about 60 percent of the watershed and 39 percent of the area is forested. The majority of the disturbed land is located in the upper two-thirds of the watershed. The remaining one percent is residential land use, located near the mouth of Curleys Run.

Curleys Run Watershed is primarily interbedded sedimentary rock, which accounts for 69.8 percent of the watershed. Sandstone comprises the remaining 30.2 percent of the area. The predominant soil association in the watershed is the Gilpin-Ernest-Cavode series accounting for 44.6 percent. The remaining portion of the watershed is comprised of the Udorthents-Ernest-Gilpin and Hazleton-Dekalb-Buchanan soil associations (25.5 percent and 29.9 percent, respectively). Currently, Curleys Run is listed as a HQ-CWF by Pennsylvania Code Title 25.

Historical data shows that mining began in this area in the early nineteenth century. Currently, there are two active mining permits in the watershed (17990104 and 17960113). The majority of mining done in the watershed has been strip mining. Most of the land has been reclaimed to meet standards, however, untreated discharges and seeps continue to impact Curleys Run. The major source of pollution in State Water Plan Subbasin 08C is acidic water from abandoned mines (WRAS, 2001).

Sky Haven Coal, Inc. is the permittee for both of the active permits in the watershed. Permit number 17990104 is a surface coal mine that is permitted to mine in the Upper and Middle Kittanning coal seams. This facility discharges into an UNT Grimes Run. The portion of the permitted area in the Curleys Run Watershed has been backfilled (Kuzemchock, 2004). Permit number 17960113 is permitted to mine in the Upper and Middle Kittanning and Lower Freeport seams. It is a strip and auger mine operation. This permit discharges to Curleys Run. R S Carlin Inc. is in the process of releasing their bonds in the area. They are not actively mining any part of the Curleys Run Watershed.

AMD METHODOLOGY

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

The statistical analysis described below can be applied to situations where all of the pollutant loading is from nonpoint sources, as well as those where there are both point and nonpoint sources. The following defines what are considered point sources and nonpoint sources for the purposes of our evaluation; point sources are defined as permitted discharges or a discharge that has a responsible party, 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 in combination with nonpoint sources, the evaluation will use the point source data and perform a mass balance with the receiving water to determine the impact of the point source.

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

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

PR = required percent reduction for the current iteration

Cc = criterion in mg/l

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

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

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

Mean = average observed concentration

Standard Deviation = standard deviation of observed data

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

LTA = Mean * (1 – PR99) where (2)

LTA = allowable LTA source concentration in mg/l

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

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

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

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

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

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

METHOD TO QUANTIFY TREATMENT POND POLLUTANT LOAD

The following is an explanation of the quantification of the potential pollution load reporting to the stream from permitted pit water treatment ponds that discharge water at established effluent limits.

Surface 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 is removed and placed in the previous cut where the coal has been removed. In this fashion, an active mining operation has a pit that progresses through the mining site during the life of the mine. The pit may have water reporting to it, as it is a low spot in the local area. Pit water can be the result of limited shallow groundwater seepage, direct precipitation into the pit, and surface runoff from partially regarded areas that have been backfilled but not yet revegetated. Pit water is pumped to nearby treatment ponds where it is treated to the required treatment pond effluent limits. The standard effluent limits are as follows, although stricter effluent limits may be applied to a mining permit's effluent limits to insure that the discharge of treated water does not cause in-stream limits to be exceeded.

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

Discharge from treatment ponds on a mine site is intermittent and often varies as a result of precipitation events. Measured flow rates are almost never available. If accurate flow data are available, it is used along with the Best Available Technology (BAT) limits to quantify the WLA 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

The following is an approach that can be used to determine a waste load allocation for an active mining operation when treatment pond flow rates are not available. The methodology involves quantifying the hydrology of the portion of a surface mine site that contributes flow to the pit and then calculating waste load allocation using NPDES treatment pond effluent limits.

The total water volume reporting to ponds for treatment can come from two primary sources: direct precipitation to the pit and runoff from the unregraded area following the pit's progression through the site. Groundwater seepage reporting to the pit is considered negligible compared to the flow rates resulting from precipitation.

In an active mining scenario, a mine operator pumps pit water to the ponds for chemical treatment. Pit water is often acidic with dissolved metals in nature. At the treatment ponds, alkaline chemicals are added to increase the pH and encourage dissolved metals to precipitate and settle. Pennsylvania averages 41.4 inches of precipitation per year (Mid-Atlantic River Forecast Center, National Weather Service, State College, PA, 1961-1990, ttp://www.dep.state.pa.us/dep/subject/hotopics/drought/PrecipNorm.htm). A maximum pit dimension without special permit approval is 1500 feet long by 300 feet wide. Assuming that 5 percent of the precipitation evaporates and the remaining 95 percent flows to the low spot in the active pit to be pumped to the treatment ponds, results in the following equation and average flow rates for the pit area.

