

**FINAL**

**Licking Creek Watershed TMDL**  
Clarion County, Pennsylvania

Prepared by:

Pennsylvania Department of Environmental Protection



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**FINAL TMDL  
Licking Creek Watershed  
Clarion County, Pennsylvania**

**Introduction**

This Total Maximum Daily Load (TMDL) calculation has been prepared for segments in the Licking Creek Watershed (Attachment A). It was done to address the impairments noted on the 1996 Pennsylvania 303(d) list, required under the Clean Water Act, and covers the one listed segment shown in Table 1. Metals in acidic discharge water from abandoned coalmines causes the impairment. The TMDL addresses the three primary metals associated with acid mine drainage (iron, manganese, aluminum), and pH.

<b>Table 1. 303(d) Sub-List Clarion River</b>								
HUC 05010005; State Water Plan (SWP) Subbasin: 17B								
Year	Miles	Segment ID	DEP Stream Code	Stream Name	Designated Use	Data Source	Source	EPA 305(b) Cause Code
1996	4.0 1.5	5366	49269	Licking Creek	CWF	303 (d) List	Resource Extraction	Metals & *Other Inorganics
1996	6.3	5367	49269	Licking Creek	CWF	303 (d) List	Resource Extraction	Metals
1996	3.7	5368	49270	Cherry Run	CWF	303 (d) List	Resource Extraction	Metals & *Other Inorganics
1996	1.0	5369	49305	Anderson Run	CWF	303 (d) List	Resource Extraction	Metals & *Other Inorganics
1996	1.4 1.5	5370	49310	Little Licking Creek	CWF	303 (d) List	Resource Extraction	Metals & *Other Inorganics
1998	6.71	5366	49269	Licking Creek	CWF	SWMP	AMD	Other Inorganics & Metals
1998	6.41	5367	49269	Licking Creek	CWF	SWMP	AMD	Metals
1998	7.57	5368	49270	Cherry Run	CWF	SWMP	AMD	Metals & Other Inorganics
1998	3.13	5369	49305	Anderson Run	CWF	SWMP	AMD	Other Inorganics & Metals
1998	2.97	5370	49310	Little Licking Creek	CWF	SWMP	AMD	Other Inorganics & Metals
2002	4.0 1.5	5366	49269	Licking Creek	CWF	SWMP	AMD	Metals & Other Inorganics
2002	6.3	5367	49269	Licking Creek	CWF	SWMP	AMD	Metals
2002	3.7	5368	49270	Cherry Run	CWF	SWMP	AMD	Metals & Other Inorganics

2002	1.0	2369	49305	Anderson Run	CWF	SWMP	AMD	Metals & Other Inorganics
2002	1.4 1.5	5370	49310	Little Licking Creek	CWF	SWMP	AMD	Metals & Other Inorganics
2004	6.7	5366	49269	Licking Creek	CWF	SWMP	AMD	*Other Inorganics & Metals
2004	6.4	5367	49269	Licking Creek	CWF	SWMP	AMD	*Other Inorganics & Metals
2004	0.4	20030828-1430-JJM	49317	Licking Creek, Unt	CWF	SWMP	AMD	Metals
2004	7.6	5368	49270	Cherry Run	CWF	SWMP	AMD	*Other Inorganics & Metals
2004	3.1	5369	49305	Anderson Run	CWF	SWMP	AMD	*Other Inorganics & Metals
2004	3.0	5370	49310	Little Licking Creek	CWF	SWMP	AMD	Metals & *Other Inorganics
2004	0.7	20030708-1430-JJM	49313	Little Licking Creek, Unt	CWF	SWMP	AMD	Metals
2004	3.05	20030815-1215-JJM	49308	Mineral Run	CWF	SWMP	AMD	pH & Metals
2004	0.91	20030828-1230-JJM	49309	Mineral Run	CWF	SWMP	AMD	pH & Metals
2006	6.72	7717	49269	Licking Creek	CWF	SWMP	AMD	Metals
2006	6.46	7718	49269	Licking Creek	CWF	SWMP	AMD	Metals
2006	3.58	6321	49269	Licking Creek	CWF	SWMP	AMD Grazing Ag Petro Acts	Metals, pH Siltation Metals, pH
2006	5.28	6339	49269	Licking Creek	CWF	SWMP	AMD	Metals, pH & Siltation
2006	0.61	6256	49302	Licking Creek, Unt	CWF	SWMP	AMD	Metals & Siltation
2006	1.46	6256	46304	Licking Creek, Unt	CWF	SWMP	AMD	Metals & Siltation
2006	0.39	5890	49317	Licking Creek, Unt	CWF	SWMP	AMD	Metals
2006	0.58	7046	49318	Licking Creek, Unt	CWF	SWMP	AMD Grazing Ag	Metals Nutrients & Siltation
2006	0.86	7046	49319	Licking Creek, Unt	CWF	SWMP	Grazing Ag Road Runoff AMD	Nutrients & Siltation Siltation Metals
2006	0.68	7046	49325	Licking Creek, Unt	CWF	SWMP	Grazing Ag Road Runoff AMD	Nutrients & Siltation Siltation Metals
2006	1.42	7046	42326	Licking Creek, Unt	CWF	SWMP	Grazing Ag Road Runoff AMD	Nutrients & Siltation Siltation Metals
2006	0.49	7046	49327	Licking Creek, Unt	CWF	SWMP	Grazing Ag AMD	Nutrients & Siltation Metals
2006	0.8	7046	49328	Licking Creek, Unt	CWF	SWMP	Grazing Ag Road Runoff AMD	Nutrients & Siltation Siltation Metals

2006	2.39	7046	46329	Licking Creek, Unt	CWF	SWMP	Grazing Ag AMD	Nutrients & Siltation Metals
2006	0.5	7046	49330	Licking Creek, Unt	CWF	SWMP	Grazing Ag Road Runoff AMD	Nutrients & Siltation Siltation Metals
2006	0.37	7046	49331	Licking Creek, Unt	CWF	SWMP	Grazing Ag Road Runoff AMD	Nutrients & Siltation Siltation Metals
2006	0.4	7046	49332	Licking Creek, Unt	CWF	SWMP	Grazing Ag Road Runoff AMD	Nutrients & Siltation Siltation Metals
2006	0.45	7046	49333	Licking Creek, Unt	CWF	SWMP	Grazing Ag Road Runoff AMD	Nutrients & Siltation Siltation Metals
2006	0.61	7046	49334	Licking Creek, Unt	CWF	SWMP	Grazing Ag Road Runoff AMD	Nutrients & Siltation Siltation Metals
2006	0.48	7046	49335	Licking Creek, Unt	CWF	SWMP	Grazing Ag Road Runoff AMD	Nutrients & Siltation Siltation Metals
2006	1.32	7046	49336	Licking Creek, Unt	CWF	SWMP	Grazing Ag Road Runoff AMD	Nutrients & Siltation Siltation Metals
2006	0.49	7046	49337	Licking Creek, Unt	CWF	SWMP	Grazing Ag Road Runoff AMD	Nutrients & Siltation Siltation Metals
2006	0.46	7046	49338	Licking Creek, Unt	CWF	SWMP	Grazing Ag Road Runoff AMD	Nutrients & Siltation Siltation Metals
2006	0.37	7046	49339	Licking Creek, Unt	CWF	SWMP	Grazing Ag Road Runoff AMD	Nutrients & Siltation Siltation Metals
2006	0.4	7046	49340	Licking Creek, Unt	CWF	SWMP	Grazing Ag Road Runoff AMD	Nutrients & Siltation Siltation Metals
2006	0.61	7046	49341	Licking Creek, Unt	CWF	SWMP	Grazing Ag Road Runoff AMD	Nutrients & Siltation Siltation Metals
2006	1.05	7046	49342	Licking Creek, Unt	CWF	SWMP	Grazing Ag Road Runoff AMD	Nutrients & Siltation Siltation Metals
2006	1.1	6254	49270	Cherry Run	CWF	SWMP	AMD	Metals
2006	1.75	6782	49270	Cherry Run	CWF	SWMP	AMD	pH
2006	7.61	7719	49270	Cherry Runt	CWF	SWMP	AMD	Metals
2006	3.93	6235	49271	Cherry Run, Unt	CWF	SWMP	AMD	Metals
2006	0.789	6235	49272	Cherry Run, Unt	CWF	SWMP	AMD	Metals
2006	2.1	62353	49273	Cherry Run, Unt	CWF	SWMP	AMD	Metals
2006	1.29	6235	49274	Cherry Run, Unt	CWF	SWMP	AMD	Metals
2006	0.43	6235	49275	Cherry Run, Unt	CWF	SWMP	AMD	Metals
2006	0.49	6235	49276	Cherry Run, Unt	CWF	SWMP	AMD	Metals
2006	0.64	6235	49277	Cherry Run, Unt	CWF	SWMP	AMD	Metals

2006	1.05	6235	49279	Cherry Run, Unt	CWF	SWMP	AMD	Metals
2006	0.71	6235	49280	Cherry Run, Unt	CWF	SWMP	AMD	Metals
2006	1.96	6252	49282	Cherry Run, Unt	CWF	SWMP	AMD	Metals
2006	1.35	6256	49286	Cherry Run, Unt	CWF	SWMP	AMD	Metals & Siltation
2006	0.71	6256	49287	Cherry Run, Unt	CWF	SWMP	AMD	Metals & Siltation
2006	1.27	6256	49288	Cherry Run, Unt	CWF	SWMP	AMD	Metals & Siltation
2006	2.95	6256	49289	Cherry Run, Unt	CWF	SWMP	AMD	Metals & Siltation
2006	4.54	6256	49290	Cherry Run, Unt	CWF	SWMP	AMD	Metals & Siltation
2006	1.12	6254	49291	Cherry Run, Unt	CWF	SWMP	AMD	Metals
2006	1.37	6254	49292	Cherry Run, Unt	CWF	SWMP	AMD	Metals
2006	0.35	6254	49293	Cherry Run, Unt	CWF	SWMP	AMD	Metals
2006	0.85	6254	49294	Cherry Run, Unt	CWF	SWMP	AMD	Metals
2006	0.7	6254	49295	Cherry Run, Unt	CWF	SWMP	AMD	Metals
2006	0.74	6254	49297	Cherry Run, Unt	CWF	SWMP	AMD	Metals
	1.95	7719						
2006	0.48	6782	49661	Cherry Run, Unt	CWF	SWMP	AMD	pH
2006	1.35	6256	64180	Cherry Run, Unt	CWF	SWMP	AMD	Metals & Siltation
2006	0.58	6256	64181	Cherry Run, Unt	CWF	SWMP	AMD	Metals & Siltation
2006	0.05	6256	64182	Cherry Run, Unt	CWF	SWMP	AMD	Metals & Siltation
2006	2.69	6256	64183	Cherry Run, Unt	CWF	SWMP	AMD	Metals & Siltation
2006	1.25	6256	64947	Cherry Run, Unt	CWF	SWMP	AMD	Metals & Siltation
2006	3.7	7720	49305	Anderson Run	CWF	SWMP	AMD	Metals
2006	1.49	6265	49306	Anderson Run, Unt	CWF	SWMP	AMD	Metals, pH & Siltation
2006	2.97	7721	49310	Little Licking Creek	CWF	SWMP	AMD	Metals
2006	1.4	6256	49311	Little Licking Creek, Unt	CWF	SWMP	AMD	Metals & Siltation
2006	0.37	6256	49312	Little Licking Creek, Unt	CWF	SWMP	AMD	Metals & Siltation
2006	0.72	5690	49313	Little Licking Creek, Unt	CWF	SWMP	AMD	Metals
2006	2.79	7046	49320	Craggs Run	CWF	SWMP	AMD & Grazing Related Ag	Metals, Nutrients & Siltation
2006	0.4	7046	49321	Craggs Run	CWF	SWMP	AMD, Grazing Related Ag & Road Runoff	Metals, Nutrients & Siltation
2006	0.93	7046	49322	Craggs Run	CWF	SWMP	AMD, Grazing Related Ag & Road Runoff	Metals, Nutrients & Siltation
2006	0.67	7046	49323	Craggs Run	CWF	SWMP	AMD, Grazing Related Ag & Road Runoff	Metals, Nutrients & Siltation
2006	0.61	7046	49324	Craggs Run	CWF	SWMP	AMD & Grazing Related Ag	Metals, Nutrients & Siltation
2006	3.06	5685	49308	Mineral Run	CWF	SWMP	AMD	pH & Metals
2006	0.91	5685	49309	Mineral Run	CWF	SWMP	AMD	pH & Metals

\*Other Inorganics listing is not included on 2006 Integrated List.

