BRUSH CREEK WATERSHED TMDL
Westmoreland County

For Acid Mine Drainage Affected Segments

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Pennsylvania Department of Environmental Protection

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Introduction

This report presents the Total Maximum Daily Loads (TMDLs) developed for segments in the Brush Creek 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 (shown in Table 1). High levels of metals 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.

Table 1. 303(d) Sub-List								
State Water Plan (SWP) Subbasin: 19-A Turtle Creek								
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1996	0.5	NA	37246	Brush Creek	TSF	305(b) Report	RE	Metals
1998	No new survey.							
2002	No new survey.							

Resource Extraction=RE
Trout Stocking = TSF

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

Directions to the Brush Creek Watershed

The Brush Creek Watershed is located in Southwestern Pennsylvania, occupying the west central portion of Westmoreland County. The watershed area is found on United States Geological Survey maps covering portions of the Irwin, Greensburg, Murrysville, Bradock, and McKeesport USGS 7.5-Minute Quadrangles. The area within the watershed consists of 57.5 square miles. A majority of the land within the Brush Creek Watershed is developed with forestland scattered throughout. There is agriculture in the northern portion of the watershed.

[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.*

Brush Creek flows into Turtle Creek at the town of Trafford. The western part of Brush Creek can be accessed by taking State Route 993 North from U.S. Route 30 near Irwin. The eastern part of Brush Creek can be accessed by taking State Route 66 south from U.S. Route 22 in Delmont, and then State Route 993 from Route 66.

Segments addressed in this TMDL

There are no active mining operations in the watershed. All of the discharges in the watershed are from abandoned mines and will be treated as non-point sources. Each segment on the PA 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

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

segments with the same source and cause listing are addressed collectively, and on a watershed basis.

Basic Steps for Determining a TMDL

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

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

Watershed History

Brush Creek is part of the Monongahela River Basin. It flows directly into Turtle Creek in Trafford. Turtle Creek flows to the Monongahela River in Bessemer. The Brush Creek Watershed is located in the Allegheny Plateau Physiographic Province. The watershed consists of rolling hills and very deeply incised valleys. The maximum elevation on a few hilltops reaches 1,300 feet and the minimum elevation is 790 feet at the confluence with Turtle Creek. The watershed is in the Irwin Syncline, which trends northeast and southwest. The flanks of the syncline are very gently dipping.

There are many towns located in the headwaters of numerous tributaries that flow to Brush Creek. Harrison City, Manor, McCullough, Ardara, Westmoreland City, Irwin, and western parts of Jeannette are all in the Brush Creek Watershed. The mouth of Brush Creek is at Trafford. Much of the area has been disturbed by small surface mines, large deep mines, and contains several refuse piles.

Mining begin in the area in the early 1850s. Early mining operations often employed the room and pillar method of mining with shaft or slope entry systems. The first car of coal shipped east of the Allegheny Mountains was mined in the Westmoreland Coal Company’s Shady Grove (later North Side) Colliery in Irwin in 1853. Coal was hauled from the mine to the freight station by horse drawn wagon and loaded into a then “standard” boxcar of nine-ton capacity. It was a high quality, metallurgical-grade coal that helped Pittsburgh meet its growing steel production demands of the late nineteenth and early twentieth centuries (Pullman Swindell 1977).

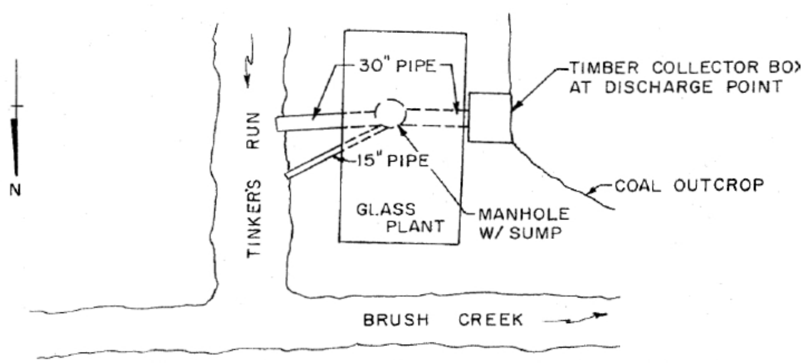
The North Side and Larimer mines near Irwin opened in 1852 and 1855 respectively, followed by the Paintertown mine (1865), Adams (1871), and the Biddle and Guffey Mines (1872). The opening of the South Side mine is unknown but is presumed to coincide with the Larimer, Adams, and Biddle operations. By 1907 the North Side, Larimer, and Paintertown mines had closed while mining continued until the 1940's and early 50's in the South Side, Adams, and Biddle mines (Pullman Swindell 1977). Today many of these sites are abandoned and unreclaimed, causing acid mine drainage runoff to the streams. There are some abandoned mines on the Upper Freeport coal seam, but most of the abandoned mine features on surface mines, refuse piles, and deep mines are on the Pittsburgh coal seam. These deep mines discharge water that has a severe impact on Brush Creek. Two deep mine discharges in particular are very damaging. These discharges are referred to as the Irwin and Coal Run discharges. An explanation of each follows.

Coal Run Discharges

Coal Run enters Brush Creek through a stone culvert that runs beneath Legislative Route 64209 and the Pennsylvania Railroad corridor, see Mine Map: Irwin and Coal Run Area in Attachment A. About one-third of the way inside this culvert from the north end, two twelve inch pipes protrude from the east wall. These pipes become clogged with iron ioxide formations resulting in very erratic flow rates. The average flow rate is estimated to be around 1MGD. In addition to these two piped discharges, upstream of the culvert is evidence of seepage of mine drainage along the stream bank. Brush Creek upstream of Coal Run has low concentrations of metals. The Coal Run discharges are small relative to the Irwin discharges located on Tinkers Run.

Irwin Discharges

The Irwin discharges are comprised of two separate pipe discharges. These two discharges flow into a tributary called Tinkers Run and turn all of Tinkers Run and much of Brush Creek red for a long distance. They are the largest mine discharges in Westmoreland County, with an average flow of over 7,700 gpm. These discharges are located along the outcrop line behind a light industrial building in Irwin, PA. The discharge originates in the South Mine and flow through the old mine drainage way. As the AMD exits the mine it is conveyed beneath the building via a six-foot wide timber box that flows into a 30" pipe. Somewhere within the building this 30" pipe empties into a sump pump from which a 30" pipe and a 15" pipe direct the water to Tinkers Run as shown below (Pullman Swindell 1977).



Below are pictures of the 15" pipe discharge on Tinkers Run and the confluence of Tinkers Run with Brush Creek.

Figure 1. Irwin discharge to Tinkers Run

Figure 2. Confluence of Tinkers Run and Brush Creek

There are no mine sites currently active in the watershed. The most recent surface mining permit is mined and reclaimed. This site was SMP No. 65940102 issued to Thomas C. Mull. It is in Penn Township, Westmoreland County, near the town of Ardara.

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

Allowable loads are determined for each point of interest using Monte Carlo simulation. Monte Carlo simulation is an analytical method meant to imitate real-life systems, especially when other analyses are too mathematically complex or too difficult to reproduce. Monte Carlo simulation calculates multiple scenarios of a model by repeatedly sampling values from the probability distribution of the uncertain variables and using those values to populate a larger data set. Allocations were applied uniformly for the watershed area specified for each allocation point.

For each source and pollutant, it was assumed that the observed data were log-normally distributed. Each pollutant source was evaluated separately using @Risk[3] by performing 5,000 iterations to determine the required percent reduction so that the water quality criteria, as defined in the *Pennsylvania Code. Title 25 Environmental Protection, Department of Environmental Protection, Chapter 93, Water Quality Standards,* will be met instream at least 99 percent of the time. For each iteration, the required percent reduction is:

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

PR = required percent reduction for the current iteration

Cc = criterion in mg/l

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

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

Mean = average observed concentration

Standard Deviation = standard deviation of observed data

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

LTA = Mean * (1 – PR99) where (2)

LTA = allowable LTA source concentration in mg/l

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

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

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

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

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. 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.

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)

$$TMDL = WLA + LA + MOS$$

A TMDL equation consists of a waste load allocation (WLA), load allocation (LA), and a margin of safety (MOS). The waste load allocation is the portion of the load assigned to point sources. The load allocation is the portion of the load assigned to non-point sources. The margin of safety is applied to account for uncertainties in the computational process. The margin of safety may be expressed implicitly (documenting conservative processes in the computations) or explicitly (setting aside a portion of the allowable load). The TMDL allocations in this report are based on available data. Other allocation schemes could also meet the TMDL.

