# MAHANOY CREEK WATERSHED TMDL Columbia, Northumberland and Schuylkill Counties

#### Prepared for:

Pennsylvania Department of Environmental Protection



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## TMDL<sup>1</sup> Mahanoy Creek Watershed Columbia, Northumberland and Schuylkill Counties, Pennsylvania

#### **INTRODUCTION**

This Total Maximum Daily Load (TMDL) calculation has been prepared for segments in the Mahanoy Creek Watershed (Attachment A). It was done to address the impairments noted on the 1996, 1998, and draft 2002 Pennsylvania Section 303(d) lists and the 2000 305(b) report required under the Clean Water Act. The TMDL covers five segments on these lists (Table 1). High levels of metals, and in some areas depressed pH, caused these impairments. All impairments resulted from acid drainage from coal mining. The TMDL addresses the three primary metals (iron, manganese, and aluminum) associated with acid mine drainage (AMD) and pH.

Table 1. Mahanoy Creek Segments Addressed

Clate I	Tater ra	n (SWP) Sub		- Dusquen	dilla ittivei			EPA
Year	Miles	Segment ID	DEP Stream Code	Stream Name	Designated Use	Data Source	Source	305(b) Cause Code
1996	52.2	Not placed on GIS	17556	Mahanoy Creek	WWF	305(b) Report	RE	Metals
1998	26.07	2227	17556	Mahanoy Creek	WWF	SWMP	AMD	Metals
1998	27.59	2228	17556	Mahanoy Creek	WWF	SWMP	AMD	Metals
2000	26.1	2227	17556	Mahanoy Creek	WWF	SWMP	AMD	Metals
2000	27.6	2228	17556	Mahanoy Creek	WWF	SWMP	AMD	Metals
2002	11.1	20000808- 1500- MAF	17556	Mahanoy Creek	WWF	SWAP	AMD	Metals
2002	21.6	20000810- 1530- MAF	17556	Mahanoy Creek	WWF	SWAP	AMD	Metals
2002	6.6	20010629- 1230- MAF	17556	Mahanoy Creek	WWF	SWAP	AMD	Metals
2002	12.8	20010820- 1200- MAF	17556	Mahanoy Creek	WWF	SWAP	AMD	Metals, pH
2002	2.3	20010820- 1201- MAF	17556	Mahanoy Creek	WWF	SWAP	AMD	Water/Flo Variability pH

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<sup>&</sup>lt;sup>1</sup> Pennsylvania's 1996 and 1998 Section 303(d) lists were approved by the U.S. Environmental Protection Agency (USEPA). The 2000 Section 303(d) list was not required by 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*.

Year	Miles	Segment ID	DEP Stream Code	Susqueha Stream Name	Designated Use	Data Source	Source	EPA 305(b) Cause Code
2002	2	20010820- 1501- MAF	17556	Mahanoy Creek	WWF	SWAP	AMD	Water/ Flow Variability
2002	7.7	2227	17556	Mahanoy Creek	WWF	SWAP	AMD	Metals
1996	5	Not placed on GIS	17683	Shenandoah Creek	CWF	305(b) Report	RE	Metals
1998	4.66	2240	17683	Shenandoah Creek	CWF	SWMP	AMD	Metals
2000	4.67	2240	17683	Shenandoah Creek	CWF	SWMP	AMD	Metals
2002	4.7	2240	17683	Shenandoah Creek	CWF	SWAP	AMD	Metals
1996	Not currently on 303(d) List		Unt. Mahanoy Creek					
1998	Not currently on 303(d) List		) List	Unt. Mahanoy Creek				
2000	Not curr	ently on 303(d	) List	Unt. Mahanoy Creek				
2002	2.3	20010629- 0930- MAF	17673	Unt. Mahanoy Creek	CWF	SWAP	AMD	Metals, Siltation
1996	5.8	Not placed on GIS	17639	Zerbe Run	CWF	305(b) Report	RE	Metals
1998	4.82	7087	17639	Zerbe Run	CWF	SWMP	AMD	Metals
2000	4.83	7087	17639	Zerbe Run	CWF	SWMP	AMD	Metals
2002	7.7	20000809- 1430- MAF	17639	Zerbe Run	CWF	SWAP	AMD	Metals, pH

Attachment B includes a justification of differences between the 1996, 1998, draft 2000 and draft 2002 303(d) lists.

WWF = Warm Water Fishes

CWF = Cold Water Fishes

RE = Resource Extraction

AMD = Abandoned Mine Drainage

SWMP = Surface Water Monitoring Program

SWAP = Surface Water Assessment Program

#### **LOCATION**

The Mahanoy Creek Watershed is approximately 157 square miles in area. It is located in portions of Columbia, Northumberland and Schuylkill Counties, with its mouth located about 10 miles south of Sunbury, Pennsylvania. Mahanoy Creek flows 50 miles west from its headwaters near Mahanoy City, Schuylkill County, to its confluence with the Susquehanna

River, near Herndon, Northumberland County. Mahanoy Creek can be accessed from Interstate 81 by traveling west on State Route 901.

#### **SEGMENTS ADDRESSED IN THIS TMDL**

The Mahanoy Creek Watershed is affected by pollution from AMD. This pollution has caused high levels of metals in Mahanoy Creek, Shenandoah Creek, an unnamed tributary to Mahanoy Creek near Lavelle and Zerbe Run. Low pH affects Zerbe Run and Mahanoy Creek upstream of Gordon. There are numerous seeps, boreholes and tunnel discharges entering Mahanoy Creek throughout most of the watershed. The unnamed tributary to Mahanoy Creek is affected by AMD from a discharge in its headwaters. Zerbe Run is mostly affected by AMD discharges from the North Franklin Mine. Shenandoah Creek receives AMD from the abandoned Weston and Hammond Mines.

#### **CLEAN WATER ACT REQUIREMENTS**

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

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

- States to develop lists of impaired waters for which current pollution controls are not stringent enough to meet water quality standards (the list is used to determine which streams need TMDLs);
- States to establish priority rankings for waters on the lists based on severity of pollution and the designated use of the waterbody; states must also identify those waters for which TMDLs will be developed and a schedule for development;
- States to submit the list of waters to USEPA every 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 (BMPs), etc.). These TMDLs were developed in partial fulfillment of the 1996 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA*.

#### **SECTION 303(D) LISTING PROCESS**

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

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

The assessment method requires selecting representative stream segments based on factors such as surrounding land uses, stream characteristics, surface geology, and point source discharge locations. The biologist selects as many sites as necessary to establish an accurate assessment for a stream segment; the length of the stream segment can vary between sites. All the biological surveys 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 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.

<sup>&</sup>lt;sup>2</sup> Section 305(b) of the Clean Water Act requires a biannual description of the water quality of the waters of the state.

#### BASIC STEPS FOR DETERMINING A TMDL

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

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

#### WATERSHED BACKGROUND

The Mahanoy Creek Watershed lies completely within the Appalachian Mountain Section of the Ridge and Valley Province. There is a vertical drop in the watershed of about 1,500 feet from its headwaters to its mouth. The watershed is characterized by highly permeable, well-drained soils derived from the weathering of sandstone and shale. The primary landuses are forested land, agriculture and coal mines (66 percent, 21 percent and 9 percent, respectively). Interbedded sedimentary rock and sandstone comprise the major rock types in the watershed (70 percent and 30 percent, respectively). They are also home to the thirty-eight coal seams that were mined throughout the watershed. Twenty-two of these were principally mined, with the Mammoth and Buck Mountain Beds being the most important (Operation Scarlift 1975).

Underground mining of anthracite coal began in this area as early as the 1800s. The heaviest concentrations of deep mines in the Western Middle Coal field of the Anthracite Region were located in areas south of Trevorton, around Mahanoy City, north and northwest of Ashland and southwest of Girardville. Most deep mines were eventually forced to close due to large amounts of water entering them and the high cost of pumping the water out of the mines. Coal mining then shifted to surface mining in the mid-20<sup>th</sup> century. Mining peaked at 100 million tons in the Anthracite Region during the early 1900s. Approximately, 25 percent of the watershed has been affected by strip mining. These areas are found south of Trevorton and north of Ashland, eastward to Girardville. (Operations Scarlift 1975)

The Mahanoy Creek Watershed has been part of various studies due to its numerous large mine discharges. A Scarlift report and three USGS surveys have pinpointed 32 mine discharges affecting water quality in the watershed. Over half of these are considered to be large discharges (greater than 1.0 cubic foot per second). A 1996 USGS investigation concluded that water quality of the mine discharges has been improving over the years, perhaps due to the reclamation of abandoned mine lands in the watershed. However, AMD is still the primary pollutant to the watershed.

A recent biological assessment conducted by the Pa. DEP (Friday 2002) identifies three main pollutants in the watershed. These pollutants are AMD, agriculture and raw sewage. High concentrations of metals was named as the major cause of impairment in Mahanoy Creek, Zerbe Run, Shenandoah Creek and an unnamed tributary to Mahanoy Creek, near Lavelle. Depressed pH was found to be a cause of impairment in the upper portion of Mahanoy Creek and in Zerbe Run. Sewage contributes impairments to streams in the upper part of the watershed; however, the effects are often masked by the AMD. Agricultural activities mostly affect streams in the lower portion of the watershed. Raw sewage and agricultural activities impairments will not be addressed in this report.

#### **Permits in the Mahanoy Creek Watershed**

Today, there are numerous active mining operations in the watershed; however, many have no NPDES permits (no discharge) or are permitted under the NPDES program for erosion and sedimentation control ponds only. The sedimentation ponds have no recorded discharges and have not been assigned waste load allocations. It has been determined that effects from sedimentation ponds are negligible because their potential discharges are based on infrequent and temporary events and the ponds should rarely discharge if reclamation and revegetation is concurrent. In addition, sedimentation ponds are designed in accordance with PA Code Title 25 Chapter 87.108 (h) to at minimum contain runoff from a 10-year 24-hour precipitation event. The majority of these operations are reprocessing old coal banks left behind by previous underground and surface mining. The operations are mainly concentrated near abandoned deep mines and collieries (Operation Scarlift 1975). There are a small number of operations that have effluent limits for mine drainage treatment facilities that require waste load allocations (Table 2).

Table 2. NPDES permits associated with mining permits requiring waste load allocations (WLAs) in the Mahanoy Creek Watershed

Mining Permit	Company	NPDES Permit
UMP49921301	Chestnut Coal - #11 Slope	PA0596035
SMP19960101	City of Philadelphia - Continental	PA0223719
SMP54753035	N & L Coal Co. – Lost Creek	PA0612545
SMP49803201	Reading Anthracite Co.	PA0595978
UMP49871304	West Cameron Mining – Lenig Tunnel	PA0595306

In addition to NPDES permits issued as part of mining permits for mine drainage treatment, there are additional facilities that discharge metals in the Mahanoy Creek Watershed that require waste load allocations. These permits are issued as industrial waste permits under the Department's Water Pollution Control Program and are generally for backwashing of filters from water treatment facilities or from process water from metal-processing industries (Table 3).

Table 3. NPDES permits not associated with mining permits requiring waste load allocations (WLAs) in the Mahanoy Creek Watershed

NPDES Permit	Facility
PA0061697	Gilberton Power Company, John B. Rich Memorial Power Station
PA0062758	Municipal Authority of Borough of Shenandoah, Water Treatment Plant
PA0063061	Ashland Area Municipal Authority, Water Treatment Plant
PA0063258	Mahanoy Township Authority, Water Treatment Plant

#### **TMDL ENDPOINTS**

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

Because 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 the water quality standards must be met 99 percent of the time. The iron TMDLs are expressed at total recoverable as the iron data used for this analysis were reported as total recoverable. Table 3 shows the water quality criteria for the selected parameters.

Table 3. 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
	0.3	Dissolved
Manganese (Mn)	1.00	Total Recoverable
pH *	6.0-9.0	N/A

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

#### TMDL ELEMENTS (WLA, LA, MOS)

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

#### **TMDL ALLOCATIONS SUMMARY**

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

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 re-evaluated to reflect current conditions. Table 5 presents the estimated reductions identified for all points in the watershed. Attachment D gives detailed TMDLs by segment analysis for each allocation point.

Table 5. Mahanoy Creek Watershed Summary Table

	Table 5.	· ·	k Watershed S	Table 5. Mahanoy Creek Watershed Summary Table					
Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	NPS Load Reduction (lbs/day)	% Reduction			
	MC1 – Mahanoy Creek upstream of Girardville								
Aluminum (lbs/day)	105.28	27.37	1.67	25.7	77.91	74%			
Iron (lbs/day)	2274.14	159.19	1.67	157.52	2114.95	93%			
Manganese(lbs/day)	674.94	94.49	0.83	93.66	580.45	86%			
Acidity (lbs/day)	2482.99	893.88	-	893.88	1589.11	64%			
	SC	1 – Shenando	ah Creek nea	r mouth					
Aluminum (lbs/day)	20.41	16.14	6.52	9.62	4.27	21%			
Iron (lbs/day)	152.80	19.93	5.52	14.41	132.87	87%			
Manganese(lbs/day)	224.94	18.03	3.32	14.71	206.91	92%			
Acidity (lbs/day)	134.30	NA	-	NA	NA	NA			
	M	C2 – Mahanoy	Creek near (	Gordon					
Aluminum (lbs/day)	726.24	101.67	57.59	44.08	542.39	85%*			
Iron (lbs/day)	6038.72	422.71	242.14	180.57	3368.19	89%*			
Manganese(lbs/day)	2677.90	348.13	161.42	186.71	1542.41	82%*			
Acidity (lbs/day)	834.88	83.49	-	83.49	193.61	70%*			
		Unt.MC – ""Bi	g Run" near r	nouth					
Aluminum (lbs/day)	7.41	3.00	-	3.00	4.41	60%			
Iron (lbs/day)	43.24	6.41	-	6.41	36.83	86%			
Manganese(lbs/day)	27.62	8.81	-	8.81	18.81	69%			
Acidity (lbs/day)	77.66	NA	-	NA	NA	NA			
MC3 – Mahanoy Creek near Gowen City									
Aluminum (lbs/day)	836.31	117.08	0.63	116.45	90.25	44%*			
Iron (lbs/day)	5850.55	292.53	0.32	292.21	119.73	30%*			
Manganese(lbs/day)	2674.46	294.19	0.16	294.03	55.77	16%*			
Acidity (lbs/day)	1827.80	329.01	-	329.01	669.74	68%*			
	N	/IC4 – Mahano	y Creek near	Kneas					

Aluminum (lbs/day)	742.13	304.27	24.44	279.83	0	0%*
Iron (lbs/day)	3658.92	914.73	36.93	877.80	0	0%*
Manganese(lbs/day)	3260.67	521.71	24.62	497.09	358.69	41%*
Acidity (lbs/day)	6842.46	1436.92	-	1436.92	3906.75	74%*

<sup>\*</sup> Total of loads affecting this segment is less than the allowable load calculated at this point, therefore no reduction is necessary. NA = not applicable

Wasteload allocations are being assigned to nine permitted discharges (shown in the following tables) for iron, aluminum, and manganese. The wasteload allocations are based on measured flow data and the permit limits, which are either Best Available Technology (BAT) limits or Water Quality-Based Limits (WQBEL) depending on the particular circumstances for each discharge. All necessary reductions in this TMDL document are assigned to the non-point sources.

#### Waste Load Allocation - Gilberton Power Company John B. Rich Memorial Power Station

The Gilberton Power Company (NPDES PA0061697) has a permitted discharge from its John B. Rich Memorial Power Station that is evaluated in the calculated allowable loads at MC2. Outfall 001 is a discharge from cooling tower blow-down. Effluent limits from this facility (permitted through the Pa. DEP Water Program, not the Mining Program) were determined using the PennTox Model that uses proposed discharge concentrations and design flow values to evaluate what concentration of pollutants the receiving stream can assimilate (evaluated at Q 7-10) and maintain its designated uses. This discharge does not have effluent limits for aluminum currently; a concentration of 4.0 mg/L was assigned to the discharge for aluminum in the effluent. The following table shows the waste load allocation for this discharge.

Table 6. Waste Load Allocations at Gilberton Power					
Parameter	Monthly Avg. Allowable Conc.	Average Flow	Allowable Load		
	(mg/L)	(MGD)	(lbs/day)		
Outfall 001					
Al	2.00	0.310	5.17		
Fe	12.56	0.310	32.47		
Mn	8.37	0.310	21.64		

#### <u>Waste Load Allocation – Mahanoy Township Water</u> Treatment Plant

Mahanoy Township (NPDES PA0063258) has a permitted discharge from its water treatment plant that is evaluated in the calculated allowable loads at MC1. Outfall 001 is a discharge from water treatment plant wastewater lagoons. Effluent limits from this facility (permitted through the Pa. DEP Water Program, not the Mining Program) were determined using BAT limits for total iron and total manganese. Effluent limits from this facility for total aluminum were determined using the PennTox Model that uses proposed discharge concentrations and design flow values to evaluate what concentration of pollutants the receiving stream can assimilate (evaluated at Q 7-10) and maintain its designated uses. The following table shows the waste load allocation for this discharge.

Table 7. Waste Load Allocations at Mahanoy Township WTP					
Parameter	Monthly Avg. Allowable Conc.	Average Flow	Allowable Load		
	(mg/L)	(MGD)	(lbs/day)		
Outfall 001					
Al	2.0	0.100	1.67		
Fe	2.0	0.100	1.67		
Mn	1.0	0.100	0.83		

#### Waste Load Allocation - N&L Coal Company, Lost Creek Operation

The N&L Coal Company (SMP 54753035; NPDES PA00595608) has a permitted discharge from its Lost Creek surface mine that is evaluated in the calculated allowable loads at SC1. Outfall 001 is a discharge from a mine drainage treatment facility. This discharge does not have effluent limits for aluminum currently; a concentration of 2.0 mg/L was assigned to the discharge for aluminum in the effluent. The following table shows the waste load allocation for this discharge.

Table 8. Waste Load Allocations at Lost Creek					
Parameter	Monthly Avg. Allowable Conc.	Average Flow	Allowable Load		
	(mg/L)	(MGD)	(lbs/day)		
Outfall 001					
Al	2.0	0.135	2.25		
Fe	3.0	0.135	3.38		
Mn	2.0	0.135	2.25		

#### Waste Load Allocation – Municipal Authority of Borough of Shenandoah Water Treatment Plant

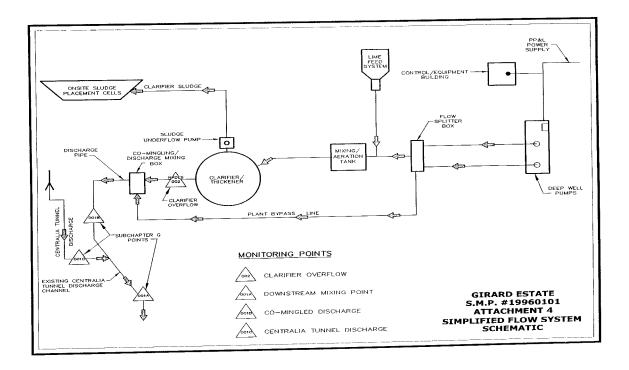
The Municipal Authority of the Borough of Shenandoah (NPDES PA0062758) has a permitted discharge from its water treatment plant that is evaluated in the calculated allowable loads at SC1. Outfall 001 is a discharge from filter and clarifier backwash, floor drains, sample analyzers, and plant overflow. Effluent limits from this facility (permitted through the Pa. DEP Water Program, not the Mining Program) were determined using BPT limits for total iron, total aluminum, and total manganese. The following table shows the waste load allocation for this discharge.

Table 9. Waste Load Allocations at Shenandoah Borough WTP					
Parameter	Monthly Avg. Allowable Conc.	Average Flow	Allowable Load		
	(mg/L)	(MGD)	(lbs/day)		
Outfall 001					
Al	4.0	0.128	4.27		
Fe	2.0	0.128	2.14		
Mn	1.0	0.128	1.07		

#### Waste Load Allocation - City of Philadelphia (Trustee) Girard Estate, Continental Mine

The City of Philadelphia (SMP19960101C3; NPDES PA0223719) has a permitted discharge from its Continental Mine operation that is evaluated in the calculated allowable loads at MC2. Outfall 002 is effluent from a treatment plant that treats water pumped from the deep mine pool. The pump runs intermittently throughout the year. Half of the water is treated with caustic soda and a lime kilm dust and then combined with the rest of the pumped water. The treated discharge is piped about one-mile south where it meets the Centralia Tunnel Discharge and then flows another 0.5-mile down a ravine before entering Mahanoy Creek. This discharge does not have effluent limits for aluminum currently; a concentration of 1.5 mg/L was assigned to the discharge for aluminum in the effluent. In addition, this permit has discharge points of 001C (abandoned Centralia Tunnel discharge), 001B (commingled treated and bypass water), and 001A (channel containing combined waters of 001B, 001C, and 002) that are covered as Subchapter G discharges using baseline pollutant loadings (see flow schematic below). According to Subchapter G, as long as these discharges are not degraded (pollution loads increased over the baseline loads as stipulated in the permit), the operator is responsible for no further treatment. In addition, pumping and treatment of water from Outfall 002 adds additional water to point 001C, which discharges to Mahanoy Creek and allows for dilution and neutralization of the pollutant loads coming from Outfalls 001A and 001B. Therefore, no allocations are necessary to these points. The following table shows the waste load allocation for this discharge.

Table 10. Waste Load Allocations at Continental Mine									
Parameter	Monthly Avg. Allowable Conc.	Average Flow	Allowable Load						
	(mg/L)	(MGD)	(lbs/day)						
Outfall 002									
Al	0.75	8.38	52.42						
Fe	3.0	8.38	209.67						
Mn	2.0	8.38	139.78						



Waste Load Allocation - Ashland Area Municipal Authority Water Treatment Plant

The Municipal Authority of the Ashland Area Municipal Authority Water Treatment Plant (NPDES PA0063061) has a permitted discharge from its water treatment plant that is evaluated in the calculated allowable loads at MC3. Outfall 001 is a discharge from filter backwash the water treatment plant. Effluent limits from this facility (permitted through the Pa. DEP Water Program, not the Mining Program) were determined using BPT limits for total iron, total aluminum, and total manganese. The following table shows the waste load allocation for this discharge.

Table 11. Waste Load Allocations at Ashland Area Municipal Authority Water Treatment Plant										
Parameter	Monthly Avg. Allowable Conc.	Average Flow	Allowable Load							
	(mg/L)	(MGD)	(lbs/day)							
Outfall 001										
Al	4.0	0.019	0.63							
Fe	2.0	0.019	0.32							
Mn	1.0	0.019	0.16							

Waste Load Allocation - Chestnut Coal Company, Chestnut Slope #11

The Chestnut Coal Company (UMP 49921301R2; NPDES PA0596035) has a permitted discharge from its Chestnut Slope #11 operation that is evaluated in the calculated allowable loads at MC4.

Outfall 001 is a discharge from treatment pond B that treats water pumped from the deep mine. This discharge does not have effluent limits for aluminum currently; a concentration of 2.0 mg/L was assigned to the discharge for aluminum in the effluent. The following table shows the waste load allocation for this discharge.

Table 12. Waste Load Allocations at Chestnut Slope #11								
Parameter	Monthly Avg. Allowable Conc.	Average Flow	Allowable Load					
	(mg/L)	(MGD)	(lbs/day)					
Outfall 001								
Al	2.0	0.864	14.41					
Fe	3.0	0.864	21.62					
Mn	2.0	0.864	14.41					

#### Waste Load Allocation - Reading Anthracite Company, Treverton Refuse Bank #228

The Reading Anthracite Company (SMP49803201R4; NPDES PA0595978) has a permitted discharge from its Treverton Refuse Bank #228 operation that is evaluated in the calculated allowable loads at MC4. Outfall 002 is a discharge from the treatment pond that treats water collected from a series of seeps along the base of a refuse bank. Water is discharged from treatment ponds on this permit to an adjacent treatment pond on Reading Anthracite Company Treverton Slush Bank #57 (SMP49803202), which has no surface discharge. The following table shows the waste load allocation for this discharge.

Table 13. Waste Load Allocations at Treverton Refuse Bank #228								
Parameter	Monthly Avg. Allowable Conc.	Average Flow	Allowable Load					
	(mg/L)	(MGD)	(lbs/day)					
Outfall 002								
Al	1.4	0.036	0.42					
Fe	3.0	0.036	0.90					
Mn	2.0	0.036	0.60					

#### Waste Load Allocation – West Cameron Mining, Lenig Tunnel

The West Cameron Mining Company (UMP 49871304C2; NPDES PA0595306) has a permitted discharge from its Lenig Tunnel operation that is evaluated in the calculated allowable loads at MC4. Outfall 001 is a discharge from the treatment pond that treats water pumped from the deep mine. This discharge does not have effluent limits for aluminum currently; a concentration of 2.0 mg/L was assigned to the discharge for aluminum in the effluent. The following table shows the waste load allocation for this discharge.

Table 14. Waste Load Allocations at Lenig Tunnel								
Parameter	Ionthly Avg. Allowable Conc. (mg/L)	Average Flow	Allowable Load					
	(g, _)	(MGD)	(lbs/day)					
Outfall 001								
Al	2.0	0.576	9.61					
Fe	3.0	0.576	14.41					
Mn	2.0	0.576	9.61					

#### RECOMMENDATIONS

Various methods to eliminate or treat pollutant sources and to provide a reasonable assurance that the proposed TMDLs can be met exist in Pennsylvania. These methods include PADEP's primary efforts to improve water quality through reclamation of abandoned mine lands (for abandoned mining) and through the National Pollution Discharge Elimination System (NPDES) permit program (for active mining). Funding sources available that are currently being used for projects designed to achieve TMDL reductions include the Environmental Protection Agency (EPA) 319 grant program and Pennsylvania's Growing Greener Program (which has awarded almost \$37 M since 1999 for watershed restoration and protection in mine-drainage impacted watersheds and abandoned mine reclamation). In 2006 alone, federal funding through the Office of Surface Mining (OSM) contributed \$949 K for reclamation and mine drainage treatment through the Appalachian Clean Streams Initiative and another \$298 K through Watershed Cooperative Agreements. According to the Department of the Interior, Office of Surface Mining (www.osmre.gov/annualreports/05SMCRA2AbandMineLandReclam.pdf), during 2005, Pennsylvania reclaimed 54 acres of gob piles, 73 acres of pits, 2,500 acres of spoil areas, 7,658 feet of highwall, and treated 94,465 gallons of mine drainage under their environmental (Priority 3) program only (priorities 1&2 are for reclaiming features threatening public health and safety with much larger number of features reclaimed).

OSM reports that nationally, of the \$8.5 billion of high priority (defined as priority 1&2 features or those that threaten public health and safety) coal related AML problems in the AML inventory, \$6.6 billion (78%)have yet to be reclaimed; \$3.6 billion of this total is attributable to Pennsylvania watershed costs. Almost 83 percent of the \$2.3 billion of coal related environmental problems (priority 3) in the AML inventory are not reclaimed. The Bureau of Abandoned Mine Reclamation, the Department's primary bureau in dealing with abandoned mine reclamation (AMR) issues, has established a comprehensive plan for abandoned mine reclamation throughout the Commonwealth to prioritize and guide reclamation efforts for throughout the state to make the best use of valuable funds (<a href="www.dep.state.pa.us/dep/deputate/minres/bamr/complan1.htm">www.dep.state.pa.us/dep/deputate/minres/bamr/complan1.htm</a>). In developing and implementing a comprehensive plan for abandoned mine reclamation, the resources (both human and financial) of the participants must be coordinated to insure cost-effective results. The following set of principles is intended to guide this decision making process:

• Partnerships between the DEP, watershed associations, local governments, environmental groups, other state agencies, federal agencies and other groups organized to reclaim

abandoned mine lands are essential to achieving reclamation and abating acid mine drainage in an efficient and effective manner.

- Partnerships between AML interests and active mine operators are important and essential in reclaiming abandoned mine lands.
- Preferential consideration for the development of AML reclamation or AMD abatement projects will be given to watersheds or areas for which there is an <u>approved rehabilitation plan</u>. (guidance is given in Appendix B to the Comprehensive Plan).
- Preferential consideration for the use of designated reclamation moneys will be given to projects that have obtained other sources or means to partially fund the project or to projects that need the funds to match other sources of funds.
- Preferential consideration for the use of available moneys from federal and other sources will be given to projects where there are institutional arrangements for any necessary long-term operation and maintenance costs.
- Preferential consideration for the use of available moneys from federal and other sources will be given to projects that have the greatest worth.
- Preferential consideration for the development of AML projects will be given to AML problems that impact people over those that impact property.
- No plan is an absolute; occasional deviations are to be expected.

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

In addition to the abandoned mine reclamation program, regulatory programs also are assisting in the reclamation and restoration of Pennsylvania's land and water. PADEP has been effective in implementing the NPDES program for mining operations throughout the Commonwealth. During 2006, District Mining Offices issued 31 new remining permits with the potential for reclaiming 1,058 acres of abandoned mine lands; an additional 328 acres were reclaimed during 2006 from existing remining permits. This reclamation was done at no cost to the Commonwealth or the federal government. Long-term treatment agreements were initialized for 109 facilities/operators who need to assure treatment of post-mining discharges or discharges they degraded which will provide for long-term treatment of 211 discharges. Of the 109 agreements, 34 have been finalized with 17 conventional bonding agreements totaling \$75 M and 17 with treatment trusts totaling \$73 M. According to OSM, "PADEP is conducting a program where active mining sites are, with very few exceptions, in compliance with the approved regulatory program". In addition, the Commonwealth dedicates 359 full-time equivalents (staff) to its regulatory and AML programs.

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

Pennsylvania is striving for complete reclamation of its abandoned mines and plugging of its orphaned wells. Mine reclamation and well plugging refers to the process of cleaning up environmental pollutants and safety hazards associated with a site and returning the land to a productive condition, similar to DEP's Brownfields program. Since the 1960's, Pennsylvania has been a national leader in establishing laws and regulations to ensure reclamation and plugging occur after active operation is completed. Realizing this task is no small order, DEP has developed concepts to make abandoned mine reclamation easier. These concepts, collectively called Reclaim PA, include legislative, policy land management initiatives designed to enhance mine operator, volunteer land DEP reclamation efforts. Reclaim PA has the following four objectives.