41.4 in. precip./yr x 0.95 x 1 ft./12/in. x 1500'x300'/pit x 7.48 gal/ft^3 x 1yr/365days x 1day/24hr. x 1hr./60 min. =

= 21.0 gal/min average discharge from direct precipitation into the open mining pit area.

Pit water also can result from runoff from the unregraded and revegetated area following the pit. In the case of roughly backfilled and highly porous spoil, there is very little surface runoff. It is estimated that 80 percent of precipitation on the roughly regraded mine spoil infiltrates, 5 percent evaporates, and 15 percent may run off to the pit for pumping and potential treatment (Jay Hawkins, Office of Surface Mining, Department of the Interior, Personal Communications, 2003). Regrading and revegetation of the mine spoil is conducted as the mining progresses. The PADEP encourages concurrent backfilling and revegetation through its compliance efforts and it is in the interest of the mining operator to minimize the company's reclamation bond liability by keeping the site reclaimed and revegetated. Experience has shown that reclamation and revegetation is accomplished two to three pit widths behind the active mining pit area. PADEP uses three pit widths as an area representing potential flow to the pit when reviewing the NPDES permit application and calculating effluent limits based on best available treatment technology and insuring that in-stream limits are met. The same approach is used in the following equation, which represents the average flow reporting to the pit from the unregraded and unrevegetated spoil area.

41.4 in. precip./yr x 3 pit areas x 1 ft./12/in. x 1500'x300'/pit x 7.48 gal/ft^3 x 1yr/365days x 1day/24hr. x 1hr./60 min. x 15 in. runoff/100 in. precipitation =

= 9.9 gal./min. average discharge from spoil runoff into the pit area.

The total average flow to the pit is represented by the sum of the direct pit precipitation and the water flowing to the pit from the spoil area as follows:

Total Average Flow = Direct Pit Precipitation + Spoil Runoff

Total Average Flow = 21.0 gal./min + 9.9 gal./min. = 30.9 gal./min.

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

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

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

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

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

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

Also, it is the goal of PADEP’s permit review process to not issue mining permits that would cause negative impacts to the environment. As a step to insure that a mine site does not produce acid mine drainage, it is common to require the addition of alkaline materials (waste lime, baghouse lime, limestone, etc.) to the backfill spoil materials to neutralize any acid-forming materials that may be present. This practice of ‘alkaline addition’ or the incorporation of naturally occurring alkaline spoil materials (limestone, alkaline shale or other rocks) may produce alkaline pit water with very low metals concentrations that does not require treatment. A comprehensive study in 1999 evaluated mining permits issued since 1987 and found that only 2.2 percent resulted in a post-mining pollution discharge (Evaluation of Mining Permits Resulting in Acid Mine Drainage 1987-1996: A Post Mortem Study, March 1999). As a result of efforts to insure that acid mine drainage is prevented, most mining operations have alkaline pit water that often meets effluent limits and requires little or no treatment.

While most mining operations are permitted and allowed to have a standard, 1500’ x 300’ pit, most are well below that size and have a corresponding decreased flow and load. Where pit dimensions are greater than the standard size or multiple pits are present, the calculations to define the potential pollution load can be adjusted accordingly. Hence, the above calculated waste load allocation is very generous and likely high compared to actual conditions that are generally encountered. A large margin of safety is included in the waste load allocation calculations.

This is an explanation of the quantification of the potential pollution load reporting to the stream from permitted pit water treatment ponds that discharge water at established effluent limits. This allows for including active mining activities and their associated waste load in the TMDL calculations to more accurately represent the watershed pollution sources and the reductions necessary to achieve in-stream limits. When a mining operation is concluded its waste load allocation is available for a different operation. Where there are indications that future mining in a watershed is greater than the current level of mining activity, an additional waste load allocation amount may be included to allow for future mining.

TMDL ENDPOINTS

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

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

Table 2. Applicable Water Quality Criteria

Parameter	***Criterion Value (mg/l)***	***Total Recoverable/Dissolved***
Aluminum (Al)	0.75	Total Recoverable
Iron (Fe)	1.50 0.3	30-day average; Total Recoverable Dissolved
Manganese (Mn)	1.00	Total Recoverable
pH *	6.0-9.0	N/A

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

TMDL ELEMENTS (WLA, LA, MOS)

A TMDL equation consists of a wasteload allocation (WLA), load allocation (LA) and a margin of safety (MOS). The WLA is the portion of the load assigned to point sources. The LA is the portion of the load assigned to nonpoint sources. The MOS is applied to account for uncertainties in the computational process. The MOS may be expressed implicitly (documenting conservative processes in the computations) or explicitly (setting aside a portion of the allowable load).

TMDL ALLOCATIONS SUMMARY

Methodology for dealing with pH impairments is discussed in Attachment D. Information for the TMDL analysis using the methodology described above is contained in the TMDLs by segment section in Attachment E.