Allocation Summary

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

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

Each permitted discharge in a segment is assigned a waste load allocation and the total waste load allocation for each segment is included in this table. There are currently no permitted discharges in the watershed and therefore all waste load allocations are equal to zero. The difference between the TMDL and the WLA at each point is the load allocation (LA) at the point. The LA at each point includes all loads entering the segment, including those from upstream allocation points. The percent reduction is calculated to show the amount of load that needs to be reduced within a segment in order for water quality standards to be met at the point.

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

Table 3. TMDL Component Summary for the Brush Creek Watershed

Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Reduction %
BRSH12	*Mouth of Tinkers Run*						
	Fe	4,459.2	44.6	0.0	44.6	4,414.6	99
	Mn	129.9	32.5	0.0	32.5	97.4	75
	Al	16.7	9.4	0.0	9.4	7.4	44
	Acidity	128.9	128.9	NA	NA	0.0	0
BRSH11	*Brush Creek downstream of Tinkers Run*						
	Fe	6,983.4	69.8	0.0	69.8	2,499.0	97
	Mn	227.5	68.2	0.0	68.2	61.9	48
	Al	ND	NA	NA	NA	0.0	0
	Acidity	356.8	356.8	NA	NA	0.0	0
BRSH10	*Brush Creek downstream of Unnamed Tributary 37266*						
	Fe	2,736.4	246.3	0.0	246.3	0.0	0
	Mn	134.5	134.5	NA	NA	0.0	0
	Al	ND	NA	NA	NA	0.0	0
	Acidity	0.0	0.0	NA	NA	0.0	0
BRSH09	*Brush Creek downstream of Unnamed Tributary 37264*						
	Fe	3,056.2	152.8	0.0	152.8	194.4	56
	Mn	143.9	143.9	NA	NA	0.0	0
	Al	ND	NA	NA	NA	0.0	0
	Acidity	0.0	0.0	NA	NA	0.0	0
BRSH08	*Mouth of Unnamed Tributary 37263*						
	Fe	4.6	1.0	0.0	1.0	3.6	79
	Mn	1.16	1.04	0.0	1.04	0.12	10
	Al	6.4	1.1	0.0	1.1	5.3	83
	Acidity	0.0	0.0	NA	NA	0.0	0
BRSH06	*Mouth of Unnamed Tributary 37258*						
	Fe	ND	NA	NA	NA	0.0	0
	Mn	ND	NA	NA	NA	0.0	0
	Al	ND	NA	NA	NA	0.0	0
	Acidity	0.0	0.0	NA	NA	0.0	0

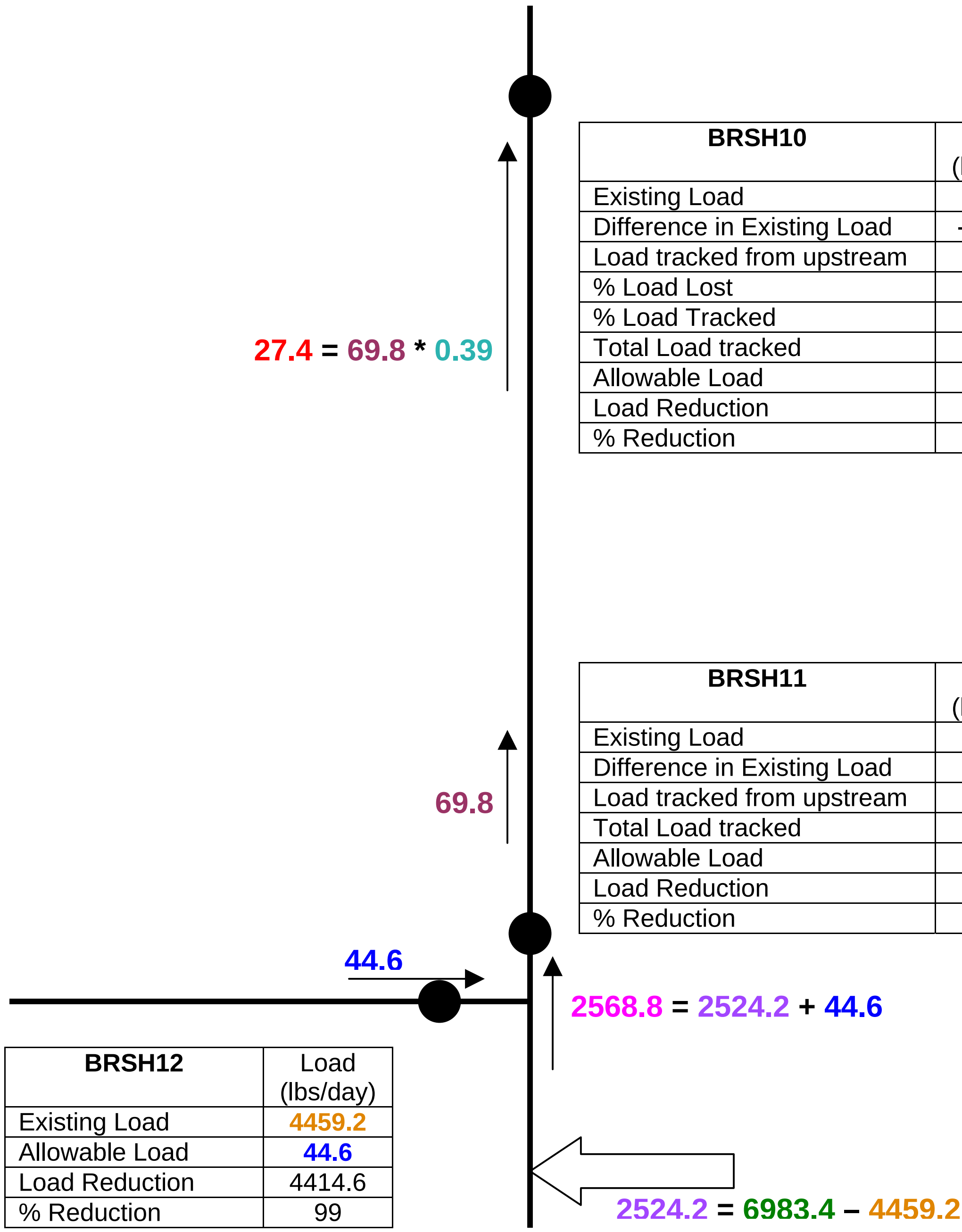
Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Reduction %
BRSH05	*Brush Creek near Ardara*						
	Fe	1,433.3	172.0	0.0	172.0	0.0	0
	Mn	145.2	145.2	NA	NA	0.0	0
	Al	34.4	18.2	0.0	18.2	10.8	37
	Acidity	0.0	0.0	NA	NA	0.0	0
BRSH04	*Mouth of Unnamed Tributary 37253*						
	Fe	2.7	2.7	NA	NA	0.0	0
	Mn	1.7	1.7	NA	NA	0.0	0
	Al	1.8	1.0	0.0	1.0	0.8	43
	Acidity	0.0	0.0	NA	NA	0.0	0
BRSH03	*Brush Creek upstream of Unnamed Tributary 37251*						
	Fe	2,725.2	54.5	0.0	54.5	1,309.4	96
	Mn	175.9	175.9	NA	NA	0.0	0
	Al	188.7	24.5	0.0	24.5	147.3	86
	Acidity	0.0	0.0	NA	NA	0.0	0
BRSH02	*Brush Creek downstream of Unnamed Tributary 37248*						
	Fe	2,523.0	75.7	0.0	75.7	0.0	0
	Mn	156.6	156.6	NA	NA	0.0	0
	Al	315.3	28.4	0.0	28.4	122.7	81
	Acidity	0.0	0.0	NA	NA	0.0	0
BRSH01	*Mouth of Brush Creek*						
	Fe	2,196.8	87.9	0.0	87.9	0.0	0
	Mn	169.7	169.7	NA	NA	0.0	0
	Al	266.0	31.9	0.0	31.9	0.0	0
	Acidity	0.0	0.0	NA	NA	0.0	0

ND, all values below the detection limit.
NA meets WQS. No TMDL necessary.