- To encourage private and public participation in abandoned mine reclamation efforts
- To improve reclamation efficiency through better communication between reclamation partners
- To increase reclamation by reducing remining risks
- To maximize reclamation funding by expanding existing sources and exploring new sources

Reclaim PA is DEP's initiative designed to maximize reclamation of the state's quarter million acres of abandoned mineral extraction lands. Abandoned mineral extraction lands in Pennsylvania constituted a significant public liability – more than 250,000 acres of abandoned surface mines, 2,400 miles of streams polluted with mine drainage, over 7,000 orphaned and abandoned oil and gas wells, widespread subsidence problems, numerous hazardous mine openings, mine fires, abandoned structures and affected water supplies – representing as much as one third of the total problem nationally. The coal industry, through DEP-promoted remining efforts, can help to eliminate some sources of AMD and conduct some of the remediation identified in the above recommendations through the permitting, mining, and reclamation of abandoned and disturbed mine lands. Special consideration should be given to potential remining projects within these areas, as the environmental benefit versus cost ratio is generally very high.

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

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

Citizen and stakeholder involvement is critical to watershed reclamation in Pennsylvania and is strongly encouraged through the TMDL program and process. The Mahanoy Creek Watershed Association was formed to combat the AMD problems of the area. In 1999, the group received a grant from the Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR) to increase awareness of AMD impacts in the watershed. They also received a Watershed Rehabilitation and Partnership Act (WRAP) grant in 1999 to construct wetlands in order to treat AMD problems in Mahanoy Creek. The Swamp is a 4-acre wetland located upstream of the village of Gordon. Five to 10 percent of water from the stream is diverted into the swamp where the pollutants can settle out before returning back to the stream. The Swamp is the first part of the four-part passive treatment project. In 2000, the group received a Growing Greener Grant to assess the effects of AMD and for possible remedial alternatives for abandoned mine lands in the watershed. In 2001, they received a Clean Water Act Section 319 Grant to expand the Swamp project and allow 750-1,500 gallons of water per minute to be treated. (Pa.DEP WRAS 2000). Efforts should be made to prioritize funding for additional reclamation projects in the Mahanoy Creek Watershed to restore those waters. Each DEP Regional Office (6) and each District Mining Office (5) have watershed managers to assist stakeholder groups interested in restoration in their watershed. Most Pennsylvania county conservation districts have a watershed specialist who can also provide assistance to stakeholders (www.pacd.org). Potential funding sources for AMR projects can be found at www.dep.state.pa.us/dep/subject/pubs/water/wc/FS2205.pdf.

In 2004, the U.S. Geological Survey published an assessment report of the Mahanoy Creek Watershed. Below is the *Remedial Priorities and Alternatives* section of the report that provides initial prioritization and recommendations for restoration in the watershed. These recommendations can be used as a blueprint for the Mahanoy Creek Watershed Association as they pursuing funding, as it is available, for implementation of restoration projects in the watershed.

Flow and concentration data for the high base-flow samples collected in March 2001 were used to determine priority ranks of the AMD sources on the basis of loads of dissolved iron, manganese, and aluminum and to indicate the minimum size of wetlands for iron removal. The AMD source with the highest loading was assigned a rank of 1, with successively higher ranks assigned to AMD sources in descending order of dissolved metal loading (table 8). To provide context for comparing the AMD sources, the dissolved metals loading at each AMD source was expressed as a percentage of the sum of dissolved metals loading for all sampled AMD sources in the watershed (table 8). Generally, the AMD sources with the largest flow rates and iron concentrations were ranked among the top 15 AMD sources; however, the AMD ranking generally did not correlate with the acidity, pH, or aluminum concentration (fig. 11). Although concentrations increased with decreased flow (fig. 3), the contaminant loadings generally increased with flow. The top 4 AMD sources, Helfenstein Tunnel (M29), Packer #5 Breach (M13), Packer #5 Borehole (M12), and Girard Mine seepage (M11), on the basis of dissolved metals loading in March 2001 accounted for more than 50 percent of the metals loading to Mahanoy Creek, whereas the top 15 AMD sources accounted for more than 99 percent of the metals loading (table 8). When sampled in March 2001, the top 15 AMD sources had flow rates ranging from 0.4 to 17.2 ft3/s (680 to 29,200 L/min) and pH from 3.9 to 6.7. Nine of the top 15 AMD sources, including the top 4, were net alkaline (alkalinity greater than acidity); the others were net acidic and will require additional alkalinity to facilitate metals removal and maintain near-neutral pH. The March 2001 high base-flow data for flow rate and dissolved metal concentrations were considered useful in the evaluation of AMD priorities because (1) flow rates in March 2001 were near normal based on long-term streamflow record for Shamokin Creek (Cravotta and Kirby, 2004a), (2) six previously identified intermittent AMD sources were not discharging during the August 2001 low base-flow survey, and (3) acidity is determined largely by dissolved metals concentrations (Cravotta and Kirby, 2004b). Ideally, loadings and associated AMD priorities should be determined on the basis of long-term aver-ages, but these data were not available. Data for pH were not used for the ranking computations because pH tends to be an unstable parameter that does not indicate the ultimate potential for acidic conditions (Cravotta and Kirby, 2004b). Furthermore, when pH or hydrogen ion loadings were included in the ranking computations, results were not changed appreciably. Estimates of the metals loads and corresponding rankings of AMD priorities also were similar on the basis of the metals in whole-water (total) and 0.45-µm filtered (dissolved) subsamples. The ranking sequence for the top AMD sources based on the high base-flow data generally matched that based on the low base-flow data (fig. 12). However, 2 of the top 15 AMD sources, the Vulcan-Buck Mountain seepage (M02) and the Bast Mine overflow (M20), ranked 7 and 11, respectively, were not flowing in August 2001 (table 3, fig. 12). With the exception of AMD sources with elevated

concentrations of aluminum, such as the Vulcan-Buck Mountain Mine (M02 and M03), Centralia Mine (M19), and Doutyville Tunnel (M31), the concentration of dissolved iron greatly exceeded the other metals, indicating iron was the predominant source of acidity (fig. 12). Manganese typically was greater than or equal to the aluminum concentration. The AMD priority ranking could have been developed using various other constituents or computational methods. Because the proportions of dissolved iron, aluminum, and manganese in the AMD varied from site to site, different rankings could result by weighting the metals with different factors such as dividing the concentration by regulatory standards. Cherry and others (2001) and Herlihy and others (1990) used a combination of biological and chemical metrics to assess AMD effects on a watershed scale. Williams and others (1996, 1999) used flow and chemical constituents including acidity, metals, and sulfate to develop a ranking scheme based primarily on contaminant loading; pH was used as a "tie-breaker." For the current study, rankings on the basis of sulfate were similar to those computed on the basis of dissolved metals (table 8). When net-alkalinity loading was considered, the ranks for various AMD sources with substantial alkalinity and metals loading shifted to lower ranks (table 8). For example, the top five AMD sources on the basis of metals loading, Helfenstein Tunnel (M29), Packer #5 Mine Breach (M13) and Borehole (M12), Girard Mine seepage (M11), and North Franklin Mine Drift and Bore-hole (M32), had net-alkalinity rankings of 25, 20, 24, 21, and 15, respectively (table 8). These rankings indicate that acidity loading from these sources is less than that from other top-ranked AMD sources; however, because of site specific limitations, their treatment is not necessarily more feasible than other large AMD sources. Ultimately, the feasibility of remediation of a particular discharge must consider the AMD quality and loading rates, if the site is accessible for treatment, and if funding, construction permits, and other resources can be obtained for implementation. Although such details have not been considered for this assessment, possible remedial alternatives and comments on site-specific issues for consideration by managers and landowners that may be involved in decisions to implement remediation are summarized in table 8. Generally, to meet water-quality criteria for 0.3 mg/L dissolved iron, nearly all the AMD sources would require construction of some sort of settling basin or wetland to facilitate iron oxidation, hydrolysis, and deposition. Hence, to provide a basis for evaluating alternatives for passive treatment, the minimum wetland size for each AMD source was computed using the data for maximum flow rate and maximum iron concentration for the March 2001 and August 2001 data and considering criteria of Hedin and others (1994) for an iron-removal rate of 180 lb/acre/d (20 g/m2/d) (table 8). The computed wetland sizes ranged from 5.8 acres for the Helfenstein Tunnel discharge (M29) to less than 0.1 acre for seven small AMD discharges. Small wetland acreages were computed for sites with low flow rates and low concentrations of dissolved iron; however, many of these AMD sources, such as seepage from the North Franklin Mine (M33 and M34) or the Tunnel Mine (M22), could have high concentrations of dissolved aluminum (table 8). Consequently, a larger treatment area than that computed based on iron alone may be needed. If the AMD is net acidic and (or) has elevated concentrations of aluminum, treatment steps or components that add alkalinity to the AMD could be appropriate in addition to a wetland (fig. 2). Because many of the AMD sources in the Mahanov Creek Basin have large flow and metal loading rates (table 8), innovative designs that accelerate iron oxidation (Dietz and Dempsey, 2002) and (or) incorporate automatic flushing for

solids removal (Vinci and Schmidt, 2001; Weaver and others, 2004; Schueck and others, 2004) may be advantageous. Furthermore, bench-scale testing of the possible treatment alternatives, such as that by Cravotta (2002, 2003), Cravotta and others (2004), and Dietz and Dempsey (2002), could be helpful for the selection and design of treatment alternatives. Various restoration activities could be considered to mitigate the AMD contamination in the Mahanoy Creek Basin. Because many of the AMD sources are large or have insufficient land area for construction of active or passive-treatment systems, the prevention of infiltration through mine spoil or into the underground mines is warranted. If surface reclamation or streamflow restoration is planned or completed, the design of any AMD treatment system should consider additional monitoring to document potential changes in flow and loading rates. The following restoration strategies that were identified to meet TMDLs in the Shamokin Creek Basin (Pennsylvania Department of Environmental Protection, 2001; Cravotta and Kirby, 2004a) generally could be applicable in the Mahanoy Creek Basin and other watersheds affected by abandoned mines.

- Reclamation of abandoned surface mines, including removal of abandoned highwalls and spoil banks and filling abandoned surface-mine pits would eliminate surface- water accumulations that become contaminated with mine drainage because of contact with exposed acid-producing strata and reduce the amount of surface runoff directed into the mine-pool systems. The regrading of disturbed areas, if returned to original contour before mining, would provide a more natural flow pattern for runoff and prevent surface water from percolating through abandoned refuse and entering underground mine pools.
- Removal, regrading, and (or) replanting of abandoned coal-refuse piles would reduce the amount of sediments, silt, and coal-waste runoff into surface streams and eliminate a source of AMD.
- Restoration of surface channels and flow of streams that now disappear into spoil banks and enter deep-mine pools could lessen the volume of water discharged by AMD sources.
- Site-specific assessments to determine whether passive treatment is practical and which treatment systems are best suited for specific discharges should include discharge water quality and flow, topographical setting, construction costs, and long-term operation and maintenance costs. Suitable technology may not be available to passively treat many of these high-volume discharges.

Table 8. Priority rankings and possible remedial alternatives for abandoned mine drainage in Mahanoy Creek Basin, Pennsylvania. [Priority rankings based on instantaneous loadings of dissolved metals, net alkalinity, or sulfate during March 26-28, 2001. Remedial alternatives are not identified in order of preference; any treatment design would require additional data and specific analysis; VFCW, vertical-flow compost wetland; ALD, anoxic limestone drain; OLD, flushable oxic limestone drain; OLC, open limestone channel; X, applicable; +, additional; -, not applicable; ?, insufficient data; =, equal to; >, greater than or equal to; <, less than; ≤, less than or equal to; g/m²/d, grams per meter squared per day; lb/acre/d, pounds per acre per day]

lved		nk				Remedial Alternatives <sup>4</sup>						1	actes 5
Percentage diss of Fe, Al, and Mn k	Metals rank <sup>2</sup>	Net alkalinity ra	Sulfate rank	Principal characteristics <sup>3</sup>	Remove culm bank	VFCW	ALD	OLD	OLC	Aerobic pond(s)	Active treatment	Comments	Wetland area, act
18.7	1	25	1	net alkaline; oxic	-	-	-	-	-	Х	Х	Area inadequate for passive treatment.	5.8
11.6	2	20	3	Very large flow; very high Fe, Mn; low Al; net alkaline; anoxic	1	-	1	-	1	Х	Х	Area adequate for wetland (?). Combine w/borehole.	3.9
11.4	3	24	2	Very large flow; high Fe, Mn; low Al; net alkaline; anoxic	1	1	1	,	- 1	х	Х	Area adequate for wetland (?). Combine w/breach.	3.4
10.8	4	21	9	Very large flow; high Fe, Mn; low Al; net alkaline; oxic	1	-	1	-	1	Х	Х	Area inadequate for passive treatment.	3.0
10.3	5	15	4	Very large flow; moderate Fe, Mn; moderate Al; net alkaline?; oxic	1	1	1	Х	- 1	+	Х	Area available for passive treatment.	2.6
8.4	6	1	5	Very large flow; moderate Fe, Mn; very high Al; net acidic; oxic	Х	Х	- 1	-	1	+	Х	Area available for passive treatment.	0.9
7.1	7	2	8	Intermittent flow; moderate Fe, Mn; high Al; net acidic; anoxic	1	1	1	- 1	Х	1	1	Fill channel with limestone or consider diversion well.	0.9
4.8	8	22	6	Very large flow; high Fe, Mn; low Al; net alkaline; oxic	- 1	-	- 1	,	- 1	Х	х	Area inadequate for passive treatment.	1.7
4.1	9	3	12	Very large flow; moderate Fe, Mn; moderate Al; net acidic; anoxic	- 1	-	Х	,	Х	+	Х	Area inadequate for passive treatment.	1.0
3.4	10	23	7	Large flow; high Fe, Mn; moderate Al; net alkaline; suboxic	-	-	-	,	-	Х	-	Area adequate for wetland (?).	1.3
3.0	11	19	10	Intermittent flow; high Fe, Mn; low Al; net alkaline; oxic	-	-	-	-	-	Х	-	Area adequate for wetland (?).	.6
2.2	12	4	11	Large flow; moderate Fe, Mn; moderate Al; net acidic?; oxic	-	-	-	Х	х	+	-	Area inadequate for passive treatment (?).	.4
1.6	13	18	15	Large flow; moderate Fe, Mn; low Al; net alkaline; anoxic	- 1	-	- 1	-	- 1	Х	'	Area inadequate for passive treatment (?).	.3
.9	14	14	14	Moderate flow; very high Fe, Mn; low Al; net alkaline; anoxic	1	1	1	- 1	- 1	Х	1	Discharge drains to existing wetland.	.4
.9	15	9	13	Moderate flow; high Fe, Mn; moderate Al; net acidic; oxic	-	-	-	Х	-	+	-	Area available for passive treatment.	.4
.3	16	16	17	Moderate flow; high Fe, Mn; low Al; net alkaline; oxic	- 1	-	- 1	-	-	Х	-	Area adequate for wetland (?).	.1
.3	17	17	16	Intermittent flow; moderate Fe, Mn; low Al; net alkaline; anoxic	1	- 1	1	-	- 1	Х	- 1	Discharge drains to existing wetland.	<.1
.1	18	5	19	Moderate flow; moderate Fe, Mn; moderate Al; net acidic; anoxic	- 1	-	Х	-	-	+	-	Area available for passive treatment.	.1
.1	19	7	18	Small flow; moderate Fe, Mn; very high Al; net acidic; oxic	Х	Х	-	-	-	+	-	Source removal best; area available for treatment.	<.1
.1	20	6	22	Small flow; high Fe, Mn; very high Al; net acidic; anoxic	Х	1	1	- 1	1	1	1	Source removal best; area available for treatment.	<.1
.1	21	8	21	Intermittent flow; moderate Fe, Mn; very high Al; net acidic; oxic	Х	Х	1	,	1	+	-	Source removal best; area available for treatment.	<.1
<.1	22	13	20	Moderate flow; moderate Fe, Mn; low Al; net alkaline; oxic	-	-	-	-	-	Х	-	Possibly enhance existing ponds for treatment.	.1
<.1	23	12	23	Small flow; moderate Fe, Mn; low Al; net alkaline; anoxic	-	-	-	-	-	Х	-	Area available for passive treatment.	<.1
<.1	24	11	24	Small flow; low Fe, Mn; low Al; net alkaline; suboxic	-	-	-	-	-	х	-	Area available for passive treatment.	<.1
<.1	25	10	25	Small flow; low Fe, Mn; low Al; net alkaline; oxic	-	-	-	-	-	Х	-	Discharge drains to existing wetland.	<.1
<.1	26	28	26	Intermittent flow; moderate Fe, Mn; moderate Al; net alkaline?; oxic	?	-	-	-	-	-	-	Insufficient data.	-
<.1	27	26	27	Intermittent flow; not sampled.	?	-	-	-	-	-	-	Insufficient data.	-
<.1	28	27	28	Intermittent very large flow; not sampled.	-	-	-	-	-	-	?	Insufficient data.	-
	11.6 11.4 10.8 10.3 8.4 7.1 4.8 4.1 3.4 3.0 2.2 1.6 9 .9 .3 .3 .1 .1 .1 .1 .1 .1 .1 .1 .1 .1 .1 .1 .1	18.7       1         11.6       2         11.4       3         10.8       4         10.3       5         8.4       6         7.1       7         4.8       8         4.1       9         3.4       10         3.0       11         2.2       12         1.6       13         .9       14         .9       15         .3       16         .3       17         .1       18         .1       19         .1       20         .1       21         <.1	18.7       1       25         11.6       2       20         11.4       3       24         10.8       4       21         10.3       5       15         8.4       6       1         7.1       7       2         4.8       8       22         4.1       9       3         3.4       10       23         3.0       11       19         2.2       12       4         1.6       13       18         .9       14       14         .9       15       9         .3       16       16         .3       17       17         .1       18       5         .1       19       7         .1       20       6         .1       21       8         <.1	18.7         1         25         1           11.6         2         20         3           11.4         3         24         2           10.8         4         21         9           10.3         5         15         4           8.4         6         1         5           7.1         7         2         8           4.8         8         22         6           4.1         9         3         12           3.4         10         23         7           3.0         11         19         10           2.2         12         4         11           1.6         13         18         15           .9         14         14         14           .9         15         9         13           .3         16         16         17           .3         17         17         16           .1         18         5         19           .1         19         7         18           .1         20         6         22           .1         21         8	11.6	Principal characteristics   Principal characteristics	Principal characteristics   Principal characteristics	18.7   1   25   1   Very large flow; high Fe, Mn; low Al; net alkaline; oxic   10.8   4   21   9   Very large flow; moderate Fe, Mn; low Al; net alkaline; oxic   10.3   5   15   4   Very large flow; moderate Fe, Mn; low Al; net alkaline; oxic   10.3   5   15   4   Very large flow; moderate Fe, Mn; low Al; net alkaline; oxic   10.3   5   15   4   Very large flow; moderate Fe, Mn; low Al; net alkaline; oxic   10.3   5   15   4   Very large flow; moderate Fe, Mn; low Al; net alkaline; oxic   10.3   5   15   4   Very large flow; moderate Fe, Mn; word   10.8   8   22   6   Very large flow; moderate Fe, Mn; low Al; net alkaline; oxic   10.8   8   22   6   Very large flow; moderate Fe, Mn; low Al; net alkaline; oxic   10.8   10   23   7   Large flow; moderate Fe, Mn; low Al; net alkaline; oxic   10   10   10   10   10   10   10   1	18.7   1   25   1   Very large flow; high Fe, Mn; low Al; net alkaline; oxic   10.8   4   21   9   Very large flow; high Fe, Mn; low Al; net alkaline; anoxic   10.8   4   21   9   Very large flow; high Fe, Mn; low Al; net alkaline; anoxic   10.8   4   21   9   Very large flow; high Fe, Mn; low Al; net alkaline; anoxic   10.8   4   21   9   Very large flow; high Fe, Mn; low Al; net alkaline; anoxic   10.8   4   21   9   Very large flow; moderate Fe, Mn; wery high Al; net acidic; oxic   10.3   5   15   4   Very large flow; moderate Fe, Mn; wery high Al; net acidic; oxic   10.3   5   15   4   Very large flow; moderate Fe, Mn; wery high Al; net acidic; oxic   10.4   10   5   Very large flow; moderate Fe, Mn; wery high Al; net acidic; anoxic   2   8   Very large flow; moderate Fe, Mn; low Al; net alkaline; oxic   2   10   2   8   Very large flow; high Fe, Mn; low Al; net alkaline; anoxic   2   2   2   2   4   11   Large flow; moderate Fe, Mn; moderate Al; net acidic; anoxic   3.0   11   19   10   Intermittent flow; high Fe, Mn; low Al; net alkaline; oxic   2   2   2   4   11   Large flow; moderate Fe, Mn; how Al; net alkaline; oxic   3   4   10   23   7   net alkaline; oxic   5   2   2   2   2   4   11   Large flow; moderate Fe, Mn; how Al; net alkaline; oxic   5   2   2   2   3   3   3   3   3   3   3	Principal characteristics   Principal characteristics	18.7   1   25   1	18.7   1   25   1	Principal characteristics   Principal characteristics

Site descriptions given in tables 1 and 3.

- 2. Rankings based on instantaneous loadings computed as product of flow rate and concentration of relevant constituents. Metals loading based on concentrations of dissolved iron, aluminum, and manganese. Net-alkalinity concentration computed as measured alkalinity minus computed acidity per equations 7 and 8. Rank of 1 for greatest loading; rank value increases with decreased loading.
- 3. Principal characteristics based on maxima and minima for flow rate and concentrations of alkalinity, dissolved metals, and oxygen (in mg/L) for samples collected in March and August 2001 (table 3). Flow (ft<sup>3</sup>/s): 'very large' if minimum  $\geq$  2.0; 'large' if maximum  $\geq$  1.0 and  $\leq$  2.0; 'moderate' if maximum  $\geq$  0.1 and  $\leq$  1.0; 'small' if maximum  $\leq$  0.1; 'intermittent' if maximum or minimum = 0. Iron and manganese (mg/L): 'very high' if minimum Fe  $\geq$  12 and minimum Mn  $\geq$  4; 'high' if minimum Fe  $\leq$  12 and minimum Mn  $\leq$  4; 'high' if maximum Fe  $\leq$  3 and maximum Mn  $\leq$  1. Aluminum (mg/L): 'very high' if maximum  $\geq$  4; 'high' if maximum  $\geq$  2; 'moderate' if maximum  $\leq$  2; 'low' if maximum  $\leq$  0.2. Net alkalinity (alkalinity computed acidity; mg/L as CaCO<sub>3</sub>): 'net acidic?' if maximum  $\leq$  5; 'net acidic' if maximum  $\leq$  0; 'net alkaline?' if minimum  $\geq$  0 or if missing and minimum pH  $\geq$  6.4; 'net alkaline' if minimum  $\geq$  5. Dissolved oxygen (mg/L): 'anoxic' if maximum  $\leq$  1; 'suboxic' if maximum  $\leq$  2; 'oxic' if minimum  $\geq$  2.
- 4. Remedial alternatives initially identified on the basis of maxima and minima for flow rate and water quality (in mg/L): 'Remove culm bank' if maximum pH < 4.0; 'Aerobic pond' if minimum net alkalinity  $\geq$  5; 'VFCW and aerobic pond' if minimum net alkalinity < 5, maximum dissolved oxygen > 1, maximum Al  $\geq$  2, and maximum flow  $\leq$  6.5; 'ALD and aerobic pond' if minimum net alkalinity < 5, maximum dissolved oxygen  $\leq$  1, maximum Al < 3, and maximum flow  $\leq$  6.5; 'OLC' if minimum net alkalinity < 5, maximum Al < 5, and maximum flow  $\leq$  10; 'Active Treatment' if minimum flow > 2 or maximum net alkalinity < -300.
- 5. Minimum wetland size computed by dividing the product of maximum flow rate and maximum iron concentration, in grams per day, by 20 g/m²/d (180 lb/acre/d) per Hedin and others (1994). If smaller loading rate used, increase area by constant factor: for loading rate of 10 or 5 g/m²/d, multiply wetland area estimate by 2 or 4, respectively.

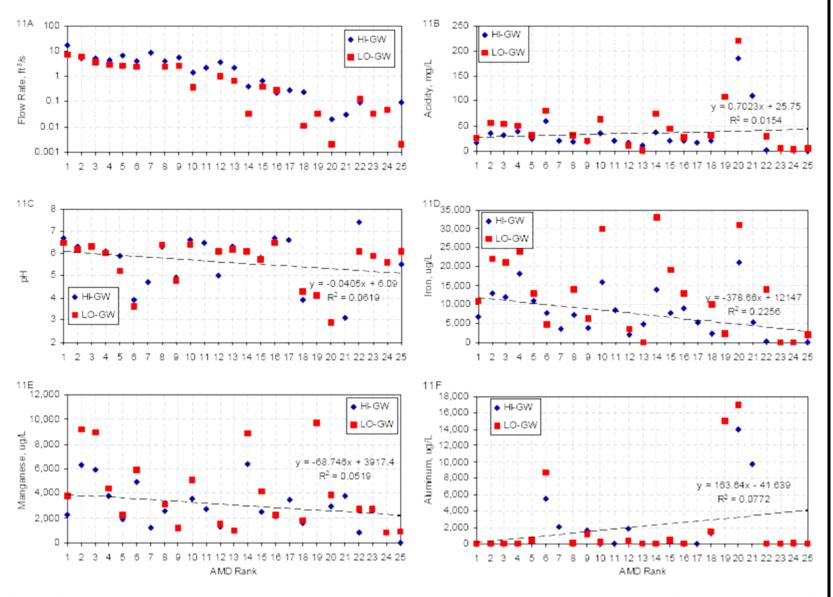


Figure 11. Relation between priority ranking based on dissolved metals loading in March 2001 for top 25 abandoned mine drainage (AMD) sites and (A) flow rate, (B) acidity, (C) pH, (D) iron, (E) manganese, and (F) aluminum concentrations for high base-flow (HI-GW) and low base-flow (LO-GW) AMD samples, Mahanoy Creek Basin, Pennsylvania. Flow rate in cubic feet per second ( $ft^3/s$ ); concentrations in millgrams per liter ( $ft^3/s$ ) or micrograms per liter ( $ft^3/s$ ).

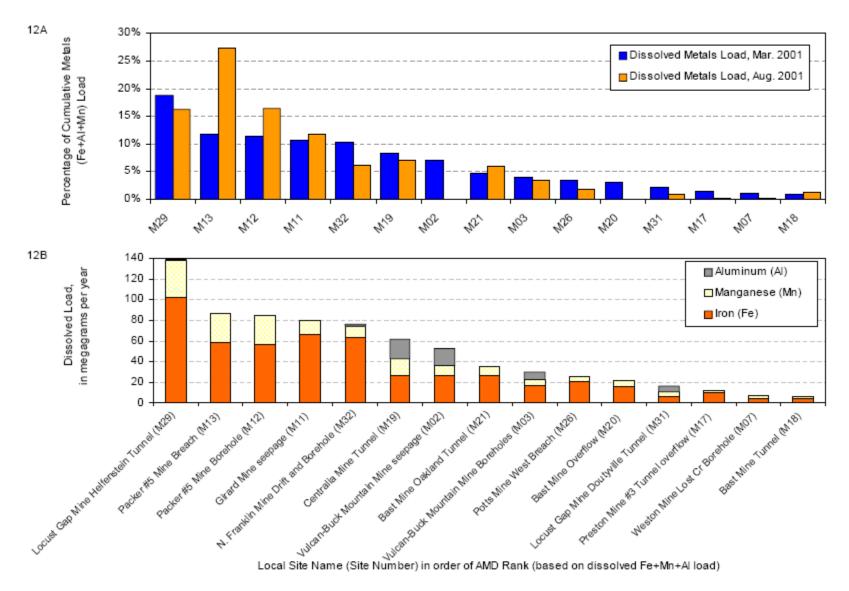


Figure 12. Comparison of priority ranks for top 15 abandoned mine drainage (AMD) sites, Mahanoy Creek Basin, Pennsylvania, (A) on the basis of concentrations of iron, aluminum, and manganese in filtered samples collected during high base-flow conditions (HI-GW) in March 2001 and low base-flow conditions (LO-GW) in August 2001, and (B) considering relative contributions of dissolved iron, manganese, and aluminum to the dissolved metals loading during March 2001.

#### **PUBLIC PARTICIPATION**

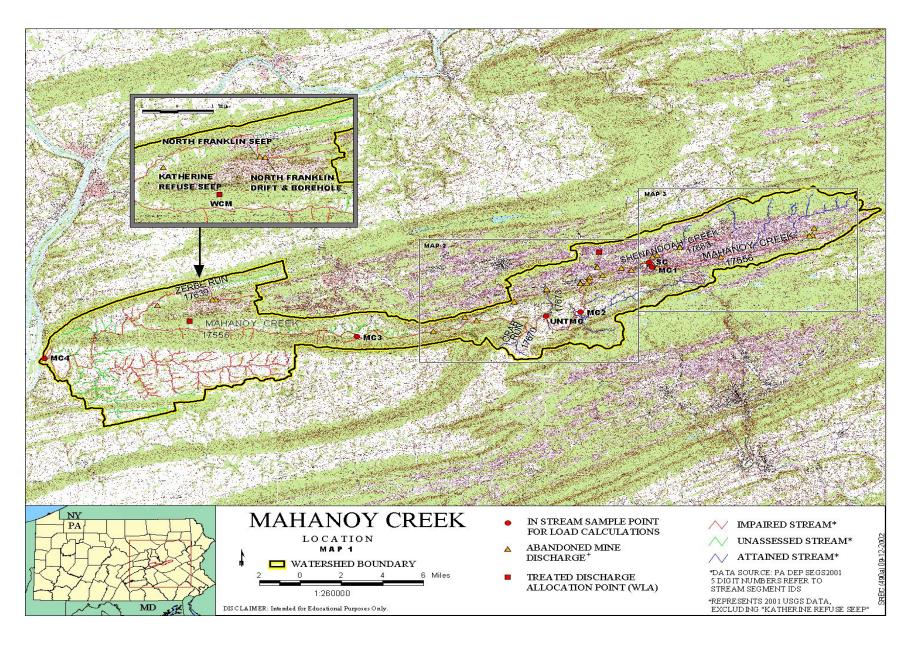
Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* on December 14, 2002 and the Shamokin News Item on January 11, 2003 to foster public comment on the allowable loads calculated. A public meeting was held on January 16, 2003 at the Girardville Borough Hall in Girardville, PA to discuss the proposed TMDL. An additional public meeting was held on February 6, 2007 at the Girardville Borough Hall in Girardville, PA to discuss the revised TMDL.