Cold Water Fishes=CWF

Surface Water Monitoring Program = SWMP  
Abandoned Mine Drainage = AMD

### **Directions to the Licking Creek Watershed**

The Licking Creek Watershed is approximately 52.2 square miles in area and is located in southern Clarion County and flows through Licking, Madison, Monroe, Perry, Piney, Porter and Toby Townships. The boroughs of Callensburg, Sligo and Rimersburg are located in the watershed. Licking Creek flows approximately 13.4 miles from its headwaters southeast of the town of Curllsville to its confluence with the Allegheny River in the town of Callensburg. Licking Creek is classified as a Cold Water Fishery (CWF) under Title 25 PA Code Chapter 93, Section 93.9r and can be found on the Clarion, Knox, Rimersburg and Sligo 7-1/2 minute quadrangles. Licking Creek (stream code – 49269) is part of the Hydrologic Unit Code 5010005 - Clarion River (formerly State Water Plans 17A and 17B). Major tributaries include Little Licking Creek, Anderson Run, Cherry Run, Mineral Run and Craggs Run.

Licking Creek can be accessed by taking exit 53 from Interstate 80 (I-80) and traveling south on Canoe Ripple Road (TR3007) for approximately 5.9 miles to the intersection with Rt. 58. Turn right onto Rt. 58 and continue to travel approximately 750 feet. At this point, Rt. 58 veers off to the right. Continue straight onto Rt. 368 West and travel for approximately 1.0 mile through the town of Callensburg. Licking Creek flows under Rt. 368 at this point. The Licking Creek flows into the Allegheny River approximately 3500 feet downstream from this point and the confluence of Licking Creek and Cherry Run is approximately 900 feet upstream.

### **Segments addressed in this TMDL**

The Licking Creek Watershed is affected by pollution from AMD. This pollution has caused high levels of metals in the mainstem of Licking Creek and its tributaries. Anderson Run and Mineral Run exhibit high levels of metals along with depressed pH. The sources of the AMD are seeps and discharges from areas disturbed by surface mining. Most of the discharges originate from mining on the Lower Kittanning and Clarion coal seams or refuse piles associated with them.

There are six permitted bituminous coal surface mining permits and one bituminous coal mining activity permit (coal preparation plant) in the Licking Creek Watershed. Active mining has been completed on three of the coal surface mining permits (Thomas E. Siegel SMP#3675SM77, Ancient Sun, Inc. SMP#16020102 and Neiswonger Construction, Inc. SMP#16050111); therefore a waste load allocation (WLA) will not be assigned to these permits. The three remaining issued permits (RFI Energy, Inc. SMP#s 16920107 (NPDES PA0211435, Mine # 230), 16940107 (PA0226831, Mine # 225) are actively mining coal and will be assigned WLAs and 16050109 (PA0257966, Callander Mine) will not be assigned WLAs because the treatment facility discharges to an adjacent watershed).

All of the remaining discharges in the watershed are from abandoned mines and are considered to be nonpoint sources of pollution because they are from abandoned Pre-Act mining operations or from coal companies that have gone out of business and forfeited their bonds with the

Pennsylvania Department of Environmental Protection (PADEP). The distinction between non-point and point sources in this case is determined on the basis of whether or not there is a responsible party for the discharge. Where there is no responsible party the discharge is considered to be a non-point source and it is not assigned a WLA.

Each segment on the 303(d) list will be addressed as a separate TMDL. These TMDLs will be expressed as long-term, average loadings. Due to the nature and complexity of mining effects on the watershed, expressing the TMDL as a long-term average gives a better representation of the data used for the calculations.

The use designations for the stream segments in this TMDL can be found in PA Title 25 Chapter 93.

## **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 four 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.).

### **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 305(b) 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 included kick-screen sampling of benthic macro invertebrates, habitat surveys, and measurements of pH, temperature, conductivity, dissolved oxygen, and alkalinity. Benthic macro invertebrates 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.

### **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 Scrubgrass Creek Watershed TMDL.

## Watershed History

The Licking Creek Watershed flows through the north central most area of the main bituminous coal region in northwestern Pennsylvania. Deep mining (small drift mines for household use) was the principal mining method in Clarion County until the 1920's when the prominent mining process started to shift towards strip mining. The surface mining of coal in the Licking Creek watershed and the initiation of the production of AMD from surface mining probably peaked from the mid 1960's through the late 1970's. The permitting of coal mining at that time was done without the benefits of today's techniques for the prediction and prevention of AMD.

Surface mining has been documented throughout the watershed as early as the 1930s and continues on a small scale today. The date of the earliest mining within this watershed is not known. The mining history prior to the 1970's, sometimes referred to as pre-Act mining (mining that occurred before the passage of the Surface Mining Control and Reclamation Act of 1977), will likely be an unknown as records are not available. Only the environmental scars, such as unreclaimed pits, mine land and discharges, remain as records of the sites of the unknown mines. Surface mining has occurred on the Upper and Lower Freeport, Upper, Middle and Lower Kittanning and Clarion Coal seams.

The majority of well-documented mining in the Licking Creek Watershed occurred in the 1970's and 1980's. The following provides a brief outline of the mining history of the Licking Creek watershed. Although most of the files no longer exist, some information has been saved through microfiche:

**Table 2. Licking Creek Watershed Mining History**

Company Name	Permit Number	Mine Name	Date Issued	Acreage	Coal Seam(s)	Status
C&K Coal Company	2766BSM78	C&K #54	6/30/1967	741.0	LC, LK	Bond Forfeited - Passive Treatment
C&K Coal Company	2767BSM31	C&K #65	11/13/1968	191.0	LC, UC, LK	Reclamation Completed
C&K Coal Company	2768BSM26	C&K #69	2/25/1969	767.0	UC, LK, MK	Bond Forfeited - Passive Treatment
C&K Coal Company	2769BSM1	C&K #70	2/25/1969	1173.0	LK, MK	Bond Forfeited - Passive Treatment
C&K Coal Company	2769BSM16	C&K #73	4/25/1970	422.0	LC, UC, LK, MK	Reclamation Completed
C&K Coal Company	3670BSM11	C&K #76	4/2/1971	530.5	LK, MK	Reclamation Completed
C&K Coal Company	3672BSM4	Vantage #1	5/16/1972	544.0	UC, LC, LK, MK	Bond Forfeited - Passive Treatment
REM Coal Company Inc.	3672SM20	REM #1	11/9/1972	528.0	LK, MK	Reclamation Completed
C&K Coal Company	3674SM8	C&K #82	8/24/1974	230.0	MK, UK	Reclamation Completed
C&K Coal Company	3674SM25	Shannon #10	12/30/1974	687.3	LC, UC, MK	Bond Forfeited - Passive Treatment
Shannon Coal Company	3674SM27	Shannon #2	12/30/1974	755.0	LK, MK	Reclamation Completed
Shannon Coal Company	3674SM38	Shannon #7	12/30/1974	124.0	C, LK, MK	Reclamation Completed
C&K Coal Company	3674SM29	Shannon #1	12/31/1974	522.0	LK, MK	Bond Forfeited - Passive Treatment
C&K Coal Company	3674SM30	C&K #3	12/31/1974	838.0	C, LK, MK	Bond Forfeited - Passive Treatment
Glacial Minerals Inc.	3674SM52	Over	1/5/1975	204.0	LC, UC, LK, MK	Reclamation Completed
Donald W. Dietz	3675SM6	Dietz #3	1/21/1975	330.0	C, LK, MK	Bond Forfeited
Shannon Coal Company	3674SM28	Shannon	2/20/1975	471.0	LK, MK	Reclamation Completed
Donald W. Dietz	3675SM5	Dietz #4	5/13/1975	353.0	MK, LF	Bond Forfeited
C&K Coal Company	3674SM60	C&K #15	6/10/1975	335.0	UC, LC, LK, MK	Reclamation Completed
C&K Coal Company	3674SM37	Shannon #5	7/22/1975	889.0	MK, UK, UF	Bond Forfeited - Passive Treatment