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

Table 3. Summary Table–Curleys Run Watershed

Station	Parameter	Existing Load (lbs/day)	Allowable Load (lbs/day)	WLA	LA	Load Reduction (lbs/day	Percent Reduction
CR1.0	Mouth of Curleys Run						
	Fe	1.0	1.0	0.1	0.9	0.1	10
	Mn	3.2	0.7	0.1	0.6	2.6	81
	Al	3.7	1.5	0.1	1.4	2.3	65
	Acidity	23.2	5.8	0.0	5.8	17.4	75
	Alkalinity	205.7					

A WLA is being assigned to one permitted operation (Sky Haven Coal, Inc. SHMO) for iron, manganese, and aluminum. Acidity is narratively addressed to be exceeded by the alkalinity at all times, because a numeric standard was not included in the permit, no WLA is assigned for this parameter. The WLA was calculated using the methodology explained in the *Method to Quantify Treatment Pond Pollutant Load* section of this report. No required reduction of this permit is necessary at this time because there are nonpoint contributions upstream and downstream of the discharge that when reduced will satisfy the TMDL. All necessary reductions are assigned to the nonpoint sources. Table 4 contains the WLA for the permitted operation.

Table 4. Waste load Allocation of Permitted Operation

Parameter	*Allowable Average Monthly Conc. (mg/l)*	*Average Flow (MGD)*	*Allowable Load (lbs/day)*
SHMO			
Fe	3.0	0.0041	0.1
Mn	2.0	0.0041	0.1
Al	2.0	0.0041	0.1

RECOMMENDATIONS

The Mosquito Creek Sportsman's Association (Association) is an active group in this watershed. The Association has been working on the acid deposition issues in the headwaters of Mosquito Creek and continued support of their activities in the watershed is recommended. It is also recommended that a watershed group for Curleys Run be formed in order to focus on concerns in the watershed.

The PADEP BAMR administers an environmental regulatory program for all mining activities, including mine subsidence regulation, mine subsidence insurance, and coal refuse disposal. PADEP BAMR also conducts a program to ensure safe underground bituminous mining and protect certain structures from subsidence; administers a mining license and permit program; administers a regulatory program for the use, storage, and handling of explosives; and provides for training, examination, and certification of applicant's blaster's licenses. In addition, PADEP BAMR administers a loan program for bonding anthracite underground mines and for mine subsidence, administers the USEPA Watershed Assessment Grant Program, the Small Operator's Assistance Program (SOAP), and the Remining Operator's Assistance Program (ROAP).

Reclaim PA is PADEP's initiative designed to maximize reclamation of the state's quarter million acres of abandoned mineral extraction lands. Abandoned mineral extraction lands in Pennsylvania constitute a significant public liability - more than 250,000 acres of abandoned surface mines, 2,400 miles of stream polluted with AMD, 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.

Since the 1960s, Pennsylvania has been a national leader in establishing laws and regulations to ensure mine reclamation and well plugging occur after active operation is completed. 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 PADEP's Brownfields Program. Pennsylvania is striving for complete reclamation of its abandoned mines and plugging of its orphan wells. Realizing this task is no small order, PADEP has developed Reclaim PA, a collection of concepts to make abandoned mine reclamation easier. These concepts include legislative, policy, and land management initiatives designed to enhance mine operator/volunteer/PADEP 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.

PUBLIC PARTICIPATION

In the beginning stages of the Curleys Run Watershed TMDL, an early notification letter was sent to inform stakeholders and interested parties that a TMDL would be completed in their watershed and offer them the opportunity to submit information for TMDL development. The PADEP considered all the information submitted and all pertinent information was included in the report.

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* on January 8, 2005, and The Progress on January 27, 2005, to foster public comment on the allowable loads calculated. A public meeting was held on February 2, 2005, at the Karthaus Fire Hall in Karthaus, Pa., to discuss the proposed TMDL.