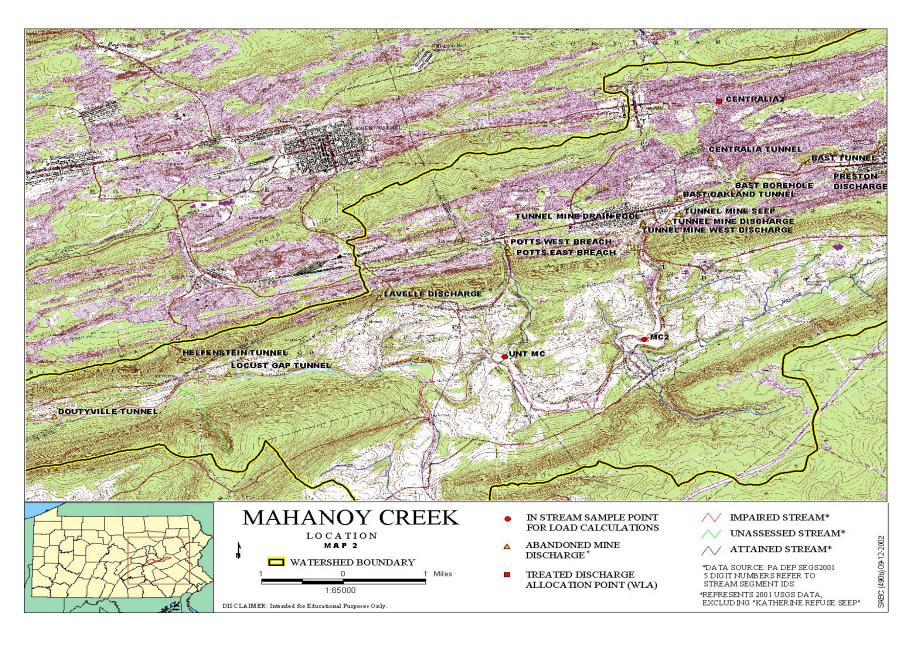
#### **REFERENCES**

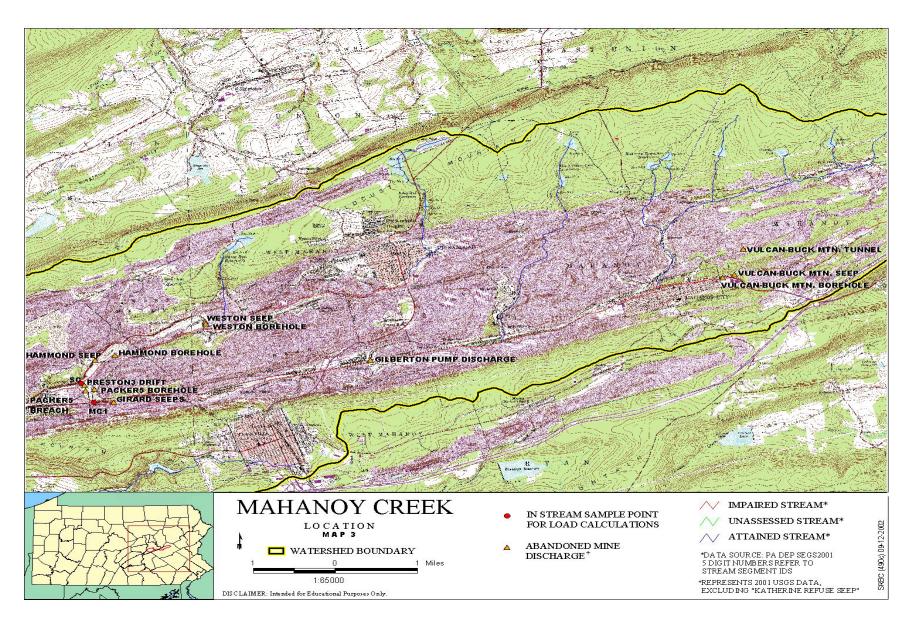
- Cravotta, Charles A. 2004. Effects of Abandoned Coal-Mine Drainage on Streamflow and Water Quality in the Mahanoy Creek Basin, Schuylkill, Columbia, and Northumberland Counties, Pennsylvania, 2001. U.S. Department of the Interior, U. S. Geological Survey Scientific Investigations Report 2004-5291.
- Friday, Martin. 2002. Unpublished. Mahanoy Creek Biological Assessment Data. Pennsylvania Department of Environmental Protection.
- Pennsylvania Department of Environmental Protection. 2000. Watershed Restoration and Action Strategies (WRAS) for Subbasin 06B, Mahanoy Creek and Shamokin Creek Watersheds, (Susquehanna River), Northumberland and Schuylkill Counties.
- Sanders and Thomas, Inc. for Pennsylvania Department of Environmental Resources. 1975. Mahanoy Creek Mine Drainage Pollution Project. Operation Scarlift.
- Reed, Lloyd A., Mark M Beard, and Douglas J. Growitz. 1987. Quality of Water in Mines in the Western Middle Coal Field, Anthracite Coal Region, East-Central Pennsylvania. U.S. Geological Survey. Water-Resources Investigations Report 85-4038.
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## Attachment A

Mahanoy Creek Watershed Maps







### **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 EPA codes;
- 3. changes to source(s)/cause(s), and/or miles due to revised assessments;
- 4. corrections of misnamed streams or streams placed in inappropriate SWP subbasins; and
- 5. unnamed tributaries no longer identified as such and placed under the named watershed listing.

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

The most notable difference between the 1998 and Draft 2000 303(d) lists are the listing of unnamed tributaries in 2000. In 1998, the GIS stream layer was coded to the named stream level so there was no way to identify the unnamed tributary records. As a result, the unnamed tributaries were listed as part of the first downstream named stream. The GIS stream coverage used to generate the 2000 list had the unnamed tributaries coded with the Pa. DEP's five-digit stream code. As a result, the unnamed tributary records are now split out as separate records on the 2000 303(d) list. This is the reason for the change in the appearance of the list and the noticeable increase in the number of pages. After due consideration of comments from EPA and PADEP on the Draft 2000 Section 303(d) list, the Draft 2002 Pa Section 303(d) list was written in a manner similar to the 1998 Section 303(d) list.

## Attachment C

Method for Addressing Section 303(d) Listings for pH

#### Method for Addressing 303(d) Listings for pH

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

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

Each sample point used in the analysis of pH by this method must have measurements for total alkalinity and total acidity. Net alkalinity is alkalinity minus acidity, both being in units of milligrams per liter (mg/l) CaCO<sub>3</sub>. 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.

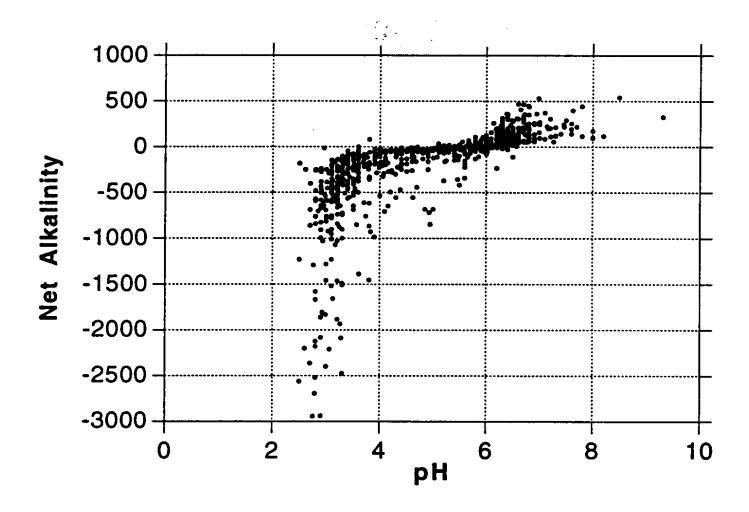


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania.

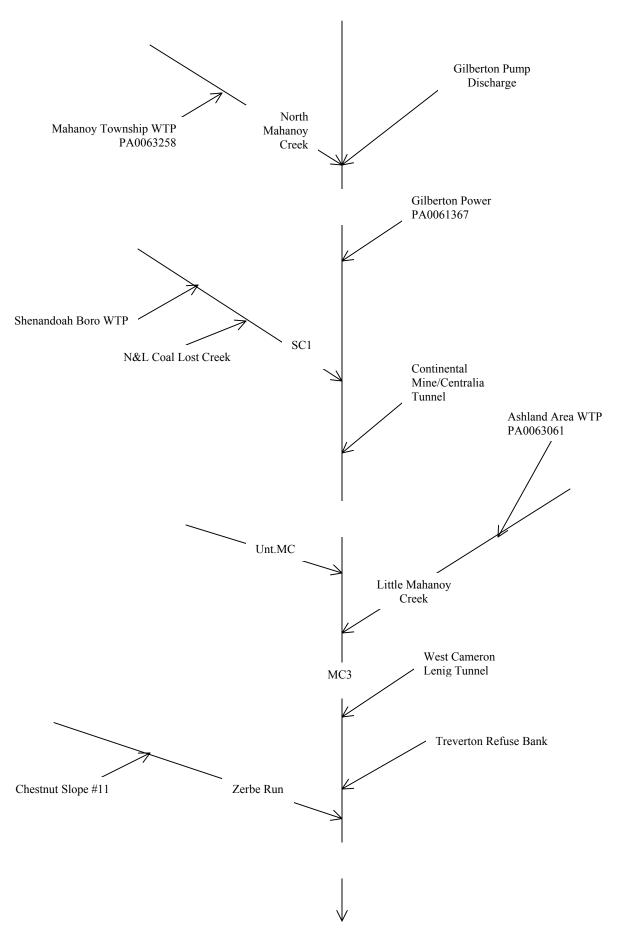
# Attachment D TMDLs By Segment

### **Mahanoy Creek**

Mahanoy Creek is a warm-water fishery (WWF) that flows into the Susquehanna River near the town of Herndon in Northumberland County and is found in State Water Plan 06B. A total of 6 sample locations (MC1-MC4, SC1, Unt.MC) were used in the assessment of the Mahanoy Creek Watershed. Four sampling sites on Mahanoy Creek, one site on Shenandoah Creek, and one site on an unnamed tributary to Mahanoy Creek were included in calculations.

Mahanoy Creek is listed as impaired on the 1996 PA Section 303(d) list for metals and depressed pH from AMD. Although this TMDL will focus primarily on metals, pH and reduced acid loading will be performed as well. The objective is to reduce acid loading to the stream, which will in turn raise the pH to the desired range and keep a net alkalinity above zero, 99% of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 2). The method and rationale for addressing pH is contained in Attachment B.

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



### Waste Load Allocation - Mahanoy Township Water Treatment Plant

Mahanoy Township (NPDES PA0063258) has a permitted discharge from its water treatment plant that is evaluated in the calculated allowable loads at MC1. Outfall 001 is a discharge from water treatment plant wastewater lagoons. Effluent limits from this facility (permitted through the Pa. DEP Water Program, not the Mining Program) were determined using BAT limits for total iron and total manganese. Effluent limits from this facility for total aluminum were determined using the PennTox Model that uses proposed discharge concentrations and design flow values to evaluate what concentration of pollutants the receiving stream can assimilate (evaluated at Q 7-10) and maintain its designated uses. The following table shows the waste load allocation for this discharge.

Table C1. Waste Load Allocations at Mahanoy Township WTP						
Parameter	Monthly Avg. Allowable Conc.	Average Flow	Allowable Load			
	(mg/L)	(MGD)	(lbs/day)			
Outfall 001						
Al	2.0	0.100	1.67			
Fe	2.0	0.100	1.67			
Mn	1.0	0.100	0.83			

<u>TMDL calculations- MCl – Mahanoy Creek upstream of Girardville</u>

Mahanoy Creek above MC1 represents all of the Mahanoy Creek Watershed upstream of Girardville. There are four known discharges entering this section of Mahanoy Creek. According to the Scarlift Report, the flow from these discharges is actually larger then the flow of the stream at the point of contact. The Gilberton Pump Discharge is located on the east side of Gilberton. The pumping station intermittently pumps water from the mine pool into the creek. The purpose of this is to maintain the mine pool at a certain level to keep the town from flooding (Operation Scarlift 1975). Other discharges in this section are part of the Vulcan-Buck Mountain Group located east of Mahanov City. Reports vary on location and number of discharges, but the most recent survey conducted by the USGS identified a seep and borehole, near the Rt. 54 crossing (Cravotta 2001). The Girard Mine Discharge is located east of Girardville on the south bank of Mahanoy Creek. It emerges as a series of seeps that drain the abandoned Girard Mine workings from Ashland Mountain. Unreclaimed surface mining pits run along the base of the mountain trapping the surface runoff. The water is directed into the Girard Mine Pool, which drains all of the seeps (Operation Scarlift 1975). See Appendix F for water quality data on the Girard Mine Discharge.

The Gilberton Pumped Discharge, operated by the PADEP BAMR, was not discharging during any of the days when data were collected that were used develop loads in this TMDL. During the twelve year period of 1993 through 2003, the Gilberton Pump operated about 42.4 percent of the time and discharged roughly 2.5 billion gallons of mine pool water per year to Mahanoy Creek. This creates an average discharge over that time period of 6.9 MGD (about 4,800 GPM). Because these large discharges and their

effects were not captured in the sampling data, the flow adjusted concentration method (Attachment D) was applied to the sampling data from MC1 to reflect changes in water quality that would occur if the Gilberton Pump were discharging during the sampling event.

The TMDL for sample point MC1 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this headwaters segment of Mahanoy Creek was computed using water-quality sample data collected at point MC1 modified using the flow adjusted concentration method. The average (adjusted) flow measured at sampling point MC1 (16.54 MGD) is used for these computations. Because this is the most upstream point of this segment, the allowable load allocations calculated at MC1 is equal to the actual load that will directly affect the downstream point MC2.

Sample data at point MC1 shows that the headwaters segment has a pH ranging between 5.0 and 6.7. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for aluminum, iron, manganese and acidity at MC1 has been calculated. Table C2 shows the measured and allowable concentrations and loads at MC1. Table C3 shows percent reductions for aluminum, iron, manganese and acidity required at this point. Load allocations were calculated at MC1 and for the Gilberton Pump Discharge, while a waste load allocation was calculated for the Mahanoy Township WWTP (NPDES PA0063258).

Table C2		Measured		Allowable	e
Flow (gpm)=	11486.11	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.76	105.28	0.20	27.37
	Iron	16.49	2274.14	1.15	159.19
	Manganese	4.89	674.94	0.69	94.49
	Acidity	18.00	2482.99	6.48	893.87
	Alkalinity	22.00	3034.76		

Table C3. Allocations MC1							
MC1 Al (Lbs/day) Fe (Lbs/day) Mn (Lbs/day) Acidity (Lbs/day							
Existing Load @ MC1	35.27	1728.05	454.85	2482.99			
Allowable Load @ MC1	27.37	159.19	94.49	893.87			
Load Reduction @ MC1	7.90	1568.86	360.36	1589.12			
% Reduction required @ MC1	74%	93%	86%	64%			

When loads were mass balanced for this segment, it was found that the sum of all NPS loads was larger than the allowable aluminum load at MC1. Load allocations to the Gilberton Pump Discharge were made to assure that the total TMDL would not be exceeded by the NPS contribution from the discharge. The calculations to reduce

aluminum loads from the Gilberton Pump Discharge to assure that load allocations to nonpoint sources would be met at MC1 are shown in Attachment G.

# Waste Load Allocation – N&L Coal Company, Lost Creek Operation

The N&L Coal Company (SMP 54753035; NPDES PA00595608) has a permitted discharge from its Lost Creek surface mine that is evaluated in the calculated allowable loads at SC1. Outfall 001 is a discharge from a mine drainage treatment facility. This discharge does not have effluent limits for aluminum currently; a concentration of 2.0 mg/L was assigned to the discharge for aluminum in the effluent. The following table shows the waste load allocation for this discharge.

Table C4. Waste Load Allocations at Lost Creek						
Parameter	Monthly Avg. Allowable Conc.	Average Flow	Allowable Load			
	(mg/L)	(MGD)	(lbs/day)			
Outfall 001						
Al	2.0	0.135	2.25			
Fe	3.0	0.135	3.38			
Mn	2.0	0.135	2.25			

<u>Waste Load Allocation – Municipal Authority of Borough of Shenandoah Water</u> Treatment Plant

The Municipal Authority of the Borough of Shenandoah (NPDES PA0062758) has a permitted discharge from its water treatment plant that is evaluated in the calculated allowable loads at SC1. Outfall 001 is a discharge from filter and clarifier backwash, floor drains, sample analyzers, and plant overflow. Effluent limits from this facility (permitted through the Pa. DEP Water Program, not the Mining Program) were determined using BPT limits for total iron, total aluminum, and total manganese. The following table shows the waste load allocation for this discharge.

Table C5. Waste Load Allocations at Shenandoah Borough WTP							
Parameter	Monthly Avg. Allowable Conc.	Average Flow	Allowable Load				
	(mg/L) (MGD) (lbs/day)						
Outfall 001							
Al	4.0	0.128	4.27				
Fe	2.0	0.128	2.14				
Mn	1.0	0.128	1.07				

TMDL calculations-SC1 – Shenandoah Creek near confluence with Mahanoy Creek

Shenandoah Creek above SC represents all of the Shenandoah Creek Watershed upstream. Shenandoah Creek is affected by five known discharges. The Preston Water

Level Drift is located east of Girardville, near the streams confluence with Mahanoy Creek. A seep and a borehole, draining the Hammond Mine, enter the stream through a wetlands area near the village of Connerton. Drainage from the Weston Mine enters the stream near the village of Lost Creek through a seep and borehole.

The TMDL for sample point SC1 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment of Shenandoah Creek was computed using water-quality sample data collected at point SC1. The average flow (5.69 MGD) is used for these computations. Because this is the most upstream point of this segment, the allowable load allocations calculated at SC1 is equal to the actual load that will directly affect the downstream point MC2.

Sample data at point SC1 shows that the headwaters segment has a pH ranging between 6.4 and 6.9. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

TMDLs for aluminum, iron and manganese at SC1 have been calculated. Water quality standards for pH are being met at this point; therefore, no TMDL is necessary. Table C6 shows the measured and allowable concentrations and loads at SC1. Table C7 shows percent reductions for aluminum, iron, and manganese required at this point.

Table C6		Measured		Allowable	)
Flow (gpm)=	3949.72	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.43	20.41	0.34	16.14
	Iron	3.22	152.80	0.42	19.93
	Manganese	4.74	224.94	0.38	18.03
	Acidity	2.83	134.30	NA	NA
	Alkalinity	79.50	3772.64		

Table C7. Allocations SC1						
SC1 Al (Lbs/day) Fe (Lbs/day) Mn (Lbs/day)						
Existing Load @ SC1	20.41	152.80	224.94			
Allowable Load @ SC1	16.14	19.93	18.03			
Load Reduction @ SC1	4.27	132.87	206.91			
% Reduction required @ SC1	21%	87%	92%			

<u>Waste Load Allocation – Gilberton Power Company John B. Rich Memorial Power</u> Station

The Gilberton Power Company (NPDES PA0061697) has a permitted discharge from its John B. Rich Memorial Power Station that is evaluated in the calculated allowable loads at MC1. Outfall 001 is a discharge from cooling tower blow-down. Effluent limits from this facility (permitted through the Pa. DEP Water Program, not the Mining Program)

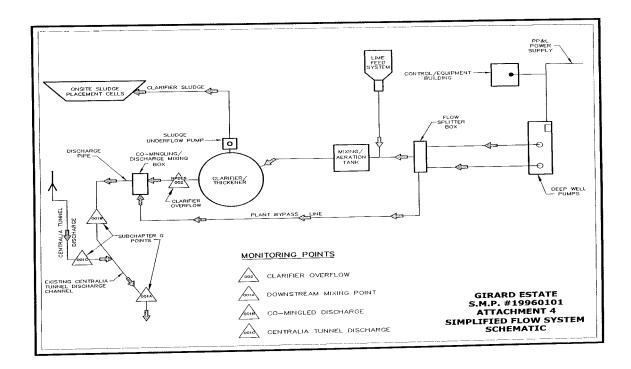
were determined using the PennTox Model that uses proposed discharge concentrations and design flow values to evaluate what concentration of pollutants the receiving stream can assimilate (evaluated at Q 7-10) and maintain its designated uses. This discharge does not have effluent limits for aluminum currently; a concentration of 4.0 mg/L was assigned to the discharge for aluminum in the effluent. The following table shows the waste load allocation for this discharge.

Table C8. Waste Load Allocations at Gilberton Power						
Parameter	Monthly Avg. Allowable Conc.	Average Flow	Allowable Load			
	(mg/L)	(MGD)	(lbs/day)			
Outfall 001						
Al	2.00	0.310	5.17			
Fe	12.56	0.310	32.47			
Mn	8.37	0.310	21.64			

Waste Load Allocation - City of Philadelphia (Trustee) Girard Estate, Continental Mine

The City of Philadelphia (SMP19960101C3; NPDES PA0223719) has a permitted discharge from its Continental Mine operation that is evaluated in the calculated allowable loads at MC2. Outfall 002 is effluent from a treatment plant that treats water pumped from the deep mine pool. The pump runs intermittently throughout the year. Half of the water is treated with caustic soda and a lime kilm dust and then combined with the rest of the pumped water. The treated discharge is piped about one-mile south where it meets the Centralia Tunnel Discharge and then flows another 0.5-mile down a ravine before entering Mahanoy Creek. This discharge does not have effluent limits for aluminum currently; a concentration of 1.5 mg/L was assigned to the discharge for aluminum in the effluent. In addition, this permit has discharge points of 001C (abandoned Centralia Tunnel discharge), 001B (commingled treated and bypass water), and 001A (channel containing combined waters of 001B, 001C, and 002) that are covered as Subchapter G discharges using baseline pollutant loadings (see flow schematic below). According to Subchapter G, as long as these discharges are not degraded (pollution loads increased over the baseline loads as stipulated in the permit), the operator is responsible for no further treatment. In addition, pumping and treatment of water from Outfall 002 adds additional water to point 001C, which discharges to Mahanov Creek and allows for dilution and neutralization of the pollutant loads coming from Outfalls 001A and 001B. Therefore, no allocations are necessary to these points. The following table shows the waste load allocation for this discharge.

TableC9. Waste Load Allocations at Continental Mine						
Parameter	Monthly Avg. Allowable Conc.	Average Flow	Allowable Load			
	(mg/L)	(MGD)	(lbs/day)			
Outfall 002						
Al	0.75	8.38	52.42			
Fe	3.0	8.38	209.67			
Mn	2.0	8.38	139.78			



### TMDL calculations-MC2 – Mahanoy Creek near Gordon

Mahanoy Creek at MC2 represents all of the watershed area between MC1 and MC2. The source of the AMD impairment in this segment is due to 10 known discharges between Girardville and Ashland and Gordon.

The Centralia Tunnel is located about one mile north of Ashland. The tunnel drains the Centralia and Continental Mines. Part of the Centralia Mine Pool extends under the topographical watershed boundary into the Shamokin Creek Watershed, draining some of that watershed as well. From the tunnel opening, the discharge flows south a few hundred feet and then mixes with a treated discharge from the City of Philadelphia, Girard Estate. Before mixing with the treated discharge, the Centralia drainage is quite acidic. By the time the discharge combines with the treatment water and flows the final

0.50 mile down a ravine to Mahanoy Creek, the pH has risen significantly. See Appendix F for water quality data from this discharge.

The Packer 5 Group Discharges are some of the largest discharges entering Mahanoy Creek in this segment. These discharges are located on the eastern edge of Girardville. The Packer 5 Borehole flows west about 800 ft. through ditches and culverts before it enters Mahanoy Creek. Drainage from the Packer 5 Breach surfaces just west of the borehole. It flows directly into drainage from the borehole on its way to Mahanoy Creek. Both discharges drain all or parts of 14 different mine pools. The Operation Scarlift Report states that this group of discharges accounts for 30 percent of the AMD affecting Mahanoy Creek.

The Preston Mine Discharge is located on the southwestern edge of Girardville and drains the Preston No.3 Mine. The Bast Group Discharges include the Bast Tunnel and Borehole, and the Oakland Tunnel. They are all located on the north banks of Mahanoy Creek between Girardville and Ashland. The Bast Tunnel and Borehole are smaller discharges than the Oakland Tunnel. All three discharges drain the Bast Mine Pool; however, the Oakland Tunnel also drains the Germantown Mine Pool. The Centralia Tunnel and the Centralia Treated Discharge that was previously mentioned also drain into this segment of Mahanoy Creek. The Tunnel Mine Discharges are a series of seeps located along the east and west banks of Mahanoy Creek on the southeastern side of Ashland. They all drain the Tunnel Mine Pool (Operation Scarlift 1975). The allowable load allocations calculated at MC2 is equal to the actual load that will directly affect the downstream point MC3.

The TMDL for this section of Mahanoy Creek consists of a load allocation to all of the watershed area between MC1 and MC2. The load allocation for this segment was calculated using water-quality data collected at the point that had been adjusted using the flow adjusted concentration method described in Appendix E to include better characterize the effects of the Continental Mine pumped discharge on MC2 and other downstream points. This was done because the water quality data used were not taken during a period of time when the Continental Mine pumped discharge was operating. The average instream flow adjusted to include the waste load allocation flow for the Continental Mine was used for point MC2 (60.348 mgd).

The measured and allowable loading for point MC2 for aluminum, iron and manganese was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points MC1/SC1 show the total load that was permitted from upstream sources. This value was added to the difference in existing loads between point MC1/SC1 and MC2 to determine a total load tracked for the segment of stream between MC2 and MC1/SC1. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at MC2.

TMDLs for aluminum, iron and manganese at MC2 have been calculated. Water quality standards for pH are being met at this point; therefore, no TMDL is necessary. Table C10

shows the measured and allowable concentrations and loads at MC2. Table 11 shows percent reductions for aluminum, iron, manganese and acidity required at this point.

Table C10		Measured		Allowable	)
Flow (gpm)=	41908.33	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	1.44	726.24	0.20	101.67
	Iron	12.00	6038.72	0.84	422.71
	Manganese	5.32	2677.90	0.69	348.13
	Acidity	1.66	834.88	0.17	83.49
	Alkalinity	58.76	29572.03		

Table C11 Allocations MC2						
MC2	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)		
Existing Load @ MC2	726.24	6038.72	2677.90	834.88		
Difference in measured Loads between upstream						
loads and existing MC2	542.96	3369.64	1616.60	-1782.41		
Percent loss calculated at MC2	0%	0%	0%	69%		
Additional load tracked from above samples	101.10	421.26	273.94	893.88		
Percentage of upstream loads that reach MC2	100%	100%	100%	31%		
Total load tracked between upstream and MC2	644.06	3790.90	1890.54	277.10		
Allowable Load @ MC2	101.67	422.71	348.13	83.49		
Load Reduction @ MC2	542.39	3368.19	1542.41	193.61		
% Reduction required at MC2	85%	89%	82%	70%		

The existing aluminum load at MC2 was measured to be 726.24 lbs/day. This was 542.96 lbs/day greater than the upstream contributing loads. This increase in aluminum load in this segment can be attributed to aluminum entering the river in this segment. The total aluminum load tracked was 542.39 lbs/day greater than the calculated allowable aluminum load of 101.67 lbs/day; therefore an 85% reduction for aluminum is necessary. The existing iron load was reported to be 6038.72 lbs/day. An increase of 3369.64 lbs/day of iron has entered the Mahanoy Creek between MC1/SC1 and MC2. The total iron load tracked was found to be 3368.19 lbs/day greater than the calculated allowable iron load of 422.71 lbs. An 89% reduction is required for iron. Mahanoy Creek has gained 1616.60 lbs/day of manganese by the time it reaches sample point MC2. The total load tracked was 1542.41 lbs/day greater than the allowable load of 348.13 lbs/day; therefore an 82% manganese reduction is necessary. Mahanoy Creek lost 1782.41 lbs/day of acid by the time it reaches sample point MC2. The total load tracked was 193.61 lbs/day greater than the allowable load of 83.49 lbs/day; therefore a 70% acid reduction is necessary.

### **Unnamed Tributary to Mahanoy Creek at Unt.MC**

The unnamed tributary to Mahanoy Creek at Unt.MC represents all of the watershed area of the unnamed tributary. Locally, this tributary is named Big Run. It originates in the village of Locustdale and flows south through Lavelle to its confluence with Mahanoy Creek. The only known discharges that affect this stream are the Potts Discharges. They are located in the headwaters of the stream, just south of Locustdale on SR4027. These seeps drain the Potts Mine Pool. The East Breach seeps from the side of the mountain on the eastern side of SR4027 and drains into an unnamed tributary to Mahanoy Creek. The West Breach is found to the west of the road and drains into the unnamed tributary.

The TMDL for sample point Unt.MC consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment of Big Run was computed using water-quality sample data collected at point Unt.MC. The instream flow at point Unt.MC (2.40 mgd) was used in the calculations. Because this is the most upstream point of this segment, the allowable load allocations calculated at Unt.MC is equal to the actual load that will directly affect the downstream point MC3.

Sample data at point Unt.MC shows that the headwaters segment has a pH ranging between 7.86 and 8.2. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

TMDLs for aluminum, iron and manganese at Unt.MC have been calculated. Water quality standards for pH are being met at this point; therefore, no TMDL is necessary. Table C12 shows the measured and allowable concentrations and loads at Unt.MC. Table C13 shows percent reductions for aluminum, iron, and manganese required at this point.

Table C12		Measured		Allowable	e
Flow (gpm)=	1662.90	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.37	7.41	0.15	3.00
	Iron	2.16	43.24	0.32	6.41
	Manganese	1.38	27.62	0.44	8.81
	Acidity	3.88	77.66	NA	NA
	Alkalinity	134.0	2682.14		

Table C13. Allocations Unt.MC									
Unt.MC Al (Lbs/day) Fe (Lbs/day) Mn (Lbs/day)									
Existing Load @ Unt.MC	7.41	43.24	27.62						
Allowable Load @ Unt.MC	3.00	6.41	8.81						
Load Reduction @ Unt.MC	4.41	36.83	18.81						
% Reduction required @ Unt.MC 60% 86% 69%									

### Waste Load Allocation -Ashland Area Municipal Authority Water Treatment Plant

The Ashland Area Municipal Authority (NPDESPA0063061) has a permitted discharge from its water treatment plant that is evaluated in the calculated allowable loads at MC3. Outfall 001 is a discharge from filter backwash the water treatment plant. Effluent limits from this facility (permitted through the Pa. DEP Water Program, not the Mining Program) were determined using BPT limits for total iron, total aluminum, and total manganese. The following table shows the waste load allocation for this discharge.