In the instance that the allowable load is equal to the existing load (e.g. manganese point BRSH10, Table 3), the simulation determined that water quality standards are being met instream 99% of the time and no TMDL is necessary for the parameter at that point. Although no TMDL is necessary, the loading at the point is considered at the next downstream point. In addition, when all measured values are below the method detection limit, denoted by ND (e.g. aluminum point BRSH11, Table 3), no TMDL is necessary. In this case the accounting for upstream loads is not carried through to the next downstream point. Rather, there is a disconnect noted and the allowable load is considered to start over because the water quality standard is satisfied.

At point BRSH03, the calculated iron TMDL is less than the upstream loads. The data set contained one sample for iron that was considerably higher than the other samples, which resulted in an elevated standard deviation (greater variation in the data). This in conjunction with our regulatory standard of protecting the water quality standard at these points 99% of the time results in greater reductions and, comparatively, a smaller allowable load at the point. In this case, it is assumed that with treatment, statistical variability will be decreased and water quality standards will also be met at BRSH03.

Following is an example of how the allocations, presented in Table 3 are calculated. For this example, iron allocations for points BRSH12, BRSH11 and BRSH10 are shown. As demonstrated in the example, all upstream contributing loads are accounted for at each point. Attachment C contains the TMDLs by segment analysis for each allocation point in a detailed discussion. These analyses follow the example. Attachment A contains a map of the sampling point locations for reference.



BRSH10	Load (lbs/day)
Existing Load	2736.4
Difference in Existing Load	-4247.0
Load tracked from upstream	**69.8**
% Load Lost	61
% Load Tracked	**39**
Total Load tracked	**27.4**
Allowable Load	246.3
Load Reduction	0.0
% Reduction	0

BRSH11	Load (lbs/day)
Existing Load	**6983.4**
Difference in Existing Load	**2524.2**
Load tracked from upstream	**44.6**
Total Load tracked	**2568.8**
Allowable Load	**69.8**
Load Reduction	2499.0
% Reduction	97

BRSH12	Load (lbs/day)
Existing Load	**4459.2**
Allowable Load	**44.6**
Load Reduction	4414.6
% Reduction	99

Recommendations

Sealing the deep mine discharges cannot be recommended. The volume of flow discharging at the Irwin sites would not be contained for any length of time if the current locations were sealed. Their present location is in the bank of Tinkers Run, where they flow directly into the stream. If sealed, the water would be re-routed, discharging at an unknown location. The potential for property damage would be tremendous.

Due to the large extent of the mine workings and the depth of the mines, daylighting these abandoned mine sites would not be practical. The Westmoreland County Industrial Development organization obtained a Growing Greener Grant that will develop a plan for relocating and treating the discharges. The grant will assess the feasibility of recovering iron as a resource and development of an economic zone for using the treated water.

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 1960s, 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.

Public Participation

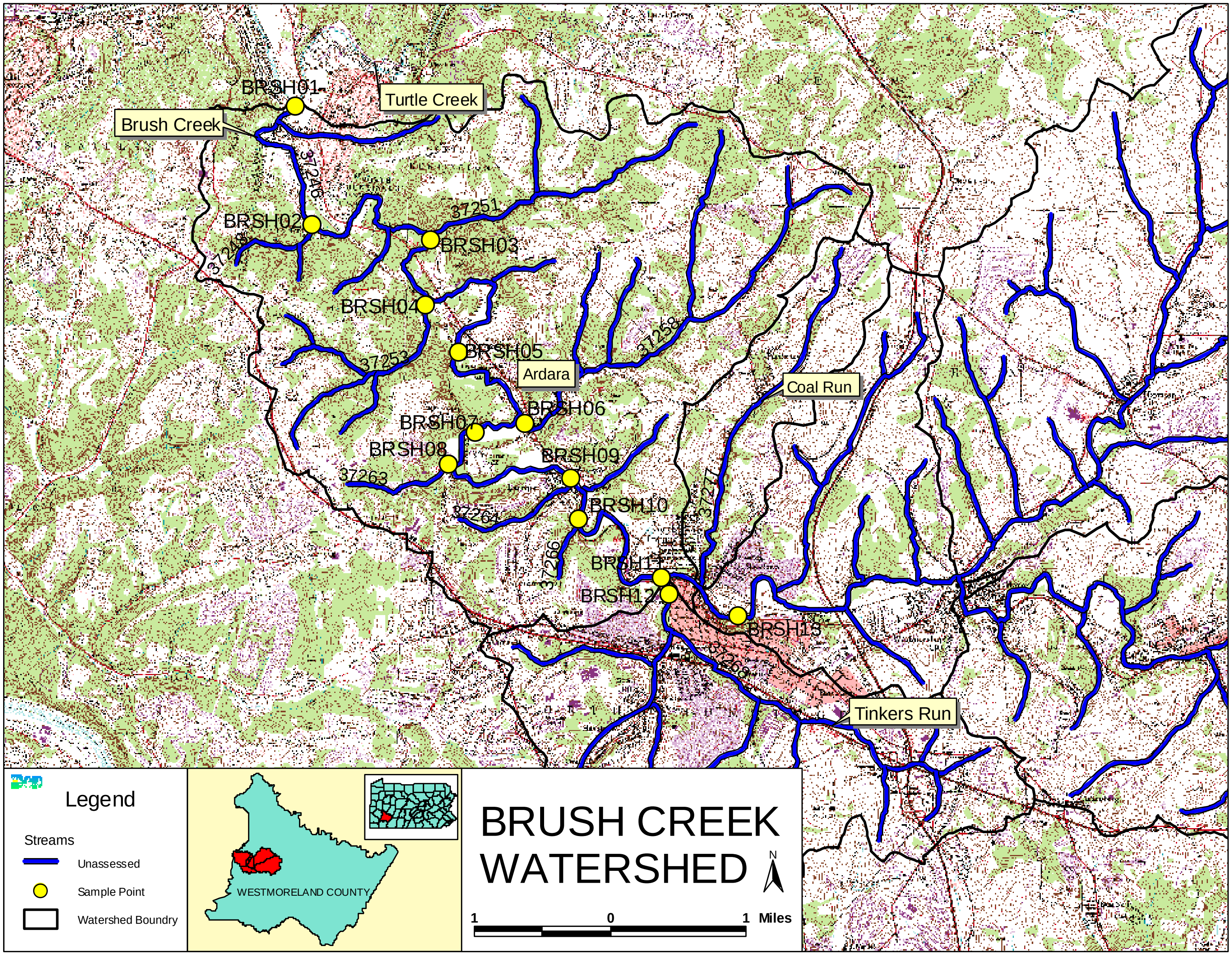
Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* on March 13, 2004 and the *Tribune Review* on March 10, 2004 to foster public comment on the allowable loads calculated. The public comment period on this TMDL was open from March 13 to May 12, 2004. A public meeting was held on March 25, 2004 at the North Huntingdon Township Municipal Building in North Huntingdon to discuss the proposed TMDL.

Reference

Pullman Swindell 1977. Irwin Syncline Basin Mine Drainage Pollution Abatement Project: Operation Scarlift Project SL103-5. Pullman Swindell. Pittsburgh, PA.