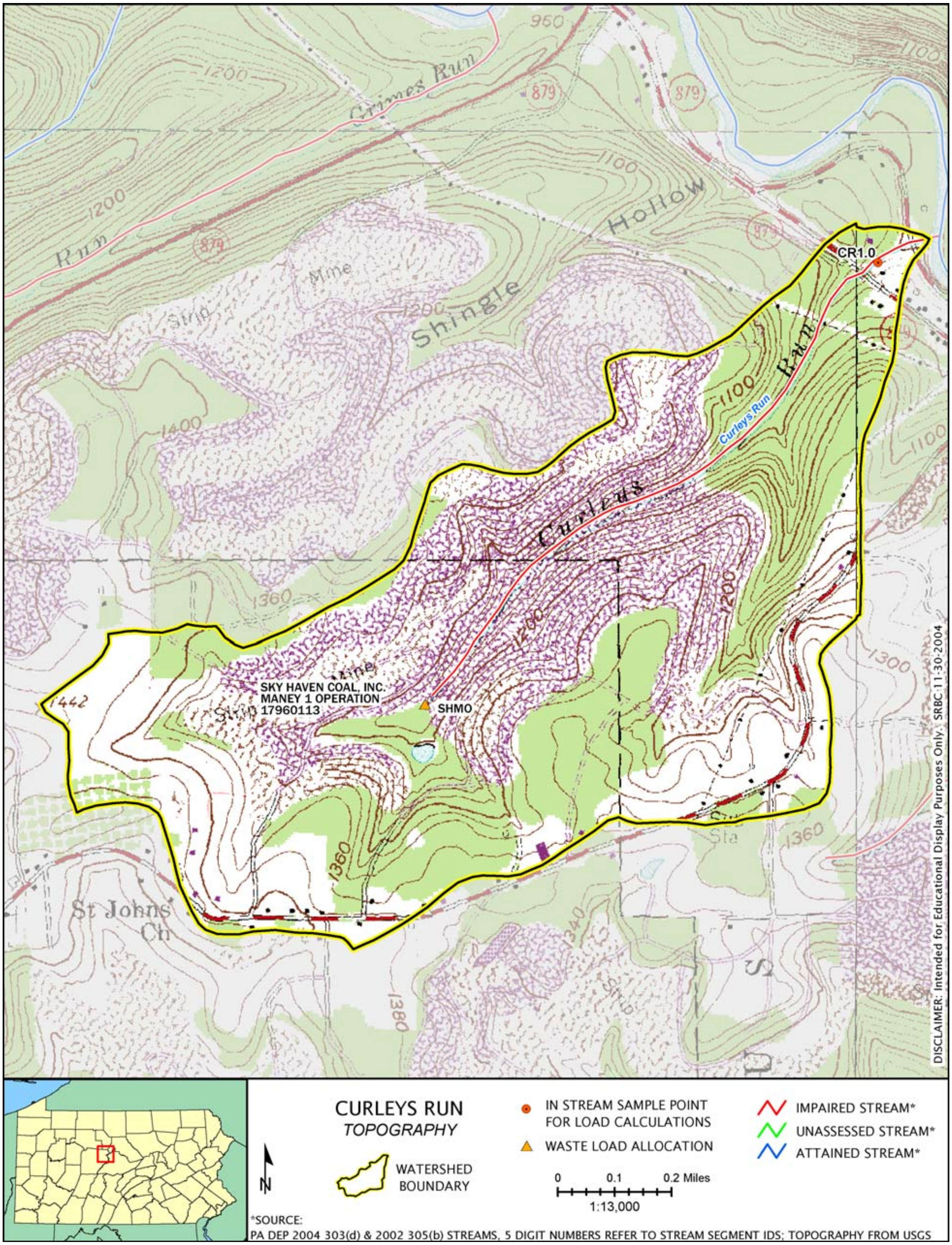
REFERENCES

Kuzemchock, Walter. 2004. Personal Conversation about permits in the Curleys Run Watershed.

Watershed Restoration Action Strategy (WRAS). 2001. Pennsylvania Department of Environmental Protection. State Water Plan Subbasin 08C Clearfield Creek Watershed.

Attachment A

Curleys Run Watershed Map



CURLEYS RUN
TOPOGRAPHY
WATERSHED BOUNDARY
IN STREAM SAMPLE POINT FOR LOAD CALCULATIONS
WASTE LOAD ALLOCATION
IMPAIRED STREAM*
UNASSESSED STREAM*
ATTAINED STREAM*
0 0.1 0.2 Miles
1:13,000
N
*SOURCE:
PA DEP 2004 303(d) & 2002 305(b) STREAMS, 5 DIGIT NUMBERS REFER TO STREAM SEGMENT IDS; TOPOGRAPHY FROM USGS
DISCLAIMER: Intended for Educational Display Purposes Only. SRBC 11-30-2004
CR1.0
SHMO
SKY HAVEN COAL, INC.
MANEY 1 OPERATION
17960113
Curleys Run
Shingle Hollow
Grimes Run
St Johns Ch

Attachment B

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

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

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

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

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

Prior to 1998, segment lengths were computed using a map wheel and calculator. The segment lengths listed on the 1998 303(d) list were calculated automatically by the GIS (ArcInfo) using a constant projection and map units (meters) for each watershed. Segment lengths originally calculated by using a map wheel and those calculated by the GIS did not always match closely. This was the case even when physical identifiers (e.g., tributary confluence and road crossings) matching the original segment descriptions were used to define segments on digital quad maps. This occurred to some extent with all segments, but was most noticeable in segments with the greatest potential for human errors using a map wheel for calculating the original segment lengths (e.g., long stream segments or entire basins). The 2002 Pa. Section 303(d) list was written in a manner similar to the 1998 Section 303(d) list.

In 2004, Pennsylvania developed the Integrated List of All Waters. The water quality status of Pennsylvania's waters is summarized using a five-part categorization of waters according to their water quality standard (WQS) attainment status. The categories represent varying levels of WQS attainment, ranging from Category 1, where all designated water uses are met, to Category 5, where impairment by pollutants requires a TMDL to correct. These category determinations are based on consideration of data and information consistent with the methods outlined by the Statewide Surface Water Assessment Program. Each PADEP five-digit waterbody segment is placed in one of the WQS attainment categories. Different segments of the same stream may appear on more than one list if the attainment status changes as the water flows downstream. The listing categories are as follows:

Category 1: Waters attaining all designated uses.