Table C14. Waste Load Allocations at Ashland Area Municipal Authority Water Treatment Plant										
Parameter	Monthly Avg. Allowable Conc.	Average Flow	Allowable Load							
	(mg/L)	(MGD)	(lbs/day)							
Outfall 001										
Al	4.0	0.019	0.63							
Fe	2.0	0.019	0.32							
Mn	1.0	0.019	0.16							

### Mahanoy Creek between MC2 and MC3

Mahanoy Creek at MC3 represents all of the watershed area between MC2 and MC3. The source of the AMD impairment is due to six known discharges west of Gordon. The discharges being accounted for in this TMDL include the Lavelle Discharge (also called Mowry Discharge or Laurel Hill Discharge), the Locust Gap Tunnel, the Doutyville Tunnel and the Helfenstein Tunnel Discharge. The Lavelle Discharge is located one-mile northwest of Lavelle and overflows the old Laurel Hill Slope (Operation Scarlift 1975). The discharge flows about one-mile down Mahanoy Mountain and enters Mahanoy Creek. The Locust Gap Tunnel Discharge is located on the north bank of Mahanoy Creek about 2 miles southwest of Lavelle. The tunnel extends into Mahanoy Mountain and drains part of the Locust Gap Mine Pool. Part of the mine pool extends under the topographical watershed boundary into the Shamokin Creek Watershed. Therefore, the tunnel drains part of that watershed (Operation Scarlift 1975). The Doutyville Tunnel is located about 1.5 miles southwest of the village of Helfenstein. The discharge flows south through a ravine before entering Mahanoy Creek. This tunnel extends north into Mahanoy Mountain and also drains the Locust Gap Mine Pool that extends under the topographical watershed boundary into the Shamokin Creek Watershed (Operation Scarlift 1975). The Helfenstein Tunnel is located just north of the village of Helfenstein. It too drains the Locust Gap Mine Pool that extends under the topographical watershed boundary into the Shamokin Creek Watershed. The discharge flows less than 0.50 mile down Mahanoy Mountain into Mahanoy Creek. See Appendix F for water quality data on the Locust Gap and Doutyville Tunnel discharges.

The TMDL for this section of Mahanoy Creek consists of a load allocation to all of the watershed area between MC2 and MC3. The load allocation for this segment was calculated using water-quality data collected at the point that had been adjusted using the flow adjusted concentration method described in Appendix E to include better

characterize the effects of the Continental Mine pumped discharge on MC3 and other downstream points. This was done because the water quality data used were not taken during a period of time when the Continental Mine pumped discharge was operating. The average instream flow adjusted to include the waste load allocation flow for the Continental Mine was used for point MC3 (94.67 mgd) was used in the calculations.

There currently is no entry for this segment on the Pa. Section 303(d) list for impairment due to pH. Sample data at this point are net alkaline with pH ranging between 6.9 and 7.6. Therefore, acidity will not be addressed in this TMDL.

The measured and allowable loading for point MC3 for aluminum, iron and manganese was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points MC2/Unt.MC show the total load that was permitted from upstream sources. This value was added to the difference in existing loads between point MC2/Unt.MC and MC3 to determine a total load tracked for the segment of stream between MC3 and MC2/Unt.MC. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at MC3

TMDLs for aluminum, iron and manganese at MC3 have been calculated. Water quality standards for pH are being met at this point; therefore, no TMDL is necessary. Table C15 shows the measured and allowable concentrations and loads at MC3. Table C16 shows percent reductions for aluminum, iron, and manganese required at this point.

Table C15		Measured		Allowable	)
Flow (gpm)=	65743.06	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	1.06	836.31	0.15	117.08
	Iron	7.41	5850.55	0.37	292.53
	Manganese	3.39	2674.46	0.37	294.19
	Acidity	2.32	1827.80	0.42	329.01
	Alkalinity	38.60	30476.55		

Table C16. Allocations MC3										
MC3	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)						
Existing Load @ MC3	836.31	5850.55	2674.46	1827.80						
Difference in measured Loads between upstream loads and existing MC3	102.03	-231.76	-31.22	915.26						
Percent loss calculated at MC3	0%	4%	2%	0%						
Additional load tracked from above samples	105.30	429.44	357.10	83.49						
Percentage of upstream loads that reach MC3	100%	96%	98%	100%						
Total load tracked between upstream and MC3	207.33	412.26	349.96	998.75						
Allowable Load @ MC3	117.08	292.53	294.19	329.01						
Load Reduction @ MC3	90.25	119.73	55.77	669.74						
% Reduction required at MC3	44%	30%	16%	68%						

The existing aluminum load at MC3 was measured to be 836.31 lbs/day. This was 102.03 lbs/day greater than the upstream contributing loads. This increase in aluminum load in this segment can be attributed to aluminum entering the river in this segment. The total aluminum load tracked was 90.25 lbs/day greater than the calculated allowable aluminum load of 117.08 lbs/day; therefore a 44% reduction for aluminum is necessary. The existing iron load was reported to be 5850.55 lbs/day, a decrease of 231.76 lbs/day from upstream. The total iron load tracked was found to be 119.73 lbs/day greater than the calculated allowable iron load of 292.53 lbs/day. A 30% reduction is required for iron. The existing manganese load at MC3 was measured to be 2674.46 lbs/day. This was 31.22 lbs/day less than the upstream contributing loads. The total manganese load tracked was 55.77 lbs/day greater than the calculated allowable manganese load of 294.19 lbs/day; therefore a 16% reduction for manganese is necessary. The existing acid load was reported to be 1827.80 lbs/day, an increase of 915.26 lbs/day from upstream. This increase in acid load in this segment can be attributed to acid entering the river in this segment. The total acid load tracked was found to be 669.74 lbs/day greater than the calculated allowable acid load of 329.01 lbs/day. A 68% reduction is required for acid.

### Waste Load Allocation - Chestnut Coal Company, Chestnut Slope #11

The Chestnut Coal Company (UMP 49921301; NPDES PA0596035) has a permitted discharge from its Chestnut Slope #11 operation that is evaluated in the calculated allowable loads at MC4. Outfall 001 is a discharge from treatment pond B that treats water pumped from the deep mine. This discharge does not have effluent limits for aluminum currently; a concentration of 2.0 mg/L was assigned to the discharge for aluminum in the effluent. The following table shows the waste load allocation for this discharge.

Table C17. Waste Load Allocations at Chestnut Slope #11									
Parameter	Monthly Avg.	Average Flow	Allowable Load						
	Allowable Conc. (mg/L)	(MGD)	(lbs/day)						
Outfall 001									
Al	2.0	0.864	14.41						
Fe	3.0	0.864	21.62						
Mn	2.0	0.864	14.41						

Waste Load Allocation - Reading Anthracite Company, Treverton Refuse Bank #228

The Reading Anthracite Company (SMP49803201R4; NPDES PA0595978) has a permitted discharge from its Treverton Refuse Bank #228 operation that is evaluated in the calculated allowable loads at MC4. Outfall 002 is a discharge from the treatment pond that treats water collected from a series of seeps along the base of a refuse bank. Water is discharged from treatment ponds on this permit to an adjacent treatment pond on Reading Anthracite Company Treverton Slush Bank #57 (SMP49803202), which has no surface discharge. The following table shows the waste load allocation for this discharge.

Table C18. Waste Load Allocations at Treverton Refuse Bank #228									
Parameter	Monthly Avg. Allowable Conc.	Average Flow	Allowable Load						
	(mg/L)	(MGD)	(lbs/day)						
Outfall 002									
Al	1.4	0.036	0.42						
Fe	3.0	0.036	0.90						
Mn	2.0	0.036	0.60						

### Waste Load Allocation – West Cameron Mining, Lenig Tunnel

The West Cameron Mining Company (UMP 49871304C2; NPDES PA0595306) has a permitted discharge from its Lenig Tunnel operation that is evaluated in the calculated allowable loads at MC4. Outfall 001 is a discharge from the treatment pond that treats water pumped from the deep mine. This discharge does not have effluent limits for aluminum currently; a concentration of 2.0 mg/L was assigned to the discharge for aluminum in the effluent. The following table shows the waste load allocation for this discharge.

Table C19. Waste Load Allocations at Lenig Tunnel										
Parameter	Monthly Avg. Allowable Conc.	Average Flow	Allowable Load							
	(mg/L)	(MGD)	(lbs/day)							
Outfall 001										
Al	2.0	0.576	9.61							
Fe	3.0	0.576	14.41							
Mn	2.0	0.576	9.61							

## Mahanoy Creek Between MC3 and MC4

Mahanoy Creek at MC4 represents all of the watershed area between MC3 and MC4. Most of the AMD impairment in this section of the stream is from Zerbe Run. The abandoned discharges affecting Zerbe Run are the North Franklin discharges and the Katherine Refuse Seep. The North Franklin discharges are located south of Trevorton along Route 225. The drift and borehole, the larger of the two discharges, are said to cause over 90 percent of the AMD impairment to Zerbe Run (Operation Scarlift 1975). The other discharge is a bank seep. Both discharges drain the North Franklin Mine Pool, which is found between Big and Mahanoy Mountains. The drainage flows into an unnamed tributary to Zerbe Run and then continues down a ravine towards Trevorton where it meets Zerbe Run. The Katherine Refuse Seep is located southwest of Trevorton along Zerbe Run. The seep emerges from refuse banks and flows west a few hundred feet where it meets Zerbe Run. This seep drains the most western part of the North Franklin Mine Pool. See Appendix F for water quality data on these discharges.

There were an insufficient number of samples with flow for Zerbe Run; therefore, it will be accounted for in this TMDL. Besides mine drainage from Zerbe Run, it also is possible that there are numerous small seeps along the north bank of Mahanoy Creek between the villages of Gowen City and Hunter that are contributing to this impairment.

The TMDL for this section of Mahanoy Creek consists of a load allocation to all of the watershed area between MC3 and MC4. The load allocation for this segment was calculated using water-quality data collected at the point that had been adjusted using the flow adjusted concentration method described in Appendix E to include better characterize the effects of the Continental Mine pumped discharge on MC4. This was done because the water quality data used were not taken during a period of time when the Continental Mine pumped discharge was operating. The average instream flow adjusted to include the waste load allocation flow for the Continental Mine was used for point MC4 (169.746 mgd) was used in these calculations.

There currently is no entry for this segment on the Pa. Section 303(d) list for impairment due to pH. Sample data at this point is net alkaline with pH ranging between 6.4 and 7.3. Therefore, acidity will not be addressed in this TMDL.

The measured and allowable loading for point MC4 for aluminum, iron and manganese was computed using water-quality sample data collected at the point. This was based on

the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points MC3 show the total load that was permitted from upstream sources. This value was added to the difference in existing loads between point MC3 and MC4 to determine a total load tracked for the segment of stream between MC4 and MC3. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at MC4.

TMDLs for aluminum, iron, manganese, and acid at MC4 have been calculated. Table C20 shows the measured and allowable concentrations and loads at MC4. Table C21 shows percent reductions for aluminum, iron, and manganese required at this point.

Table C20		Measured		Allowable		
Flow (gpm)=	117879.17	Concentration	Load	Concentration	Load	
		mg/L	lbs/day	mg/L	lbs/day	
	Aluminum	0.52	742.13	0.22	304.27	
	Iron	2.59	3658.92	0.65	914.73	
	Manganese	2.30	3260.67	0.37	521.71	
	Acidity	4.83	6842.46	1.02	1436.92	
	Alkalinity	33.45	47354.55			

Table C21. Allocations MC4										
MC4	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)						
Existing Load @ MC4	742.13	3658.92	3260.67	6842.46						
Difference in measured Loads between upstream										
loads and existing MC4	-118.62	-2228.56	561.59	5014.66						
Percent loss calculated at MC4	14%	38%	0%	0%						
Additional load tracked from above samples	141.52	329.46	318.81	329.01						
Percentage of upstream loads that reach MC4	86%	62%	100%	100%						
Total load tracked between upstream and MC4	121.71	204.27	880.40	5343.67						
Allowable Load @ MC4	304.27	914.73	521.71	1436.92						
Load Reduction @ MC4	0	0	358.69	3906.75						
% Reduction required at MC4	0%	0%	41%	74%						

The aluminum load at MC4 of 121.71 lbs/day was less is than the allowable aluminum load at MC4 of 304.27 lbs/day; therefore, no reduction in aluminum at MC4 is necessary. The iron load at MC4 of 204.27 lbs/day was less is than the allowable iron load at MC4 of 914.73 lbs/day; therefore, no reduction in iron at MC4 is necessary. The existing manganese load at MC4 was measured to be 3260.67 lbs/day. This was 561.59 lbs/day greater than the upstream contributing loads. This increase in manganese load in this segment can be attributed to manganese entering the river. The total manganese load tracked was 358.69 lbs/day greater than the calculated allowable manganese load of 358.69 lbs/day; therefore a 41% reduction in manganese is necessary. The existing acid load at MC4 was measured to be 6842.46 lbs/day. This was 5014.66 lbs/day greater than

the upstream contributing loads. This increase in acidity load in this segment can be attributed to acid entering the river. The total acid load tracked was 3906.75 lbs/day greater than the calculated allowable acid load of 1436.92 lbs/day; therefore a 74% reduction in acid is necessary.

# Margin of Safety (MOS)

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

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

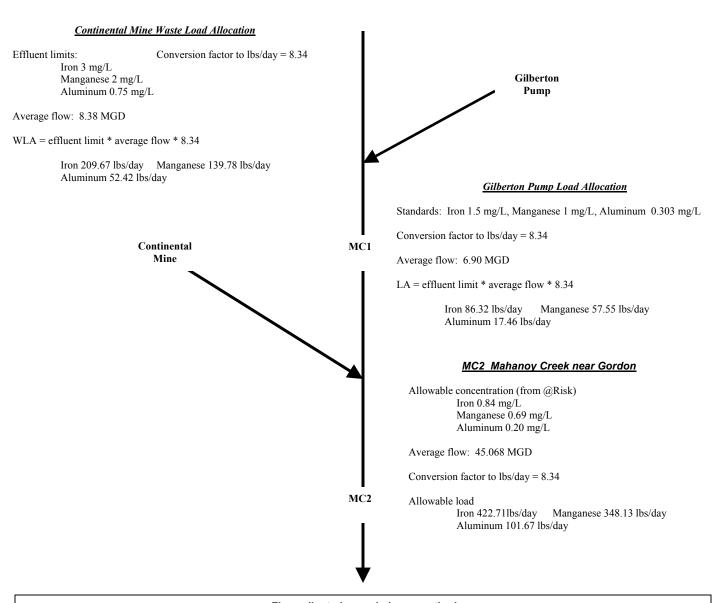
### Seasonal Variation

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

### Critical Conditions

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

# Attachment E Flow Adjusted Concentration Method



### Flow adjusted mass balance method

Total Flow: 8.38 MGD (Continental Mine flow) + 45.068 MGD (instream flow measured at MC2) + 6.90 (Gilberton Pump flow) = 60.348 MGD

Flow ratio to total:

Continental Mine 8.38/60.348 = 0.14

MC2 45.068/60.348 = 0.75

Gilberton Pump 6.90/60.348 = 0.11

Flow adjusted iron concentration at MC2 (2/14/1991) = (flow ratio Continental \* iron concentration Continental) + (flow ratio MC2 \* iron concentration MC2) + (flow ratio Gilberton \* iron concentration Gilberton) = (0.14\*3) + (0.75\*15.6) + (0.11\*30) = 0.42 + 11.70 + 3.30 = 15.42 mg/L

Flow adjusted total allowable iron load @ MC2 = allowable iron concentration from @Risk simulation using average flow adjusted iron concentration @ MC2 \* total flow @ MC2 \* 8.34

= 0.84 \* 60.348 \* 8.34 = 422.77 lbs/day iron

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

LA @ MC2 = TMDL - WLA = 422.77 - 209.67 = 213.10 lbs/day

TMDL = 422.77 lbs/day iron WLA = 209.67 lbs/day iron\*

LA = 213.10 lbs/day iron

# 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	рН
Girard	Girard Mine Seepage	USGS	*	10/30/1991	897.66	61	79	19	4.2	*	6.4
	Girard discharge	Pottsville DMO	*	6/4/1997	*	0	72	15.5	3.15	0.135	6.3
	Girard discharge	Pottsville DMO	*	7/2/1997	1350	0	72	21.2	3.64	0.135	6.3
	Girard discharge	Pottsville DMO	*	8/19/1997	1000	36	84	23.9	4.05	0.2	6.3
	Girard discharge	Pottsville DMO	*	4/8/1998	*	0.00	82.00	20.70	3.46	0.2	6.3
	Girard discharge	Pottsville DMO	*	5/5/1999	3500	28.00	1.80	21.70	5.29	0.737	6.1
	Girard mine seepage	USGS	*	3/28/2001	1840.21	29	90	18	3.8	0.4	6.1
	Girard mine seepage	USGS	*	8/22/2001	1225.3	46	66	24	4.4	1.2	6

 Average=
 1635.53
 25.00
 68.35
 20.50
 4.00
 0.43
 6.23

 StDev=
 971.22
 23.17
 27.97
 2.91
 0.66
 0.40
 0.14

TMDL Site	Study Point	Company	Permit #	Date	Flow (gpm)	Acid mg/l	Alk mg/l	Fe mg/l	Mn mg/l	Al mg/l	рН
SC1	Shenandoah Creek below operation, MP002	N & L Coal Co.	54920101	6/18/1992	*	0		0.542			6.9
	Shenandoah Creek below Girardville wetland (MP002)	City of Philadelphia - Hammond Mine	54960202	3/11/1999	*	0	76	6.93	5.02	0.592	6.7
	Shenandoah Creek below Girardville wetland (MP002)	City of Philadelphia - Hammond Mine	54960202	6/8/1999	*	0.00	96.00	6.83	6.12	0.561	6.7
	Shenandoah Creek below Girardville wetland (MP002)	City of Philadelphia - Hammond Mine	54960202	7/13/1999	*	0.00	94.00	3.73	5.77	0.5	6.9
	Shenandoah Creek below Girardville wetland (MP002)	City of Philadelphia - Hammond Mine	54960202	11/22/1999	*	0.00	90.00	3.55	5.92	0.5	6.6
	Shenandoah Creek below Girardville wetland (MP002)	City of Philadelphia - Hammond Mine	54960202	12/5/2000	*	0.00	84.00	2.72	5.41	0.5	6.8
	Shenandoah Creek below Girardville wetland (MP002)	City of Philadelphia - Hammond Mine	54960202	2/7/2001	*	0.00	78.00	4.03	4.97	0.5	6.9
	Shenandoah Creek nr. Girardville	USGS	*	3/28/2001	5430.86	14	56	4.1	4	0.21	6.7
	Shenandoah Creek below Girardville wetland (MP002)	City of Philadelphia - Hammond Mine	54960202	6/28/2001	*	0	82	1.85	5.93	0.5	6.4
	Shenandoah Creek nr. Girardville	USGS	*	8/20/2001	2468.57	20	82	2.8	7	0.11	6.9
	Shenandoah Creek below Girardville wetland (MP002)	City of Philadelphia - Hammond Mine	54960202	9/27/2001	*	0	72	1.24	6.54	0.2	6.7
	Shenandoah Creek below Girardville wetland (MP002)	City of Philadelphia - Hammond Mine	54960202	3/2/2002	*	0	78	0.3	0.05	0.5	6.6

 Average=
 NA
 2.83
 79.50
 3.22
 4.74
 0.43
 6.73

 StDev=
 NA
 6.74
 11.41
 2.14
 2.30
 0.16
 0.16

								Fe	Mn	Al	
TMDL Site	Study Point	Company	Permit #	Date	Flow (gpm)	Acid mg/l	Alk mg/l	mg/l	mg/l	mg/l	рН
MC1	Mahanoy Creek at Girardville	USGS	*	3/28/2001	14407.5	10	6	14.75	4.29	1.41	5.9
	Mahanoy Creek at Girardville	USGS	*	8/20/2001	3518.8	16	26	16.72	4.76	0.32	6.3
	Mahanoy Creek at Girardville	USGS	*	10/11/2001	2140.9	28	34	17.99	5.63	0.56	6.7

Total flow including Gilberton Pump = 16.54 MGD

Average= 6689.07 StDev= 6719.77 18.00 9.17 22.00 16.49 4.89 0.76 14.42 1.64 0.68 0.57

0.76 6.30 0.57 0.40

TMDL Site	Study Point	Company	Permit #	Date	Flow (gpm)	Acid mg/l	Alk mg/l	Fe ma/l	Mn ma/l	Al mg/l	На
Centralia 2	Treated Discharge (002)	City of Philadelphia - Continental Mine		10/24/2001	(0. /	1	95	0.89	2	0.11	8.03
	Treated Discharge (002)	City of Philadelphia - Continental Mine	19960101	10/31/2001	8800	10	101	2.41	2.03	0.1	8.17
	Treated Discharge (002)	City of Philadelphia - Continental Mine	19960101	11/7/2001	8800	1	71	0.91	0.99	1	7.95
	Treated Discharge (002)	City of Philadelphia - Continental Mine	19960101	1/30/2002	4096	1	43	1.38	2	0.62	8.36
	Treated Discharge (002)	City of Philadelphia - Continental Mine	19960101	4/11/2002	4085	1	14	0.12	0.99	0.4	8.33
	Treated Discharge (002)	City of Philadelphia - Continental Mine	19960101	4/19/2002	4024	1	97	0.36	2.95	0.59	8.67
	Treated Discharge (002)	City of Philadelphia - Continental Mine	19960101	4/24/2002	3986	1	100	0.33	2.05	0.92	8.87
	Treated Discharge (002)	City of Philadelphia - Continental Mine	19960101	4/30/2002	3952	1	69	0.24	5	0.62	8.29

 Average=
 5817.88
 2.13
 73.75
 0.83
 2.25
 0.55
 8.33

 StDev=
 2469.88
 3.18
 31.55
 0.77
 1.28
 0.33
 0.31

TMDL Site	Study Point	Company	Permit #	Date	Flow (gpm)	Acidity, mg/L	Alkalinity, mg/L	Fe, mg/L	,	Al, mg/L	рН
MC2	Mahanoy Creek MP122	White Pine Coal Co.	54870206	02/14/91	*	0.5	50.5	15.42	5.72	1.22	6.63
	Mahanoy Creek MP122	White Pine Coal Co.	54870206	05/14/91	*	0.5	56	13.02	5.72	1.29	6.73
	Mahanoy Creek MP122	White Pine Coal Co.	54870206	08/07/97	*	0.5	93.4	11.75	7.15	1.22	7.3
	Mahanoy Creek MP122	White Pine Coal Co.	54870206	11/14/91	*	0.5	85.2	11.22	6.92	0.92	7.06
	Mahanoy Creek MP122	White Pine Coal Co.	54870206	12/19/91	*	*	*	12.35	6.10	*	7.09
	Mahanoy Creek MP122	White Pine Coal Co.	54870206	02/12/92	*	*	*	12.35	6.17	*	7.26
	Mahanoy Creek MP122	White Pine Coal Co.	54870206	04/17/92	*	*	*	12.72	6.32	*	6.84
	Mahanoy Creek MP122	White Pine Coal Co.	54870206	05/14/92	*	*	*	11.52	5.50	*	6.68
	Mahanoy Creek MP122	White Pine Coal Co.	54870206	08/13/92	*	*	*	11.37	6.40	*	6.9
	Mahanoy Creek MP122	White Pine Coal Co.	54870206	10/13/92	*	*	*	14.82	5.00	1.26	6.5
	Mahanoy Creek MP122	White Pine Coal Co.	54870206	11/12/92	*	1	43	15.05	6.17	1.22	6.48
	Mahanoy Creek MP122	White Pine Coal Co.	54870206	12/21/92	*	1	58.8	10.10	4.90	1.37	6.82

Mahanoy Creek MP122	White Pine Coal Co.	54870206	02/04/93	*	0	56	15.65	5.92	1.37	6.7
Mahanoy Creek MP122	White Pine Coal Co.	54870206	02/23/93	*	*	*	15.42	6.17	*	6.93
Mahanoy Creek MP122	White Pine Coal Co.	54870206	04/01/93	*	11.8	20	29.00	4.14	4.05	6.4
Mahanoy Creek MP122	White Pine Coal Co.	54870206	05/12/93	*	*	*	11.07	5.20	*	6.18
Mahanoy Creek MP122	White Pine Coal Co.	54870206	08/12/93	*	*	*	13.55	5.04	1.68	6.5
Mahanoy Creek MP122	White Pine Coal Co.	54870206	08/18/93	*	*	*	16.62	7.17	*	6.65
Mahanoy Creek MP122	White Pine Coal Co.	54870206	06/10/94	*	0	54	14.67	6.22	1.06	6.4
Mahanoy Creek MP122	White Pine Coal Co.	54870206	07/16/94	*	0	68	10.51	5.57	1.00	7.4
Mahanoy Creek MP122	White Pine Coal Co.	54870206	08/17/94	*	*	*	8.82	4.97	*	6.35
Mahanoy Creek MP122	White Pine Coal Co.	54870206	11/16/94	*	0	78	13.02	6.25	1.38	6.6
Mahanoy Creek MP122	White Pine Coal Co.	54870206	02/14/95	*	*	*	13.85	5.87	*	6.67
Mahanoy Creek MP122	White Pine Coal Co.	54870206	03/23/95	*	0	56	13.40	5.31	0.98	6.5
Mahanoy Creek MP122	White Pine Coal Co.	54870206	05/02/95	*	0	60	8.67	6.47	1.01	6.6
Mahanoy Creek MP122	White Pine Coal Co.	54870206	08/10/95	*	0	58	16.47	6.71	0.85	6.3
Mahanoy Creek MP122	White Pine Coal Co.	54870206	08/16/95	*	*	*	12.72	5.72	*	7.05
Mahanoy Creek MP122	White Pine Coal Co.	54870206	11/16/95	*	*	*	8.60	2.95	*	6.37
Mahanoy Creek MP122	White Pine Coal Co.	54870206	12/05/95	*	0	60	13.55	5.72	1.05	6.4
Mahanoy Creek MP122	White Pine Coal Co.	54870206	02/15/96	*	*	*	12.20	5.27	*	6.32
Mahanoy Creek MP122	White Pine Coal Co.	54870206	04/03/96	*	8.6	40	11.75	4.91	2.11	6.3
Mahanoy Creek MP122	White Pine Coal Co.	54870206	05/17/96	*	*	*	10.77	4.75	*	6.42
Mahanoy Creek MP122	White Pine Coal Co.	54870206	06/14/96	*	*	*	13.47	9.32	4.82	6.49
Mahanoy Creek MP122	White Pine Coal Co.	54870206	06/16/96	*	*	*	13.77	5.35	*	6.26
Mahanoy Creek MP122	White Pine Coal Co.	54870206	08/19/96	*	*	*	13.92	5.65	*	6.49
Mahanoy Creek MP122	White Pine Coal Co.	54870206	09/11/96	*	2.2	62	14.45	5.95	0.93	6.2
Mahanoy Creek MP122	White Pine Coal Co.	54870206	10/16/96	*	*	*	12.42	4.75	*	6.87
Mahanoy Creek MP122	White Pine Coal Co.	54870206	11/13/96	*	*	*	11.37	4.22	*	6.65
MP #122	White Pine Coal Co.	54870206	01/21/97	*	*	*	14.90	5.35	*	6.78
MP #122	White Pine Coal Co.	54870206	02/12/97	*	*	*	12.87	5.27	*	6.68
MP #122	White Pine Coal Co.	54870206	03/13/97	*	*	*	12.27	5.35	*	6.94
MP #122	White Pine Coal Co.	54870206	04/08/97	*	*	*	12.72	4.97	*	6.78
MP #122	White Pine Coal Co.	54870206	05/13/97	*	*	*	12.27	5.35	*	6.94
MP #122	White Pine Coal Co.	54870206	06/20/97	*	*	*	13.02	5.72	*	6.67
MP #122	White Pine Coal Co.	54870206	07/14/97	*	*	*	11.75	5.87	*	6.94
MP #122	White Pine Coal Co.	54870206	08/11/97	*	*	*	15.87	5.95	*	7.03
MP #122	White Pine Coal Co.	54870206	09/16/97	*	*	*	14.37	5.95	*	6.77
MP #122	White Pine Coal Co.	54870206	10/17/97	*	*	*	11.75	5.87	*	6.94
MP #122	White Pine Coal Co.	54870206	11/17/97	*	*	*	9.95	5.80	*	7.21

MP #122	White Pine Coal Co.	54870206	01/14/98	*	*	*	13.47	4.45	*	6.78
MP #122	White Pine Coal Co.	54870206	02/18/98	*	*	*	8.75	3.47	*	6.78
MP #122	White Pine Coal Co.	54870206	1	*	*	*	11.82	3.92	*	6.86
MP #122	White Pine Coal Co.	54870206		*	*	*		4.22	*	6.55
MP #122	White Pine Coal Co.	54870206		*	*	*		3.92	*	6.49
MP #122	White Pine Coal Co.	54870206		*	*	*		5.87	*	6.6
MP #122	White Pine Coal Co.	54870206		*	*	*		5.27	*	6.9
MP #122	White Pine Coal Co.	54870206	09/16/98	*	*	*	9.65		*	6.93
MP #122	White Pine Coal Co.	54870206		*	*	*	10.10	5.35	*	6.93
MP #122	White Pine Coal Co.	54870206	1	*	*	*		5.80	*	7.05
MP #122	White Pine Coal Co.	54870206	1	*	*	*		5.72	*	7.1
Railroad Bridge 28-121/60 (same as										
122) Railroad Bridge 28-121/60 (same as	White Pine Coal Co.	54870206	01/13/99	*	*	*	10.10	5.27	*	6.87
122)	White Pine Coal Co.	54870206	02/15/99	*	*	*	13.55	4.97	*	6.61
Railroad Bridge 28-121/60 (same as	White Dine Coel Co	E4070206	02/16/00	*	*	*	10.47	4.37	*	7.04
122) First Railroad Bridge Below BI-01 (same	White Pine Coal Co.	54870206	03/16/99	-		-	10.47	4.37		7.04
as 122)	White Pine Coal Co.	54870206	03/18/99	*	*	*	10.26	4.65	*	6.4
Railroad Bridge 28-121/60 (same as 122)	White Pine Coal Co.	54870206	04/13/99	*	*	*	12 25	5.05	*	6.86
Railroad Bridge 28-121/60 (same as	Willie Fille Coal Co.	34670200	04/13/99				13.23	3.03	$\overline{}$	0.00
122)	White Pine Coal Co.	54870206	05/21/99	*	*	*	14.67	5.72	*	6.71
Railroad Bridge 28-121/60 (same as 122)	White Pine Coal Co.	54870206	06/15/99	*	*	*	12 57	5.50	*	6.8
Railroad Bridge 28-121/60 (same as	White I life Godi Go.	04070200	00/10/00				12.01	0.00		
122)	White Pine Coal Co.	54870206	07/14/99	*	*	*	10.17	5.12	*	6.92
Railroad Bridge 28-121/60 (same as 122)	White Pine Coal Co.	54870206	08/09/99	*	*	*	11.07	5.72	*	7.11
Railroad Bridge 28-121/60 (same as										
122) First Railroad Bridge Below BI-01 (same	White Pine Coal Co.	54870206	09/08/99	*	*	*	9.42	5.20	*	6.87
as 122)	White Pine Coal Co.	54870206	09/23/99	*	*	*	9.59	4.69	*	6.5
Railroad Bridge 28-121/60 (same as		F 4070000	10/10/00		*	*	0.05	4.07		0.74
122) Railroad Bridge 28-121/60 (same as	White Pine Coal Co.	54870206	10/13/99	*	,		9.35	4.97	*	6.71
122)	White Pine Coal Co.	54870206	11/17/99	*	*	*	10.92	5.80	*	6.81
Railroad Bridge 28-121/60 (same as	White Dine Coal Co	F4070000	40/40/00	*	*	*	10.47	4.07	*	0.40
122) Railroad Bridge 28-121/60 (same as	White Pine Coal Co.	54870206	12/16/99			-	10.47	4.67		6.48
122)	White Pine Coal Co.	54870206	01/13/00	*	*	*	10.77	5.05	*	6.64
Railroad Bridge 28-121/60 (same as 122)	White Pine Coal Co.	54870206	02/21/00	*	*	*	10.40	5.27	*	6.8
Railroad Bridge 28-121/60 (same as	Willio i ilie odal od.	04070200	02/2 1/00				10.40	5.21		0.0
122)	White Pine Coal Co.	54870206	03/15/00	*	*	*	9.27	4.52	*	6.61
First Railroad Bridge Below BI-01 (same as 122)	White Pine Coal Co.	54870206	03/18/00	*	0	64	10.26	4.65	*	6.6
do (EE)		10.0.0200	00, .0,00			, ,,	1.5.20			