Attachment A

Brush Creek Watershed Maps



BRSH01
Turtle Creek
Brush Creek
37246
BRSH02
37249
37251
BRSH03
BRSH04
37258
37253
BRSH05
Ardara
Coal Run
BRSH06
BRSH07
BRSH08
BRSH09
37263
37264
BRSH10
37277
37266
BRSH11
BRSH12
BRSH13
37269
Tinkers Run
Legend
Streams
Unassessed
Sample Point
Watershed Boundry
WESTMORELAND COUNTY
BRUSH CREEK WATERSHED
N
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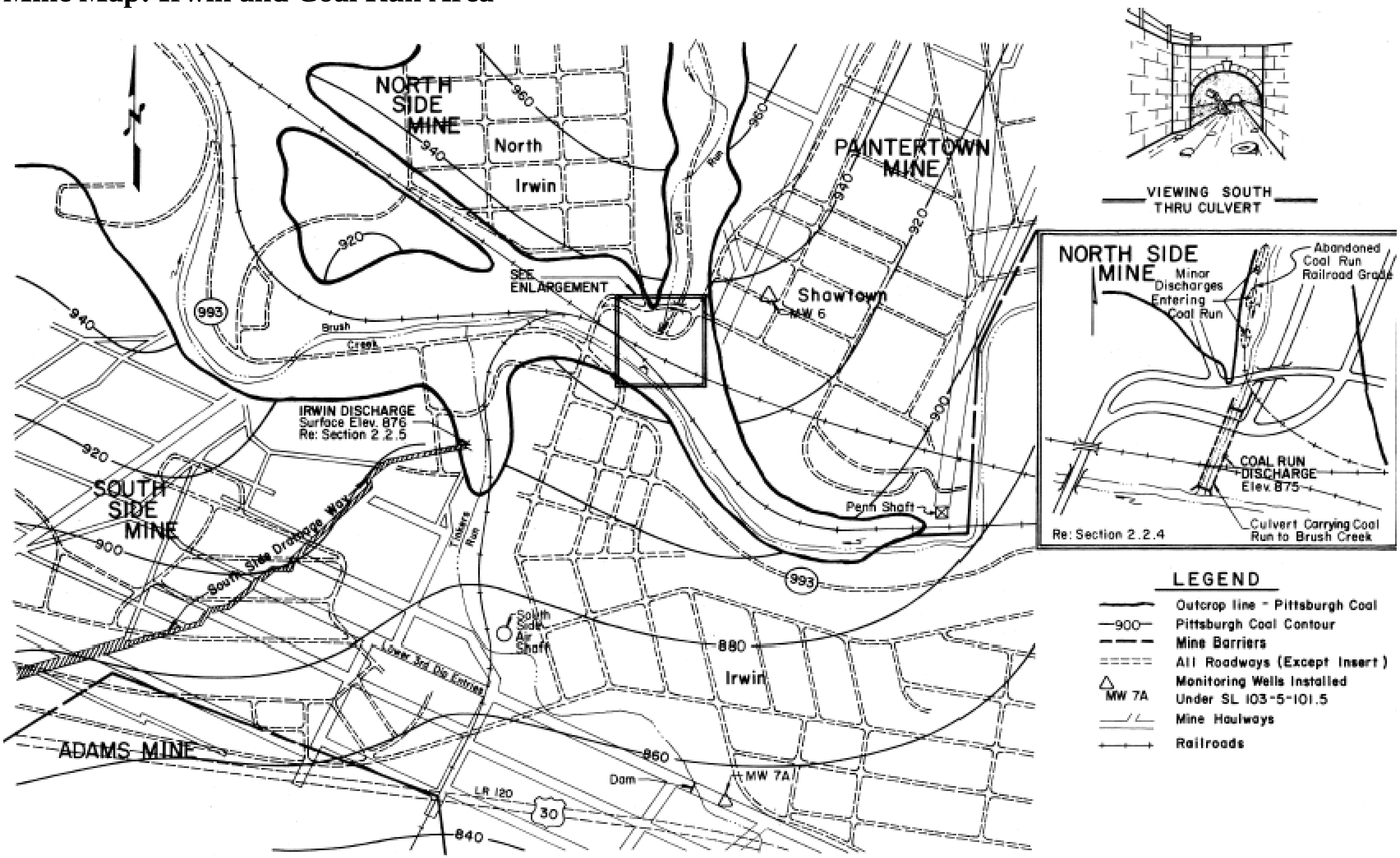
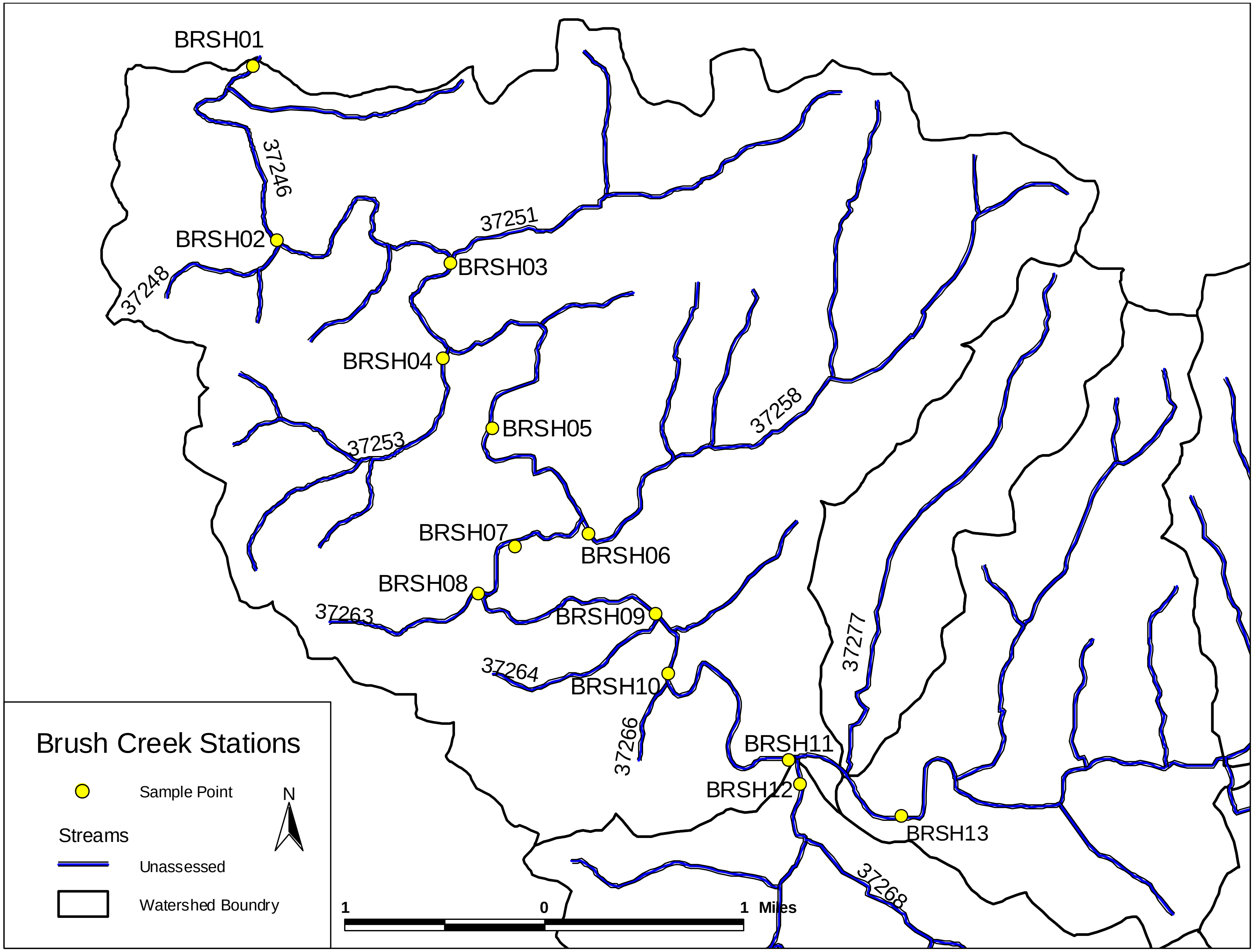
Mine Map: Irwin and Coal Run Area



Operation Scarlift Project No. SL103-5


BRSH01
BRSH02
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BRSH09
BRSH10
BRSH11
BRSH12
BRSH13
37246
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37258
37263
37264
37266
37268
37277
Brush Creek Stations
Sample Point
N
Streams
Unassessed
Watershed Boundry
1
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1 Miles

Attachment B

Surface Mining Control and Reclamation Act

Surface Mining Control and Reclamation Act

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

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

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

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

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

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

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

Related Definitions

Pre-Act (Pre-Law) - Mines that ceased operating by the effective date of SMCRA and are not subject to the requirements of SMCRA.

Bond – A instrument by which a permittee assures faithful performance of the requirements of the acts, this chapter, Chapters 87-90 and the requirements of the permit and reclamation plan.

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

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

Attachment C
TMDLs By Segment

Brush Creek

The TMDL for Brush Creek consists of load allocations of four tributaries and seven sampling sites along the stream. Only four samples were taken at BRSH07 rather than the six samples at all other stations. The incomplete data set was not used to develop a TMDL at the point. The limited data causes a higher standard deviation, which results in lower allowable loads. Because the data is comparable to data at both the closest up and downstream points, BRSH09 and BRSH05 respectively, it is acceptable to not calculate a TMDL at point BRSH07. Data for BRSH07 is included in Appendix E.

Brush Creek is listed as impaired on the PA Section 303(d) list by high metals from AMD as being the cause of the degradation to the stream. Brush Creek is contained in Part C of the PA Section 303(d) list. Part C contains segments without segment ids and GIS locations. After field investigation it was determined that Brush Creek is impaired by metals from Coal Run to the mouth. Sample data collected on 04/24/2003 from Brush Creek upstream of Coal Run, Point BRSH13 (Attachment A), showed that the stream is meeting water quality standards. The major sources of AMD to Brush Creek come from the Irwin discharges on Tinkers Run and the Coal Run discharge, which is evidenced by heavy metals staining in Brush Creek below these streams.