C&K Coal Company	3675SM37	C&K #98	11/10/1975	275.0	MK, LK	Reclamation Completed
Colt Resources Inc.	3675SM47	Colt #9	1/6/1976	71.0	LK, MK	Reclamation Completed
Chernicky Coal Co. Inc.	3675SM74	Chernicky #1	2/9/1976	20.0	LK	Bond Forfeited
C&K Coal Company	1675SM50	C&K #101	2/17/1976	430.0	LK, MK	Reclamation Completed
Glacial Minerals Inc.	3675SM24	Moore	2/24/1976	86.0	LK, MK	Bond Forfeited - Passive Treatment
C&K Coal Company	3675SM43	Dietz #6	5/24/1976	152.0	UK, MK	Reclamation Completed
W.A. Cotterman Coal Co.	3676SM28	Stewart	5/26/1976	82.0	UF	Reclamation Completed
Colt Resources Inc.	3675SM26	Colt #6	6/7/1976	33.0	LK	Reclamation Completed
Colt Resources Inc.	3675SM26	Colt #6	6/7/1976	33.0	LK	Reclamation Completed
Thomas E. Siegel	3675SM77	Coursen	6/10/1976	30.0	C	Stage II Eligible
C&K Coal Company	3676SM9	Shannon #18	9/7/1976	363.0	LK, MK	Bond Forfeited - Passive Treatment
Shannon Coal Company	3676SM15	Shannon #12	10/6/1976	160.0	LK, MK	Reclamation Completed
Clarion Fossil Fuels Corp.	3676SM26	Fossil Fuels #4	10/19/1976	141.0	LK, MK	Reclamation Completed
C&K Coal Company	3676SM17	C&K #113	1/18/1977	307.1	MK, LK	Reclamation Completed
C&K Coal Company	3677SM26	C&K #63	6/12/1977	536.0	C, LK, MK, LF	Reclamation Completed
Shannon Coal Company	3677SM21	Mine #20	7/26/1977	220.0	MK, LK	Reclamation Completed
C&K Coal Company	3677SM21	Shannon #20	7/26/1977	220.0	LK, MK	Reclamation Completed
C&K Coal Company	3774SM5	C&K #82	8/24/1977	544.0	C	Reclamation Completed
Glacial Minerals Inc.	3677SM30	West Freedom	11/7/1977	245.0	LK, MK	Reclamation Completed
Thomas Snyder Coal	3677SM16	Thomas Snyder #3	8/29/1978	1.0	UF	Reclamation Completed
Colt Resources Inc.	3678BC17	Wassum	2/12/1979	33.0	LK	Reclamation Completed
Glacial Minerals Inc.	3678BC8	Conner	4/30/1979	29.5	LF	Reclamation Completed
Shannon Coal Company	1679112	Shannon #23	1/10/1980	166.0	C, LK, MK	Expired
C&K Coal Company	1679137	C&K #151	2/25/1980	21.0	C, B	Reclamation Completed
Glacial Minerals Inc.	1679120	Warner	3/3/1980	119.0	LF, UK	Reclamation Completed
Chernicky Coal Co. Inc.	1679118	Summerville	4/24/1980	64.0	C, LK, B	Bond Forfeited
Colt Resources Inc.	1679143	Stephens	6/10/1980	580.0	C, LK, MK, UK, UF, LF	Reclamation Completed
Glacial Minerals Inc.	1679140	Mito	7/9/1980	205.0	C, B, UK, LK	Bond Forfeited - Passive Treatment
C&K Coal Company	16810104	C&K #166	2/6/1981	322.0	LC, UC, MK	Bond Forfeited - Passive Treatment
C&K Coal Company	1679149	C&K #152	2/9/1981	850.0	UC, LC, LK, MK	Reclamation Completed
C&K Coal Company	1680107	C&K #148	6/11/1981	187.0	C, LK	Reclamation Completed
Chernicky Coal Co. Inc.	16800127	Glosser	6/19/1981	25.0	C, B	Bond Forfeited
C&K Coal Company	1679123	C&K #110	7/2/1981	169.0	C, B, LK, MK	Reclamation Completed
Glacial Minerals Inc.	16810117	Tintown Operation	1/29/1982	284.0	LF, MK	Bond Forfeited
C&K Coal Company	16810125	C&K #171	2/1/1982	139.0	C, LK	Reclamation Completed
Colt Resources Inc.	16810105	Terwilliger	9/7/1982	51.0	LK, MK, LF	Reclamation Completed
Glacial Minerals Inc.	16830102	Conner #3	2/2/1984	79.0	UF	Reclamation Completed
C&K Coal Company	16753056	Budd Stewart	6/13/1984	485.0	LK, MK	Reclamation Completed
Glacial Minerals Inc.	16810111	Neeper	7/18/1984	48.0	UK, MK	Reclamation Completed
C&K Coal Company	16830114	Tremba Horner	8/15/1984	704.0	LK, MK	Bond Forfeited - Passive Treatment
C&K Coal Company	16810135	Savelli Stewart Rinehart	8/25/1984	529.0	MK, LK, UC, LC	Reclamation Completed
Glacial Minerals Inc.	16840105	Stewart #2	11/2/1984	56.0	UF	Reclamation Completed
Colt Resources Inc.	16793028	Bailey	5/14/1985	172.3	C, LK, MK, UK	Reclamation Completed
C&K Coal Company	16743037	C&K #5	6/30/1985	554.0	LK, MK	Reclamation Completed
C&K Coal Company	16813004	Ochs Myers	6/30/1985	181.0	UC, LC, LK, MK	Reclamation Completed
C&K Coal Company	16743024	Shannon #9	7/15/1985	140.0	LK, MK	Reclamation Completed
C&K Coal Company	16743038	C&K #710	7/15/1985	280.2	LK, MK	Reclamation Completed
C&K Coal Company	16753010	C&K #90	7/15/1985	1126.6	UC, LC, LK, MK	Reclamation Completed

C&K Coal Company	16753017	Murray Wingert	7/15/1985	294.0	UC, LC, LK, MK	Reclamation Completed
C&K Coal Company	16753153	C&K #709	7/15/1985	164.0	LK, MK	Reclamation Completed
C&K Coal Company	16763009	Shannon #18	7/15/1985	256.0	LK, MK	Reclamation Completed
C&K Coal Company	16773021	Luther Matthews	7/15/1985	198.0	LK, MK	Reclamation Completed
C&K Coal Company	16703006	C&K #75	8/1/1985	1190.0	UC, LC, LK, MK	Reclamation Completed
Ancient Sun, Inc.	16850102	Wells	10/23/1985	19.6	MK, UK	Reclamation Completed
Colt Resources Inc.	16830121	Stahlman	2/4/1986	167.5	MK	Reclamation Completed
C&K Coal Company	16850110	C&K #202	3/10/1986	379.0	LK, MK	Reclamation Completed
Crispin Contracting Co.	16850107	Stewart	4/8/1986	14.5	LK	Reclamation Completed
RFI Energy Inc.	16831604	Shannon Prep Plant	6/17/1986	36.2		Active
C&K Coal Company	16831602	Rimersburg Prep Plant	6/17/1986	21.5		Bond Forfeited - Passive Treatment
Doverspike Brothers Coal Co.	16860112	McKinney	3/19/1987	107.5	UF	Reclamation Completed
Eyes Dozer Service	16870102	Gourley	8/24/1987	11.1	LK	Reclamation Completed
C&K Coal Company	16880102	C&K #125	2/5/1988	380.5	LK, MK	Reclamation Completed
Colt Resources Inc.	16880101	Louge	6/6/1988	108.0	MK	Reclamation Completed
Ancient Sun, Inc.	16900112	Kelly	2/1/1991	140.2	MK	Reclamation Completed
Colt Resources Inc.	16900111	Martz	2/20/1992	41.7	UK, MK	Reclamation Completed
C&K Coal Company	16910106	C&K #222	6/11/1992	255.0	LK, MK, UF	Reclamation Completed
Doverspike Brothers Coal Co.	16920101	Cyphert	10/20/1992	27.4	MK	Bond Forfeited
RFI Energy Inc.	16920107	RFI #230	4/29/1993	274.0	C, LK, MK	Active
C&K Coal Company	16930104	C&K #224	11/8/1993	230.0	C, LK, MK	Reclamation Completed
Cookport Coal Company Inc.	16940104	Mortimer	11/16/1994	28.4	MK	Reclamation Completed
RFI Energy Inc.	16940107	RFI #225	5/16/1995	217.0	MK, LK	Active
Ancient Sun, Inc.	16020102	Saylor-McKinney	6/19/2003	27.9	UF	Stage II Bond Release
RFI Energy Inc.	16050109	Callander	1/10/2006	85.0	LK, MK	Active
Neiswonger Construction, Inc.	16050111	Mohney	5/10/2006	86.0	MK, UK	Stage I Bond Release

In 1975, the Department of Environmental Resources contracted with Buchart-Horn, Consulting Engineers and Planners, to perform an acid mine drainage abatement study on the Licking Creek Watershed. The ensuing report, called the Licking Creek Mine Drainage Pollution Abatement Project, Operation Scarlift Report SL-194, established 111 sampling and flow measurement stations in the Licking Creek Watershed. The acid loading in the watershed was determined to be from a large number of seeps, rather than from a smaller number of larger discharges. Anderson Run, Mineral Run, Little Licking Creek and Unnamed Tributary No. 10114 to Cherry Run were determined to be the primary contributors of acid loading in the watershed. Specific abatement recommendations, consisting of the reclamation of spoil piles (regrading and revegetation), were provided for 50 different areas in the watershed. For the location of the sampling points and project areas refer to the map contained in the ScarLift SL-194 Report.

In the mid 1980's, BAMR contracted with Earth Satellite Corp. to complete a statewide abandoned mine lands inventory. This comprehensive photo interpretive inventory known as NALIS identified 5290 "Problem Areas" statewide with a total of 59 of these "Problem Areas" within the Licking Creek Watershed. The Knox District staff reassessed all of these "Problem Areas" and the NALIS inventory was updated to reflect current conditions.

## AMD Methodology

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

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

Allowable loads are determined for each point of interest using Monte Carlo simulation. Monte Carlo simulation is an analytical method meant to imitate real-life systems, especially when other analyses are too mathematically complex or too difficult to reproduce. Monte Carlo simulation calculates multiple scenarios of a model by repeatedly sampling values from the probability distribution of the uncertain variables and using those values to populate a larger data set. Allocations were applied uniformly for the watershed area specified for each allocation point. For each source and pollutant, it was assumed that the observed data were log-normally distributed. Each pollutant source was evaluated separately using @Risk<sup>1</sup> by performing 5,000 iterations to determine the required percent reduction so that the water quality criteria, as defined in the *Pennsylvania Code, Title 25 Environmental Protection, Department of Environmental Protection, Chapter 93, Water Quality Standards*, will be met instream at least 99 percent of the time. For each iteration, the required percent reduction is:

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

PR = required percent reduction for the current iteration

Cc = criterion in mg/l

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

$$Cd = \text{RiskLognorm}(\text{Mean}, \text{Standard Deviation}) \text{ where (1a)}$$

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<sup>1</sup> @Risk – Risk Analysis and Simulation Add-in for Microsoft Excel, Palisade Corporation, Newfield, NY, 1990-1997.

Mean = average observed concentration

Standard Deviation = standard deviation of observed data

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

$$\text{LTA} = \text{Mean} * (1 - \text{PR99}) \text{ where (2)}$$

LTA = allowable LTA source concentration in mg/l

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

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

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

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

In Low pH TMDLs, acidity is compared to alkalinity as described in Attachment B. Each sample point used in the analysis of pH by this method must have measurements for total alkalinity and total acidity. Net alkalinity is alkalinity minus acidity, both in units of milligrams per liter (mg/l) CaCO<sub>3</sub>. Statistical procedures are applied, using the average value for total

alkalinity at that point as the target to specify a reduction in the acid concentration. By maintaining a net alkaline stream, the pH value will be in the range between six and eight. This method negates the need to specifically compute the pH value, which for streams affected by low pH may not be a true reflection of acidity. This method assures that Pennsylvania's standard for pH is met when the acid concentration reduction is met.

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

This document contains one or more future mining Waste Load Allocations (WLA) to accommodate possible future mining operations. The Knox District Mining Office determined the number of and location of the future mining WLAs. All comments and questions concerning permitting issues and future mining WLAs are to be directed to the appropriate DMO.