Railroad Bridge 28-121/60 (same as	White Pine Coal Co.	54870206	04/18/00	*	*	*	12.27	4.60	*	6.64
Railroad Bridge 28-121/60 (same as 122)	White Pine Coal Co.	54870206	05/17/00	*	*	*	9.57		*	6.57
First Railroad Bridge Below BI-01 (same as 122)	White Pine Coal Co.	54870206	06/19/00	*	0	62	10.16	4.57	*	6.7
Mahanoy Creek MP122	White Pine Coal Co.	54870206	01/17/01	*	*	*	9.35	4.75	*	6.9
Mahanoy Creek MP122	White Pine Coal Co.	54870206	02/15/01	*	*	*	10.25	4.82	*	6.98
Mahanoy Creek MP122	White Pine Coal Co.	54870206	03/13/01	*	0	60	15.27	3.94	1.57	6.6
Mahanoy Creek MP122	White Pine Coal Co.	54870206	03/15/01	*	*	*	9.65	4.67	*	6.8
Mahanoy Creek nr. Gordon	USGS	*	03/26/01	41857.76	0.87	0	10.10	5.72	2.64	7
Mahanoy Creek MP122	White Pine Coal Co.	54870206	04/16/01	*	*	*	12.12	4.67	*	6.5
Mahanoy Creek MP122	White Pine Coal Co.	54870206	05/15/01	*	*	*	9.65	4.97	*	6.7
Mahanoy Creek MP122	White Pine Coal Co.	54870206	06/12/01	*	*	*	10.62	4.90	*	6.74
Mahanoy Creek MP122	White Pine Coal Co.	54870206	06/30/01	*	0	68	8.57	4.86	0.58	7
Mahanoy Creek MP122	White Pine Coal Co.	54870206	07/19/01	*	*	*	8.52	5.20	*	6.94
Mahanoy Creek nr. Gordon	USGS	*	08/20/01	20736	14	66	10.02	5.87	0.65	6.9
Mahanoy Creek MP122	White Pine Coal Co.	54870206	08/20/01	*	*	*	10.25	4.97	*	6.87
Mahanoy Creek MP122	White Pine Coal Co.	54870206	09/12/01	*	*	*	10.10	5.35	*	7
Mahanoy Creek MP122	White Pine Coal Co.	54870206	10/18/01	*	*	*	10.55	5.65	*	7.47
Mahanoy Creek MP122	White Pine Coal Co.	54870206	11/14/01	*	*	*	11.97	5.65	*	7.24
Mahanoy Creek MP122	White Pine Coal Co.	54870206	11/29/01	*	0	76	10.73	5.44	0.58	7
Mahanoy Creek MP122	White Pine Coal Co.	54870206	12/19/01	*	*	*	9.42	4.75	*	7
Mahanoy Creek MP122	White Pine Coal Co.	54870206	01/22/02	*	*	*	12.57	5.20	*	6.95
Mahanoy Creek MP122	White Pine Coal Co.	54870206	02/06/02	*	0	74	11.90	5.52	0.69	6.8
Mahanoy Creek MP122	White Pine Coal Co.	54870206	02/18/02	*	*	*	12.57	5.20	*	6.8
Mahanoy Creek MP122	White Pine Coal Co.	54870206	03/11/02	*	*	*	13.62	4.97	*	6.95
Mahanoy Creek MP122	White Pine Coal Co.	54870206	04/16/02	*	*	*	9.72		*	6.84
Mahanoy Creek MP122	White Pine Coal Co.	54870206	05/16/02	*	*	*	13.32	4.30	*	6.7

 $\frac{\text{Total flow including Gilberton Pump \& Continental Mine = 60.348}}{\text{MGD}}$ 

Average= 31296.88 1.6588 58.756 12.00 5.32 1.44 5

StDev= 14935.33973 3.813389044 19.08817435 2.60 0.83 1.00 7

6.75836538

								Fe	Mn	Al	
TMDL Site	Study Point	Company	Permit #	Date	Flow (gpm)	Acid mg/l	Alk mg/l	mg/l	mg/l	mg/l	pН
мс3	Mahanoy Creek MP145	White Pine Coal Co.	54870206	11/14/1991	*	0.5	66	5.48	5.86	0.70	7.53
	Mahanoy Creek MP145	White Pine Coal Co.	54870206	11/12/1992	*	1	35	7.24	3.59	1.03	6.92
	Mahanoy Creek nr. Gowen City	USGS	*	3/26/2001	107270.6	6	26	4.64	2.33	0.52	7.3

Mahanoy Creek nr. Gowen City	USGS	*	8/21/2001	29398.44	0.075	10	16.40	1.41	2.88	7.6
Mahanoy Creek nr. Gowen City	USGS	*	10/11/2001	28725.19	4	56	3.29	3.76	0.17	7.5
	Total flow including Gilberton Pump & Continental Mine = 94.67		<b>A</b>	FF404 44	0.00	20.00	7.41	3.39	1.06	7.37
	<u>MGD</u>		Average=	55131.41	2.32	38.60	7.41	3.39	1.06	1.31
			StDev=	45155.12	2.57	22.60	5.22	1.68	1.06	0.28
								I		

								Fe	Mn	Al	
TMDL Site	Study Point	Company	Permit #	Date	Flow (gpm)	Acid mg/l	Alk mg/l	mg/l	mg/l	mg/l	pН
Unt.MC	MP127	White Pine Coal Co.	54870206	11/14/1991	*	0.5	134	0.22	1.65	0.7	7.86
	MP127	White Pine Coal Co.	54870206	11/12/1992	*	1	112	2.52	2	0.7	7.95
	Unt. To Mahanoy Creek nr. Lavelle	USGS	*	3/28/2001	2728.84	6	110	1.1	0.93	0.04	8.2
	Unt. To Mahanoy Creek nr. Lavelle	USGS	*	8/22/2001	596.95	8	180	4.8	0.95	0.031	8

 Average=
 NA
 3.88
 134.00
 2.16
 1.38
 0.37
 8.00

 StDev=
 NA
 3.71
 32.54
 2.00
 0.53
 0.38
 0.14

TMDL Site	Study Point	Company	Permit #	Date	Flow (gpm)	Acid mg/l	Alk mg/l	Fe mg/l	Mn mg/l	Al mg/l	pН
LGT	Locust Gap overflow	White Pine Coal Co.	54870206	5/10/1988		46	42	14.5			6.1
	Locust Gap Tunnel MP134	White Pine Coal Co.	54870206	11/14/1991	*	29	40.8	23	7	8.0	6.7
	Locust Gap Tunnel	USGS	*	10/29/1991	934.32	24	49	22	6.6	*	6.37
	Locust Gap Tunnel	Pottsville DMO	*	7/2/1997	3717	0	60	11.8	3.43	0.804	6.3
	Locust Gap Tunnel	Pottsville DMO	*	8/14/1997	2006	20	64	15.3	4.18	0.688	6.2
	Locust Gap Tunnel	Pottsville DMO	*	9/24/1997	1888	32	62	18.6	4.23	0.835	6.2
	Locust Gap Tunnel	Pottsville DMO	*	5/5/1999	9515	0.00	62.00	7.98	2.36	0.594	6.4
	Locust Gap Tunnel	USGS	*	3/28/2001	6428.16	20	50	7.3	2.3	0.73	6.7
	Locust Gap Tunnel	USGS	*	8/21/2001	2724.49	26	56	12	3.8	0.54	6.5

 Average=
 3887.57
 21.89
 53.98
 14.72
 4.30
 0.76
 6.39

 StDev=
 3048.63
 14.67
 8.85
 5.63
 1.64
 0.17
 0.21

									Fe	Mn	Al	
TMD	DL Site	Study Point	Company	Permit #	Date	Flow (gpm)	Acid mg/l	Alk mg/l	mg/l	mg/l	mg/l	pН
D	TVC	Doutyville Tunnel	White Pine Coal Co.	54870206	5/10/1988	*	64	9	13.6	4.15	1.07	5.4
		Doutyville Tunnel	Reading Anthracite Co.	49840103	5/4/1990	*	11	17.9	8.3	2.8	*	6.1
		Doutyville Tunnel	Reading Anthracite Co.	49840103	7/18/1990	*	18.6	11.7	7.5	3	*	6
		Doutyville Tunnel	Reading Anthracite Co.	49840103	11/16/1990	*	9.2	3.4	5.2	17.7	*	4.48
		Doutyville Tunnel	Reading Anthracite Co.	49840103	5/6/1991	*	32	*	6.35	10.1	*	4.34

Doutyville Tunnel	Reading Anthracite Co.	49840103	6/20/1991	*	16	8	3.5 9.5	*	*
Doutyville Tunnel	Reading Anthracite Co.	49840103	9/19/1991	*	30	12	4.1 8.6	*	5.2
Doutyville Tunnel	USGS	*	10/29/1991	560.59	40	7	15 4.5	*	5.9
Doutyville Tunnel	White Pine Coal Co.	54870206	11/14/1991	*	54	9.6	16 4.8	1.8	5.46
Doutyville Tunnel	Reading Anthracite Co.	49840103	12/20/1991	*	23	10	3.8 9	*	6.18
Doutyville Tunnel	Reading Anthracite Co.	49840103	3/11/1992	*	35	0	4.68 1.57	*	3.7
Doutyville Tunnel	Reading Anthracite Co.	49840103	4/14/1992	*	30	0	5.05 1.88	*	4.08
Doutyville Tunnel	Reading Anthracite Co.	49840103	5/20/1992	*	30	1	5 1.8	*	3.77
Doutyville Tunnel	Reading Anthracite Co.	49840103	6/19/1992	*	29.5	1	5.6 1.74	*	4.05
Doutyville Tunnel	Reading Anthracite Co.	49840103	7/21/1992	*	37	1	4.9 1.75	*	3.93
Doutyville Tunnel	Reading Anthracite Co.	49840103	8/17/1992	*	37	3	5.3 1.8	*	4.28
Doutyville Tunnel	Reading Anthracite Co.	49840103	9/28/1992	*	35	1	4.9 1.8	*	3.68
Doutyville Tunnel	Reading Anthracite Co.	49840103	10/27/1992	*	47	5	6 1.9	*	4.05
Doutyville Tunnel	Reading Anthracite Co.	49840103	11/18/1992	*	40	3	5.5 1.8	*	4
Doutyville Tunnel	Reading Anthracite Co.	49840103	12/3/1992	*	33.2	1.1	5.1 1.7	*	3.97
Doutyville Tunnel	Reading Anthracite Co.	49840103	1/27/1993	*	30.9	5.3	17 1.9	*	4.17
Doutyville Tunnel	Reading Anthracite Co.	49840103	3/8/1993	*	27.8	3.3	5.5 1.6	*	4.41
Doutyville Tunnel	Reading Anthracite Co.	49840103	4/6/1993	*	29.2	4.3	8.4 2.2	*	4.64
Doutyville Tunnel	Reading Anthracite Co.	49840103	4/19/1993	*	38	1	3 1.3	*	3.74
Doutyville Tunnel	Reading Anthracite Co.	49840103	4/24/1993	*	0	74	6.26 2.27	1.59	7.6
Doutyville Tunnel	Reading Anthracite Co.	49840103	5/14/1993	*	23	1	3.3 1.5	*	3.95
Doutyville Tunnel	Reading Anthracite Co.	49840103	6/15/1993	*	25.4	6	5.17 1.82	*	4.94
Doutyville Tunnel	Reading Anthracite Co.	49840103	7/14/1993	*	20.6	6	4.72 1.74	*	4.82
Doutyville Tunnel	Reading Anthracite Co.	49840103	8/17/1993	*	19.6	7	5.6 2.03	*	4.87
Doutyville Tunnel	Reading Anthracite Co.	49840103	9/21/1993	*	42.5	5	5.48 2.22	*	4.58
Doutyville Tunnel	Reading Anthracite Co.	49840103	10/22/1993	*	40.7	4	6.5 2.23	*	4.37
Doutyville Tunnel	Reading Anthracite Co.	49840103	11/12/1993	*	39	1	4.8 2.2	*	3.89
Doutyville Tunnel	Reading Anthracite Co.	49840103	12/22/1993	*	26.5	2	4.4 1.8	*	4.12
Doutyville Tunnel	Reading Anthracite Co.	49840103	10/25/1994	*	22.1	1	4.6 1.6	*	3.9
Doutyville Tunnel	Reading Anthracite Co.	49840103	11/11/1994	*	40.7	1	6.5 2.2	*	4.37
Doutyville Tunnel	Reading Anthracite Co.	49840103	12/27/1994	*	23.8	2.2	3.8 1.5	*	4.02
Doutyville Tunnel	Reading Anthracite Co.	49840103	4/24/1995	*	21.4	9.9	4.5 1.7	*	4.91
Doutyville Tunnel	Reading Anthracite Co.	49840103	6/5/1995	*	36.4	4.5	4.3 1.4	*	4.3
Doutyville Tunnel	Reading Anthracite Co.	49840103	6/16/1995	*	38	1	3.3 1.3	*	3.82
Doutyville Tunnel	Reading Anthracite Co.	49840103	7/21/1995	*	25.9	3.6	4.5 1.4	*	4.21
Doutyville Tunnel	Reading Anthracite Co.	49840103	8/22/1995	*	18.5	8.6	5.3 1.6	*	5.2
Doutyville Tunnel	Reading Anthracite Co.	49840103	9/18/1995	*	12	10.5	4.3 1.6	*	5.75

Doutyville Tunnel	Reading Anthracite Co.	49840103	3/4/1996	*	10.7	7.4	2 0.96 *	5
Doutyville Tunnel	Reading Anthracite Co.	49840103	5/28/1996	*	15.6	6.7	2.9 1.1 *	5.53
Doutyville Tunnel	Reading Anthracite Co.	49840103	6/14/1996	*	7.7	5.4	3.6 1.4 *	5.4
Doutyville Tunnel	Reading Anthracite Co.	49840103	7/25/1996	*	15.7	9.5	3.9 1.6 *	4.84
Doutyville Tunnel	Reading Anthracite Co.	49840103	8/19/1996	*	19.4	7.6	3.7 1.6 *	4.55
Doutyville Tunnel	Reading Anthracite Co.	49840103	12/6/1996	*	27.6	1	2.2 1.2 *	3.97
Doutyville Tunnel	Reading Anthracite Co.	49840103	3/10/1997	*	22	3	2.7 1.3 *	4.08
Doutyville Tunnel	Reading Anthracite Co.	49840103	4/3/1997	*	30.00	1.00	* 1.30 *	4.1
Doutyville Tunnel	Reading Anthracite Co.	49840103	6/9/1997	*	21	1	2.9 1.2 *	4.05
Doutyville Tunnel	Pottsville DMO	*	7/2/1997	800	28	9.4	5.49 1.84 1.89	5
Doutyville Tunnel	Reading Anthracite Co.	49840103	7/18/1997	*	15	7	2.2 1.7 *	4.75
Doutyville Tunnel	Pottsville DMO	*	8/14/1997	1445	18.8	9.2	5.18 1.88 2.29	4.9
Doutyville Tunnel	Reading Anthracite Co.	49840103	8/25/1997	*	28	2.1	4.8 1.9 *	4.68
Doutyville Tunnel	Pottsville DMO	*	9/24/1997	747	32	9	4.48 1.75 2.68	4.7
Doutyville Tunnel	Reading Anthracite Co.	49840103	9/26/1997	*	31.7	6.3	3.4 1.7 *	4.64
Doutyville Tunnel	Reading Anthracite Co.	49840103	10/10/1997	*	24.3	8.8	5 1.9 *	4.93
Doutyville Tunnel	Reading Anthracite Co.	49840103	11/17/1997	*	23	8.8	5 1.8 *	4.62
Doutyville Tunnel	Reading Anthracite Co.	49840103	3/26/1998	*	17.90	1.20	2.40 1.10 *	4.18
Doutyville Tunnel	Reading Anthracite Co.	49840103	4/20/1998	*	40.7	1	3.1 1 *	3.73
Doutyville Tunnel	Reading Anthracite Co.	49840103	5/18/1998	*	12.7	9.2	2.2 1.2 *	4.76
Doutyville Tunnel	Reading Anthracite Co.	49840103	6/19/1998	*	8.3	12.7	3 1.3 *	5.64
Doutyville Tunnel	Reading Anthracite Co.	49840103	7/15/1998	*	5.3	9	3.7   1.6   *	5.6
Doutyville Tunnel	Reading Anthracite Co.	49840103	8/20/1998	*	23.8	4.2	3.6 1.8 *	5.51
Doutyville Tunnel	Reading Anthracite Co.	49840103	9/24/1998	*	24.6	9.5	4.4 1.7 *	5.1
Doutyville Tunnel	Reading Anthracite Co.	49840103	11/18/1998	*	28	4.6	4.3 2 *	5.12
Doutyville Tunnel	Reading Anthracite Co.	49840103	12/16/1998	*	16.2	8.8	4.5 1.9 *	5.73
Doutyville Tunnel	Reading Anthracite Co.	49840103	2/16/1999	*	22.3	7.7	4.5 1.3 *	4.76
Doutyville Tunnel	Reading Anthracite Co.	49840103	3/15/1999	*	20.4	6.6	3.6 1.05 *	4.72
Doutyville Tunnel	Reading Anthracite Co.	49840103	5/12/1999	*	18.40	8.10	4.10 1.50 *	4.87
Doutyville Tunnel	Reading Anthracite Co.	49840103	6/22/1999	*	13.20	15.60	4.50 1.60 *	6.2
Doutyville Tunnel	Reading Anthracite Co.	49840103	8/20/1999	*	12.30	9.70	4.60 1.50 *	5.22
Doutyville Tunnel	Reading Anthracite Co.	49840103	9/8/1999	*	13.40	10.30	4.50 1.50 *	5.35
Doutyville Tunnel	Reading Anthracite Co.	49840103	10/20/1999	*	13.10	10.90	4.50 1.50 *	5.26
Doutyville Tunnel	Reading Anthracite Co.	49840103	11/10/1999	*	13.60	11.10	4.30 1.50 *	5.18
Doutyville Tunnel	Reading Anthracite Co.	49840103	12/28/1999	*	12.20	9.80	4.60 1.60 *	5.3
Doutyville Tunnel	Reading Anthracite Co.	49840103	1/3/2000	*	32.60	1.00	4.80 1.10 *	3.57
Doutyville Tunnel	Reading Anthracite Co.	49840103	4/18/2000	*	16.20	2.50	4.50 1.50 *	4.66

Doutyville Tunnel	Reading Anthracite Co.	49840103	5/12/2000	*	22.10	8.40	4.10	1.50	*	4.8
Doutyville Tunnel	Reading Anthracite Co.	49840103	6/27/2000	*	8.40	10.50	2.40	1.20	*	4.37
Doutyville Tunnel	Reading Anthracite Co.	49840103	7/10/2000	*	14.30	5.70	4.30	1.10	*	4.12
Doutyville Tunnel	Reading Anthracite Co.	49840103	8/24/2000	*	18.30	6.60	4.60	1.10	*	3.88
Doutyville Tunnel	Reading Anthracite Co.	49840103	9/19/2000	*	15.70	8.10	4.20	1.40	*	4.05
Doutyville Tunnel	Reading Anthracite Co.	49840103	10/16/2000	*	16.20	7.80	4.30	1.50	*	4.21
Doutyville Tunnel	Reading Anthracite Co.	49840103	11/21/2000	*	16.40	10.20	5.10	1.70	*	5.3
Doutyville Tunnel	Reading Anthracite Co.	49840103	12/20/2000	*	63.00	1.00	3.70	1.40	*	3.54
Doutyville Tunnel	Reading Anthracite Co.	49840103	1/31/2001	*	29.00	8.80	4.00	1.30	*	4.81
Doutyville Tunnel	Reading Anthracite Co.	49840103	2/12/2001	*	16.60	7.20	4.10	1.30	*	4.22
Doutyville Tunnel	Reading Anthracite Co.	49840103	3/20/2001	*	20.30	6.90	4.40	1.50	*	4.32
Locust Gap/Doutyville Tunnel	USGS	*	3/28/2001	1315.53	26	0	3.2	1.3	2.1	5
Doutyville Tunnel	Reading Anthracite Co.	49840103	4/11/2001	*	19.4	6.7	4.3	1.3	*	4.35
Doutyville Tunnel	Reading Anthracite Co.	49840103	5/22/2001	*	20.7	7.8	4.1	1.4	*	4.61
Doutyville Tunnel	Reading Anthracite Co.	49840103	6/11/2001	*	19.5	10.1	4.4	1.4	*	5.19
Doutyville Tunnel	Reading Anthracite Co.	49840103	7/24/2001	*	17	9.2	4.3	1.4	*	4.73
Locust Gap/Doutyville Tunnel	USGS	*	8/21/2001	369.99	8	20	4.4	1.5	1.6	6.1
Doutyville Tunnel	Reading Anthracite Co.	49840103	8/22/2001	*	18	12	1.5	*	*	4.6
Doutyville Tunnel	Reading Anthracite Co.	49840103	9/18/2001	*	5	15	4.6	1.4	*	5.93
Doutyville Tunnel	Reading Anthracite Co.	49840103	10/23/2001	*	2.7	18.9	5	1.6	*	6.14
Doutyville Tunnel	Reading Anthracite Co.	49840103	11/27/2001	*	9	11.1	5.3	1.8	*	5.5
Doutyville Tunnel	Reading Anthracite Co.	49840103	12/21/2001	*	29.7	6.3	4.9	2.4	*	4.7

 Average=
 873.02
 23.81
 7.22
 4.87
 2.17
 1.88
 4.74

 StDev=
 423.05
 11.86
 8.04
 2.47
 2.25
 0.49
 0.74

		_		_				Fe	Mn		
TMDL Site	Study Point	Company	Permit #	Date	Flow (gpm)	Acid mg/l	Alk mg/l	mg/l	mg/l	mg/l	pН
WCM	DM001	West Cameron Mining	49871304	5/22/1996		44	11.6	5.77	2.11	1.22	5.2
	DM001	West Cameron Mining	49871304	5/19/1997		34	22	8.55	2.04	0.842	5.7
	DM001	West Cameron Mining	49871304	8/19/1997		48	30	13	2.28	0.915	5.9
	DM001	West Cameron Mining	49871304	11/18/1997		30	36	15.4	2.26	0.61	6
	DM001	West Cameron Mining	49871304	2/9/1998		28	26	9.08	1.99	0.803	5.7
	DM001	West Cameron Mining	49871304	2/12/1998		15.6	24	8.79	2	0.912	5.7
	DM001	West Cameron Mining	49871304	3/12/1998		0	38	1.01	0.606	1.41	9.9
	DM001	West Cameron Mining	49871304	6/10/1998		3.8	16.4	6.36	1.89	0.902	5.4
	DM001	West Cameron Mining	49871304	9/21/1998		5	30	13.3	2.33	0.877	5.8

DM001	West Cameron Mining	49871304	3/2/1999		2.6	32	12 2.14 0.717	5.8
DM001	West Cameron Mining	49871304	5/5/1999	50	46	0	3.25 1.71 2.73	3.6
DM001	West Cameron Mining	49871304	6/7/1999		44	0	4.7 2.32 3.04	3.8
DM001	West Cameron Mining	49871304	6/10/1999		0	5240	4.76 2.56 3.28	10.8
DM001	West Cameron Mining	49871304	7/13/1999		40	0	4.07 2.98 3.61	3.8
DM001	West Cameron Mining	49871304	7/29/1999		0	40	1.2 1.13 1.8	6.4
DM001	West Cameron Mining	49871304	9/28/1999		0	74	<.3 0.905 1.19	8
DM001	West Cameron Mining	49871304	10/26/1999		0	36	0.903 0.902 2.47	6.5
DM001	West Cameron Mining	49871304	12/17/1999		0	48	0.467 0.873 0.896	9.3
DM001	West Cameron Mining	49871304	1/22/2000	50	6.4	11.2	<.3 0.672 0.767	5.1
DM001	West Cameron Mining	49871304	1/26/2000	108	38	0	1.66 1.28 3.38	3.9
DM001	West Cameron Mining	49871304	2/16/2000		34	0	0.746 1.11 2.7	3.8
DM001	West Cameron Mining	49871304	3/18/2000		0	30	1.17   1.08   3.24	6.3
DM001	West Cameron Mining	49871304	4/26/2000		46	0	3.46 1.42 3.35	3.6
DM001	West Cameron Mining	49871304	5/1/2000		42	0	1.04 1.11 3	3.6
DM001	West Cameron Mining	49871304	6/14/2000		24	6.2	1.21 1.11 2.92	4.3
DM001	West Cameron Mining	49871304	7/20/2000		40	0	1.97   1.68   2.94	3.7
DM001	West Cameron Mining	49871304	10/19/2000		0	62	0.542 1.26 0.94	9.3
DM001	West Cameron Mining	49871304	11/27/2000		0	104	1.74 1.45 2.15	9.1
DM001	West Cameron Mining	49871304	12/11/2000		0	56	3.51 1.36 3.97	6.8
DM001	West Cameron Mining	49871304	2/14/2001		0	1202	6 2.28 2.36	10.5
DM001	West Cameron Mining	49871304	4/30/2001		0	684	0.893 0.766 3	10.4
DM001	West Cameron Mining	49871304	6/7/2001		0	4970	3.91 2.3 2.83	11
DM001	West Cameron Mining	49871304	7/19/2001		0	3940	7.48 3.79 4.2	10.8
DM001	West Cameron Mining	49871304	9/17/2001		0	446	7.21 3.84 3.31	10.2
DM001	West Cameron Mining	49871304	10/16/2001		0	430	4.64 2.97 3.12	10.1
DM001	West Cameron Mining	49871304	11/26/2001		0	5230	2.04 1.81 2.82	10.8
DM001	West Cameron Mining	49871304	12/13/2001		0	4310	1.09 0.855 2.36	11
DM001	West Cameron Mining	49871304	1/21/2002		0	74	2.37 1.44 2.19	7.2
DM001	West Cameron Mining	49871304	3/5/2002		0	212	1.3 1.43 2.56	10
DM001	West Cameron Mining	49871304	4/24/2002		0	142	2.01 1.09 3.44	9.5
DM001	West Cameron Mining	49871304	6/5/2002		0	126	0.458 1.23 1.11	8.7
DM001	West Cameron Mining	49871304	8/20/2002		0	1364	1.29 1.2 3.64	10.6
DM001	West Cameron Mining	49871304	9/16/2002		0	700	1.23 0.995 3.17	10.5
DM001	West Cameron Mining	49871304	9/26/2002		0	876	1.9 1.35 3.17	10.3
DM001	West Cameron Mining	49871304	11/6/2002		0	138	1.59 1.21 4.79	8.1
DM001	West Cameron Mining	49871304	12/4/2002		0	716	0.946 0.904 4.34	10.5