For all sample points on Brush Creek, pH fell within the water quality criterion range of 6.0 and 9.0, and all points were net alkaline. Because the water quality standards are being met, TMDLs for pH are not necessary.

An allowable long-term average in-stream concentration was determined at each sample point for aluminum, iron, and manganese. 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.

TMDL Calculations - Sample Point BRSH12, Mouth of Tinkers Run

The TMDL for sample point BRSH12 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point BRSH12. The average flow (14.49 MGD), measured at point BRSH12, is used for these computations.

Table C1. TMDL Calculations at Point BRSH12				
Flow = 14.49 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Fe	36.89	4,459.2	0.37	44.6
Mn	1.07	129.9	0.27	32.5
Al	0.14	16.7	0.08	9.4
Acidity	1.07	128.9	1.07	128.9
Alkalinity	141.53	17,109.5		

Table C2. Calculation of Load Reduction Necessary at Point BRSH12				
	Fe (lbs/day)	Mn (lbs/day)	Al (lbs/day)	Acidity (lbs/day)
Existing Load	4,459.2	129.9	16.7	128.9
Allowable Load	44.6	32.5	9.4	128.9
Load Reduction	4,414.6	97.4	7.4	0.0
% Reduction Segment	99	75	44	0

TMDL Calculations - Sample Point BRSH11, Brush Creek downstream of Tinkers Run

The TMDL for sample point BRSH11 consists of a load allocation to all of the area between BRSH11 and BRSH12, shown in Attachment A. The load allocation for this stream segment was computed using water-quality sample data collected at point BRSH11. The average flow (23.77 MGD), measured at the sampling point BRSH11, is used for these computations

All values for aluminum are below the method detection limit, denoted by ND. Because the WQS is met, a TMDL for aluminum is not necessary.

Table C3. TMDL Calculations at Point BRSH11				
Flow = 23.77 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Fe	35.23	6,983.4	0.35	69.8
Mn	1.15	227.5	0.34	68.2
Al	ND	ND	NA	NA
Acidity	1.80	356.8	1.80	356.8
Alkalinity	124.30	24,638.1		

The calculated load reductions for all the loads that enter point BRSH11 must be accounted for in the calculated reductions at the sample point shown is Table C4. Because aluminum is not detected at BRSH11 under current conditions, it is not necessary to account for upstream loads for aluminum. A comparison of measured iron and manganese loads between points BRSH11 and BRSH12 shows that there is additional loading entering the segment for both parameters.

The total segment load is the sum of the upstream loads and the load directly entering the segment.

Table C4. Calculation of Load Reduction Necessary at Point BRSH11				
	Fe (lbs/day)	Mn (lbs/day)	Al (lbs/day)	Acidity (lbs/day)
Existing Load at BRSH11	6,983.4	227.5	ND	356.8
Difference in Existing Load between BRSH12 & BRSH11	2,524.2	97.6	-	227.8
Upstream Loads that affect BRSH11	44.6	32.5	-	128.9
Total Load tracked through segment	2,568.8	130.1	-	356.7
Allowable Load at BRSH11	69.8	68.2	NA	356.8
Total removal required at BRSH11	2,499.0	61.9	0	0.0
Total % Reduction BRSH11	97	48	0	0

TMDL Calculations - Sample Point BRSH10, Brush Creek downstream of Unnamed Tributary 37266

The TMDL for sample point BRSH10 consists of a load allocation to all of the area between BRSH10 and BRSH11, shown in Attachment A. The load allocation for this stream segment was computed using water-quality sample data collected at point BRSH10. The average flow (24.83 MGD), measured at the sampling point BRSH10, is used for these computations

All values for aluminum are below the method detection limit, denoted by ND. Water quality analysis determined that the existing and allowable manganese loads are equal. Because WQS are met, TMDLs for aluminum and manganese are not necessary.

Table C5. TMDL Calculations at Point BRSH10				
Flow = 24.83 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Fe	13.22	2,736.4	1.19	246.3
Mn	0.65	134.5	0.65	134.5
Al	ND	ND	NA	NA
Acidity	0.00	0.0	0.00	0.0
Alkalinity	104.90	21,718.7		

The calculated load reductions for all the loads that enter point BRSH10 must be accounted for in the calculated reductions at the sample point shown is Table C6. Because aluminum is not detected at BRSH10 under current conditions, it is not necessary to account for upstream loads for aluminum. A comparison of measured iron and manganese loads between points BRSH10 and BRSH11 shows that there is a loss of loading within the segment for both parameters. For loss of load, the percent of load lost within the segment is calculated and applied to the upstream loads to determine the amount of the upstream load that is tracked through the segment.

Table C6. Calculation of Load Reduction Necessary at Point BRSH10				
	Fe (lbs/day)	Mn (lbs/day)	Al (lbs/day)	Acidity (lbs/day)
Existing Load at BRSH10	2736.4	134.5	ND	0.0
Difference in Existing Load between BRSH10 & BRSH11	-4247.0	-93.0	-	-356.8
Upstream Loads that affect BRSH10	69.8	68.2	-	356.8
Percent Load Lost	61	41	-	100
Percent Load Tracked	39	59	-	0
Total Load tracked through segment	27.4	40.3	-	0.0
Allowable Load at BRSH10	246.3	134.5	NA	0.0
Total removal required at BRSH10	0.0	0.0	0.0	0.0
Total % Reduction BRSH10	0	0	0	0

TMDL Calculations - Sample Point BRSH09, Brush Creek downstream of Unnamed Tributary 37264

The TMDL for sample point BRSH09 consists of a load allocation to all of the area between sample point BRSH09 and BRSH10, shown in Attachment A. The load allocation for this stream segment was computed using water-quality sample data collected at point BRSH09. The average flow (26.55 MGD), measured at the sampling point BRSH09, is used for these computations

All values for aluminum are below the method detection limit, denoted by ND. Water quality analysis determined that the existing and allowable manganese loads are equal. Because WQS are met, TMDLs for aluminum and manganese are not necessary.

Table C7. TMDL Calculations at Point BRSH09				
Flow = 26.55 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Fe	13.80	3,056.2	0.69	152.8
Mn	0.65	143.9	0.65	143.9
Al	ND	ND	NA	NA
Acidity	0.00	0.0	0.00	0.0
Alkalinity	104.17	23,069.3		

The calculated load reductions for all the loads that enter point BRSH09 must be accounted for in the calculated reductions at the sample point shown is Table C8. Because aluminum is not detected at BRSH09 under current conditions, it is not necessary to account for upstream loads for aluminum. A comparison of measured iron and manganese loads between points BRSH09 and BRSH10 shows that there is additional load entering the segment for iron and manganese. The total segment load is the sum of the upstream loads and the load directly entering the segment.

Table C8. Calculation of Load Reduction Necessary at Point BRSH09				
	Fe (lbs/day)	Mn (lbs/day)	Al (lbs/day)	Acidity (lbs/day)
Existing Load at BRSH09	3,056.2	143.9	ND	0.0
Difference in Existing Load between BRSH09 & BRSH10	319.8	9.4	-	0.0
Load tracked from upstream	27.4	40.3	-	0.0
Total Load tracked through segment	347.2	49.7	-	0.0
Allowable Load at BRSH09	152.8	143.9	NA	0.0
Total removal required at BRSH09	194.4	0.0	0.0	0.0
Total % Reduction BRSH09	56	0	0	0

TMDL Calculations - Sample Point BRSH08, mouth of Unnamed Tributary 37263

The TMDL for sample point BRSH08 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point BRSH08. The average flow (0.30 MGD), measured at point BRSH08, is used for these computations.

Table C9. TMDL Calculations at Point BRSH08				
Flow = 0.30 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Fe	1.84	4.6	0.39	1.0
Mn	0.47	1.2	0.42	1.0
Al	2.59	6.4	0.44	1.1
Acidity	0.00	0.0	0.00	0.0
Alkalinity	62.65	155.7		

Table C10. Calculation of Load Reduction Necessary at Point BRSH08				
	Fe (lbs/day)	Mn (lbs/day)	Al (lbs/day)	Acidity (lbs/day)
Existing Load	4.6	1.16	6.4	0.0
Allowable Load	1.0	1.04	1.1	0.0
Load Reduction	3.6	0.12	5.3	0.0
% Reduction Segment	79	10	83	0

TMDL Calculations - Sample Point BRSH06, mouth of Unnamed Tributary 37258

All metals concentrations fell below the detection limits; therefore, no TMDLs are necessary for metals at BRSH06.