The following are examples of what is or is not intended by the inclusion of future mining WLAs. This list is by way of example and is not intended to be exhaustive or exclusive:

- 1 The inclusion of one or more future mining WLAs is not intended to exclude the issuance of future non-mining NPDES permits in this watershed or any waters of the Commonwealth.
- 2 The inclusion of one or more future mining WLAs in specific segments of this watershed is not intended to exclude future mining in any segments of this watershed that does not have a future mining WLA.
- 3 The inclusion of future mining WLAs does not preclude the amending of this AMD TMDL to accommodate additional NPDES permits.

### **Method to Quantify Treatment Pond Pollutant Load**

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

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

Standard Treatment Pond Effluent Limits:

Alkalinity > Acidity  
6.0 <= pH <= 9.0  
Al <= 0.75 mg/l (Criteria)  
Fe <= 3.0 mg/l (BAT)  
Mn <= 2.0 mg/l (BAT)

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

$$\text{Flow (MGD)} \times \text{BAT limit (mg/l)} \times 8.34 = \text{lbs/day}$$

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

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

In an active mining scenario, a mine operator pumps pit water to the ponds for chemical treatment. Pit water is often acidic with dissolved metals in nature. At the treatment ponds, alkaline chemicals are added to increase the pH and encourage dissolved metals to precipitate and settle. Pennsylvania averages 41.4 inches of precipitation per year (Mid-Atlantic River Forecast Center, National Weather Service, State College, PA, 1961-1990, <http://www.dep.state.pa.us/dep/subject/hotopics/drought/PrecipNorm.htm>). A maximum pit dimension without special permit approval is 1,500 feet long by 300 feet wide. Assuming that 5 percent of the precipitation evaporates and the remaining 95 percent flows to the low spot in the active pit to be pumped to the treatment ponds, results in the following equation and average flow rates for the pit area.

$$41.4 \text{ in. precip/yr} \times 0.95 \times 1 \text{ ft}/12\text{in.} \times 1,500' \times 300' / \text{pit} \times 7.48 \text{ gal}/\text{ft}^3 \times 1\text{yr}/365\text{days} \times 1\text{day}/24\text{hr} \\ \times 1\text{hr}/60 \text{ min} =$$

$$= 21.0 \text{ gal}/\text{min} \text{ average discharge from direct precipitation into the open mining pit area}$$

Pit water also can result from runoff from the ungraded and revegetated area following the pit. In the case of roughly backfilled and highly porous spoil, there is very little surface runoff. It is estimated that 80 percent of precipitation on the roughly regraded mine spoil infiltrates, 5 percent evaporates, and 15 percent may run off to the pit for pumping and potential treatment (Jay Hawkins, Office of Surface Mining, Department of the Interior, Personal Communications,

2003). Regrading and revegetation of the mine spoil is conducted as the mining progresses. The PADEP encourages concurrent backfilling and revegetation through its compliance efforts and it is in the interest of the mining operator to minimize the company's reclamation bond liability by keeping the site reclaimed and revegetated. Experience has shown that reclamation and revegetation is accomplished two to three pit widths behind the active mining pit area. PADEP uses three pit widths as an area representing potential flow to the pit when reviewing the NPDES permit application and calculating effluent limits based on best available treatment technology and insuring that instream limits are met. The same approach is used in the following equation, which represents the average flow reporting to the pit from the ungraded and unvegetated spoil area.

$$41.4 \text{ in. precip/yr} \times 3 \text{ pit areas} \times 1 \text{ ft}/12 \text{ in.} \times 1,500' \times 300' / \text{pit} \times 7.48 \text{ gal}/\text{ft}^3 \times 1 \text{ yr}/365 \text{ days} \times 1 \text{ day}/24 \text{ hr} \times 1 \text{ hr}/60 \text{ min} \times 15 \text{ in. runoff}/100 \text{ in. precip} =$$

$$= 9.9 \text{ gal}/\text{min} \text{ average discharge from spoil runoff into the pit area}$$

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

$$\text{Total Average Flow} = \text{Direct Pit Precipitation} + \text{Spoil Runoff}$$

$$\text{Total Average Flow} = 21.0 \text{ gal}/\text{min} + 9.9 \text{ gal}/\text{min} = 30.9 \text{ gal}/\text{min}$$

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

$$\begin{aligned} &\text{Allowable Aluminum WLA:} \\ &30.9 \text{ gal}/\text{min} \times 0.75 \text{ mg}/\text{l} \times 0.01202 = 0.3 \text{ lbs}/\text{day} \end{aligned}$$

$$\begin{aligned} &\text{Allowable Iron WLA:} \\ &30.9 \text{ gal}/\text{min} \times 3 \text{ mg}/\text{l} \times 0.01202 = 1.1 \text{ lbs}/\text{day} \end{aligned}$$

$$\begin{aligned} &\text{Allowable Manganese WLA:} \\ &30.9 \text{ gal}/\text{min} \times 2 \text{ mg}/\text{l} \times 0.01202 = 0.7 \text{ lbs}/\text{day} \end{aligned}$$

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

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

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

While most mining operations are permitted and allowed to have a standard, 1,500 ft x 300 ft pit, most are well below that size and have a corresponding decreased flow and load. Where pit dimensions are greater than the standard size or multiple pits are present, the calculations to define the potential pollution load can be adjusted accordingly. Hence, the above calculated WLA is very generous and likely high compared to actual conditions that are generally encountered. A large MOS is included in the WLA calculations.

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

Derivation of the flow used in the future mining WLAs:

$$30.9 \text{ gal/min} \times 2 \text{ (assume two pits)} \times 0.00144 = 0.09 \text{ MGD}$$

### **Future TMDL Modifications**

In the future, the Department may adjust the load and/or wasteload allocations in this TMDL to account for new information or circumstances that are developed or discovered during the implementation of the TMDL when a review of the new information or circumstances indicate that such adjustments are appropriate. Adjustment between the load and wasteload allocation will only be made following an opportunity for public participation. A wasteload allocation adjustment will be made consistent and simultaneous with associated permit(s) revision(s)/reissuances (i.e., permits for revision/reissuance in association with a TMDL revision will be made available for public comment concurrent with the related TMDL's availability for public comment). New information generated during TMDL implementation may include, among other things, monitoring data, BMP effectiveness information, and land use information. All changes in the TMDL will be tallied and once the total changes exceed 1% of the total

original TMDL allowable load, the TMDL will be revised. The adjusted TMDL, including its LAs and WLAs, will be set at a level necessary to implement the applicable WQS and any adjustment increasing a WLA will be supported by reasonable assurance demonstration that load allocations will be met. The Department will notify EPA of any adjustments to the TMDL within 30 days of its adoption and will maintain current tracking mechanisms that contain accurate loading information for TMDL waters.

### **Changes in TMDLs That May Require EPA Approval**

- Increase in total load capacity.
- Transfer of load between point (WLA) and nonpoint (LA) sources.
- Modification of the margin of safety (MOS).
- Change in water quality standards (WQS).
- Non-attainment of WQS with implementation of the TMDL.
- Allocations in trading programs.

### **Changes in TMDLs That May Not Require EPA Approval**

- Total loading shift less than or equal to 1% of the total load.
- Increase of WLA results in greater LA reductions provided reasonable assurance of implementation is demonstrated (a compliance/implementation plan and schedule).
- Changes among WLAs with no other changes; TMDL public notice concurrent with permit public notice.
- Removal of a pollutant source that will not be reallocated.
- Reallocation between LAs.
- Changes in land use.

### **TMDL Endpoints**

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

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

**Table 3                      Applicable Water Quality Criteria**

<b>Parameter</b>	<b><i>Criterion Value (mg/l)</i></b>	<b><i>Total Recoverable/Dissolved</i></b>
Aluminum (Al)	0.75	Total Recoverable
Iron (Fe)	1.50	Total Recoverable
Manganese (Mn)	1.00	Total Recoverable
pH *	6.0-9.0	N/A

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

There were not enough samples at any sample point to check for correlation between metals and flow for Licking Creek.

### **Allocation Summary**

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

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

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

**Table 4. Summary Table–Licking Creek Watershed**

<b>Station</b>	<b>Parameter</b>	<b>Existing Load (lbs/day)</b>	<b>TMDL Allowable Load (lbs/day)</b>	<b>WLA (lbs/day)</b>	<b>LA (lbs/day)</b>	<b>Load Reduction (lbs/day)</b>	<b>Percent Reduction %</b>
25	N.E. Headwaters Branch of Licking Creek (49329)						
	Al	1.9	1.9	0.0	1.9	0	0
	Fe	2.5	2.4	0.0	2.4	0.1	6
	Mn	4.3	1.0	0.0	1.0	3.3	76
	Acidity	2.66	2.66	0.0	2.66	0	0
26	S.E. Headwaters Unt (49336) of Licking Creek (						
	Al	4.9	4.9	0.0	4.9	0.0	0
	Fe	12.2	9.9	0.0	9.9	2.3	19
	Mn	50.5	8.6	0.0	8.6	41.9	83
	Acidity	0.0	0.0	0.0	0.0	0.0	0
24	Licking Creek (49269) Upstream of Confluence with Craggs Run						
	Al	14.0	10.5	2.8	7.7	3.5	25
	Fe	15.5	15.5	11.25	4.25	0.0	0
	Mn	24.5	29.5	7.5	22.0	0.0	0
	Acidity	171.8	171.8	0.0	0.0	0.0	0
23	Craggs Run (49320)						
	Al	6.0	4.0	0.56	3.44	2.0	34
	Fe	2.6	2.6	2.25	0.35	0.0	0
	Mn	8.1	3.2	1.5	1.7	4.9	61
	Acidity	0.0	0.0	0.0	0.0	0.0	0
18	Licking Creek (49269) Upstream of Confluence with Little Licking Creek						
	Al	31.1	9.9	2.8	7.1	18.7	65
	Fe	418.7	25.1	11.25	13.85	393.6	94
	Mn	263.7	18.5	7.5	11.0	240.2	93
	Acidity	401.8	401.8	0.0	401.8	0.0	0
27	Headwaters of Little Licking Creek (49310)						
	Al	1.7	1.7	0.0	1.7	0.0	0
	Fe	4.3	4.1	0.0	4.1	0.2	4
	Mn	7.9	2.2	0.0	2.2	5.7	72
	Acidity	0.0	0.0	0.0	0.0	0.0	0
20	Unt (49311) To Little Licking Creek						
	Al	0.9	0.9	0.0	0.9	0.0	0
	Fe	5.6	2.3	0.0	2.3	3.3	60
	Mn	10.1	2.1	0.0	2.1	8.0	79
	Acidity	0.0	0.0	0.0	0.0	0.0	0
17	Mineral Run (49308)						
	Al	49.1	4.4	2.24	2.16	44.7	91
	Fe	321.3	9.6	9.0	0.6	311.7	97
	Mn	214.6	8.6	6.0	2.6	206.0	96
	Acidity	1429.8	0.0	0.0	0.0	1429.8	100
14	Anderson Run (49305)						
	Al	79.9	6.4	2.8	3.6	73.5	92
	Fe	547.7	16.4	11.25	5.15	531.3	97
	Mn	382.2	11.5	7.5	4.0	370.7	97
	Acidity	2218.3	110.9	0.0	110.9	2107.4	95
12	Licking Creek Upstream of Confluence with Unt (49301)						
	Al	135.1	29.7	2.8	26.9	0.0	0
	Fe	992.7	119.5	11.25	108.25	0.0	0

Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Reduction %
	Mn	1012.0	60.7	7.5	53.2	115.8	66
	Acidity	1835.7	881.1	0.0	881.1	0.0	0
11	Licking Creek Upstream of the Confluence with Cherry Run (49270)						
	Al	152.4	24.4	2.8	21.6	22.6	48
	Fe	631.7	88.4	<i>11.25</i>	77.15	0.0	0
	Mn	1009.7	80.8	7.5	73.3	0.0	0
	Acidity	982.6	982.56	0.0	0.0	0.0	0
7	Unt (49289) Cherry Run Upstream of Confluence with Cherry Run						
	Al	8.2	8.2	0.0	NA	NA	0
	Fe	142.0	19.9	0.0	19.9	122.1	86
	Mn	95.3	22.9	0.0	22.9	72.4	76
	Acidity	0.0	0.0	0.0	0.0	0.0	0
6	Cherry Run (49270)						
	Al	18.2	18.2	0.0	18.2	0.0	0
	Fe	87.4	23.6	0.0	23.6	0.0	0
	Mn	128.6	38.6	0.0	38.6	17.6	31
	Acidity	0.0	0.0	0.0	0.0	0.0	0
5	Cherry Run (49270) Upstream of Confluence with Unt (49278)						
	Al	23.2	23.2	0.0	23.2	0.0	0
	Fe	55.2	28.2	0.0	28.2	27.0	0
	Mn	104.7	35.6	0.0	35.6	69.1	0
	Acidity	0.0	0.0	0.0	0.0	0.0	0
3	Unt (49271) to Cherry Run						
	Al	6.5	6.5	6.28	0.22	0.0	0
	Fe	3.9	3.9	25.29	0.0	0.0	0
	Mn	6.6	6.6	15.38	0.0	0.0	0
	Acidity	0.0	0.0	0.0	0.0	0.0	0
2	Mouth of Cherry Run						
	Al	32.5	32.5	0.0	32.5	0.0	0
	Fe	39.1	39.1	0.0	39.1	0.0	0
	Mn	94.9	36.1	0.0	36.1	0.0	0
	Acidity	0.0	0.0	0.0	0.0	0.0	0
1	Mouth of Licking Creek						
	Al	124.8	48.7	2.8	45.9	0.0	0
	Fe	645.9	148.6	<i>11.25</i>	137.35	0.0	0
	Mn	1095.7	164.4	7.5	156.9	0.0	0
	Acidity	0.0	0.0	0.0	0.0	0.0	0

The italicized values in the WLA column in table four are future mining wlas.

All waste load allocations were calculated using the methodology explained previously in the Method to Quantify Treatment Pond Pollutant Load section of the report.

RFI Energy Inc., permit number 16831604, Shannon Prep Plant, has no permitted discharges. There is one erosion and sediment pond, which does not require a wasteload allocation.

Wasteload allocations for the existing mining operations were incorporated into the calculations at 3 (RFI Energy, Inc. Mine # 230 TF-4 and TF-7) 3 (RFI Energy, Inc. Mine # 225 TF1, TF2 and ATF1), 3. This is the first downstream monitoring point that receives all the potential flow of

treated water from any of the treatment sites. No required reductions of these permits are necessary at this time because there are upstream non-point sources that when reduced will meet the TMDL or there is available assimilation capacity. All necessary reductions are assigned to non-point sources.

Although TMDLs for aluminum, iron and manganese are not necessary at sample point 3 because the water quality standards are met, WLAs are assigned to both of the RFI Energy, Inc., mines #230 and 225 permits. Because the standard is met for aluminum, iron and manganese at sample point 3, the actual allowed loads are the water quality standards times the flow and a conversion factor at the sample point. For sample point 3 this equals 19.4 lbs/day for aluminum, 38.8 lbs/day for iron and 25.9 lbs/day for manganese. The aluminum WLAs of 2.9 (#230 2.3 lbs/day + 0.6 #225) lbs/day, 11.5 (#230 9.3 + 2.2 #225) lbs/day for iron and 7.7 (#230 6.2 + 1.5 #225) lbs/day for manganese for this segment is acceptable and will not have a negative impact on water quality within the segment.

The RFI Energy, Inc. Mine #230 (SMP#16920107) has a non-standard pit size of 2500 feet in length and a width of 750 feet. In addition there are two pits of this size. This pit size was used in the Method to Quantify Treatment Pond Pollutant Load calculation example shown below:

$41.4 \text{ in. precip/yr} \times 0.95 \times 1 \text{ ft}/12 \text{ in.} \times 2500' \times 750' \text{ /pit} \times 7.48 \text{ gal}/\text{ft}^3 \times 1 \text{ yr}/365 \text{ days} \times 1 \text{ day}/24 \text{ hr} \times 1 \text{ hr}/60 \text{ min} = 87.5 \text{ gal}/\text{min}$  average discharge from direct precipitation into the open mining pit area. There are two pits of this size so the total is 174.9 gal/min.

$41.4 \text{ in. precip/yr} \times 3 \text{ pit areas} \times 1 \text{ ft}/12 \text{ in.} \times 2500' \times 750' \text{ /pit} \times 7.48 \text{ gal}/\text{ft}^3 \times 1 \text{ yr}/365 \text{ days} \times 1 \text{ day}/24 \text{ hr} \times 1 \text{ hr}/60 \text{ min} \times 15 \text{ in. runoff}/100 \text{ in. precip} = 41.4 \text{ gal}/\text{min}$  average discharge from spoil runoff into the pit area. There are two pits of this size so the total is 82.9 gal/min.

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

$$\text{Total Average Flow} = \text{Direct Pit Precipitation} + \text{Spoil Runoff}$$

$$\text{Total Average Flow} = 174.9 \text{ gal./min.} + 82.8 \text{ gal./min.} = 257.8 \text{ gal./min.}$$

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

Allowable Aluminum Waste Load Allocation:  
 $257.8 \text{ gal./min.} \times 0.75 \text{ mg}/\text{l} \times 0.01202 = 2.3 \text{ lbs./day}$

Allowable Iron Waste Load Allocation:  
 $257.8 \text{ gal./min.} \times 3 \text{ mg}/\text{l} \times 0.01202 = 9.3 \text{ lbs./day}$

Allowable Manganese Waste Load Allocation:  
 $257.8 \text{ gal./min.} \times 2 \text{ mg}/\text{l} \times 0.01202 = 6.2 \text{ lbs./day}$

The RFI Energy, Inc., Mine # 225 (permit SMP#16940107) is actively mining coal. Two non-standard pit sizes for Pit 1 and Pit 2 are each 1,500 feet in length with a width of 300 feet. These pit sizes were used in the Method to Quantify Treatment Pond Pollutant Load calculation and are shown in Table 5.

The RFI Energy, Inc., Callander Mine (permit SMP#16050109) is actively mining coal. Two non-standard pit sizes for Pit 1 and Pit 2 are each 450 feet in length with a width of 300 feet. The treatment pond for this permit discharges to an adjacent watershed so there will be no waste load allocation calculated.

**Table 5. Waste Load Allocation of Permitted Discharges**

Parameter	Allowable Average Monthly Conc. (mg/l)	Calculated Average Flow (MGD)	WLA (lbs/day)
<b>RFI Energy, Mine # 230 (SMP#16920107)</b>			
<b>TF-4</b>			
Al	0.75	0.37	2.3
Fe	3.0	0.37	9.3
Mn	2.0	0.37	6.2
<b>TF-7</b>			
Al	0.75	0.37	2.3
Fe	3.0	0.37	9.3
Mn	2.0	0.37	6.2
<b>RFI Energy, Inc., Mine #225 (SMP#16940107)</b>			
<b>TF1</b>			
Al	0.75	0.09	0.56
Fe	3.0	0.09	2.23
Mn	2.0	0.09	1.49
<b>TF2</b>			
Al	0.75	0.09	0.56
Fe	3.0	0.09	2.23
Mn	2.0	0.09	1.49
<b>ATF1</b>			
Al	0.75	0.09	0.56
Fe	3.0	0.09	2.23
Mn	2.0	0.09	1.49

## 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. Federal funding is through the Department the Interior, Office of Surface Mining (OSM), for reclamation and mine drainage treatment through the Appalachian Clean Streams Initiative and through Watershed Cooperative Agreements.

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, Pennsylvania'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 ([www.dep.state.pa.us/dep/deputate/minres/bamr/complan1.htm](http://www.dep.state.pa.us/dep/deputate/minres/bamr/complan1.htm)). 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 approved rehabilitation plan. (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. This reclamation was done, through the use of remining permits which have the potential for reclaiming abandoned mine lands, at no cost to the Commonwealth or the federal government. Long-term treatment agreements were initialized for facilities/operators who need to assure treatment of post-mining discharges or discharges they degraded which will provide for long-term treatment of discharges. According to OSM, "PADEP is conducting a program where active mining sites are, with very few exceptions, in compliance with the approved regulatory program".

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).