 Average=
 69.33
 12.42
 685.51
 4.00
 1.65
 2.39
 7.46

 StDev=
 33.49
 18.03
 1476.21
 3.89
 0.76
 1.16
 2.65

				<u> </u>				Fe	Mn	AI	
TMDL Site	Study Point	Company	Permit #	Date	Flow (gpm)	Acid mg/l	Alk mg/l	mg/l	mg/l	mg/l	рН
NFD	North Franklin Mine drift and borehole	USGS	*	10/31/1991	597.97	122	24	18	3	*	*
	North Franklin Mine bank seepage	USGS	*	10/31/1991	822.23	42	11	17	3.1	*	*
	North Franklin Discharge	West Cameron Mining	49871304	3/31/1994	*	23.6	4.8	7	2.2	*	4.2
	North Franklin Discharge	Chestnut Coal	49921301	6/12/1995	*	54	0	7.43	1.56	1.2	3.4
	North Franklin Discharge	Chestnut Coal	49921301	7/18/1995	*	38	26	15.3	2.5	0.823	5.7
	North Franklin Discharge	Chestnut Coal	49921301	11/21/1995	*	42	22	11	2.22	0.734	5.8
	North Franklin Discharge	Chestnut Coal	49921301	3/6/1996	*	46	8.6	6.13	2.11	0.966	4.8
	North Franklin Discharge	West Cameron Mining	49871304	3/20/1996	*	7	6.3	13.5	1.2	*	4.5
	North Franklin Discharge	West Cameron Mining	49871304	5/22/1996	*	44	11.6	5.77	2.11	1.22	5.2
	North Franklin Discharge	West Cameron Mining	49871304	6/18/1996	*	9	3.6	4	1.6	*	4.48
	North Franklin Discharge	West Cameron Mining	49871304	9/24/1996	*	8.5	9.5	4.8	2.3	*	4.36
	North Franklin Discharge	West Cameron Mining	49871304	12/26/1996	*	3.4	4.8	0.12	0.7	*	4.53
	North Franklin Discharge	Chestnut Coal	49921301	1/23/1997	*	17.8	19.2	5.14	1.85	0.5	5.6
	North Franklin Discharge	Chestnut Coal	49921301	3/11/1997	*	5	13	6.2	2	*	5.3
	North Franklin Discharge	West Cameron Mining	49871304	5/19/1997	*	34	22	8.55	2.04	0.842	5.7
	North Franklin Discharge	West Cameron Mining	49871304	6/16/1997	*	8.50	11.00	5.80	1.80	*	5.36
	North Franklin Discharge	Chestnut Coal	49921301	7/28/1997	*	40	30	12.6	2.37	0.859	5.8
	North Franklin Discharge	West Cameron Mining	49871304	8/19/1997	*	48	30	13	2.28	0.915	5.9
	North Franklin Discharge	West Cameron Mining	49871304	9/24/1997	*	5	6.3	0.66	0.44	*	4.67
	North Franklin Discharge	Chestnut Coal	49921301	10/23/1997	*	44	30	13.8	2.31	0.978	5.8
	North Franklin Discharge	West Cameron Mining	49871304	12/29/1997	*	50.00	1.00	1.1	0.97	*	3.54
	North Franklin Discharge	Chestnut Coal	49921301	1/27/1998	*	19.2	20	9.62	2.03	0.922	5.6
	North Franklin Discharge	West Cameron Mining	49871304	2/9/1998	*	28	26	9.08	1.99	0.803	5.7
	North Franklin Discharge	West Cameron Mining	49871304	2/12/1998	*	15.6	24	8.79	2	0.912	5.7
	North Franklin Discharge	West Cameron Mining	49871304	3/12/1998	*	0	38	1.01	0.606	1.41	*
	North Franklin Discharge	Chestnut Coal	49921301	9/9/1998	*	5.60	10.40	4.80	1.79	0.653	4.9
	North Franklin Discharge	West Cameron Mining	49871304	9/21/1998	*	5	30	13.3	2.33	0.877	5.8
	North Franklin Discharge	Chestnut Coal	49921301	11/18/1998	*	8.8	32	14.4	2.34	0.789	6
	North Franklin Discharge	Chestnut Coal	49921301	2/18/1999	*	6	18.2	8.33	1.71	1.48	5.7
	North Franklin Discharge	West Cameron Mining	49871304	3/2/1998	*	2.6	32	12	2.14	0.717	5.46
	North Franklin Discharge	West Cameron Mining	49871304	5/5/1999	*	46.00	0.00	3.25	1.71	2.73	3.6

North Franklin Discharge	Chestnut Coal	49921301	5/10/1999	*	6.40	11.80	2.54	1.21	<0.5	5.5
North Franklin Discharge	West Cameron Mining	49871304	7/13/1999	*	40.00	0.00	4.07	2.98	3.61	3.8
North Franklin Discharge	Chestnut Coal	49921301	8/18/1999	*	3.60	34.00	14.70	2.25	0.66	6
North Franklin Discharge	West Cameron Mining	49871304	10/26/1999	*	0.00	36.00	0.90	0.90	2.47	6.5
North Franklin Discharge	Chestnut Coal	49921301	12/7/1999	*	6.80	22.00	10.90	1.84	0.515	5.8
North Franklin Discharge	Chestnut Coal	49921301	2/15/2000	*	9.60	9.20	1.49	1.08	0.578	5.2
North Franklin Discharge	West Cameron Mining	49871304	2/16/2000	*	34.00	0.00	0.75	1.11	2.7	3.8
North Franklin Discharge	Chestnut Coal	49921301	4/24/2000	*	13.20	14.20	6.68	1.90	0.989	5.3
North Franklin Discharge	West Cameron Mining	49871304	5/1/2000	*	42.00	0.00	1.04	1.11	3	3.6
North Franklin Discharge	West Cameron Mining	49871304	6/14/2000	*	24.00	6.20	1.21	1.11	2.92	4.3
North Franklin Discharge	West Cameron Mining	49871304	7/20/2000	*	40.00	0.00	1.97	1.68	2.94	3.7
North Franklin Discharge	Chestnut Coal	49921301	10/31/2000	*	2.40	42.00	15.50	2.34	0.567	6
North Franklin Discharge	Chestnut Coal	49921301	3/13/2001	*	7.20	15.40	3.75	1.24	0.575	5.8
North Franklin Mine drift & borehole	USGS	*	3/27/2001	2410.56	34	30	11	1.9	0.39	5.9
North Franklin Mine drift & borehole	USGS	*	8/20/2001	956.75	24	34	18	3	*	5.2

 Average=
 1196.88
 24.26
 16.96
 7.74
 1.85
 1.28
 5.10

 StDev=
 822.54
 22.61
 12.34
 5.37
 0.64
 0.90
 0.84

TMDL Site	Study Point	Company	Permit #	Date	Flow (gpm)	Acid mg/l	Alk mg/l	Fe mg/l	Mn	Al mg/l	рH
	•						Aik ilig/i				•
KRS	MP-4D	Wilbur White Coal Co.	49930201	2/22/1994	577	59		20.7	1.09	7.22	3.45
	MP-4D	Wilbur White Coal Co.	49930201	3/22/1994	507	48	*	3	1.27	4.11	3.44
	MP-4D	Wilbur White Coal Co.	49930201	4/22/1994	279	63	*	2.59	1.21	4.17	3.56
	MP-4D	Wilbur White Coal Co.	49930201	5/20/1994	130	29	*	0.14	0.84	2.26	3.32
	MP-4D	Wilbur White Coal Co.	49930201	6/20/1994	362	85	*	1.99	1.5	6.17	3.26
	MP-4D	Wilbur White Coal Co.	49930201	7/25/1994	100	96	*	8.68	1.6	7.86	3.01
	MP-4D	Wilbur White Coal Co.	49930201	8/24/1994	25.7	106.87	*	6.01	1.75	7.28	3.13
	MP-4D	Wilbur White Coal Co.	49930201	9/25/1994	25.7	94.85	0	6.09	1.85	6.95	3.14
	MP-4D	Wilbur White Coal Co.	49930201	10/26/1994	25.7	77.64	*	1.75	1.76	5.86	3.07
	MP-4D	Wilbur White Coal Co.	49930201	11/23/1994	103	67.45	*	5.05	1.77	5.95	3.3
	MP-4D	Wilbur White Coal Co.	49930201	12/22/1994	200	48.48	*	0.91	0.9	3.41	3.3
	MP-4D	Wilbur White Coal Co.	49930201	1/30/1995	25.7	59.3	*	2.11	1.26	5.32	3.4
	MP-4D	Wilbur White Coal Co.	49930201	3/22/1995	100	36.36	*	0.57	1.04	3.27	3.48
	MP-4D	Wilbur White Coal Co.	49930201	4/26/1995	71.5	33.67	*	0.44	1.15	2.32	3.3
	MP-4D	Wilbur White Coal Co.	49930201	5/25/1995	46.5	5.03	*	0.343	1.23	3.01	3.41
	MP-4D	Wilbur White Coal Co.	49930201	6/27/1995	25.4	93.56	*	17.3	1.75	12.3	3.16

MP-4D	Wilbur White Coal Co.	49930201	7/24/1995	25.4	55.5	*	0.49 1.73 4.59	3.54
MP-4D	Wilbur White Coal Co.	49930201	8/25/1995	8.99	49.5	*	0.51 1.86 3.52	3.52
MP-4D	Wilbur White Coal Co.	49930201	9/26/1995	8.99	53	*	0.884 2.05 4.79	3.29
MP-4D	Wilbur White Coal Co.	49930201	10/20/1995	8.99	84.5	*	0.926 2.28 7.78	3.23
MP-4D	Wilbur White Coal Co.	49930201	11/21/1995	200	60	*	4.71 1.78 6.55	3.43
MP-4D	Wilbur White Coal Co.	49930201	12/27/1995	200	32.4	*	0.359 1.26 3.22	3.42
MP-4D	Wilbur White Coal Co.	49930201	1/26/1996	1257.36	0	*	0.722 1.578 3.54	3.5
MP-4D	Wilbur White Coal Co.	49930201	2/27/1996	557.55	24.63	*	0.751 1.28 2.91	4
MP-4D	Wilbur White Coal Co.	49930201	3/27/1996	458.31	24.7	*	0.35 1.29 3.08	3.71
MP-4D	Wilbur White Coal Co.	49930201	4/24/1996	*	26.6	*	0.35 1.2 2	3.89
MP-4D	Wilbur White Coal Co.	49930201	5/23/1996	71.5	28.28	*	0.25 1.16 2.77	3.7
MP-4D	Wilbur White Coal Co.	49930201	6/24/1996	71.5	201	*	0.32 1.49 3.62	3.46
MP-4D	Wilbur White Coal Co.	49930201	7/30/1996	71.5	46.32	*	0.41 1.47 3.85	3.45
MP-4D	Wilbur White Coal Co.	49930201	8/24/1996	25.7	71.8	*	0.72 2.11 2.52	3.3
MP-4D	Wilbur White Coal Co.	49930201	9/26/1996	35.5	85.1	*	2.23 2.4 7.31	3.56
MP-4D	Wilbur White Coal Co.	49930201	10/31/1996	99.7	61.4	*	2.46 1.97 4.73	3.4
MP-4D	Wilbur White Coal Co.	49930201	11/26/1996	130	40.4	*	1.04 1.45 3.05	3.63
MP-4D	Wilbur White Coal Co.	49930201	12/31/1996	458.31	33.3	*	0.87 0.96 1.7	3.75
MP-4D	Wilbur White Coal Co.	49930201	1/30/1997	239	31.4	*	31.4 1.19 2.35	3.6
MP-4D	Wilbur White Coal Co.	49930201	2/25/1997	458.31	34.3	*	3.23 0.96 2.3	3.56
MP-4D	Wilbur White Coal Co.	49930201	3/31/1997	279	99.60	*	0.58 1.08 2	3.68
MP-4D	Wilbur White Coal Co.	49930201	5/8/1997	279	32.9	*	5.03 1.17 2.3	3.55
MP-4D	Wilbur White Coal Co.	49930201	5/29/1997	238	28.6	*	1.13 1.27 2.34	3.61
MP-4D	Wilbur White Coal Co.	49930201	7/8/1997	200	39.4	*	1.27 1.29 2.9	3.48
MP-4D	Wilbur White Coal Co.	49930201	7/31/1997	148	24.6	*	0.11 1.54 2.21	3.83
MP-4D	Wilbur White Coal Co.	49930201	8/29/1997	*	62.06	*	4.15 1.88 6.43	3.42
MP-4D	Wilbur White Coal Co.	49930201	9/30/1997	46	66	*	2.9 2.12 5.98	3.41
MP-4D	Wilbur White Coal Co.	49930201	10/31/1997	24	51.7	*	1.31 2.1 5.37	3.25
MP-4D	Wilbur White Coal Co.	49930201	12/9/1997	46	56.7	*	1.84 2.18 4.6	3.67
MP-4D	Wilbur White Coal Co.	49930201	12/23/1997	24	46.30	*	1.41 2.15 4.8	3.55
MP-4D	Wilbur White Coal Co.	49930201	2/5/1998	162.4	0.4	*	0.41 0.07 0.32	3.47
MP-4D	Wilbur White Coal Co.	49930201	2/26/1998	279	38.9	*	0.88 1.53 5.56	3.71
MP-4D	Wilbur White Coal Co.	49930201	3/31/1998	80	41.40	*	0.62 1.18 2.97	3.82
MP-4D	Wilbur White Coal Co.	49930201	5/29/1998	80	32.6	*	0.62 1.18 2.97	3.82
MP-4D	Wilbur White Coal Co.	49930201	7/24/1998	41	41.16	*	0.64 1.99 4.12	3.61
MP-4D	Wilbur White Coal Co.	49930201	8/31/1998	24	43.7	*	0.67 1.73 4.42	3.59
MP-4D	Wilbur White Coal Co.	49930201	9/27/1998	30	38.8	*	0.59 1.72 0.33	3.58

MP-4D	Wilbur White Coal Co.	40020204	10/26/1998	9	49	*	0.00	1 5 1	4.95	3.59
				-	_	*		1.54		
MP-4D	Wilbur White Coal Co.		1/31/1999	130.2	38.2			1.42		3.61
MP-4D	Wilbur White Coal Co.	49930201	2/24/1999	147.6	27.7	*	0.53	1.35	2.76	3.67
MP-4D	Wilbur White Coal Co.	49930201	3/16/1999	275.8	28.86	*	1.99	2.13	3.25	4.06
MP-4D	Wilbur White Coal Co.	49930201	4/23/1999	275.8	20.80	*	0.37	0.98	2.41	3.86
MP-4D	Wilbur White Coal Co.	49930201	5/28/1999	89	24.30	*	0.54	1.25	2.15	3.75
MP-4D	Wilbur White Coal Co.	49930201	6/11/1999	*	30.00	0.00	0.37	1.48	2.76	3.8
MP-4D	Wilbur White Coal Co.	49930201	6/30/1999	23.8	44.90	*	0.73	1.63	1.76	3.68
MP-4D	Wilbur White Coal Co.	49930201	7/13/1999	*	38.00	0.00	0.38	1.58	3.13	3.7
MP-4D	Wilbur White Coal Co.	49930201	7/30/1999	23.9	46.80	*	0.40	1.70	4.1	3.47
MP-4D	Wilbur White Coal Co.	49930201	8/24/1999	23.9	48.00	*	0.50	1.96	3.38	3.49
MP-4D	Wilbur White Coal Co.	49930201	9/30/1999	29.6	75.10	*	1.45	2.43	6.9	3.44
MP-4D	Wilbur White Coal Co.	49930201	10/27/1999	29.6	56.60	*	0.74	2.27	5.73	3.35
MP-4D	Wilbur White Coal Co.	49930201	11/29/1999	59.3	61.80	*	0.59	2.01	4.63	3.44
MP-4D	Wilbur White Coal Co.	49930201	12/29/1999	205.6	91.60	*	1.35	3.33	8.35	3.61
MP-4D	Wilbur White Coal Co.	49930201	1/8/2000	*	40.00	0.00	0.30	1.56	3.92	3.7
MP-4D	Wilbur White Coal Co.	49930201	4/1/2000	*	32.00	0.00	0.89	1.64	5.53	3.8
MP-4D	Wilbur White Coal Co.	49930201	8/14/2001	*	91.2	0	0.3	1.1	2.09	3.8
MP-4D	Wilbur White Coal Co.	49930201	9/17/2001	*	85.8	0	0.412	2.16	3.44	3.6
MP-4D	Wilbur White Coal Co.	49930201	11/26/2001	*	84.4	0	0.373	2.01	3.95	3.6
MP-4D	Wilbur White Coal Co.	49930201	1/22/2002	*	85.4	0	0.3	0.09	0.5	3.7
MP-4D	Wilbur White Coal Co.	49930201	4/24/2002	*	69.2	0	0.305	1.37	2.92	3.9
MP-4D	Wilbur White Coal Co.	49930201	6/12/2002	*	66.8	0	0.3	1.23	2.26	3.8

Average=	160.85	53.01	0.00	2.23	1.55	4.06	3.54
StDev=	202.88	29.67	0.00	4.71	0.51	2.06	0.22

TMDL Site	Study Point	Company	Permit #	Date	Flow (gpm)	Acid mg/l	Alk mg/l	Fe mg/l	Mn mg/l	Al mg/l	рН
MC4	MP #155	White Pine Coal Co.	49920201	11/16/1985	*	1	34.4	2.31	2.96	0.74	7.23
	MP #155	White Pine Coal Co.	49920201	12/14/1988	*	1	35.2	4.21	3.96	1.01	6.4
	MP #155	White Pine Coal Co.	49920201	1/11/1989	*	1	37.1	3.45	2.58	0.74	7.1
	Mahanoy.Cr.at.Kneass	USGS		10/10/2001	46388.592	12	46	1.58	1.87	0.18	6.7
	Mahanoy.Cr.at.Kneass	USGS		8/20/2001	53194.104	6	22	1.52	0.93	0.14	7.2
	Mahanoy.Cr.at.Kneass	USGS		3/27/2001	222220.8	8	26	2.44	1.51	0.34	7.1

Total flow including Gilberton Pump & Continental Mine = 169.746 MGD

**Average=** 107267.83 4.83 33.45 2.58 2.30 0.52 6.96

Pump records for the Gilberton Discharge (below) were provided via PennFuture from PADEP

## DEPARTMENT OF ENVIRONMENTAL PROTECTION BUREAU OF ABANDONED MINE RECLAMATION GILBERTON PUMP RECORDS

Flows based on estimated 11,300 gallons per minute flow

Month Year	Kilowatt Hours required	Hour Meter starting	Hour Meter ending	Hours Operated	Estimated Gallons Pumped from Mine Pool	Annual Pumping Totals	Annual Inches of Rainfall
Dec-04				0	0		
Nov-04				0	0		
Oct-04		37042		<del>                                     </del>	0		
		36608	37042	434	294,252,000		<del> </del>
Sep-04		36165	36608	443	300,354,000		<b></b>
Aug-04	<b> </b>	35842	36165	323	300,354,000		<del></del>
Jul-04		35532	35842	310	210,180,000		<del>                                     </del>
Jun-04		35017	35532	515	349,170,000		<del>                                     </del>
May-04	450000				349,170,000		
Apr-04	153800	34526	35017	491 434	294,252,000		<del>                                     </del>
Mar-04	100600	34092 33644	34526 34092	434	303,744,000		<del> </del>
Feb-04	114200				303,744,000		<del> </del>
Jan-04	190000	32995	33644	649	303,744,000		
	100000	00000	00005	707	F20 026 000		-
Dec-03	169600	32228	32995	767	520,026,000		<del>                                     </del>
Nov-03	269400	31745	32228	483	327,474,000		-
Oct-03	39400	31318	31745	427	289,506,000		
Sep-03	101800	30907	31318	411	278,658,000		<del> </del>
Aug-03	169200	30542	30907	365	247,470,000		<del> </del>
Jul-03	53000	29919	30542	623	422,394,000		-
Jun-03	148200	29318	29919	601	407,478,000		
May-03	104800	28831	29318	367	248,826,000		
Apr-03	161800	28262	28831	616	417,648,000		
Mar-03	101800	27879	28262	383	259,674,000		
Feb-03	88800	27638	27879	241	163,398,000		
Jan-03	92600	27119	27638	519	351,882,000		
				9,850	2003 Total	3,934,434,000	65.0
Dec-02	83200	26922	27119	197	133,566,000		
Nov-02	39000	26648	26922	274	185,772,000		
Oct-02	48800	26527	26648	121	82,038,000		
Sep-02	38200	26390	26527	137	92,886,000		
Aug-02	19200	26294	26390	96	65,088,000		
Jul-02	53000	26141	26294	153	103,734,000		
Jun-02	90400	25812	26141	329	223,062,000		
May-02	100200	25387	25812	425	288,150,000		
Apr-02	25200	25195	25387	192	130,176,000		
Mar-02	25000	25099	25195	96	65,088,000		
Feb-02	400	25099	25099	0	0		
Jan-02	400	25099	25099	0	0		+
				2,020	2002 Total	1,369,560,000	44.6

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Dec-01	25600	25025	25099	74	50,172,000		
Nov-01	316	25001	25025	24	16,272,000		
Oct-01	284	25001	25001	0	0		
Sep-01	30800	24908	25001	93	63,054,000		
Aug-01	19200	24832	24908	76	51,528,000		
Jul-01	44200	24734	24832	98	66,444,000		
Jun-01	59400	24569	24734	165	111,870,000		
May-01	40600	24357	24569	212	143,736,000	* Revised elevation	
Apr-01	74800	23995	24357	362	245,436,000	pumped turned on 1113' - on	
Mar-01	56800	23851	23995	144	97,632,000	1094' - off	
Feb-01	18200	23706	23851	145	98,310,000		
Jan-01	47600	23588	23706	118	80,004,000		
				1,511	2001 Total	1,024,458,000.0	38.2
Dec-00	44400	23283	23588	305	206,790,000		
Nov-00	38000	23188	23283	95	64,410,000		
Oct-00	46200	23010	23188	178	120,684,000		
Sep-00	43400	22914	23010	96	65,088,000		
Aug-00	71000	22568	22914	346	234,588,000		
Jul-00	51200	22440	22568	128	86,784,000		
Jun-00	14800	22288	22440	152	103,056,000		
May-00	64000	22184	22288	104	70,512,000		
Apr-00	145400	21697	22184	487	330,186,000		
Mar-00	81600	21244	21697	453	307,134,000		
Feb-00	22481	21190	21244	54	36,612,000		
Jan-00	21119	21025	21190	165	111,870,000		
				2,563	2000 Total	1,737,714,000	51.2
Dec-99	210	21025	21025	0	0		
Nov-99	190	21025	21025	0	0		
Oct-99	400	21025	21025	0	0		
Sep-99	24800	20929	21025	96	65,088,000		
Aug-99	600	20929	20929	0	0		
Jul-99	0	20929	20929	0	0		
Jun-99	400	20929	20929	0	0		
May-99	68400	20737	20929	192	130,176,000		
Apr-99	42305	20370	20737	367	248,826,000		
Mar-99	40895	20346	20370	24	16,272,000		
Feb-99	89200	20101	20346	245	166,110,000		
Jan-99	0	20003	20101	98	66,444,000		
				1,022	1999 Total	692,916,000	50.6
Dec-98	31800	20003	20003	0	0		
Nov-98	21600	19801	20003	202	136,956,000		
Oct-98	0	19801	19801	0	0 1		
Sep-98	18200	19732	19801	69	46,782,000		
Aug-98	44400	19690	19732	42	28,476,000	* Pump disconnected	
Jul-98	87000	19381	19690	309	209,502,000	from automatic water level controls. Pump	
Jun-98	137400	18912	19381	469	317,982,000	started and stopped	
						manually.	

	1115' - on	360,018,000	531	18254	17723	140800	Apr-98
	1094' - off	442,734,000	653	17723	17070	156200	Mar-98
		210,180,000	310	17070	16760	86400	Feb-98
		251,538,000	371	16760	16389	73400	Jan-98
49.4	2,450,292,000	1998 Total	3,614				
		69,156,000	102	16389	16287	32800	Dec-97
		88,140,000	130	16287	16157	33800	Nov-97
		136,278,000	201	16157	15956	53600	Oct-97
		138,990,000	205	15956	15751	68000	Sep-97
		156,618,000	231	15751	15520	54000	Aug-97
		195,264,000	288	15520	15232	75800	Jul-97
	Pump on automatic	236,622,000	349	15232	14883	102400	Jun-97
	water level controls:	259,674,000	383	14883	14500	103200	May-97
	1094 ' - on	343,068,000	506	14500	13994	143800	Apr-97
	1090' - off	330,864,000	488	13994	13506	110800	Mar-97
		330,864,000	488	13506	13018	129000	Feb-97
		381,036,000	562	13018	12456	275200	Jan-97
42.1	2,666,574,000	1997 Total	3,933				
		499,686,000	737	12456	11719	84000	Dec-96
		402,732,000	594	11719	11125		Nov-96
		262,386,000	387	11125	10738		Oct-96
		208,146,000	307	10738	10431		Sep-96
		287,472,000	424	10431	10007		Aug-96
		305,778,000	451	10007	9556		Jul-96
		378,324,000	558	9556	8998		Jun-96
		457,650,000	675	8998	8323		May-96
		344,424,000	508	8323	7815		Apr-96
	Electric motor	368,832,000	544	7815	7271		Mar-96
	removed, rebuilt and reinstalled.	471,210,000	695	7271	6576		Feb-96
		302,388,000	446	6576	6130		Jan-96
70.0	4,289,028,000	1996 Total	6,326			<u> </u>	
		226,452,000	334	6130	5796		Dec-95
		237,978,000	351	5796	5445	<b>—</b>	Nov-95
		129,498,000	191	5445	5254		Oct-95
		124,074,000	183	5254	5071	<b></b>	Sep-95
		169,500,000	250	5071	4821	<b></b>	Aug-95
		248,148,000	366	4821	4455	<b>†</b>	Jul-95
		149,838,000	221	4455	4234	<b>†</b>	Jun-95
	Electric motor serviced	73,224,000	108	4234	4126	<b>†</b>	May-95
	and bearings replaced.	229,164,000	338	4126	3788	<del>                                     </del>	Apr-95
		281,370,000	415	3788	3373	<del>                                     </del>	Mar-95
		296,286,000	437	3373	2936	-	Feb-95
		317,982,000	469	2936	2467	+	Jan-95
41.2	2,483,514,000	1995 Total	3,663		1 2407	+	Jai1-9J
		308,490,000	455	2467	2012	+	Dec-94
	1	221,028,000	326	2012	1686	+	Nov-94
					1000		1404-94

Sep-94	809	1314	505	342,390,000		
Aug-94	435	809	374	253,572,000	Peerless deep well	
Jul-94	248	435	187	126,786,000	pump rebuilt.	
Jun-94	69369	248	248	168,144,000	New hour meter	
May-94	69113	69369	256	173,568,000	installed	
Apr-94	68394	69113	719	487,482,000		
Mar-94	67781	68394	613	415,614,000	,	
Feb-94	67372	67781	409	277,302,000		
Jan-94	66976	67372	396	268,488,000		
			4,860	1994 Total	3,295,080,000	46.0
Dec-93	66494	66976	482	326,796,000		
Nov-93	66292	66494	202	136,956,000		
Oct-93	66087	66292	205	138,990,000		
Sep-93	65855	66087	232	157,296,000		
Aug-93	65605	65855	250	169,500,000		
Jul-93	65282	66605	1323	896,994,000		
Jun-93	64823	65282	459	311,202,000		
May-93	64085	64823	738	500,364,000		
Apr-93	63367	64085	718	486,804,000		
Mar-93	62918	63367	449	304,422,000		
Feb-93	62584	62918	334	226,452,000		
Jan-93	62197	62584	387	262,386,000		
			5,779	1993 Total	3,918,162,000	42.7
Dec-92	61747	62197	450	305,100,000		
Nov-92	61295	61747	452	306,456,000		
Oct-92	61030	61295	265	179,670,000		
Sep-92	60800	61030	230	155,940,000		
Aug-92	60553	60800	247	167,466,000		
Jul-92	60280	60553	273	185,094,000		
Jun-92	59924	60280	356	241,368,000		
May-92	59604	59924	320	216,960,000		
Apr-92	59251	59604	353	239,334,000		
Mar-92	58950	59251	301	204,078,000		
Feb-92	58816	58950	134	90,852,000		
Jan-92	58685	58816	131	88,818,000		
		1	3,512	1992 Total	2,381,136,000	43.4

# Attachment G Iterative Aluminum Reductions for Gilberton Pump Discharge

#### Gilberton Pump Existing

#### Allowable Load at MC1

Iron load =	1726.38	Iron =	159.19
Manganese load =	453.1748	Manganese =	94.49
Aluminum load =	33.57809	Aluminum =	27.37

#### Gilberton Pump Allowable

#### Mahanoy Township WWTP

Iron conc.	1.5 mg/l	Iron =	1.67
Manganese conc.	1.0 mg/l	Manganese =	0.63
Aluminum conc.	0.75 mg/l	Aluminum =	1.67

 Iron load =
 86.319

 Manganese load =
 57.546

 Aluminum load =
 43.1595

#### Aluminum Mass Balance at MC1

#### NPS Load must be reduced to 25.7 lbs/day

Allowable load AI - WLA Mahanoy Township =

27.37-1.67 = 25.7

Total Flow = average flow at point + flow Gilberton Pump Total Flow = 9.64 MGD + 6.90 MGD = 16.54 MGD Ratio instream = 9.64/16.54 = 0.58 Ratio Gilberton Pump = 1-0.58 = 0.42

Reduction from Gilberton Pump =

43.16 - 25.70 = 17.46 lbs/day

Allowable concentration aluminum @ Gilberton 17.46 lbs/day /6.90 MGD /8.34 = 0.303409446 mg/l

 Exist
 LTA
 % Reduction

 Aluminum
 0.5835 mg/l
 0.30 mg/l
 52%

 Iron
 30 mg/l
 1.5 mg/l
 95%

 Manganese
 7.875 mg/l
 1.0 mg/l
 88%

# **Attachment H**Comment and Response

### Comments received on Proposed (Revised) Mahanoy Creek Watershed TMDL February 2, 2007

Commenter: Citizens for Pennsylvania's Future

1. Comment: PADEP failed to provide the required 30-day public comment period

The public notice for the Revised TMDL refers to it as a "proposed" TMDL", 37 Pa. Bull. 472 (January 27, 2007), and invites the public to present comments at a public meeting, <u>id.</u>, or by submitting them in writing. <u>Id.</u> At 473. In that regard, the Revised TMDL is like the Original Draft TMDL. Pennsylvania's regulations provide that "[d]raft TMDL notices shall be subject to a minimum 30-day comment period." 25 Pa. Code § 96.7(b). The public notice for the Revised TMDL itself is dated February 2, 2007, and it first became available during business hours on the morning of February 5, 2007, just one day before the public meeting, and just 18 days before the comment deadline of February 23, 2007. The 18-day public comment period provided for the Revised TMDL falls short of the 30-day period required by 25 Pa. Code § 96.7(b).

<u>Response:</u> The Department extended the public notice period from February 23, 2007 to March 2, 2007, to allow for the full 30-day comment period according to regulation. Notice of the extension of the comment period was published in the Pennsylvania Bulletin (37 Pa. Bull. 962, February 24, 2007).

<u>2. Comment</u>: Basing a TMDL on the unrepresentative 2001 monitoring data for point MC1 would be arbitrary, indefensible, and misleading.

Attached to these comments as Attachment A is a letter to the Chief of the Permits Section in PADEP's Pottsville District Mining Office dated July 21, 2006, which was copied to (then) Acting Director of the Bureau of Watershed Management. In that letter, PennFuture stated: "One prominent problem [within the Original Draft Mahanoy Creek TMDL] is that the Department's Gilberton Pump was not operating on any of the days for which instream samples were collected at the next monitoring point downstream, 'MC1'. Thus, in addition to in correctly classifying the Gilberton Pump as a nonpoint source, cf. 33 U.S.C. § 1362(14), the draft TMDL for 'Mahanoy Creek above MC1' entirely fails to account for the impact of the Gilberton Pump Discharges, which averages about 2.5 billion gallons per year." (Attachment A, p. 2 n. 2) PennFuture will address the point source classification of the Gilberton Pump in Comment 3, below. Here, we will focus on the inadequacy of the monitoring data for point MC1.

In the Original Draft TMDL, PADEP had only four monitoring events for station MC1. The Revised TMDL properly eliminates one of those events, which was for a different location (Gilberton rather than Girardville), and which occurred on the same day (8/20/2001) as one of the Girardville samples. But the three samples that remain provide an utterly insufficient basis for determining maximum daily pollutant loads for point MC1. Two of the three samples (August 20 and October 11, 2001) were taken

during a fairly severe drought. More important, all three samples were collected on dates when a major source of mine drainage contamination – PADEP's own Gilberton Pump – was not discharging, and had not been discharging for at least a week. Basing a TMDL at point MC1 on those three samples would be like basing the assessment of a power plant's cooling water discharge on three instream temperature readings taken when the generating units were idle.