TMDL Calculations - Sample Point BRSH05, Brush Creek downstream of Unnamed Tributary 37258

The TMDL for sample point BRSH05 consists of a load allocation to all of the area between sample points BRSH09, BRSH08, BRSH06, and BRSH05, shown in Attachment A. The load allocation for this stream segment was computed using water-quality sample data collected at point BRSH05. The average flow (27.95 MGD), measured at the sampling point BRSH05, is used for these computations.

Water quality analysis determined that the existing and allowable manganese loads are equal. Because the WQS is met, a TMDL for manganese is not necessary. Although a TMDL is not necessary, the measured loading is considered at the next downstream point.

Table C11. TMDL Calculations at Point BRSH05				
Flow = 27.95 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Fe	6.15	1,433.3	0.74	172.0
Mn	0.62	145.2	0.62	145.2
Al	0.15	34.4	0.08	18.2
Acidity	0.00	0.0	0.00	0.0
Alkalinity	97.97	22,838.4		

The calculated load reductions for all the loads that enter point BRSH05 must be accounted for in the calculated reductions at the sample point shown is Table C12. A comparison of measured iron, aluminum, and manganese loads between points BRSH05, BRSH06, BRSH08 and BRSH09 shows that there is additional manganese and aluminum load entering the segment and a loss of iron load. The total segment manganese and aluminum load is the sum of the upstream loads and the load directly entering the segment. For loss of iron load, the percent of load lost within the segment is calculated and applied to the upstream loads to determine the amount of the upstream load that is tracked through the segment.

Table C12. Calculation of Load Reduction Necessary at Point BRSH05				
	Fe (lbs/day)	Mn (lbs/day)	Al (lbs/day)	Acidity (lbs/day)
Existing Load at BRSH05	1,433.3	145.2	34.4	0.0
Difference in Existing Load between BRSH05, BRSH06, BRSH08 & BRSH09	-1,627.5	0.2	28.0	0.0
Upstream Loads that affect BRSH05	153.8	50.8	1.1	0.0
Percent Load Lost	53	-	-	-
Percent Load Tracked	47	-	-	-
Total Load tracked through segment	72.0	51.0	29.1	0.0
Allowable Load at BRSH05	172.0	145.2	18.2	0.0
Total removal required at BRSH05	0.0	0.0	10.8	0.0
Total % Reduction BRSH05	0	0	37	0

TMDL Calculations - Sample Point BRSH04, mouth of Unnamed Tributary 37253

The TMDL for sample point BRSH04 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point BRSH04. The average flow (1.61 MGD), measured at point BRSH04, is used for these computations.

Water quality analysis determined that the existing and allowable iron and manganese loads are equal. Because WQS are met, TMDLs for iron and manganese are not necessary. Although TMDLs are not necessary, the measured loading is considered at the next downstream point.

Table C13. TMDL Calculations at Point BRSH04

Flow = 1.61 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Fe	0.20	2.7	0.20	2.7
Mn	0.12	1.7	0.12	1.7
Al	0.14	1.8	0.08	1.0
Acidity	0.00	0.0	0.00	0.0
Alkalinity	118.37	1,585.2		

Table C14. Calculation of Load Reduction Necessary at Point BRSH04

	Fe (lbs/day)	Mn (lbs/day)	Al (lbs/day)	Acidity (lbs/day)
Existing Load	2.7	1.7	1.82	0.0
Allowable Load	2.7	1.7	1.04	0.0
Load Reduction	0.0	0.0	0.78	0.0
% Reduction Segment	0	0	43	0

TMDL Calculations - Sample Point BRSH03, Brush Creek upstream of Unnamed Tributary 37251

The TMDL for sample point BRSH03 consists of a load allocation to all of the area between sample points BRSH03, BRSH04, and BRSH05, shown in Attachment A. The load allocation for this stream segment was computed using water-quality sample data collected at point BRSH03. The average flow (35.14 MGD), measured at the sampling point BRSH03, is used for these computations.

Water quality analysis determined that the existing and allowable manganese loads are equal. Because the WQS is met, a TMDL for manganese is not necessary. Although a TMDL is not necessary, the measured loading is considered at the next downstream point.

For iron, one sample concentration was considerably higher than the other sample concentrations, which resulted in a high standard deviation. Simulation results are directly affected by the variation of a data set. In this case, the high standard deviation resulted in an allowable load smaller than the upstream loads. In this case, it is assumed that with treatment, statistical variability will be decreased and water quality standards will also be met at BRSH03.

Table C15. TMDL Calculations at Point BRSH03

Flow = 35.14 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Fe	9.30	2,725.2	0.19	54.5
Mn	0.60	175.9	0.60	175.9
Al	0.64	188.7	0.08	24.5
Acidity	0.00	0.0	0.00	0.0
Alkalinity	97.00	28,424.3		

The calculated load reductions for all the loads that enter point BRSH03 must be accounted for in the calculated reductions at the sample point shown is Table C16. A comparison of measured iron, aluminum, and manganese loads between points BRSH03, BRSH04, and BRSH05 shows that there is additional load entering the segment for all parameters. The total segment load is the sum of the upstream loads and the load directly entering the segment.

Table C16. Calculation of Load Reduction Necessary at Point BRSH03

	Fe (lbs/day)	Mn (lbs/day)	Al (lbs/day)	Acidity (lbs/day)
Existing Load at BRSH03	2,725.2	175.9	188.7	0.0
Difference in Existing Load between BRSH03, BRSH04 & BRSH05	1,289.2	29.0	152.5	0.0
Upstream Loads that affect BRSH03	74.7	52.6	19.3	0.0
Total Load tracked through segment	1,363.9	81.6	171.8	0.0
Allowable Load at BRSH03	54.5	175.9	24.5	0.0
Total removal required at BRSH03	1,309.4	0.0	147.3	0.0
Total % Reduction BRSH03	96	0	86	0

TMDL Calculations - Sample Point BRSH02, Brush Creek downstream of Unnamed Tributary 37248

The TMDL for sample point BRSH02 consists of a load allocation to all of the area between sample points BRSH02 and BRSH03 shown in Attachment A. The load allocation for this stream segment was computed using water-quality sample data collected at point BRSH02. The average flow (37.97 MGD), measured at the sampling point BRSH02, is used for these computations.

Water quality analysis determined that the existing and allowable manganese loads are equal. Because the WQS is met, a TMDL for manganese is not necessary. Although a TMDL is not necessary, the measured loading is considered at the next downstream point.

Table C17. TMDL Calculations at Point BRSH02				
Flow = 37.97 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Fe	7.97	2,523.0	0.24	75.7
Mn	0.49	156.6	0.49	156.6
Al	1.00	315.3	0.09	28.4
Acidity	0.00	0.0	0.00	0.0
Alkalinity	97.17	30,772.4		

The calculated load reductions for all the loads that enter point BRSH02 must be accounted for in the calculated reductions at the sample point shown is Table C18. A comparison of measured iron, aluminum, and manganese loads between points BRSH02 and BRSH03 shows that there is additional load entering the segment for aluminum and a loss for iron and manganese. The total segment aluminum load is the sum of the upstream loads and the load directly entering the segment. For loss of iron and manganese load, the percent of load lost within the segment is calculated and applied to the upstream loads to determine the amount of the upstream load that is tracked through the segment.

Table C18. Calculation of Load Reduction Necessary at Point BRSH02				
	Fe (lbs/day)	Mn (lbs/day)	Al (lbs/day)	Acidity (lbs/day)
Existing Load at BRSH02	2,523.0	156.6	315.3	0.0
Difference in Existing Load between BRSH02 & BRSH03	-202.2	-19.3	126.6	0.0
Upstream Loads that affect BRSH02	54.5	81.6	24.5	0.0
Percent Load Lost	7	11	-	-
Percent Load Tracked	93	89	-	-
Total Load tracked through segment	50.5	72.7	151.1	0.0
Allowable Load at BRSH02	75.7	156.6	28.4	0.0
Total removal required at BRSH02	0.0	0.0	122.7	0.0
Total % Reduction BRSH02	0	0	81	0

TMDL Calculations - Sample Point BRSH01, mouth of Brush Creek

The TMDL for sample point BRSH01 consists of a load allocation to all of the area between sample points BRSH02 and BRSH01 shown in Attachment A. The load allocation for this stream segment was computed using water-quality sample data collected at point BRSH01. The average flow (46.37 MGD), measured at the sampling point BRSH01, is used for these computations.