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

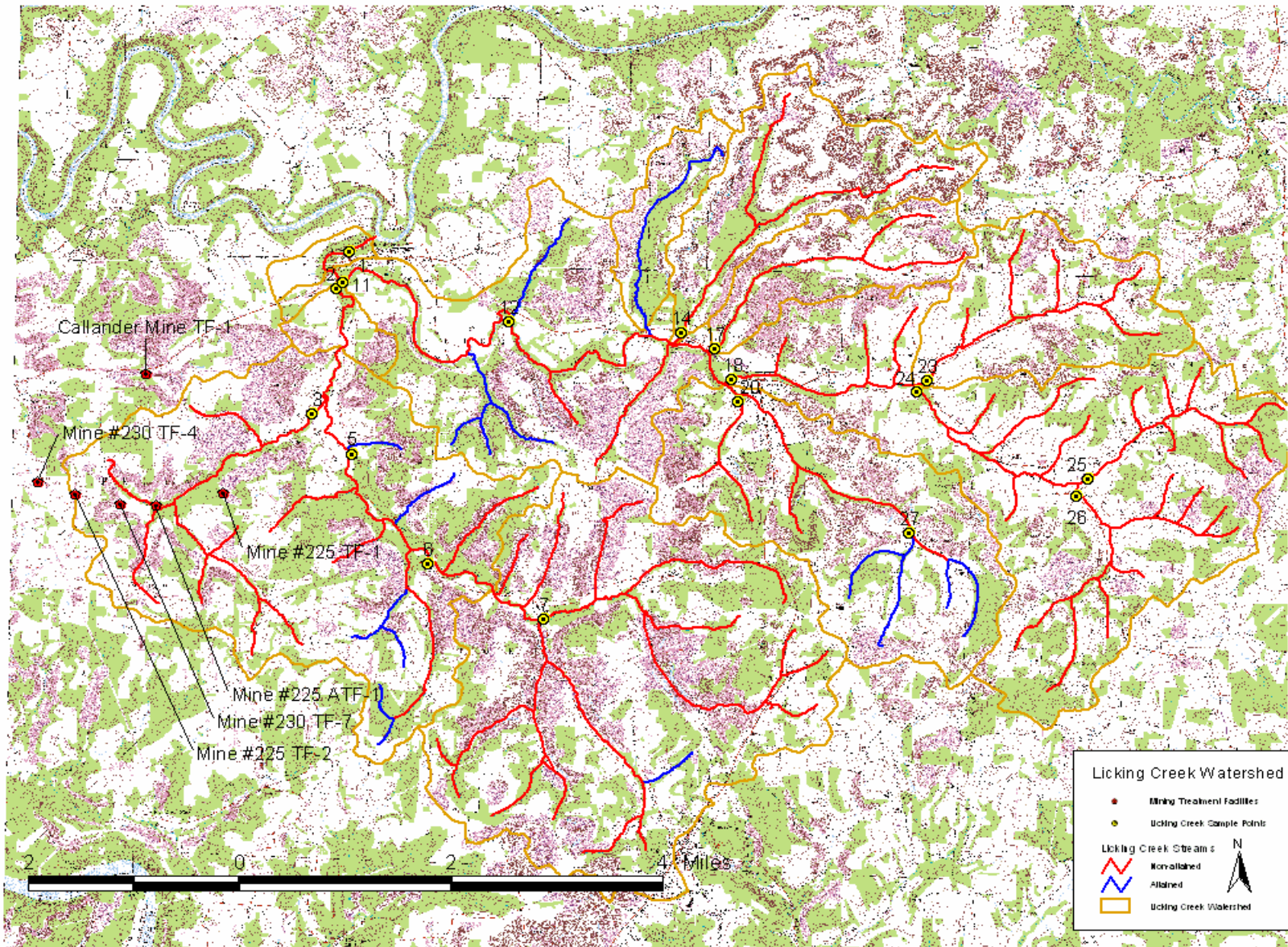
Candidate or federally-listed threatened and endangered species may occur in or near the watershed. While implementation of the TMDL should result in improvements to water quality, they could inadvertently destroy habitat for candidate or federally-listed species. TMDL implementation projects should be screened through the Pennsylvania Natural Diversity Inventory (PNDI) early in their planning process, in accordance with the Department's policy titled Policy for Pennsylvania Natural Diversity Inventory (PNDI) Coordination During Permit Review and Evaluation (Document ID# 400-0200-001).

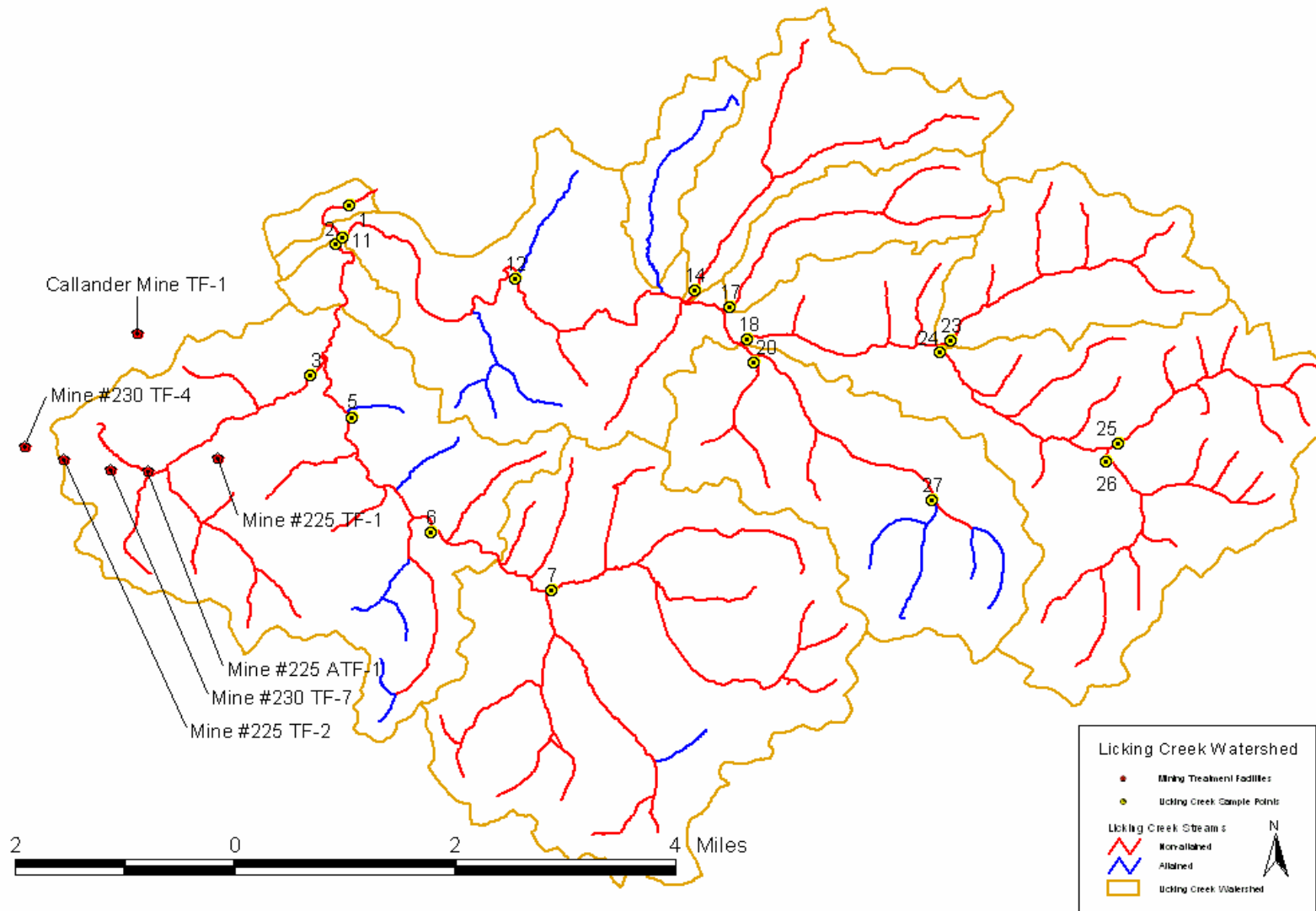
### **Public Participation**

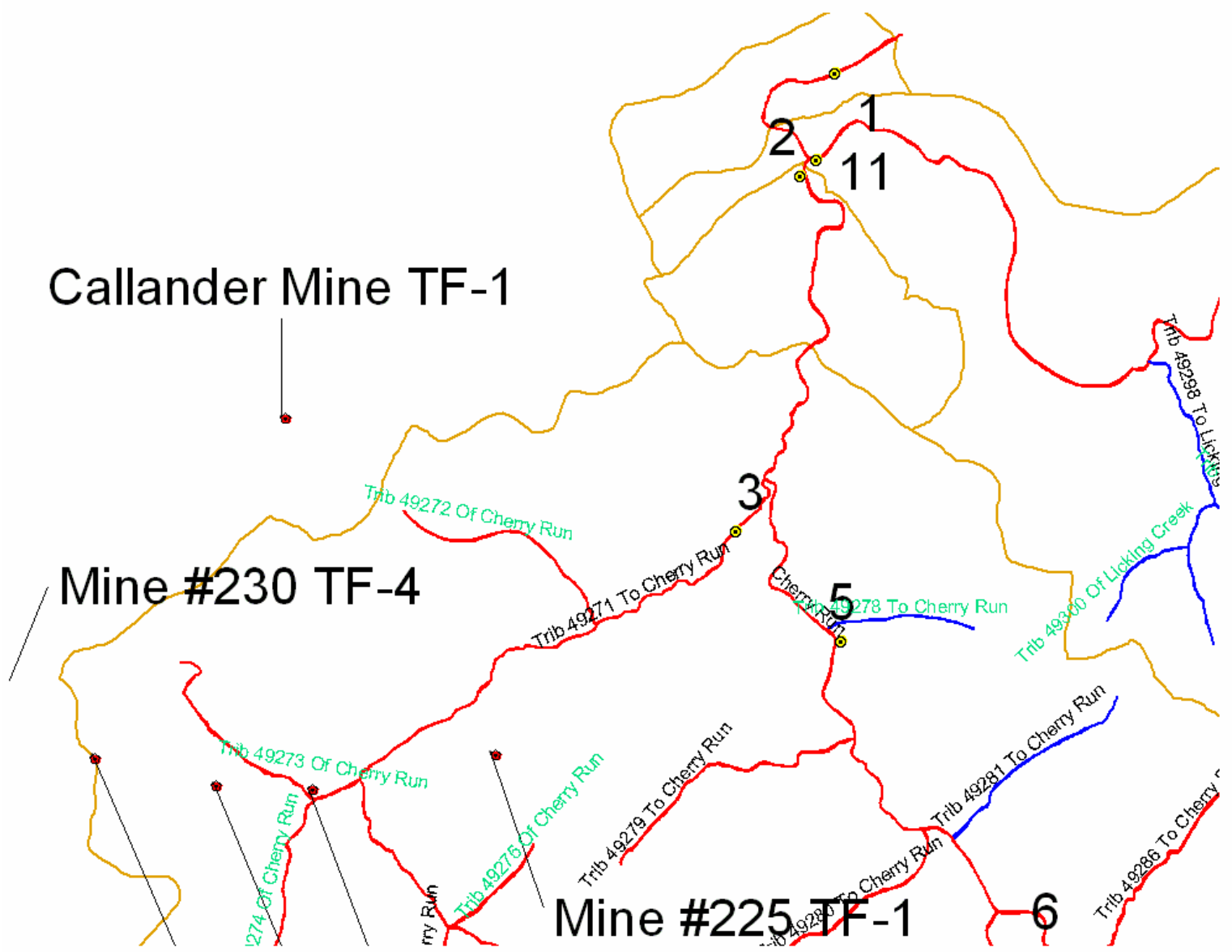
Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* on September 27, 2008 to foster public comment on the allowable loads calculated. A public meeting was held on October 2, 2008 beginning at 1 p.m., at the Knox District Mining Office in Knox, PA, to discuss the proposed TMDL.