In October 2004, PADEP responded to an information request from PennFuture by providing records that included the attached data on the operational status (Attachment B), discharge volume (Attachment C), and water quality (Attachment D) for the Gilberton Pump. There are four pumps in the Gilberton Shaft: The "State Pump" operated by PADEP, and three privately owned pumps, denoted "B&D", "Gil #1", "Gil#2". (Attachment B, p.1) The monthly ledger sheets in Attachment B show the operational status of each of the four pumps on each day of the month, with "R" standing for "running" and "S" standing for "stopped". On the three pumping records from 2001 that make up pages 2 through 3 of Attachment B, the status of the State Pump is shown in the column labeled "Status". Those records show that the State Pump was stopped ("S") on the dates of the three TMDL sampling events at MC1: March 28, August 20, and October 11, 2001. On March 28, 2001, the State Pump had been stopped for about a week; on August 20, for about eleven days; and on October 11, for twenty days. (Attachment B, pp. 2-4)

The Gilberton Pump is started when the level of the mine pool reaches a specified elevation (1,113 feet above sea level), and it is shut off when it reaches another specified elevation (1,094 feet above sea level). (Attachment C, p.2) The first page of the attached spreadsheet titled "Department of Environmental Protection, Bureau of Abandoned Mine Reclamation, Gilberton Pump Records" (Attachment C), states that the "Estimated Gallons Pumped from Mine Pool" figures in the spreadsheet are "based on [an] estimated 11,300 gallons per minute of flow," which reflects the fact that the pump is run at roughly full capacity until the mine pool level drops below the shut-off elevation. During the twelve year period of 1992 through 2003, the Gilberton Pump operated about 42.4 percent of the time, and discharged roughly 2.5 billion gallons of mine pool water per year into Mahanoy Creek upstream from point MC1. That translates into an average of about 6.9 million gallons per day (mgd), or just under 4,800 gallons per minute (gpm). See U.S. Department of Energy, Draft Environmental Impact Statement for the Gilberton Coal-to-Clean Fuels and Power Project DOE/EIS-0357 (November 2005), p. 3-15 (reporting same discharge volume figures based on information provided by PADEP).

As of late 2004, few samples of the Gilberton Pump discharge taken by PADEP apparently had been analyzed for aluminum or manganese, but PADEP had results for a few dozen samples, taken mainly during 2004, that analyzed for iron. Most of these results are consistent in showing the discharge to contain about 30 milligrams per limit (mg/l) of iron, almost all of it in the dissolved (ferrous) state, with a few results in the low 40 mg/l range in the later part of 2004. (Attachment D)

Assuming an iron concentration of 30 mg/l and an average discharge rate of slightly more that 6.9 mgd, the Gilberton Pump added an average of roughly 1,725 pounds of iron per day to Mahanoy Creek during the period 1992 through 2003. The Revised TMDL, in contrast, finds that the existing iron load at MC1 is a mere 331.79 pounds per day (Revised TMDL, pp. 8, 39), or less than 20 percent of the long-term average loading from the Gilberton Pump alone (based on the data supplied by PADEP). The shortcoming of the Revised TMDL's existing iron load figure is that the three data points on which it is based were unaffected by any loading from the then idle Gilberton Pump. That problem is not cured by the "@Risk" software's statistical manipulation, which relies on the mean and standard deviation of the extremely small and unrepresentative sample.

PennFuture suspects the highest concentrations of metals occur at MC1 when the Gilberton Pump is operating and its 11,300 gpm discharge is at or near its maximum as a percentage of the flow of Mahanoy Creek. This might be the case when a period of snowmelt or high precipitation is followed abruptly by a period of no precipitation, so that the Gilberton Pump is running around the clock to try to lower the mine pool elevation, but the flow rate in Mahanoy Creek at the discharge point is relatively low because of the lack of overland runoff reaching the stream. No matter what precise scenario constitutes the critical condition for these purposes, however, PADEP's own data for the Gilberton Pump indicate that with respect to iron contamination, the critical condition at point MC1 occurs at some time when the Gilberton Pump is operating. By relying on the scant existing monitoring data for Mahanoy Creek at point MC1, the Revised TMDL not only fails to account for a condition that exists more than 42 percent of the time (a discharge of 11,300 gpm from the Gilberton Pump adding 2.8 pounds of iron per minute to the creek), it also fails to satisfy the requirement to "take into account critical conditions for streamflow, loading, and water quality parameters". 40 CFR § 130.7(c)(1).

PennFuture also suspects that there would be a statistically significant difference between the mean iron loading for a set of samples collected at MC1 when the Gilberton Pump is operating and a set taken when the pump is idle. But even if the difference is not that pronounced, if one's objective is to ensure that water quality criteria are met at least 99 percent of the time at MC1, and one has to chose between the two data set just described, one would choose the "pump operating" set of samples to use in determining a TMDL. Using the "pump idle" set of samples would give you no confidence that the calculated load reductions would be sufficient to satisfy the water quality criteria during periods when the Gilberton Pump was operating.

Unfortunately, "pump idle" monitoring results are all PADEP apparently has for point MC1. PADEP often explains that"[t]he TMDL process uses existing and readily accessible data; it does not require further monitoring for the streams that have existing data". (Revised TMDL, p. 76) In this situation, however, that standard rejoinder is insufficient for two reasons.

First, this is literally a situation of "garbage in, garbage out". The lack of an express requirement to perform additional monitoring does not excuse the use of data that - as shown be PADEP's own monitoring data for the Gilberton Pump - are completely unrepresentative because they fail to account for all of the impact of the Gilberton Pump discharge on the stream at point MC1. Nothing in "the TMDL process" says that a state may use "existing data" no matter how bad, unreliable, or unrepresentative those data are. Using the paltry existing monitoring data for point MC1 actually may defeat a basic purpose of the TMDL process, because it may distort the evaluation of pollution sources and the setting of clean-up priorities. Pennsylvania's regulations require that load allocations (LAs) in TMDLs "shall serve as the basis for the development of nonpoint source restoration plans". 25 PA. Code § 96.4(d). The figures in the Revised TMDL for the existing loads and the required load reductions at point MC1 mask the huge reduction in the Gilberton Pump's average load of 1,725 pounds of iron per day that must be achieved in order to meet water quality criteria at MC1. As shown in Comment 8, below, the Gilberton Pump is by far the largest source of mine drainage pollutant loading in the Mahanoy Creek Watershed. By artificially making the Gilberton Pump look less significant as a pollutant loading source than it really is, the Revised TMDL also makes it appear less important than it actually is to treat that discharge.

Second, PADEP already had additional, relevant data – its own Gilberton Pump monitoring data – showing that the existing load figures in the Revised TMDL for point MC1 are far too low, and fail to account for the pollutant loadings from the Gilberton Pump and the worst-case stream conditions for the metals criteria. There is no reason for PADEP to use the three unrepresentative samples from 2001 at MC1 to the exclusion of the larger, longer-term set of data for the Gilberton Pump discharge that is already in PADEP's hands.

Given the delay that already has occurred in the development of this TMDL, PADEP should take a little additional time, collect monitoring data at point MC1 that is representative of all stream conditions – including conditions when the Gilberton Pump is operating – and revise the TMDL calculations for point MC1 based on the monitoring data. Alternately, PADEP could apply to the Gilberton Pump Discharge the "Flow Adjusted Concentration Method" applied to the City of Philadelphia/Girard Trust's Continental Mine Discharge in the Revised TMDL (Appendix E). The Revised TMDL explains that it applied the Flow Adjusted Concentration Methods at points MC2, MC3, and MC4 "because the water quality data used were not taken during a period of time when the Continental Mine Pumped Discharge was operating." (Revised TMDL, pp. 44, 47, 51) Although this statement appears to be factually incorrect, see Comment 7.a, below, its rationale applies to Point MC1 and the Gilberton Pump Discharge. PennFuture lacks the modeling software necessary to complete the entire flow adjusted mass balance analysis. But simple calculations using average flow and concentration values for the Gilberton Pump and MC1 show that when the iron concentration at MC1 is adjusted for the contribution from the Gilberton Pump, it is increased by a factor of 2.5 from 6.7 mg/l to 16.5 mg/l.

Whether by applying the Flow Adjusted Concentration Method or in some other manner, however, PADEP must revise the calculations for point MC1 by taking into account the existing body of monitoring data for the Gilberton Pump. PADEP may not base the TMDL for point MC1 on three instream samples from 2001 that fail to account for the most important factor affecting the metals loadings at that point, namely the Gilberton Pump Discharge.

<u>Response:</u> The data values used in the calculation of loads at point MC1 have been modified using the flow adjusted concentration method, one of the alternatives given by PennFuture, to model the concentration and flow volumes in Mahanoy Creek when the Gilberton Pump is discharging. The calculations were done using the values given by PennFuture (based on monitoring data conducted by the PADEP Bureau of Abandoned Mine Reclamation) of 6.90 MGD average flow volume, and metals concentrations of 30 mg/l, 7.875 mg/l and 0.5835 mg/l for iron, manganese, and aluminum, respectively. Allocations to the Gilberton Pump Discharge are load allocations to nonpoint sources.

<u>3. Comment</u>: The Gilberton Pump Discharge is a point source discharge under the Clean Water Act, and therefore must receive a WLA in the TMDL.

In its February 12, 2003 comments on the Original Draft TMDL, PennFuture argued that the Gilberton Pump Discharge is a point source discharge that must be authorized by a NPDES permit and must receive a WLA in the TMDL. Without citing any supporting authority, the revised TMDL asserts that "NPDES" permits are currently not required for transfers of water that do not alter the chemical quality of the discharge water; therefore, the Gilberton Pump Discharge will not be given a waste load allocation.: (Revised TMDL, pg.75). In fact, under the current guidance issued by the Environmental Protection Agency (EPA), the discharge from the Gilberton Pump does not constitute a "water transfer", and therefore is not exempt from the NPDES permit requirement of the Clean Water Act.

PADEP's response in the Revised TMDL overlooks two critical points. First, to be considered an NPDES-exempt "water transfer", the movement of water must be from one "navigable water" to another. Cf. 33 USC § 1363(7) ("navigable waters" means the waters of the United States, including the territorial seas."). EPA's 2005 guidance memorandum on water transfers makes this point succinctly: "[W]ater transfers release one navigable water into another". Memorandum, "Agency Interpretation Of Applicability of Section 402 of the Clean Water Act to Water Transfers" (August 5, 2005), p. 7. See also 71 Fed. Reg. 32887, 32895 (June 7, 2006) (proposed NPDES permit exclusion at 40 CFR § 122.3(i) would provide that "[w]ater transfer means an activity that conveys waters of the United States to another water of the United States without subjecting the water to intervening industrial, municipal, or commercial use").

Second, EPA does not consider groundwater, such as the Gilberton Mine Pool, to be part of the "navigable waters" or "waters of the United States" within the meaning of the Clean Water Act and its implementing regulations. <u>See</u> 33 U.S.C. § 1362(7), 40 CFR § 122.2; <u>see also</u> 25 Pa. Code § 92.2(b)(1) (incorporating by reference 40 C.F.R. §

122.2). EPA's information sheet entitled "NPDES Water Transfers Proposed Rule, Frequently Asked Questions,: makes clear that EPA's 2006 proposed rule and the 2005 interpretive memorandum on which it expressly relies, see 71 Fed. Reg. At 32889 (col.2-3), do not apply to the pumping and discharge of groundwater is not included in the scope of this rule". (Frequently Asked Questions, p. 1) Thus, in EPA's view, the Gilberton Pump Discharge is not a "water transfer" because it does not convey one water of the United States to another. It therefore would not be exempt from NPDES permitting under EPA's 2005 interpretive memorandum or its 2006 proposed rule.

The Gilberton Pump Discharge is, however, an addition of pollutants to the waters of the United States from a point source, a fact that is confirmed by the iron load figures presented in Comment 2, above, and unmistakably by the iron staining in Mahanoy Creek at the outfall. <u>See Department of Energy, Draft Environmental Impact Statement for the Gilberton Coal-to-Clear Fuels and Power Project DOE/EIS-0357 (November 2005), p. 3-15 ("The pumped water is discharged directly to Mahanoy Creek and is a source of mine-drainage contamination in the creek. The site where pumped water enters the creek is stained with iron precipitate."). As such, the discharge must be authorized by an NPDES permit.</u>

EPA's 2005 interpretive memorandum and 2006 proposed rule on water transfers make it clear that if pollutants are carried into the waters of the United States from somewhere outside the waters of the United States, it constitutes an "addition" of pollutants to the waters of the United States within the meaning of the Clean Water Act. See 33 U.S.C. § 1362(12) (defining "discharge of a pollutant"). If the pollutants are carried into the waters of the United States by "pipe, ditch, channel, tunnel, conduit" or other "discernable, confide, and discrete conveyance," 33 U.S.C. § 1362(14) (definition of "point source"), there is "a discharge of pollutant," 33 U.S.C. § 1362(12), that must be authorized by an NPDES permit. See 33 U.S.C. § 1342(a). EPA's 2005 memorandum explains that point sources need not generate pollutants in order for the NPDES permit requirements to apply: "rather, point sources need only convey pollutants into navigable water to be subject to the Act." (Memorandum. P.8 n.11 (emphasis added) (citing South Florida. Water Mgt. Dist. V. Miccosukee Tribe of Indians, 541 U.S. 95, 105 (2004)). That is precisely what the Gilberton Pump does – it conveys pollutants from outside the waters of the United States (the mine pool) into the waters of the United States (Mahanoy Creek). It adds pollutants to the waters of the United States by for human intervention in the form of the Gilberton Pump.

Only if the Gilberton Mine Pool were considered part of the navigable waters/waters of the United States might the Gilberton Pump discharge be considered a "water transfer" as defined in EPA's interpretive memorandum. There is no reason to believe, however, that EPA would assert that the mine pool constitutes part of the waters of the United States, a position that would greatly expand both the jurisdictional reach of the Clean Water Act and the responsibilities of the EPA and the states under it. In EPA's view, the pollutant-laden water withdrawn from the mine pool by the Gilberton Pump first becomes part of the waters of the United States when the Gilberton Pump Discharges it into Mahanoy Creek. As a result, and regardless of the fact that PADEP

does not alter the chemical quality of the pumped water or put it to an intervening industrial, municipal, or commercial use, the Gilberton Pump is a point source discharge that the Clean Water Act requires to be authorized by an NPDES permit. <u>See</u> 33 U.S.C. §§ 1311(a), 1342(a). As such, it must receive a WLA in the TMDL. <u>See</u> 40 C.F.R. § 130.2(h).

<u>Response:</u> The Department disagrees that the Gilberton Pump should be classified as a point source discharge and require a waste load allocation and directs the commenter to the response to the following question regarding tunnels as point sources for its rationale.

#### 4. Comment: Tunnels are point sources for all purposes under the Clean Water Act.

The rationale explained in the preceding comment also applies to the many "tunnels" mentioned in the Revised TMDL, which, like the Gilberton Pump, convey water and add pollutants to the waters of the United States from outside of the waters of the United States.

The Revised TMDL mentions by name at least seven tunnels that convey mine drainage into Mahanoy Creek or its tributaries: the Centralia, Lenig, Helfenstein, Doutyville, Bast, Oakland, and Locust Gap tunnels. Notwithstanding the facts that the Clean Water Act defines "point source" as including "any ...tunnel...from which pollutants are or may be discharges", 33 U.S.C. § 1362(14), and that the Revised TMDL is being prepared to satisfy a requirement of the Clean Water Act, the Revised TMDL classifies all of these tunnels as nonpoint sources, explaining that "the mines that built and utilized the tunnels were closed before Pennsylvania's Clean Streams Law was passed. Therefore, the tunnel discharges are classified as nonpoint sources because there is no responsible party." (Revised TMDL, p.75)

The definition of "point source" in the Clean Water Act, however, says nothing about responsible parties. The Act specifically lists "tunnel" as one example of a "point source", 33 U.S.C. § 1362(14), and thus the additional of any pollutant to the navigable waters from any tunnel is a point source discharge. See id. § 1362(6),(12), (14), (16). Pennsylvania's fabricated "distinction" between point and nonpoint sources has absolutely no foundation in the law, and to the contrary is patently inconsistent with the plain language of the Clean Water Act. All of the tunnel identifies in the Revised TMDL are point sources for all purposes under the Clean Water Act. All of the tunnels identified in the Revised TMDL are points sources for all purposes under the Clean Water Act, including for the purposes of Section 303(d), 33 U.S.C. § 1313(d) (requirement to establish maximum daily pollutant loads for impaired waters:, and its implementing regulations. The TMDL must include a WLA for each of those tunnels, as well as any other point source of mine drainages in the Mahanoy Creek Watershed. See 30 C.F.R. § 130.2(h).

Even if the law were unclear, providing a WLA for each mine tunnel discharge in the Mahanoy Creek Watershed would be a good idea. Among other things, determining the allowable pollutant load (or conversely, the necessary pollutant load reductions) for each tunnel would help with both prioritizing treatment projects and designing treatment systems.

But the law is clear. The point source discharges from the tunnels must receive WLAs.

The federal Surface Mining Conservation and Recovery Act of 1977 and its Response: amendments provide a clear division (into Title IV and Title V in the Act) between abandoned and active mining. In Section 404 (30 USC 1239), lands and waters eligible for funding under Title IV of SMCRA (the Abandoned Mine Land Fund) are defined thusly: Lands and water eligible for reclamation or drainage abatement expenditures under this title are those which were mined for coal or which were affected by such mining, wastebanks, coal processing, or other coal mining processes, except as provided for under section 411 and abandoned or left in an inadequate reclamation status prior to the date of enactment of this Act, and for which there is no continuing reclamation responsibility under State or other Federal laws. This definition is reiterated in Section 411(b): Eligible lands, waters and facilities shall be those -(1) which were mined or processed for minerals or which were affected by such mining or processing, and abandoned or left in an inadequate reclamation status prior to August 3, 1977; and (2) for which there is no continuing reclamation responsibility under State or other Federal laws. Tunnels are specifically addressed and included as abandoned mine features in Section 409(a) (30 USC The Congress declares that voids, and open and abandoned tunnels, shafts, and entryways resulting from any previous mining operation, constitute a hazard to the public health or safety and that surface impacts of any underground or surface mining operation may degrade the environment. The Secretary, at the request of the Governor of any State, or the governing body of an Indian tribe, is authorized to fill such voids, seal such abandoned tunnels, shafts, and entryways, and reclaim surface impacts of underground or surface mines which the Secretary determines could endanger life and property, constitute a hazard to the public health and safety, or degrade the environment. State regulatory authorities are authorized to carry out such work pursuant to an approved abandoned mine reclamation program. The Department has modeled its mining programs after the federal abandoned/active model, creating the Bureau of Abandoned Mine Reclamation to administer programs related to abandoned mining and the Bureau of District Mining Operations to administer programs related to active mining.

The U.S. Environmental Protection Agency and other Appalachian states have equated this abandoned/active dichotomy to the non-point source/point source dichotomy. In its September 26, 2006 decision rationale document for the Coal River Watershed in West Virginia<sup>3</sup>, allocations were separated thusly: Waste load allocations are given to NPDES-permitted discharge points and load allocations are given to discharges from activities that do not have an associated NPDES permit, such as mine forfeiture sites, AMLs (including tunnel discharges, seeps, and surface runoff)... Abandoned mine drainage can be delivered to surface waters via discrete sources (tunnel or mine opening) or diffuse, landscape-process sources (runoff, leaching from waste piles, etc.). Using the terminology recommended by PennFuture, loads allocated to abandoned mining could either be in the form of wasteload allocations (WLAs) or load

<sup>&</sup>lt;sup>3</sup> U.S. Environmental Protection Agency, Region III. September 26, 2006. Decision Rationale Total Maximum Daily Loads for Selected Streams in the Coal River Watershed, West Virginia. Available on-line at <a href="https://www.epa.gov/reg3wapd/tmdl/wv">www.epa.gov/reg3wapd/tmdl/wv</a> tmdl/Coal/Coal DR.pdf.

allocations (LAs). The primary program for implementation of waste load allocations is the NPDES permitting program; however, sources abandoned previous to 1977 do not have permitted entities to hold accountable for reclamation. Funding for reclamation of these features will come from the Abandoned Mine Reclamation Fund and other public funds. To be consistent with the Commonwealth definition of abandoned versus active mines, all abandoned mine sources should receive load allocations (implemented through public funding) and all active mine sources should receive waste load allocations (implemented through effluent limits in NPDES permits).

The Department agrees with PennFuture regarding the usefulness of an allocation directly to discrete sources of abandoned mine drainage (prioritizing discharges and designing treatment facilities) such as tunnels. Allocations to specific discharges have been completed in past TMDLs (see Shamokin Creek TMDL available on the Department's TMDL website). A policy of assigning allocations to specific abandoned mine discharges (when data are available to do so) will be incorporated into future TMDLs. However, as explained above, these allocations will be load allocations to non-point sources as opposed to wasteload allocations to point sources.

<u>5. Comment:</u> The Revised TMDL reports different analytical results than the Original Draft TMDL for the same USGS monitoring events.

The instream monitoring data for point MC2 in both the Original Draft TMDL (pp. 56-60) and the Revised TMDL (pp. 58-59) includes monitoring events performed by the United States Geological Survey (USGS) on March 26 and August 20, 2001 at a point described as "Mahanoy Creek near Gordon". The Revised and Original Draft TMDLs report the same flow, acidity and alkalinity readings for the August 20, 2001 monitoring event. The remaining results for that event, however, as well as <u>all</u> of the results for the March 26, 2001 event, are different in the Revised TMDL (p. 59) than they are in the Original Draft TMDL (p. 59). PennFuture highlights these differences because something appears to be amiss, and the Revised TMDL does not explain the inconsistencies between the data presented in the two versions of the TMDL.

Response: The differences in water quality data values between the Original Draft TMDL and the Revised TMDL are due to updates to the data set released by the USGS. The Original Draft TMDL was calculated using data considered provisional at the time they were used to calculate pollutant loadings in the TMDL document (2003). USGS performed quality assurance of the data set before releasing its final report in 2004. The differences in the water quality values mentioned in the comment are the result of changes between the provisional data set and the final data set contained in the different versions of the USGS Watershed Assessment report.

#### <u>6. Comment:</u> Data and allocations for Point MC2

a. The TMDL should explain why the instream monitoring data were replaced

In addition to the two USGS samples discussed in Comment 5, immediately above, the Original Draft TMDL used White Pine Coal Company's monitoring data for "MP-122" as the instream monitoring data for TMDL point MC2. Without explaining

why, the Revised TMDL substitutes the monitoring data for White Pine Coal Company's "MP-121" for the "MP-122" data used originally. That switch results in lower existing average instream concentrations and loads for the three metals parameters at point MC2, as illustrated in the following table.

<b>Existing Condit</b>	Existing Conditions, Point MC2 (Mahanoy Creek Near Gordon)										
Parameter	Average	Existi	ng Concentration	Average	Existing Load						
	(mg/l)			(lbs/day)							
	Original	Draft	Revised TMDL	Original	Revised TMDL						
	TMDL			Draft TMDL							
Fe	11.04		8.48	5,606.4	4,209.3						
Mn	5.57		4.57	2,828.6	2,267.7						
Al	1.70		0.98	863.3	484.2						

The Revised TMDL contains lower existing load figures than the Original Draft TMDL despite the fact that it used a <u>higher</u> average flow rate at point MC2 (51.12 mgd, corrected to 59.5 to account for the discharge from the Continental Mine) than did the Original Draft TMDL (45.07 mgd). (Revised TMDL, p. 55) <u>See</u> footnote 16, below. So, the lower average instream concentrations at point MC2 resulting from the Revised TMDL's substitution of the MP-121 data for the Original Draft's MP-122 data more than offsets the higher flow at point MC2 used in the Revised TMDL. (Note, however, that for the reasons explained in Comment 2, above, and Comment 8, below, PennFuture believes that flow adjusted concentrations and loads at point MC2 that fully account for the impacts of the Gilberton Pump Discharge would be considerably higher than those shown in the table immediately above).

Any decision to replace one set of instream monitoring data with another in revising a TMDL should be explained in the revised version of the document. That is particularly true where, as point MC2, the substitution has such a significant impact on the determination of the TMDL for one of the modeled instream points. In finalizing the TMDL, PADEP should explain why it used the MP-122 data originally, and why it decided to substitute MP-121 data for the original data in revising the TMDL.

<u>Response:</u> The change from using White Pine Coal Company's MP-122 data in the Original Draft TMDL to MP-121 data in the Revised TMDL was incorrect. The original data set (MP-122 and other data points contained in the Original Draft TMDL) has been restored to the document. All loads contained within the final TMDL are based on the data set used in the Original Draft TMDL.

b. The Revised TMDL's Load Allocation of 15.53 pounds of aluminum per day at point MC2 is patently unachievable and absurd.

The Revised TMDL itself shows that its allocations for aluminum at point MC2 are absurd. The Revised TMDL assigns 88 percent of the allowable aluminum load at point MC2 to two, permitted and treated discharges, and reserves just 12 percent of the allowable aluminum load for at least nine unpermitted and untreated mine drainage

discharges with a volume that dwarfs that of the two permitted discharges. Despite including a WLA that would allow the permitted discharges to add 115.17 pounds of aluminum per day to Mahanoy Creek, the Revised TMDL assumes that the more numerous and more voluminous unpermitted discharges will magically reduce their collective aluminum load to just 15.53 pounds per year, which is the LA for MC2. (Revised TMDL pp. 8, 43) The Revised TMDL makes no attempt to justify this grossly disproportionate allocation. It provides no basis to believe that all of the unpermitted discharges between points MC1 and MC2 ever will be treated. Worse, the monitoring data it contains suggest that even if in the infinitesimal chance that every one of those discharges were treated, they still would release more than 15.53 pounds of aluminum per day. This flaw is fatal, precluding EPA from approving the Revised TMDL.

For TMDLs that include both WLAs to point sources and LAs to nonpoint source, EPA's TMDL guidance states that "the TMDL should provide <u>reasonable assurances</u> that nonpoint source control measures will achieve expected load reductions in order for the TMDL to be approvable". EPA, "Guidelines for Reviewing TMDLs under Existing Regulations Issued in 1992" (May 20, 2002), p. 4 (emphasis added). If the agency cannot provide "reasonable assurances" that load reductions assigned to nonpoint sources will be realized, it must further reduce the WLA(s) and tighten the enforceable limits on the point source(s) in order to fulfill the requirement of ensuring that the overall load will be reduced below the level at which impairment of water quality standards begins. See 40 C.F.R. §§ 130.2(i), 130.7(c)(1).

The Revised TMDL explains that there are ten discharges of mine drainage between points MC1 and MC2, all of which, except the NPDES-permitted Outfall 002 at the City of Philadelphia's Continental Mine, the Revised TMDL classifies as nonpoint sources. They include the Centralia Tunnel Discharge, the Packer 5 Group Discharges, the Bast Group Discharges, and the Oakland Tunnel Discharge. (Revised TMDL, pp. 43-44) Six of these nonpoint source discharges were ranked by USGS among the top 15 sources in the watershed for loading of dissolved metals. (Revised TMDL, pp. 18-21)

The Revised TMDL assigns the City of Philadelphia's permitted Continental Mine discharge a WLA of 104.83 pounds of aluminum per day. It adds a WLA of 10.34 pounds per day to Gilberton Power Company's permitted wastewater discharge, for a total WLA of 115.17 pounds per day for the segment of Mahanoy Creek between points MC1 and MC2. (Revised TMDL, pp. 8, 41-42) In contrast, the Revised TMDL assigns all of the unpermitted (and currently untreated) mine drainage discharge between MC1 and MC2 a collective LA of just 15.53 pounds of aluminum per day. (Revised TMDL, p. 8) The data in the Revised TMDL show, however, that it is pure fantasy to assume that the collective aluminum load from the unpermitted discharges will be reduced to 15.53 pounds per day.

The monitoring data in the Revised TMDL for the treated discharge from the City of Philadelphia's Continental Mine shows that discharge to have an average flow of 5,818 gpm (or 8.38 mgd) and an average aluminum concentration of 0.55 mg/l.

(Revised TMDL, p. 58) So, on average, that treated discharge adds 38.44 pounds of aluminum per day to Mahanoy Creek, or more than twice as much as the Revised TMDL would assign to all of the unpermitted sources of mine drainage in the same segment. Thus, even if one were to make the completely unrealistic and unsupported assumption that treatment systems soon will be installed for every one of those discharges, one still would have no basis to believe that the treatment systems would reduce the total aluminum loading from the discharges to no more than 15.53 pounds per day. Indeed, even if it were treated, the Centralia Mine Tunnel Discharge alone would be likely to release more than 15.53 pounds of aluminum per day to Mahanoy Creek above point MC2. The USGS identifies the Centralia Mine Tunnel as having "high Al" (Revised TMDL, p. 18), and USGS Chart 12B on page 21 of the Revised TMDL shows that he Centralia Mine Tunnel releases about 20 megagrams, or about 44,000 pounds, of dissolved aluminum per year into Mahanoy Creek, which translates to about 120.5 pounds per day. Thus, in order to meet the LA of 15.53 pounds per day: 2) the existing aluminum load from the Centralia Mine Tunnel would have to be reduced by about 87 percent; and b) all aluminum loading from every other unpermitted discharge of mine drainage between MC1 and MC2 would have to be eliminated completely. The aluminum allocations for point MC2 in the Revised TMDL would require this sort of implausible scenario in order to meet the aluminum TMDL for that point.

As it turns out, the pumped discharge from the City of Philadelphia's Continental Mine is commingled with the untreated, gravity discharge from the Centralia Mine Tunnel before reaching Mahanoy Creek. (Revised TMDL, p. 42) The Revised TMDL would allow the pumped discharge to release up to 104.83 pounds per aluminum per day; it does not even attempt to justify its fanciful assumption that the aluminum loading from the tunnel discharge – together with every other unpermitted discharge in this segment of the watershed – could be reduced to just 15.53 pounds per day.

Far from providing the required "reasonable assurance" that the aluminum load from nonpoint source will be reduced to no more that 15.53 pounds per day at point MC2, the Revised TMDL shows that such an assumption is absurd. The next revision of the TMDL must include a reasonable allocation of the total maximum aluminum load at point MC2 among the permitted and unpermitted discharges. Until the TMDL provides reasonable assurance that the nonpoint source load reductions it would require are feasible, EPA is forbidden from approving the TMDL because it fails to assure attainment of the applicable water quality standards. See 40 C.F.R. §§ 130.2(i), 130.7(c)(1).