Water quality analysis determined that the existing and allowable manganese loads are equal. Because the WQS is met, a TMDL for manganese is not necessary.

Table C19. TMDL Calculations at Point BRSH01				
Flow = 46.37 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Fe	5.68	2,196.8	0.23	87.9
Mn	0.44	169.7	0.44	169.7
Al	0.69	266.0	0.08	31.9
Acidity	0.00	0.0	0.00	0.0
Alkalinity	94.37	36,497.6		

The calculated load reductions for all the loads that enter point BRSH01 must be accounted for in the calculated reductions at the sample point shown is Table C20. A comparison of measured iron, aluminum, and manganese loads between points BRSH01 and BRSH02 shows that there is additional load entering the segment for manganese and a loss for iron and aluminum. The total segment manganese load is the sum of the upstream loads and the load directly entering the segment. For loss of iron and aluminum load, the percent of load lost within the segment is calculated and applied to the upstream loads to determine the amount of the upstream load that is tracked through the segment.

Table C20. Calculation of Load Reduction Necessary at Point BRSH01				
	Fe (lbs/day)	Mn (lbs/day)	Al (lbs/day)	Acidity (lbs/day)
Existing Load at BRSH01	2,196.8	169.7	266.0	0.0
Difference in Existing Load between BRSH01 & BRSH02	-326.2	13.1	-49.3	0.0
Upstream Loads that affect BRSH01	50.5	72.7	28.4	0.0
Percent Load Lost	13	-	16	-
Percent Load Tracked	87	-	84	-
Total Load tracked through segment	43.9	85.8	23.9	0.0
Allowable Load at BRSH01	87.9	169.7	31.9	0.0
Total removal required at BRSH01	0.0	0.0	0.0	0.0
Total % Reduction BRSH01	0	0	0	0

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, and 2002 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

Monitoring Point	Date	Flow	pH	Alkalinity	Acidity	Fe	Mn	Al
		gpm		mg/L	mg/L	mg/L	mg/L	mg/L
BRSH01	07/01/02	18050	7.4	106	0	1.4	0.296	0
Latitude:	07/30/02	5125	7.5	76	0	1.66	0.303	0
40 23' 04"	04/11/03	83500	7.2	88.4	0	20.9	0.568	3.6
Longitude:	05/20/03	30604	7.6	97	0	1.92	0.391	0
79 45' 56"	07/23/03	35448	7.3	100.4	0	6.17	0.561	0.526
	08/12/03	20500	7.7	98.4	0	2.03	0.514	0
	Average	32204.50000	7.45000	94.36667	0.00000	5.68000	0.43883	0.68767
	St Dev	27257.86024	0.18708	10.65714	0.00000	7.66586	0.12522	1.44218
BRSH02	07/01/02	18000	7.4	108	0	1.64	0.35	0
Latitude:	07/30/02	4700	7.4	78	0	2.55	0.432	0
40 22' 16"	04/11/03	73231	7.2	94.4	0	30.2	0.698	5.21
Longitude:	05/20/03	23871	7.5	97.8	0	1.99	0.434	0
79 45' 47"	07/23/03	22710	7.3	104.8	0	9.25	0.649	0.763
	08/12/03	15710	7.5	100	0	2.17	0.404	0
	Average	26370.33333	7.38333	97.16667	0.00000	7.96667	0.49450	0.99550
	St Dev	23953.60232	0.11690	10.57425	0.00000	11.26638	0.14277	2.08711
BRSH03	7/1/2002	16000	7.3	112	0			
Latitude:	7/30/2002	4650	7.2	80	0	3.25	0.623	0
40 22' 13"	4/11/2003	65733	7.2	94.6	0	30.4	0.741	3.22
Longitude:	5/20/2003	22945	7.3	97.6	0	4.55	0.533	0
79 44" 48"	7/24/2003	18753	7.2	97.8	0	5.02	0.567	0
	8/12/2003	18319	7.3	100	0	3.28	0.537	0
	Average	24400.00000	7.25000	97.00000	0.00000	9.30000	0.60020	0.64400
	St Dev	21166.12191	0.05477	10.29330	0.00000	11.82089	0.08654	1.44003
BRSH04	7/1/2002	30	7.6	122	0	0	0.075	0
Latitude:	7/30/2002	75	7.8	140	0	0	0.25	0
40 21' 49"	4/11/2003	5829	7.6	66.4	0	1.2	0.123	0.815
Longitude:	5/20/2003	589	7.9	105.2	0	0	0.053	0
79 44' 49"	7/23/2003	115	7.8	133.6	0	0	0.139	0
	8/12/2003	53	8	143	0	0	0.101	0
	Average	1115.16667	7.78333	118.36667	0.00000	0.20000	0.12350	0.13583
	St Dev	2318.84199	0.16021	28.96188	0.00000	0.48990	0.06939	0.33272

Monitoring Point	Date	Flow	pH	Alkalinity	Acidity	Fe	Mn	Al
		gpm		mg/L	mg/L	mg/L	mg/L	mg/L
BRSH05	7/1/2002	20000	7	104	0	4.91	0.574	0
Latitude:	7/30/2002	4600	7.3	82	0	4.41	0.847	0
40 21' 08"	4/24/2003	26568	6.9	105.2	0	9.14	0.593	0
Longitude:	5/20/2003	25839	7.1	96.8	0	7.47	0.569	0.886
79 44' 02"	7/24/2003	21109	7.1	100.4	0	6.36	0.57	0
	8/12/2003	18353	7.2	99.4	0	4.6	0.584	0
	Average	19411.50000	7.10000	97.96667	0.00000	6.14833	0.62283	0.14767
	St Dev	7953.07540	0.14142	8.40230	0.00000	1.88118	0.11020	0.36171
BRSH06	7/1/2002	50	7.9	146	0	<0.3	<0.05	<0.5
Latitude:	7/30/2002	80	8.2	164	0	<0.3	<0.05	<0.5
40 21' 04"	5/20/2003	572	8	120.8	0	<0.3	<0.05	<0.5
Longitude:	7/24/2003	258	8.1	147.4	0	<0.3	<0.05	<0.5
79 43' 58"	8/12/2003	133	8	162.2	0	<0.3	<0.05	<0.5
	Average	218.60000	8.04000	148.08000	0.00000	NA	NA	NA
	St Dev	212.95962	0.11402	17.33355	0.00000	NA	NA	NA
BRSH07	4/24/2003	29945	6.8	103.8	0	10.4	0.635	0.509
Latitude:	5/20/2003	21076	7	101.2	0	<0.3	<0.05	<0.5
40 20' 46"	7/24/2003	18671	6.9	101	0	8.53	0.623	<0.5
Longitude:	8/12/2003	18353	7	99.6	0	7.05	0.583	<0.5
79 44' 34"	Average	22011.25000	6.92500	101.40000	0.00000	8.66000	0.61367	0.50900
	St Dev	5427.06627	0.09574	1.75119	0.00000	1.67878	0.02723	NA
BRSH08	4/24/2003	212	6.8	57.6	0	0.682	0.3	2.1
Latitude:	5/20/2003	319	6.8	52.2	0	1.02	0.399	2.54
40 20' 78"	7/23/2003	229	7.1	58.2	0	2.07	0.407	2.37
Longitude:	8/12/2003	68	7.2	82.6	0	3.6	0.755	3.36
79 44' 36"	Average	207.00000	6.97500	62.65000	0.00000	1.84300	0.46525	2.59250
	St Dev	103.88134	0.20616	13.57092	0.00000	1.31197	0.19920	0.54279
BRSH09	7/1/2002	16000	6.7	110	0	12	0.593	ND
Latitude:	7/30/2002	4475	6.9	88	0	23.1	0.868	ND
40 20' 42"	4/24/2003	26350	6.7	106.4	0	12.8	0.615	ND
Longitude:	5/20/2003	21149	6.8	111.6	0	12.6	0.653	ND
79 43' 34"	7/24/2003	18819	6.8	105.6	0	11.7	0.608	ND
	8/12/2003	23851	6.8	103.4	0	10.6	0.561	ND
	Average	18440.66667	6.78333	104.16667	0.00000	13.80000	0.64967	ND
	St Dev	7749.89246	0.07528	8.46491	0.00000	4.62212	0.11108	NA