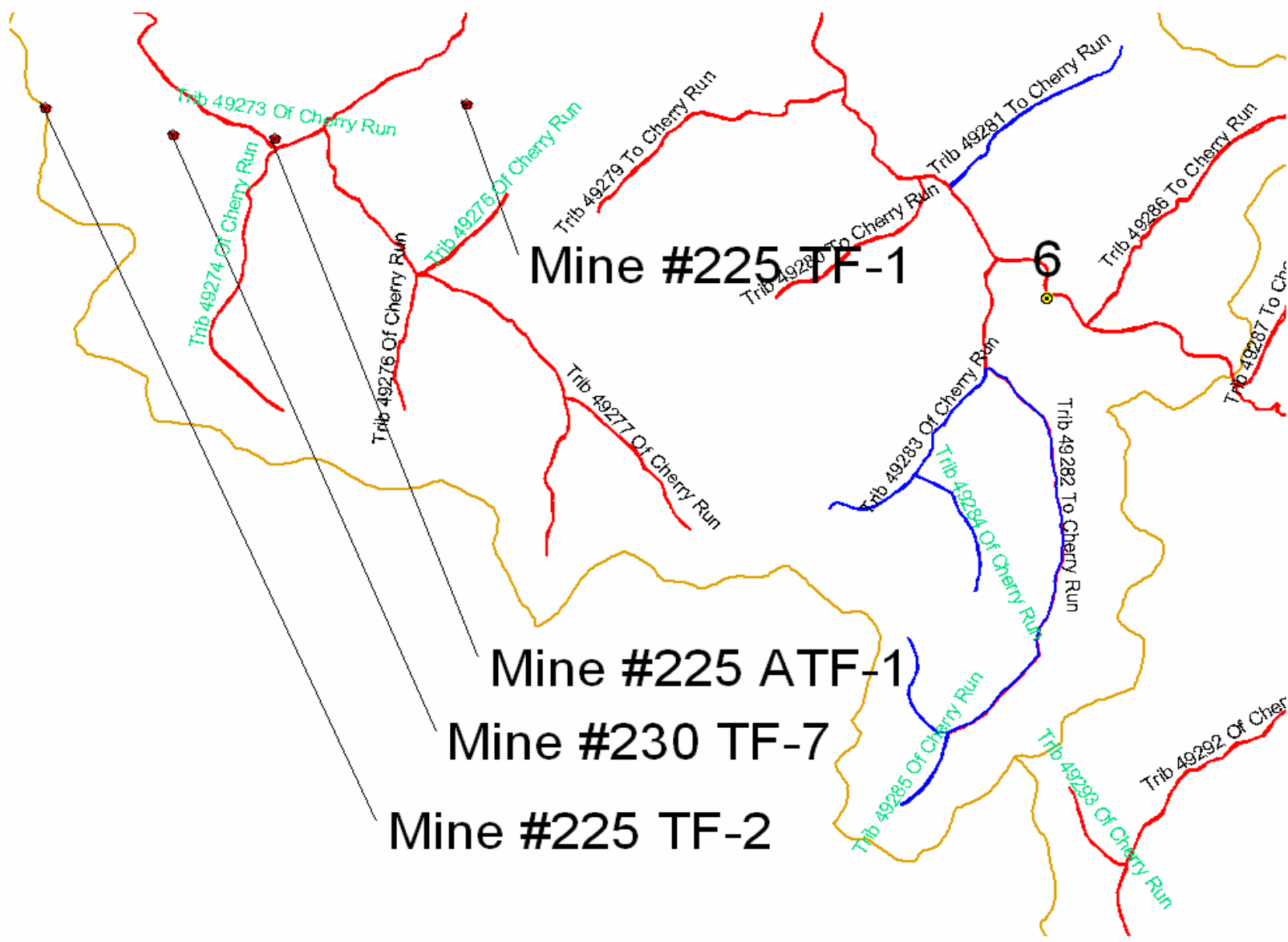
# *Attachment A*

## **Licking Creek Watershed Maps**









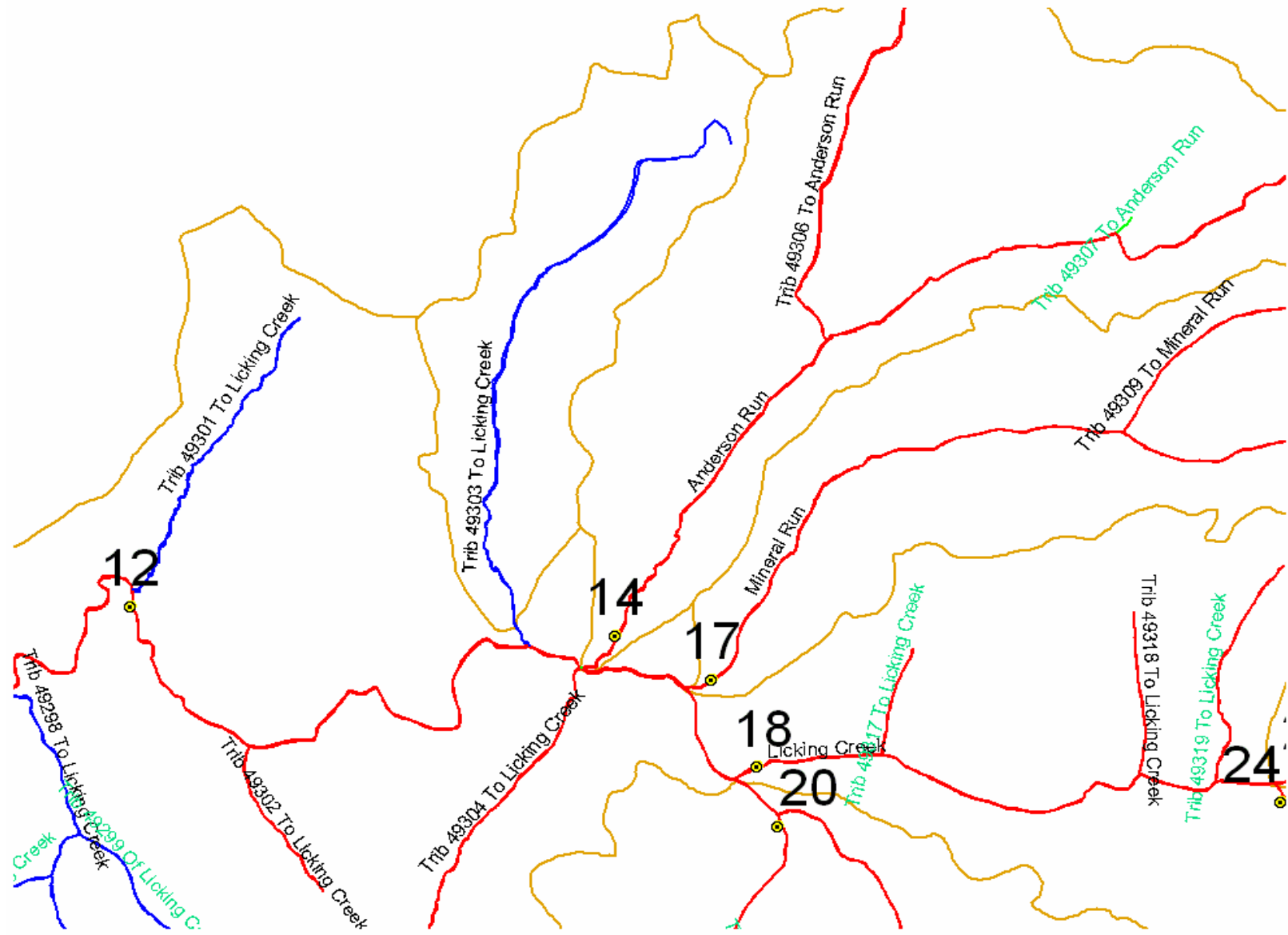
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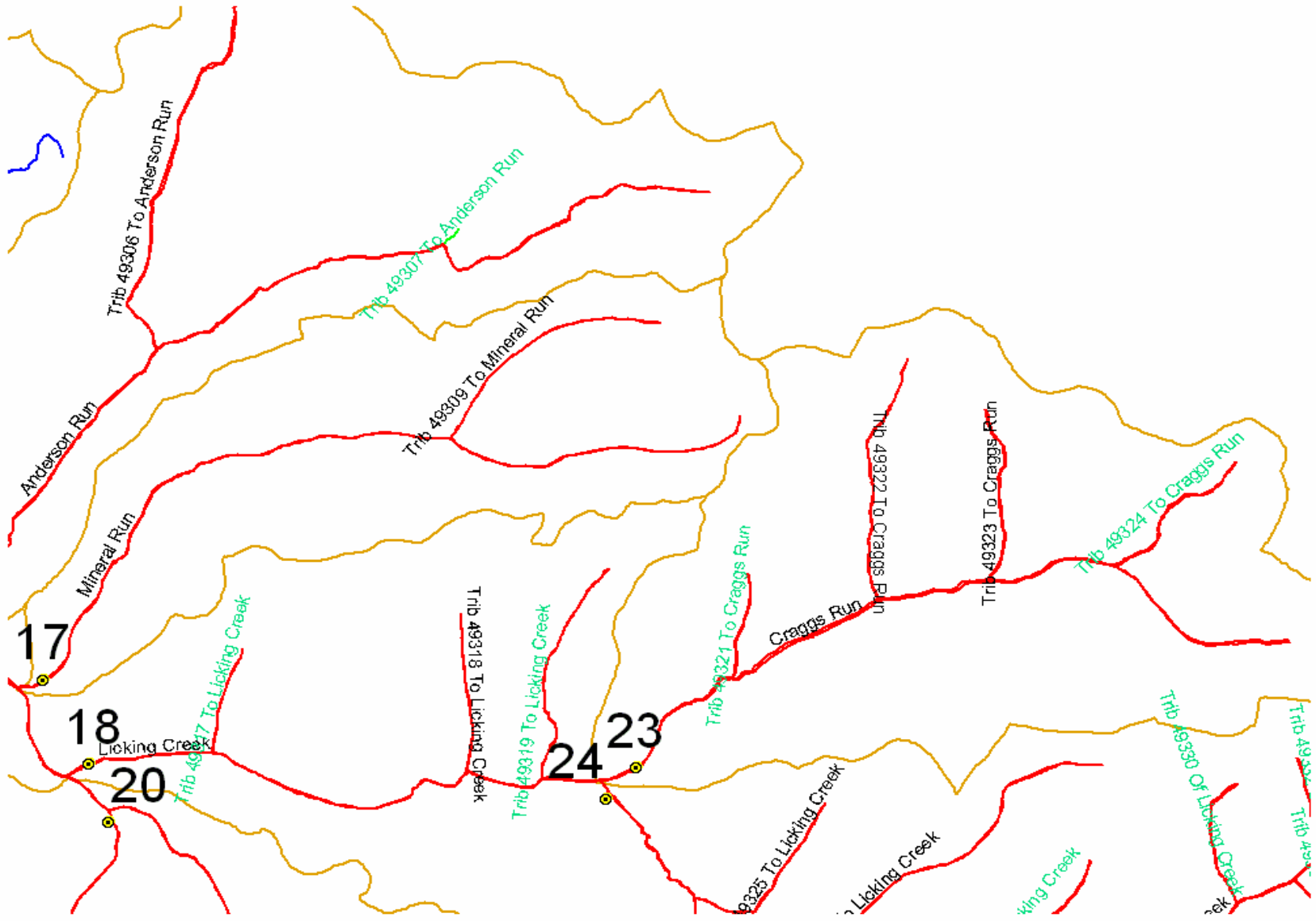
**6**