Category 2: Waters where some, but not all, designated uses are met. Attainment status of the remaining designated uses is unknown because data are insufficient to categorize a water consistent with the state's listing methodology.

Category 3: Waters for which there are insufficient or no data and information to determine, consistent with the state's listing methodology, if designated uses are met.

Category 4: Waters impaired for one or more designated use but not needing a TMDL. States may place these waters in one of the following three subcategories:

- TMDL has been completed.
- Expected to meet all designated uses within a reasonable timeframe.
- Not impaired by a pollutant.

Category 5: Waters impaired for one or more designated uses by any pollutant. Category 5 includes waters shown to be impaired as the result of biological assessments used to evaluate aquatic life use even if the specific pollutant is not known unless the state can demonstrate that nonpollutant stressors cause the impairment or that no pollutant(s) causes or contribute to the impairment. Category 5 constitutes the Section 303(d) list that USEPA will approve or disapprove under the Clean Water Act. Where more than one pollutant is causing the impairment, the water remains in Category 5 until all pollutants are addressed in a completed USEPA-approved TMDL or one of the delisting factors is satisfied.

Attachment C

Mining Permit in the Curleys Run Watershed

Permit Number	Company Name	Status
17793140	R.S. Carlin Inc.	Stage 1 Bond Release
17990104	Sky Haven Coal, Inc. Keewaydin Operation	Active
17960113	Sky Haven Coal, Inc. Maney 1 Operation	Active