Monitoring Point	Date	Flow	pH	Alkalinity	Acidity	Fe	Mn	Al
		gpm		mg/L	mg/L	mg/L	mg/L	mg/L
BRSH10	7/1/2002	16000	6.7	110	0	12.1	0.605	ND
Latitude:	7/30/2002	4400	6.8	88	0	15.4	0.826	ND
40 20' 28"	4/24/2003	22781	6.8	106.2	0	13.6	0.619	ND
Longitude:	5/27/2003	21007	6.7	112.2	0	13.3	0.656	ND
79 43' 30"	7/24/2003	18109	6.8	107	0	13.2	0.624	ND
	8/12/2003	21141	6.8	106	0	11.7	0.567	ND
	Average	17239.66667	6.76667	104.90000	0.00000	13.21667	0.64950	ND
	St Dev	6741.94529	0.05164	8.62809	0.00000	1.30141	0.09117	NA
BRSH11	7/1/2002	16000	6.3	132	3	44.3	1.4	ND
Latitude:	7/30/2002	4300	6.4	118	7.8	56.8	1.82	ND
40 20' 06	4/24/2003	20766	6.4	125	0	46.8	1.5	ND
Longitude:	5/27/2003	20797	6.4	134.2	0	44.7	1.5	ND
79 42' 48"	7/24/2003	18862	6.7	115.6	0	10.5	0.377	ND
	8/12/2003	18303	6.9	121	0	8.29	0.288	ND
	Average	16504.66667	6.51667	124.30000	1.80000	35.23167	1.14750	ND
	St Dev	6238.31207	0.23166	7.53737	3.17490	20.53491	0.64760	NA
BRSH12	7/1/2002	4200	6.1	114	0	58.6	1.38	0
Latitude:	7/30/2002	2250	6.4	124	6.4	61.4	1.81	0
40 20' 00"	4/11/2003	37446	8	138.4	0	1.44	0.121	0.83
Longitude:	5/27/2003	9759	6.2	145	0	48.2	1.51	0
79 42' 44"	7/24/2003	5233	6.2	139	0	50.7	1.57	0
	8/12/2003	1507	8.2	188.8	0	0.984	0.056	0
	Average	10065.83333	6.85000	141.53333	1.06667	36.88733	1.07450	0.13833
	St Dev	13724.96143	0.97519	25.79881	2.61279	28.05936	0.77666	0.33885
BRSH13	4/24/2003	13203	8.3	133	0	<0.3	0.065	<0.5

Attachment F
Comment and Response

Comments/Responses on the Brush Creek Watershed TMDL

Kurt J. Weist, Senior Attorney, Penn Future, submitted the following comments on May 12, 2004.

Comment: Pipes are point sources, and discharges from pipes are point source discharges.

The Brush Creek Watershed TMDL is being prepared to satisfy requirements under Section 303(d) of the federal Clean Water Act, 33 U.S.C § 1313(d). The Clean Water Act makes it clear that a pipe constitutes a "point source' as that term is used in the Act. Section 502(14) of Act defines "point source" as "any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well discrete fissure, … from which pollutants are or may be discharged." 33 U.S.C. § 1362(14)(emphasis added). The "Coal Run discharges" flow from two pipes (point sources) through a culvert (also a point source) into Coal Run. The "Irwin discharges" flow from two pipes (point sources) into Tinkers Run. Thus, the Coal Run and Irwin discharges are <u>point source</u> discharges within the meaning of the Clean Water Act.

Like all Pennsylvania mine drainage TMDLs, however, the draft Brush Creek TMDL attempts to redefine the term "point source" as a source of contaminant discharge for which there is a current NPDES permit, or for which there otherwise is a responsible party. Nothing in Section 303(d) of the Clean Water Act, however, suggest that the term "point source" takes on a different meaning for TMDL purposes than the definition supplied in Section 502(14). Under that definition, a discharge of contaminants into the waters of the United States from a pipe constitutes a point source discharge.

Even if the Clean Water Act did make the presence or absence of a responsible party the determinative factor, however, the Irwin discharges still would constitute point source discharges. Whoever owns and controls the "Glass Plant" depicted on page 7 of the draft TMDL report presumably owns, controls, and maintains the sump under the plant and the two pipes emanating from the plant that discharge the AMD into Tinkers Run. The plant owner therefore is responsible for treatment of the discharges under Section 316 of the The Clean Streams Law, 35 P.S. § 691.316. DEP (then DER) has in the past required the treatment of mine drainage from off-site abandoned mines in remarkably similar circumstances. <u>See The Carbon/Graphite Group, Inc. v. DER</u>, 1991 EHB 234 (Section 316 authorized DER to require plant owner to treat mine drainage that flowed onto and beneath plant property from off-site abandoned mines and entered plant's storm drain system and furnace basements). Similarly, any person who constructed or installed the pipes from which the Coal Run discharges emanate, or the successors in interest to those person(s), might be responsible for treating those discharges. <u>See</u> 33 U.S.C. §§ 1311(a), (g)(2), 1342(a), (b), 1362(14); 35 P.S. §§ 691.307(a), 691.315(a), 691.316; 25 Pa. Code §92.3. <u>See also Commonwealth v. Barnes & Tucker Co.,</u> 371 A.2d 461 (Pa. 1977). DEP should conduct an exhaustive search for potentially responsible parties before characterizing these mine drainage sources as "abandoned".

Response:

Acid mine drainage is considered a nonpoint source according to the U.S. EPA's Website on nonpoint source pollution. Acid mine drainage is defined as water polluted by acid, iron, sulfur and aluminum drained away from the mines and into the streams. In this case, the acid mine drainage, from abandoned mines, comes from deep mine discharges. Regardless of the pipes, the drainage would continue to enter the stream. The pipes were present at the plant before the current glass plant occupier and the current occupier has done nothing to affect the flow of the drainage through the piping underneath the plant.

Comment: Applicable Water Quality Criteria

In other mine drainage TMDLs, DEP properly identifies the instream water quality criterion for dissolved iron (0.3 mg/L as an instantaneous maximum) as one of the applicable water quality criteria. The draft Brush Creek Watershed TMDL improperly omits this criterion without offering any explanation for its inconsistency on this score with other mine drainage TMDLs.

In its response to comments submitted on other TMDLs, DEP has asserted that the water quality criterion for total iron (1.5 mg/L as a 30-day average) is more conservative than the instantaneous maximum criterion for dissolved iron. In general, however, an instantaneous maximum criterion is more conservative (less forgiving) than a monthly average criterion because with an instantaneous maximum criterion, above-average readings cannot be canceled out by below-average readings. (For a given stream, would you rather bet that the monthly average total iron concentration is less than or equal to 1.5 mg/L for 99% of the months, or that the dissolved iron concentration is less than or equal to 0.3 mg/L for 99% of the grab samples?) The water quality criterion for dissolved iron is applicable, and the TMDL should ensure that it is satisfied at least 99% of the time in all stream segments in the Brush Creek watershed.

DEP also has in the past cited data limitations as a reason for not modeling the dissolved iron instream criterion when preparing a TMDL for a stream impaired by mine drainage. But at least in the situation where the agency conducts a limited number of rounds of sampling for the express purpose of preparing a TMDL, as appears to be the case here, the samples easily could be analyzed for both dissolved and total iron. Future monitoring for the purpose of developing TMDLs for watersheds impaired by mine drainage should include both dissolved and total iron, and future TMDLs in such watershed should address both of the applicable instream criteria for iron.

Response:

Dissolved iron data was not available for the Brush Creek Watershed, and therefore TMDLs for dissolved iron were not calculated. In future TMDLs when dissolved iron data is available, the Department will calculate TMDLs for dissolved iron.

Comment: Normality of Log-Transformed Data

The draft TMDL states: “For each source and pollutant, it was assumed that the observed data were log-normally distributed.” (p.8) Why assume that fact instead of determining whether the log-transformed data are normally distributed? Particularly if normal distribution of the data is important for proper functioning of the “@Risk” Monte Carlo simulation, this characteristic should be verified rather than assumed.

Response:

A lognormal distribution is assumed because determining the distribution of small datasets, like that of Brush Creek, is difficult. More robust datasets from past TMDLs were determined to be log-normally distributed. In addition, assuming lognormal distribution is a conservative assumption.