Response: The final TMDL has changed the allocation of aluminum loads between sources. The table below shows the existing and allowable loads; the amount of the reductions necessary from nonpoint sources to meet the TMDL and the percent reduction required; and the distribution of allowable loads between the load allocation (to nonpoint sources) and the waste load allocation (to point sources). While it remains that TMDLs for mine drainage call for drastic reductions in pollutants to meet water quality standards (in general), the percentage of the allowable load allocated to nonpoint sources in the final TMDL is a more proportionate division

of the total TMDL when compared to the Revised TMDL. In the final TMDL, the allowable load (TMDL) is divided 44% LA versus 56% WLA for aluminum; 43% LA versus 57% WLA for iron; and 54% LA versus 46% WLA for manganese. Additional information has been added to the recommendations section of the report related to reasonable assurance of implementation and language has also been added to stress the importance of properly characterizing the impact of the Gilberton Pump Discharge on Mahanoy Creek when planning restoration activities to ensure that all sources of pollution will be included in any restoration planning.

MC2 – Mahanoy Creek near Gordon										
		Allowable load			Nonpoint	Percent				
	<b>Existing Load</b>	(TMDL)	WLA	LA	source reduction	reduction				
Aluminum (lbs/day)	726.24	101.67	57.59	44.08	542.39	85%*				
Iron (Ibs/day)	6038.72	422.71	242.14	180.57	3368.19	89%*				
Manganese(lbs/day)	2677.90	348.13	161.42	186.71	1542.41	82%*				
Acidity (lbs/day)	834.88	83.49	-	83.49	193.61	70%*				

#### 7. Comment: Flow Adjusted Concentration Method (Appendix E)

#### a. Idleness of Continental Mine Pump

The Revised TMDL explains that it applied the Flow Adjusted Concentration Method at points MC2, MC3, and MC4 "because the water quality data used were not taken during a period of time when the Continental Mine Pumped Discharge was operating." (Revised TMDL, pp. 44, 47, 51) The data in the Revised TMDL, however, indicated this statement is incorrect. The monitoring data in the Revised TMDL for the "Treated Discharge (002)" from the City of Philadelphia's Continental Mine show that the City's Pump was operating in October and November 2001, and in January and April, 2002. (Revised TMDL, p. 58) The instream monitoring data used in the Revised TMDL included samples collected in all four of those months at MC2 (Revised TMDL, p. 59), and at points MC3 and MC4 in October 2001. (Revised TMDL, pp. 60, 69) Thus, it appears that the Continental Mine's Pumped Discharge was flowing when at least some of the instream samples were collected at point MC2, MC3, and MC4.

<u>Response:</u> While the Continental Mine Discharge was operating in the months mentioned, it was not operating on the same days as water quality data were collected in the USGS survey. Therefore, as with the Gilberton Pump Discharge, the flow adjusted concentration method was used to model the effects of the Centralia Mine Discharge on Mahanoy Creek.

#### b. Improper use of MP-122 data in calculations

As explained in Comment 6.a., above, the Original Draft TMDL used the monitoring data for White Pine Coal Company's MP-122 to represent TMDL point MC2. Without explanation, the Revised TMDL replaced the MP-122 data with the monitoring data for MP121.

The "Flow Adjusted Mass Balance Method" illustrated in the box at the bottom of page 55 in Appendix E of the Revised TMDL improperly used some of the rejected MP-122 data in the calculations. The figure of 51.12 mgd for the "instream flow measured at MC2" is consistent with the average flow of 35,501.6 gpm derived from only two flow measurement sat MC2 reported in the revised TMDL (p. 59), which ere made by the USGS in 2001. But the iron concentration of 9.4 mg/l for the January 13, 2000 monitoring event used in the example calculation on page 55 of the Revised TMDL is the concentration at MP-122 shown in the Original Draft TMDL (p.59). The concentration at MP-121 on that same day was 8.504 mg/l, as shown on page 59 of the Revised TMDL.

To the extent the calculation made in applying the Flow Adjusted Concentration Method relied on the rejected monitoring data for MP-122, they must be performed anew using the data for MP-121 on which the Revised TMDL relies.

<u>Response</u>: As explained previously, all calculations have been changed to reflect results based on the use of the correct data set, MP-121, in the final TMDL.

8. Comment: The USGS "blueprint" greatly underestimates the largest mine drainage pollutant loading source in the Mahanoy Creek Watershed: PADEP's Gilberton Pump

The Revised TMDL states that the remedial recommendations in the USGS's 2004 assessment report for the Mahanoy Creek Watershed "can be used as a blueprint" by the Mahanoy Creek Watershed Association. (Revised TMDL, p. 15) For the reasons explained in Comment 2, above, the Revised TMDL should add the enormous caveat that the USGS assessment relied on instream monitoring data collected exclusively when the Gilberton Pump was not operating, and therefore grossly understates both the pollutant loading from the Gilberton Pump Discharge and the importance of treating that discharge. Whereas the USGS assessment indicates that the Gilberton Pump discharge accounts for less than one tenth of one percent of the dissolved metals loading in the Mahanoy Creek Watershed (Revised TMDL, p. 18), PADEP's pumping and monitoring records reveal it to be by far the largest source of metals loading.

The USGS Watershed assessment report states that he "Gilberton Mine Pump (M04)" has an "[I]ntermittent very large flow" but was "not sampled". (Revised TMDL, p. 18) The only comment offered about this pollution source was that USGS had "[I]nsufficient data" to address treatment alternatives. (<u>Id</u>.)

The USGS Watershed assessment and both versions of the Mahanoy Creek Watershed TMDL missed the importance of the Gilberton Pump as a pollutant source for the same, simple reasons: they relied on the same, completely unrepresentative instream monitoring data, and failed to utilize PADEP's monitoring data for the Gilberton Pump discharge. In fact, all of the monitoring data for point MC1 in the Revised TMDL were collected by the USGS in 2001 as part of its watershed assessment. (Revised TMDL, p.58)

USGS explained that "[f]low and concentration data for the high base-flow samples collected in March 2001 were used to determine priority ranks of the AMD sources" in the Mahanoy Creek Watershed. (Revised TMDL, p. 15) The problem, of course, was that when USGS collected its samples on March 26-28, 2001 (Revised TMDL, p. 18), the Gilberton Pump was idle. (Attachment B, p. 2) Based on its March 2001 set of samples, USGS ranked the Gilberton Pump 28th among mine drainage loading sources in the Mahanoy Creek Watershed (Revised TMDL, p. 18), so it does not appear among the "top 15" sources shown on the USGS charts reproduced on page 21 of the Revised TMDL. But using the average iron loading value of 1,725 pounds per day (which may underestimate the actual load, see Comment 2, above), the Gilberton Pump adds 285.6 megagrams (629,625 pounds) of dissolved iron per year to Mahanoy Creek. As shown in Chart 12B on page 21 of the Revised TMDL, the number one source as ranked by USGS, the Helfenstein Tunnel (M29), releases only 140 megagrams per year of dissolved iron, manganese, and aluminum combined. Thus, the Gilberton Pump is by far the largest source of mine drainage pollutants in the Mahanoy Creek Watershed, with more than double the dissolved metals load of the nearest competitor.

In short, a small, unrepresentative sample may skew the analysis of the data and lead to inaccurate conclusions and bad decisions. Before writing off the Gilberton Pump Discharge as an inconsequential source of mine drainage pollutant loading, one should take a long, hard look at PADEP's pumping records and water quality monitoring data for the discharge from the pump. In the next round of revisions to the Mahanoy Creek Watershed TMDL, PADEP or its contractor should do just that. And until such an analysis is completed, a treatment program for the Mahanoy Creek Watershed should not be based on the USGS "blueprint" alone.

<u>Response:</u> The watershed assessment and preliminary restoration plan for the Mahanoy Creek Watershed should be considered a beginning point for watershed remediation. A more thorough watershed study, including a larger body of time series data for abandoned mine discharges for characterization and prioritization, should be a logical starting point for those in the watershed interested in implementing the recommendations of the TMDL for Mahanoy Creek.

#### 9. Comment: Minor Corrections

#### a. Ashland Municipal Authority WLA

In the text on pages 12 and 46 of the Revised TMDL, "Municipal Authority of the Borough of Shenandoah (NPDES PA0062758)" should read "Ashland Area Municipal Authority Water Treatment Plant (NNPDES PA0063061)".

In the title row of Table 11 (p.12) and Table C14 (P.47), "Shenandoah Borough" should read "Ashland Area Municipal Authority".

#### b. Attachment E

In the first equation in the box on page 55 of the Revised TMDL, "Rox Coal" should read "City of Philadelphia" or "Continental Mine".

<u>Response</u>: Changes have been made in the document to rectify these errors.

#### Comments received on Original Draft Mahanoy Creek Watershed TMDL March 2003

#### **EPA Region III Comments:**

#### **Comment:**

In the *Clean Water Act Requirements* section, please change the third bullet to read that the Section 303(d) list of impaired waters is required every *two* years under the current, applicable regulations.

#### **Response:**

The change has been made to the Clean Water Act Requirements section.

#### Comment:

Please consider adding the sulfate standard to *Table 3* and note the proposed addition of sulfates to §96.3(d).

#### **Response:**

There are no segments in the watershed listed for impairment due to sulfates and therefore it will not be added to the document.

#### **Comment:**

On pages 6 and 7, it states that there are 60 active mining operations in the watershed. Out of the 60 mining operations, only one, *City of Philadelphia – Girard Estate*, has a wasteload allocation (WLA). Table 2 should include additional information, whether or not the other 59 permits either include provisions pursuant to the Clean Water Act (CWA) or have a NPDES permit.

Should any of the other permits have provisions pursuant to the CWA, wasteload allocations are required. Please include other WLAs in the TMDL and reduce load allocations accordingly.

#### **Response:**

WLAs have been added for mining and water program NPDES permits. Tables 2 & 3 have been updated to show these permits. Any other mining permits in the watershed either do not have associated NPDES permits or have NPDES permits with erosion and sedimentation ponds only (no mine drainage treatment facilities) and are not included.

#### **Comment:**

The *TMDL ALLOCATIONS SUMMARY* section needs to clearly identify any wasteload allocations. In addition, the calculations for the load allocations at Centralia2 do not show how the WLA for the *City of Philadelphia – Girard Estate* was calculated. What is stated in the last paragraph on page 37 is the daily average permit limits for iron, manganese, and acidity are 3.0 mg/l, 2.0 mg/l, and a pH range between 6.0 and 9.0 respectively, while the allocation is shown as an long-term average. Please explain (reference) how the WLA (expressed as an long-term average) will be converted into permit limits.

#### **Response:**

The WLA for Centralia2 and other WLAs have been identified in Table 5 and a reference has been made as to how a long-term average will be converted into permit limits.

#### **Comment:**

The explanation as to why no TMDL is developed for Crab Run is inadequate. Please explain that this TMDL Report does not delist Crab Run, but delisting is part of the 2002 Section 303(d) list of impaired waters.

#### **Response:**

Crab Run was incorrectly listed as being impaired by abandoned mine drainage. It will not be addressed in this report but will rather be addressed in a separate delisting report that will show supporting evidence for its removal from the list.

#### **Comment:**

The explanation as to why a siltation TMDL for Mahanoy Creek UNT known as Big Run is inadequate. If it is assumed that remediating the AMD discharges will remediate siltation, then a description of the discharges, together with a description of the existing land uses within the watershed, are required, e.g., remediating a borehole discharge may not remediate siltation.

#### **Response:**

Various disturbed lands resulting from unreclaimed surface mining are located in the Big Run watershed. 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 Big Run. Disturbed lands often include areas with little to no vegetative cover due to poor or non-existent 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 Big Run watershed will reduce or eliminate water quality impairment in the stream, land reclamation will be necessary to remediate to 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. Therefore, it is assumed that by implementing BMPs for AMD treatment, AML reclamation will be concurrently achieved and the source of erosional materials causing siltation will be eliminated. However, a separate TMDL addressing sedimentation impacts in the Big Run Watershed will be conducted at a later date to more adequately identify and quantify siltation sources in the watershed

#### Pa. DEP Pottsville District Mining Office Comments

#### **Comment:**

We (DEP – Pottsville District Mining Office) would like to see the below paragraph added to the recommendations section of the Mahanoy Creek, Panther Creek and Wabash Creek TMDLs. The main part of the paragraph is borrowed from the Shamokin Creek TMDL and appears as the last paragraph on page 55 of that document. Our main reason for this is to make sure remining is mentioned since reclamation via remining is occurring now or may in the future provide benefits in all of these watersheds.

The paragraph is as follows:

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

#### **Response:**

The paragraph was inserted into the Recommendations section of the document.

#### Citizens for Pennsylvania's Future (PennFuture) Comments

#### **Comment:**

"Abandoned" Mine Discharges

The draft TMDL report states that "[a]ll impairments are a result of acid drainage from abandoned coal mines" (p. 1), and later explains that only those "discharges that are permitted or have a responsible party... are considered point sources." (p. 21) The description of all of the sources of impairments as "abandoned" coal mines with no associated "responsible party" may be inaccurate here for at least two, and possibly as many as four, reasons.

First, the draft report itself identifies the discharge that is pumped and (partially) treated by the City of Philadelphia, Girard Estate as a permitted, point source discharge. Although the Girard Estate is pumping mine drainage from a mine pool to which abandoned mines contribute, the discharge if that wastewater is part of an active permitted mining activity and is properly classified as a point source discharge.

Second, the draft report improperly fails to classify the Gilberton pump discharge as a point source discharge. Even if the Gilberton pump is activated automatically by a device linked to the mine pool level, the discharge occurs at that location only because of active human intervention. The fact that the pumping of the mine pool at that location is intended to protect public health and welfare does not change the fact that the discharge is a point source discharge, just as the Girard Estate's discharge of pumped mine pool drainage is a point source discharge. The operator of the Gilberton pump – presumably DEP's Bureau of Abandoned Mine Reclamation – therefore should have a National Pollutant Discharge Elimination System (NPDES) permit authorizing the discharge, and any contaminant load should be assigned to it through a Wasteload Allocation rather than a Load Allocation.

Third, the draft TMDL report identifies sixty active mining operations in the Mahanoy Creek watershed. (pp. 6-7 & Table 2) If a particular mine is hydrologically connected to one of the mine drainage points identified in the draft TMDL report, the mine operator might be responsible for treating that discharge. See 35 P.S. 691.307(a), 691.316; C&K Coal Co. v. DER. 1987 EHB 786, 789 ("liability for the treatment or abatement of an off-permit, pre-existing discharge may be imposed under 315(a) of the Clean Streams Law where there is a hydrologic connection between the mining operation and the off-permit discharge"). A significant qualification, however, is that all local coal refuse reprocessing operations should be protected by the standards of 25 Pa. Code Chapter 88, Subchapter G. Pennfuture neglected to mention these significant qualifications in our comments on the draft Catawissa Creek TMDL, but it applies with equal force there. Given the obvious aesthetic and safety benefits and possible water quality benefits reclaiming the abandoned coal waste piles (Draft TMDL report, p.7), these "bank reclamation" operations should be encouraged. For other regulated mining operations, however, the TMDL report should show that active operations are not causing or contributing to one of the discharge points identified in the report as abandoned, nonpoint source discharges.

Fourth, the Department should not assume that all of the various tunnels, boreholes, and entries that discharge mine drainage in the Mahanoy Creek watershed are properly classified as

abandoned. For example, the successor in interest to the person that originally built a particular tunnel or an owner of record of the tunnel or a larger interest in real property that includes it might be responsible for the tunnel's discharge. See 33 U.S.C. 1311(a), (g)(2), 1342(a), (b), 1362(14); 35 P.S. 691.315(a), 691.316; 25 Pa. Code 92.3. See also Commonwealth v. Barnes & Tucker Co., 371 A.2d 461 (Pa. 1977). As in the Catawissa Creek watershed, the Department should conduct an exhaustive search for potentially responsible parties before characterizing all of these drainage tunnels as "abandoned."

#### **Response:**

Because there are both, point sources and nonpoint sources in this TMDL, the wording in the document on p. 1 has been changed to say, "All impairments resulted from acid drainage from coal mining." Furthermore, the mines that built and utilized the tunnels were closed before Pennsylvania's Clean Streams Law was passed. Therefore, the tunnel discharges are classified as nonpoint sources of pollution since there is no responsible party.

The Girard Estate Continental Mine Discharge (Centralia2) has been correctly classified as needing a waste load allocation as it is given effluent limits in an NPDES permit issued for the Continental Mine Operation. Only MP002 is addressed with a waste load allocation as the other three points in the permit (MP001A, MP001B, and MP001C) are given Subchapter F baseline load-based limits and required to not further contribute to the pollution loads at those points.

The Gilberton Pump discharge operates for the maintenance of groundwater levels only. It is not operated in conjunction with any resource extraction activities. NPDES permits are currently not required for transfers of water that do not alter the chemical quality of the discharge water; therefore, the Gilberton Pump discharge will not be given a waste load allocation.

#### **Comment:**

Instream Water Quality Criteria for Iron

The "TMDL Endpoints" (p.8) appropriately include the instream water quality criteria for <u>both</u> total recoverable iron and dissolved iron. These two criteria are not substitutable, "either/or" standards. They are legally independent in that each of them must be satisfied at least 99 percent of the time. <u>See</u> 25 Pa. Code 93.7(a), 96.3(c). If a stream satisfies the total iron instream criterion but not the dissolved iron criterion, it is impaired, and the TMDL must determine the load reductions necessary to ensure compliance with the dissolved iron criterion.

DEP has reason to believe that some if not all of the impaired segments do not meet the instream criterion for dissolved iron. EPA's TMDL guidance provides that "[a] TMDL must identify the loading capacity of a waterbody for the applicable pollutant." (EPA "Guidelines for Reviewing TMDLs under Existing Regulations Issued in 1992, "May 20, 2002, p. 2) Nevertheless, the draft TMDL report does not address dissolved iron loads or indicate whether achieving the load reductions necessary to attain the total iron instream criterion also would result in attainment of the instream criterion for dissolved iron. The draft report explains that "[t]he iron TMDLs are expressed as total recoverable as the iron data used for this analysis was reported as total recoverable." (p. 8). This statement appears to mean that because the monitoring data do not include dissolved iron concentrations, DEP is treating total recoverable iron as the only

applicable iron parameter and the only iron criterion that must be satisfied. The statement also could be read to mean that dissolved iron monitoring data exist, but DEP chose not to run the Monte Carlo simulation analysis using that data. Whatever the explanation, however, it does not excuse DEP from addressing dissolved iron. The TMDL must demonstrate load reductions necessary to satisfy <u>all</u> applicable water quality criteria. By impermissibly eliding over the regulatory independence of the dissolved and total iron criteria, and by failing to demonstrate what load reductions are necessary to achieve the instream criterion for dissolved iron, the draft TMDL report does not adequately address all applicable water quality standards.

It may be that through other monitoring data or documented relationships between the concentrations of total and dissolved iron in mine drainage (like the relationship between pH and net alkalinity shown in Attachment C to the draft TMDL report), DEP can demonstrate, with a reasonable degree of confidence, that the necessary reductions in total iron loads identified in the draft TMDL report will result in attainment of the dissolved iron instream criterion. Perhaps DEP cannot make this demonstration without further monitoring in the Mahanoy Creek watershed that includes analysis of dissolved iron concentrations. One way or another, however, DEP must show what must be done in order to ensure that the impaired streams are no longer impaired by a well-known constituent of mine drainage, dissolved iron. As it stands, the draft TMDL report simply does not make this required showing.

#### **Response:**

The TMDL process uses existing and readily accessible data; it does not require further monitoring for the streams that have existing data. The total iron criteria is considered to be the most conservative, i.e. most protective, standard that can be used since it takes into account both dissolved and particulate iron concentrations. In addition, the water quality standards are based on a biological endpoint, the condition of the aquatic macroinvertebrate community. It is this endpoint that will indicate if the designated uses are being attained.

#### **Comment:**

Failure to Provide Reasonable Assurance of Attainment

As in the draft report for the Catawissa Creek watershed, the "Recommendations" section of the draft TMDL report for the Mahanoy Creek watershed cites "two primary programs that provide reasonable assurance for maintenance and improvements of the water quality in the watershed"; the NPDES permitting program and DEP's "efforts to reclaim abandoned mine lands," (p.11). But something more is required here. For watersheds like this one that include both Load Allocations to nonpoint sources and Wasteload Allocations to point sources, EPA's TMDL guidance states that "the TMDL should provide reasonable assurances that nonpoint source control measures will achieve expected load reductions in order for the TMDL to be approveable." (EPA May 20, 2002 Guidelines, p.4) (emphasis added) The draft TMDL report falls far short of providing reasonable assurance that the required load reductions from nonpoint sources will be realized.

The draft TMDL report classifies all but one of the loading sources in the Mahanoy Creek watershed as <u>nonpoint</u> sources. (The lone exception is the Girard Estate's "Centralia Treated Discharge at Centralia2," but as noted in Section 1, above, the Gilberton pump discharge also

must be classified as a point source discharge.) The NPDES permitting program, however, is limited to <u>point source</u> discharges. <u>See</u> 25 Pa. Code §92.3. It is incongruous, if not disingenuous, to rely on a program that does not apply to nonpoint source discharges for the purpose of achieving reductions in loads from sources DEP has classified in the same document as <u>nonpoint</u> sources. <u>Cf. EPA May 20, 2002 Guidelines, p.4 ("When a TMDL is developed for waters impaired by <u>point sources</u> only, the issuance of a National Pollutant Discharge Elimination System (NPDES) permits provides the reasonable assurance that the wasteload allocations contained in the TMDL will be achieved.") (emphasis added).</u>

As for the various efforts to reclaim abandoned mine lands, the draft TMDL report gives no assurance that the programs will be able to make a significant dent in the watershed's reclamation problem. The report does not estimate the percentage of the abandoned mine lands in the watershed that have been reclaimed through Abandoned Mine Land Fund projects or other reclamation incentive programs. It also does not indicate the number of acres of abandoned mine land remaining in the watershed or the approximate cost of reclaiming those lands. It is well known that Pennsylvania annually receives about \$20-25 million for reclamation of abandoned mines from the federal AML Fund, but needs about \$15 billion to complete all the remaining reclamation work in the state. Even when these federal AML Funds are augmented by Growing Greener grants and funding from other sources, as well as the reclamation being achieved through refuse bank reclamation operations or other remining activities, it seems likely that it will be a long time before the reclamation of the abandoned mine lands in the watershed is substantially completed. Overall, the draft TMDL report does not demonstrate that the second "primary program" will contribute significantly in the foreseeable future to achieving the necessary load reductions.

The Mahanoy Creek Watershed Association and (once again) Mr. Wytovich surely are to be commended for their tremendous efforts in designing, installing, and expanding "The Swamp," and in developing the larger series of projects of which it is a part. But these volunteer mine drainage treatment projects face intense statewide competition for funding. Moreover, the draft TMDL report does not suggest that the planned passive treatment systems will achieve the load reductions necessary to attain water quality standards in any identified stream segment, much less in the entire watershed. In short, as laudable and well planned as they are, these grant funded treatment projects do not provide the reasonable assurance of load reductions that is needed for EPA to approve this TMDL. Only by including a more extensive implementation plan that explains how and when the necessary load reductions will be achieved can the TMDL report provide that needed assurance.

PennFuture recognizes that given all of the practical difficulties, DEP may not be able to provide reasonable assurance that the necessary load reductions actually will occur. But it is misleading to suggest that the NPDES and abandoned mine land reclamation programs will, even as supplemented by government-funded and/or volunteer projects, take care of the contaminant loading problems in the Mahanoy Creek watershed within any reasonable time frame. If the problem is simply too big for DEP to provide the required reasonable assurance, the TMDL report should say so.

#### **Response:**

A preliminary schedule of reclamation and the resources necessary to complete the reclamation are considered to be part of an implementation plan. Based on current regulations, an implementation plan is not required for this TMDL. However, recommendations included in the Mahanoy Creek Assessment report completed by the U.S. Geological Survey in 2004 and included in the recommendations section of this report provide initial guidance on prioritizing, treatment options, and associated costs for reclamation of various AMD features in the watershed. The active watershed group should use this blueprint, as well as other available plans, to determine nonpoint source abatement projects to address the loading reductions recommended in this report as funds become available. With the increase to Pennsylvania of monies from the Abandoned Mine Reclamation Fund, the Commonwealth acting in conjunction with existing stakeholder groups will be able increase the rate at which impacts to the environment from abandoned mining have historically been addressed and will provide further assurance that nonpoint source loads will be reduced.

#### **Comment:**

Methodology Used in Allocation for "Centralia Treated Discharge at Centralia2"

The "AMD Methodology" section of the draft TMDL report (pp. 21-22) explains that DEP uses two approaches when determining TMDLs for AMD-affected stream segments. One approach applies where the impacts are from point sources alone or from a combination of point and nonpoint sources, in which case the impacts of the point sources is determined by performing a mass balance with the receiving stream. (p.21). The set of example calculations for Lorberry Creek includes the application of the mass balance approach to a point source discharge (the Shadle Discharge). It appears that despite classifying the Centralia2 Discharge as a point source discharge, DEP applied the analytical approach for nonpoint sources to it. The draft TMDL report does not justify that apparent deviation from the standard methodology.

Like the Shadle Discharge into Lorberry Creek, the "Centralia Treated Discharge at Centralia2" (Centralia2 Discharge) is a point source discharge. The method used to determine the allocation for the Centralia2 Discharge, however, does not resemble the calculations applied to the Shadle Discharge. It appears that despite classifying the Centralia2 Discharge as a point source discharge, DEP applied the analytical approach for <u>nonpoint</u> sources to it. The draft TMDL report does not justify that apparent deviation from the standard methodology.

There are two obvious differences between model calculations for the Shadle Discharge (pp.26-30) and the allocation made at the Centralia2 Discharge (pp.37-38). First, the Shadle Discharge allocation involves a multi-step mass balance analysis, but the draft TMDL report does not indicate that DEP performed any similar mass balance analysis with respect to Centralia2. The draft TMDL report does not explain this apparent deviation from the model. Second, despite the absence of an applicable Best Available Technology (BAT) effluent limit in both cases, DEP calculated a Wasteload Allocation for aluminum for the Shadle Discharge but not for the Centralia2 Discharge. The draft report states that a "WLA was not computed for aluminum, since the Girard Estate NPDES permit did not have a BAT limit for aluminum." (p.37). But the absence of a BAT limit for aluminum did not prevent DEP from determining a Wasteload Allocation for aluminum for the Shadle Discharge. In the calculations for the Shadle Discharge,

DEP explained that because of the absence of an applicable BAT limit for aluminum, "the starting concentration for the modeling was arbitrary." (p.30) The draft TMDL report does not explain why, if the DEP was able to plug an aluminum concentration value into the model for the Shadle Discharge, it was unable to take a similar approach for the Centralia2 Discharge.

#### **Response:**

The methodology for the WLA for Centralia2 was should not be compared to the WLA of Lorberry Creek because these point sources are not alike. The methodology for Lorberry Creek was just given as an example.

The method used for calculating the waste load allocation for the Continental Mine (Centralia2) has been revised using the average flow and permit limits (an additional 1.5 mg/L effluent limit for aluminum was used in the calculations) to calculate waste load allocations for MP002 of the Continental Mine permit. In addition, both a flow adjusted concentration method and a mass balance approach has been used in the analysis for points MC2, MC3, and MC4 to more adequately capture true conditions in Mahanoy Creek as a result of the Continental Mine Discharge.

#### **Comment:**

Siltation in "Unnamed Tributary to Mahanoy Creek at Unt. MC"

The draft TMDL report states that the 2002 Section 303(d) list has added "siltation" as a cause of impairment of the unnamed tributary to Mahanoy Creek associated with allocation point "Unt.MC," which is also impaired by metals from acid mine drainage. (p.41) Based on the mention of "coal fines" in the description of the siltation problem, it seems likely that unreclaimed mine lands cause or contribute to this impairment. The draft report explains that the TMDL does not address this siltation impairment because "it is assumed that this impairment will be remediated by the use of best management practices implemented to remediate AMD." (p.41)

This assumption, however, is not justified by the draft report. The draft report does not identify the "best management practices" to which it refers. In light of the fact that "the only known discharges that affect this stream are the Potts Discharges" (p.41), the likely strategy for alleviating the metals impairment by "remediating AMD" in this subwatershed would be collection and treatment of the Potts Discharges. But it is extremely unlikely that treatment of these discharges would alleviate the impairment caused by the deposition of coal fines (and perhaps other silt) in the stream. Because the draft TMDL report provides no basis for concluding that treatment of the Potts Discharges would by itself eliminate the observed siltation impairment, its assumption that the siltation impairment will be remediated through the application of the same "best management practices" that are adopted to alleviate the metals contamination is unjustified. The TMDL therefore must separately address the siltation impairment of this unnamed tributary to Mahanoy Creek.

#### Agricultural Impairment of Crab Run

The 2002 Section 303(d) report lists Crab Run as being impaired by "Organic Enrichment/Low Dissolved Oxygen" and "Siltation" resulting from "Grazing Related Agriculture." The draft TMDL report explains that no TMDL will be done for Crab Run for impairments by mine drainage because recent studies show that the only impairment to Crab Run results from agricultural sources. (p.42). The draft report does not explain, however, why it does not include a TMDL addressing the documented agricultural impairment of Crab Run. It makes sense to complete the TMDL for the entire Mahanoy Creek watershed now by including a TMDL addressing the impairments of this 1.4 miles long segment caused by agricultural activities. At a minimum, the report should indicate when the watershed TMDL will be amended to include a TMDL for Crab Run.

#### **Response:**

Various disturbed lands resulting from unreclaimed surface mining are located in the Big Run watershed. 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 Big Run. Disturbed lands often include areas with little to no vegetative cover due to poor or non-existent 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 Big Run watershed will reduce or eliminate water quality impairment in the stream, land reclamation will be necessary to remediate to 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. Therefore, it is assumed that by implementing BMPs for AMD treatment, AML reclamation will be concurrently achieved and the source of erosional materials causing siltation will be eliminated. However, a separate TMDL addressing sedimentation impacts in the Big Run Watershed will be conducted at a later date to more adequately identify and quantify siltation sources in the watershed.

As stated in the *Watershed Background* section on p.7, agricultural impairments will not be addressed in this document. This document only addresses AMD impairments. Therefore, the agricultural impairments to Crab Run will not be addressed in this TMDL but at a later date in a siltation TMDL. This explanation has also been added to the *TMDL by Segment* section for Crab Run.