Attachment D

Method for Addressing 303(d) Listings for pH

Method for Addressing 303(d) Listings for pH

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

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

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

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

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.*

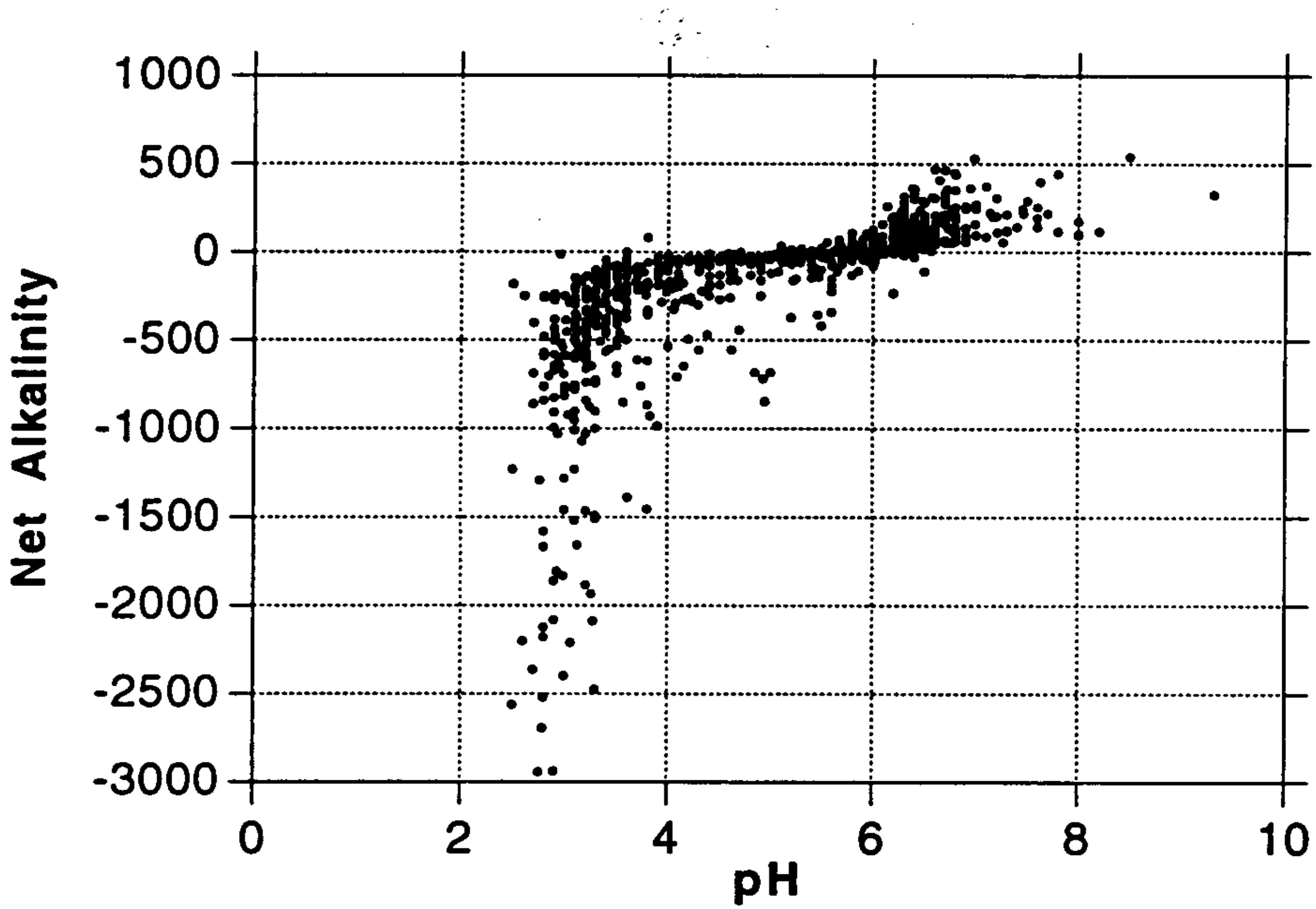


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania.

Attachment E
TMDLs By Segment

SHMO: Sky Haven Coal, Inc. Maney 1 Operation

Sky Haven Coal, Inc., MP#17960113, operates a surface mine in the Curleys Run Watershed along the stream channel. Any discharge from the operations treatment pond is treated to the Best Available Technology (BAT) limits, assigned to the permit before it enters Curleys Run.

SHMO is considered to be a point source discharge in the watershed; therefore, the allocation made at this point is a waste load allocation (WLA). The WLAs for iron, manganese, and aluminum were calculated using the methodology described in the *Method to Quantify Treatment Pond Pollutant Load* section in Attachment D. The open pit size for this operation is 520' x 80', smaller than the standard 1500' x 300'. Table E1 shows the waste load allocations for the discharge.

Table E1 Waste load Allocations at SHMO

Parameter	*Monthly Avg. Allowable Conc. (mg/l)*	*Average Flow (MGD)*	*Allowable Load (lbs/day)*
Fe	3.0	0.0041	0.1
Mn	2.0	0.0041	0.1
Al	2.0	0.0041	0.1

Curleys Run above CR1.0

Curleys Run above point CR1.0 has been determined to be impaired due to AMD. The majority of headwaters of Curleys Run have been disturbed by mining and portions of the stream are buried by spoil piles.

The TMDL for this section of Curleys Run consists of a load allocation to all of the watershed area above point CR1.0. Addressing the mining impacts above this point addresses the impairment for the segment. An instream flow measurement was available for point CR1.0 (0.57 mgd).

The 2004 303(d) list added siltation as a cause of impairment to Curleys Run above CR1.0. The assessment biologist who conducted the survey noted some coal fines are being deposited onto the streambed. Some of the disturbed mine lands in the Curleys Run Watershed have not been reclaimed. These disturbed lands could be contributing to siltation; more study would need to be conducted to determine the location and contribution of each of these sources to the stream. Disturbed lands often include areas with little to no vegetative cover due to poor or nonexistent topsoil layers. The acidity of mining waste materials that often comprise the ground cover in these areas creates a very harsh environment in which to establish vegetation. With little vegetation able to be established, erosion of materials is likely, especially during periods of heavy precipitation. These materials are transported through overland flow and subsequently deposited in the stream channel. While treatment of the abandoned mine drainage areas in the Curleys Run Watershed will reduce or eliminate water quality impairment in the river, land reclamation will be necessary to remediate impacts due to siltation of eroded materials. Best management practices (BMPs) often used in land reclamation include, but are not limited to, backfilling of open pits, regrading site topography to approximate original contours, and revegetation of regraded areas. Land reclamation is often done prior to or in conjunction with construction of systems to treat AMD in areas where both types of impacts occur, often as a method to achieve source reduction (lowering of discharge volume) of discharges. It is assumed that by implementing BMPs for AMD treatment, abandoned mine land reclamation will be completed and the source of erosional materials causing siltation will be eliminated. Therefore, siltation will not be addressed in this TMDL.

An allowable long-term average instream concentration for iron, manganese, aluminum, and acidity was determined at point CR1.0. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point CR1.0 for this stream segment are presented in Table E2.

E2. Long Term Average (LTA) for Curleys Run at Point CR1.0

	Measured Sample Data		***Allowable***	
	Conc. (mg/l)	***Load (lb/day)***	***LTA Conc. (mg/l)***	***Load (lb/day)***
Fe	0.22	1.0	0.22	1.0
Mn	0.68	3.2	0.14	0.7
Al	0.78	3.7	0.31	1.5
Acidity	4.87	23.2	1.22	5.8
Alkalinity	43.28	205.7		

All values shown in this table are long-term average daily values.

Reductions at point CR1.0 are necessary for any parameter that exceeds the allowable load at this point. Necessary reductions at point CR1.0 are shown in Table E3.

Table E3. Reductions Necessary at Point CR1.0				
	Iron (lb/day)	***Manganese (lb/day)***	***Aluminum (lb/day)***	***Acidity (lb/day)***
Existing Load at CR1.0	1.0	3.2	3.7	23.2
Existing load from upstream points	NA	NA	NA	NA
Difference of existing load and upstream existing load	1.0	3.2	3.7	23.2
Allowable loads from upstream points	NA	NA	NA	NA
Total load at CR1.0	1.0	3.2	3.7	23.2
Allowable load at CR1.0	1.0	0.7	1.5	5.8
Waste load allocation (SHMO)	0.1	0.1	0.1	0.0
Remaining load at CR1.0 (LA)	0.9	0.6	1.4	5.8
Load Reduction at CR1.0 (Total load at CR1.0 – Remaining load at CR1.0)	0.1	2.6	2.3	19.4
Percent Reduction required at CR1.0	10	81	62	75

The TMDL for Curleys Run at point CR1.0 requires that a load allocation be made for all areas above CR1.0 for total iron, total manganese, total aluminum, and total acidity.

Margin of Safety (MOS)

For each TMDL calculated in this study the MOS is applied implicitly. A MOS is built in because the allowable concentrations and loadings were simulated using Monte Carlo techniques and by 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.
- A MOS is also the fact that the calculations were performed with a daily iron average instead of the 30 day average.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

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

Attachment F

Water Quality Data Used
In TMDL Calculations

TMDL Site	Study Point	Company	Permit #	Date	Flow (gpm)	Acid (mg/l)	Alk (mg/l)	Fe (mg/l)	Mn (mg/l)	Al (mg/l)	pH
CR1.0	MP4	Sky Haven Coal, Inc	17960113	8/5/1992	325.0	4.0	36.0	0.09	0.53	*	6.72
	MP4	Sky Haven Coal, Inc.	17960113	10/15/1992	240.0	4.0	31.0	0.21	0.78	*	6.63
	MP4	Sky Haven Coal, Inc.	17960113	1/27/1993	648.0	6.0	21.0	0.35	0.70	*	5.99
	MP4	Sky Haven Coal, Inc.	17960113	5/12/1993	316.0	4.0	29.0	0.36	0.83	*	6.46
	MP4	Sky Haven Coal, Inc.	17960113	8/3/1993	87.0	<1.0	81.0	0.69	8.50	*	4.25
	MP4	Sky Haven Coal, Inc.	17960113	11/15/1993	525.0	4.0	26.0	0.28	0.66	*	6.49
	MP4	Sky Haven Coal, Inc.	17960113	4/8/1994	840.0	3.0	23.0	0.35	0.78	*	6.22
	MP4	Sky Haven Coal, Inc.	17960113	6/9/1994	143.0	4.0	47.0	0.14	0.41	*	6.48
	MP4	Sky Haven Coal, Inc.	17960113	8/1/1994	215.0	4.0	58.0	0.28	0.68	*	6.46
	MP4	Sky Haven Coal, Inc.	17960113	10/22/1994	273.0	6.0	53.0	0.07	0.47	*	6.42
	MP4	Sky Haven Coal, Inc.	17960113	2/7/1995	270.0	5.0	42.0	0.07	0.39	*	6.64
	MP4	Sky Haven Coal, Inc.	17960113	5/18/1995	110.0	4.0	35.0	0.08	0.44	*	6.50
	MP4	Sky Haven Coal, Inc.	17960113	9/23/1995	65.0	5.0	50.0	0.07	0.51	*	6.67
	MP4	Sky Haven Coal, Inc.	17960113	12/3/1995	75.0	5.0	37.0	0.05	0.39	*	6.46
	MP4	Sky Haven Coal, Inc.	17960113	3/16/1996	570.0	4.0	32.0	<0.02	0.50	*	6.35
	MP4	Sky Haven Coal, Inc.	17960113	5/8/1996	385.0	4.0	37.0	0.90	1.03	*	6.73
	MP4	Sky Haven Coal, Inc.	17960113	7/31/1996	48.0	10.0	51.0	0.11	0.96	0.83	6.57
	MP4	Sky Haven Coal, Inc.	17960113	8/27/1996	77.0	5.0	71.0	0.09	0.64	0.23	6.93
	MP4	Sky Haven Coal, Inc.	17960113	11/14/1996	490.0	3.0	40.0	0.21	0.62	*	6.42
	MP4	Sky Haven Coal, Inc.	17960113	2/19/1997	144.0	4.0	42.0	<0.07	0.41	*	6.34
	MP4	Sky Haven Coal, Inc.	17960113	5/5/1997	160.0	4.0	51.0	<0.07	0.49	*	6.54
	MP4	Sky Haven Coal, Inc.	17960113	7/30/1997	15.0	4.0	75.0	<0.07	0.35	*	7.03
	MP4	Sky Haven Coal, Inc.	17960113	10/30/1997	21.0	5.0	56.0	<0.07	0.42	*	7.62
	MP4	Sky Haven Coal, Inc.	17960113	2/9/1998	97.0	7.0	45.0	<0.07	0.45	*	6.18
	MP4	Sky Haven Coal, Inc.	17960113	5/14/1998	727.0	4.0	39.0	0.11	0.57	*	6.37
	MP4	Sky Haven Coal, Inc.	17960113	7/23/1998	44.0	5.0	76.0	0.12	0.51	*	6.60
	MP4	Sky Haven Coal, Inc.	17960113	10/30/1998	31.0	5.0	55.0	<0.07	0.27	*	6.41
	MP4	Sky Haven Coal, Inc.	17960113	1/26/1999	179.0	5.0	19.0	0.13	0.53	*	5.96
	MP4	Sky Haven Coal, Inc.	17960113	6/9/1999	43.0	<1.0	79.0	<0.07	0.27	*	7.614
	MP4	Sky Haven Coal, Inc.	17960113	8/3/1999	38.0	5.0	79.0	0.08	0.27	*	7.16
	MP4	Sky Haven Coal, Inc.	17960113	10/21/1999	36.0	6.0	44.0	<0.07	0.49	*	6.52
	MP4	Sky Haven Coal, Inc.	17960113	2/8/2000	54.0	6.0	39.0	0.15	0.38	*	6.61
	MP4	Sky Haven Coal, Inc.	17960113	5/31/2000	124.0	8.0	49.0	<0.07	0.37	*	6.89
	MP4	Sky Haven Coal, Inc.	17960113	7/26/2000	125.0	11.0	62.0	<0.07	0.41	*	6.64
	MP4	Sky Haven Coal, Inc.	17960113	10/30/2000	173.0	10.0	43.0	<0.07	0.42	*	6.40
	MP4	Sky Haven Coal, Inc.	17960113	1/24/2001	*	3.0	37.0	<0.07	0.33	*	6.30

TMDL Site	Study Point	Company	Permit #	Date	Flow (gpm)	Acid (mg/l)	Alk (mg/l)	Fe (mg/l)	Mn (mg/l)	Al (mg/l)	pH
	MP4	Sky Haven Coal, Inc.	17960113	6/5/2001	139.0	8.0	41.0	<0.07	0.37	*	6.20
	MP4	Sky Haven Coal, Inc.	17960113	9/5/2001	67.0	26.0	52.0	<0.07	0.45	*	6.30
	MP4	Sky Haven Coal, Inc.	17960113	11/12/2001	80.0	8.0	36.0	<0.07	0.41	*	6.80
	CURL1.0	SRBC-604(b) Report	*	12/11/2001	390.0	0.0	34.0	<0.30	0.563	<0.50	6.70
	CURL1.0	SRBC-604(b) Report	*	2/12/2002	842.5	0.0	24.0	0.645	1.07	0.898	7.00
	MP4	Sky Haven Coal, Inc.	17960113	3/15/2002	107.0	3.0	36.0	<0.07	0.33	*	7.40
	CURL1.0	SRBC-604(b) Report	*	3/26/2002	910.7	3.4	30.0	<0.30	0.488	<0.50	6.20
	CURL1.0	SRBC-604(b) Report	*	6/3/2002	860.9	0.0	36.0	<0.30	0.825	0.872	6.60
	CURL1.0	SRBC-604(b) Report	*	6/18/2002	1,334.4	0.0	34.0	<0.30	0.959	1.09	6.80
	MP4	Sky Haven Coal, Inc.	17960113	6/21/2002	511.0	5.0	43.0	0.07	0.48	*	6.40
	CURL1.0	SRBC-604(b) Report	*	7/23/2002	405.7	0.0	60.0	<0.30	0.488	<0.5	7.40
	MP4	Sky Haven Coal, Inc.	17960113	9/12/2002	57.0	4.0	60.0	<0.07	0.25	*	7.10
	MP4	Sky Haven Coal, Inc.	17960113	12/19/2002	323.0	3.0	20.0	<0.07	0.48	*	5.70
	MP4	Sky Haven Coal, Inc.	17960113	4/10/2003	1,077.0	4.0	27.0	<0.07	0.60	*	6.90
	MP4	Sky Haven Coal, Inc.	17960113	6/17/2003	793.0	6.0	31.0	<0.07	0.67	*	7.30
	MP4	Sky Haven Coal, Inc.	17960113	9/29/2003	1,750.0	3.0	33.0	0.10	0.78	*	6.90
	MP4	Sky Haven Coal, Inc.	17960113	1/6/2004	3,455.0	2.0	23.0	0.13	0.77	*	6.60
	MP4	Sky Haven Coal, Inc.	17960113	4/8/2004	98.0	2.0	27.0	0.22	0.21	<0.20	6.70
				Average=	394.61	4.87	43.28	0.22	0.68	0.78	6.58
				StDev=	565.87	3.83	16.15	0.21	1.10	0.33	0.51

"*" signifies no data were collected

Note: All concentrations are in units of milligrams per liter (mg/l); all discharge measurements are in units of gallons per minute (GPM)

Attachment G
Comment and Response

No formal comments were received for the Curleys Run Watershed TMDL.