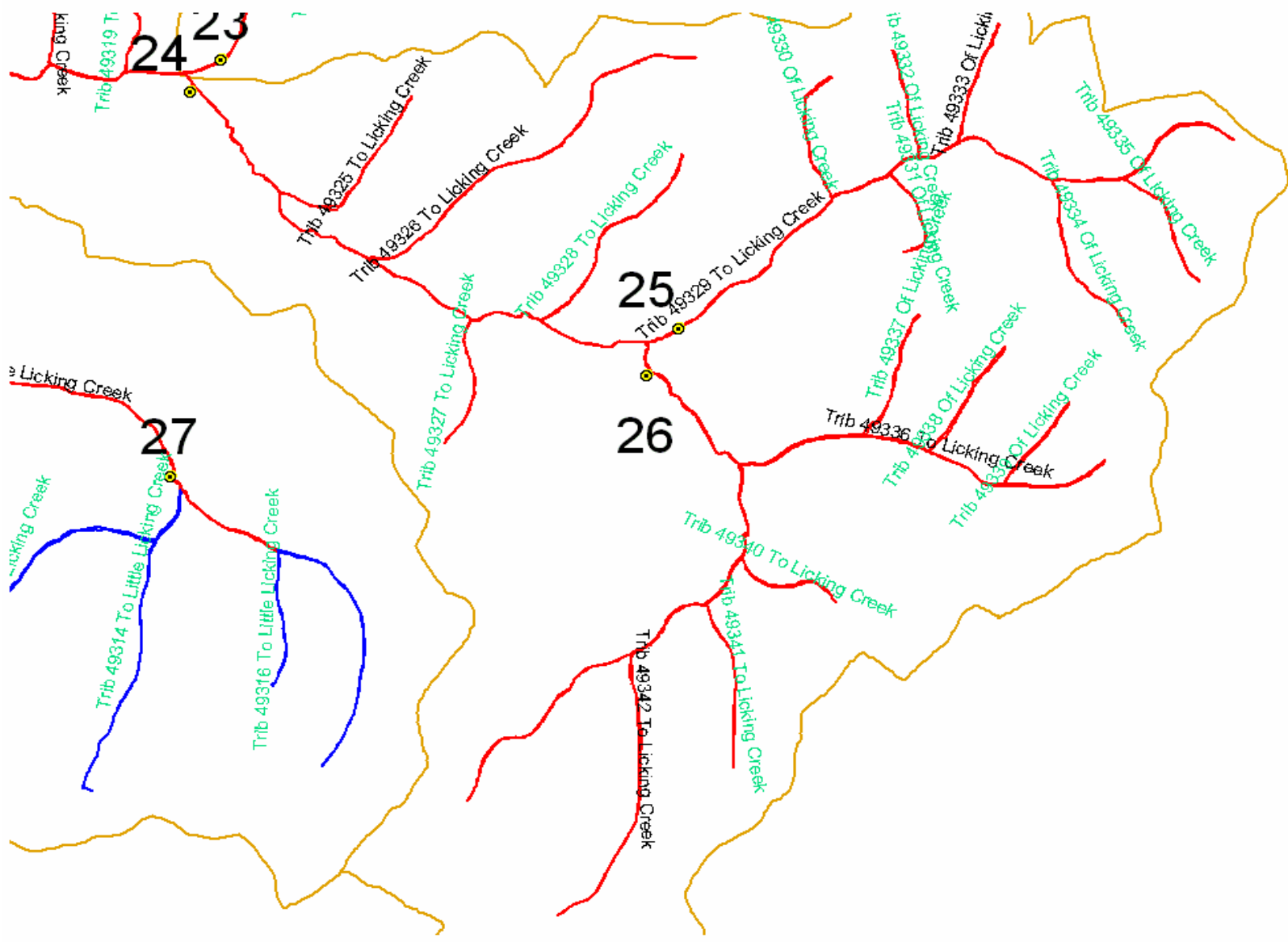
**Mine #225 ATF-1**

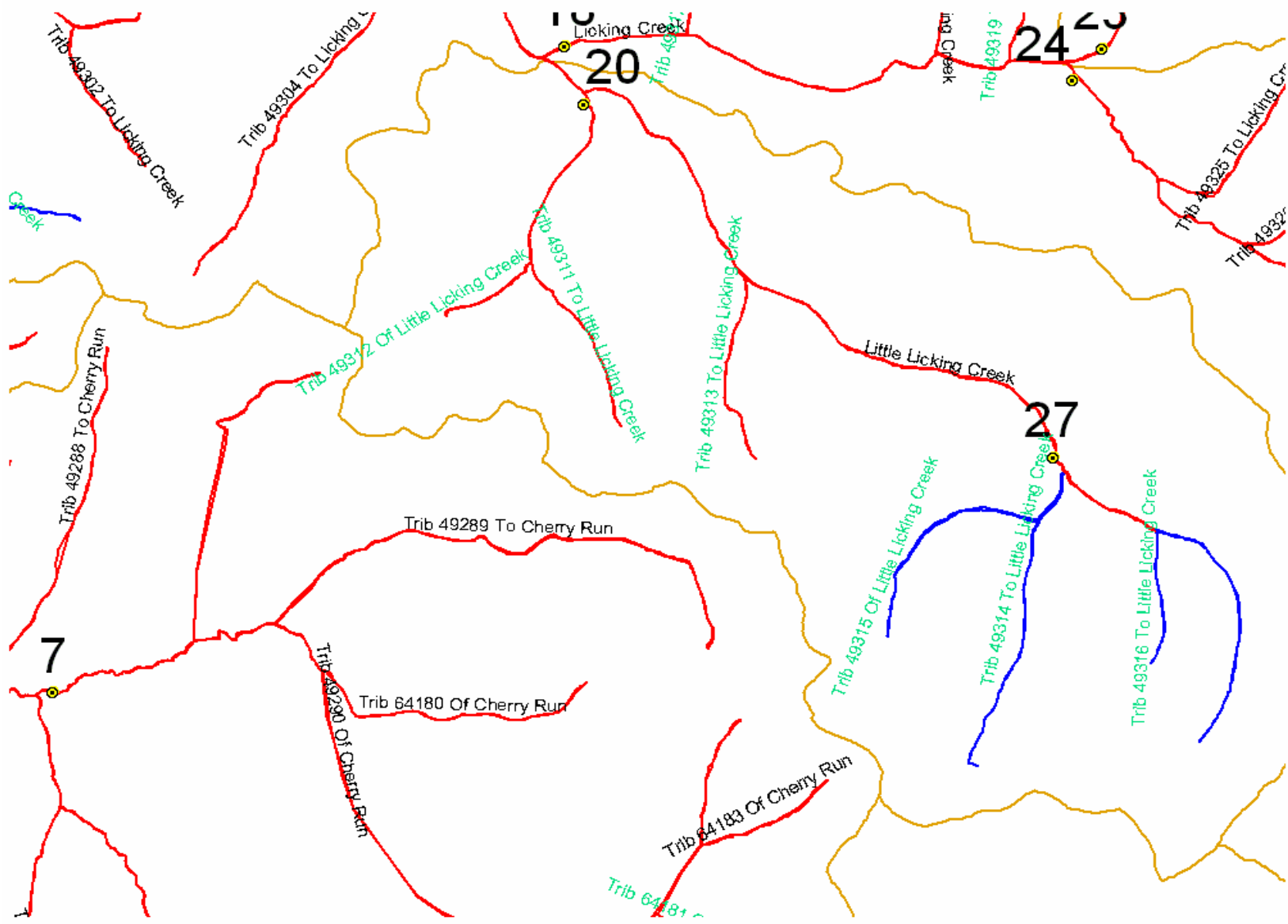
**Mine #230 TF-7**

**Mine #225 TF-2**

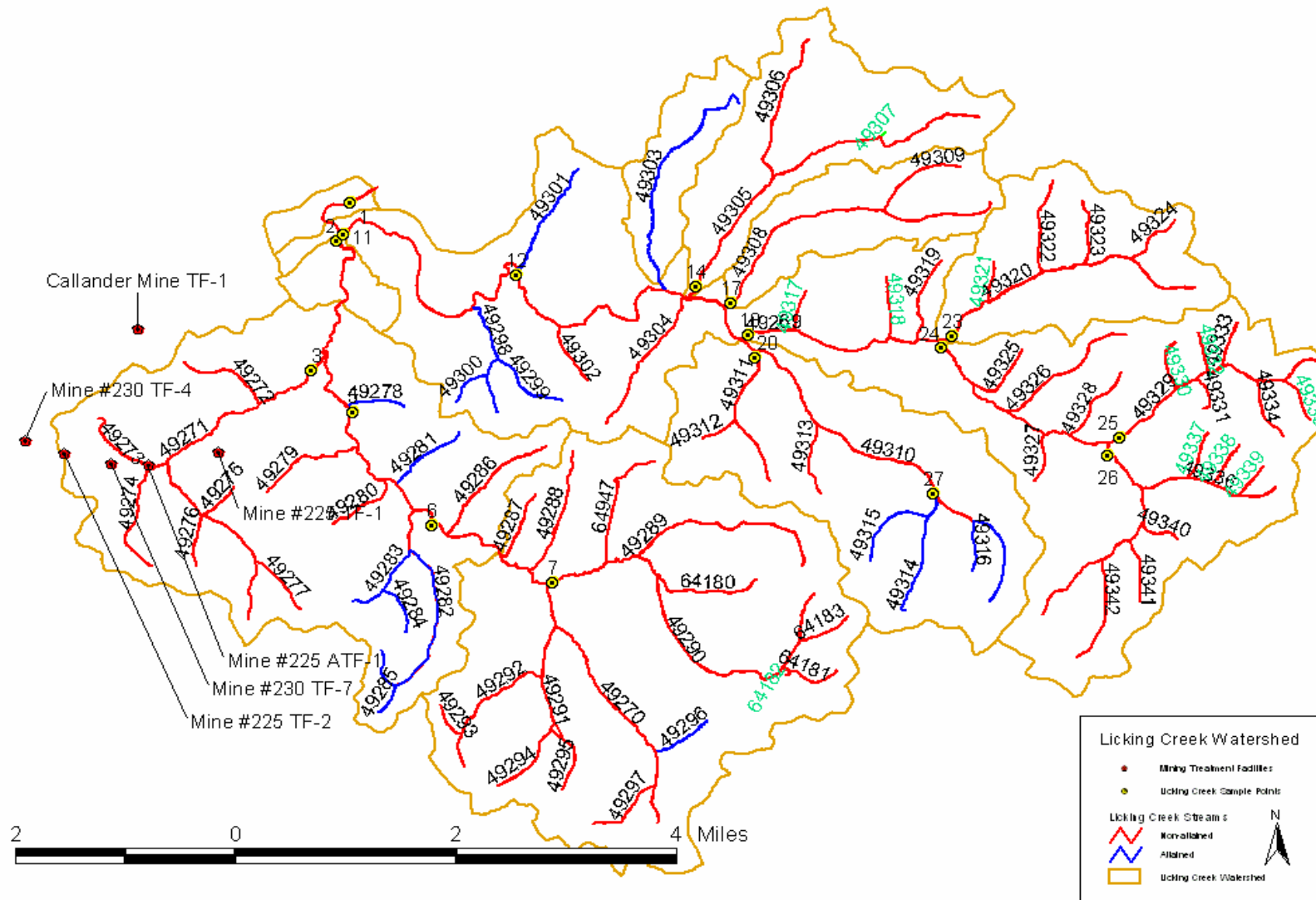












# *Attachment B*

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

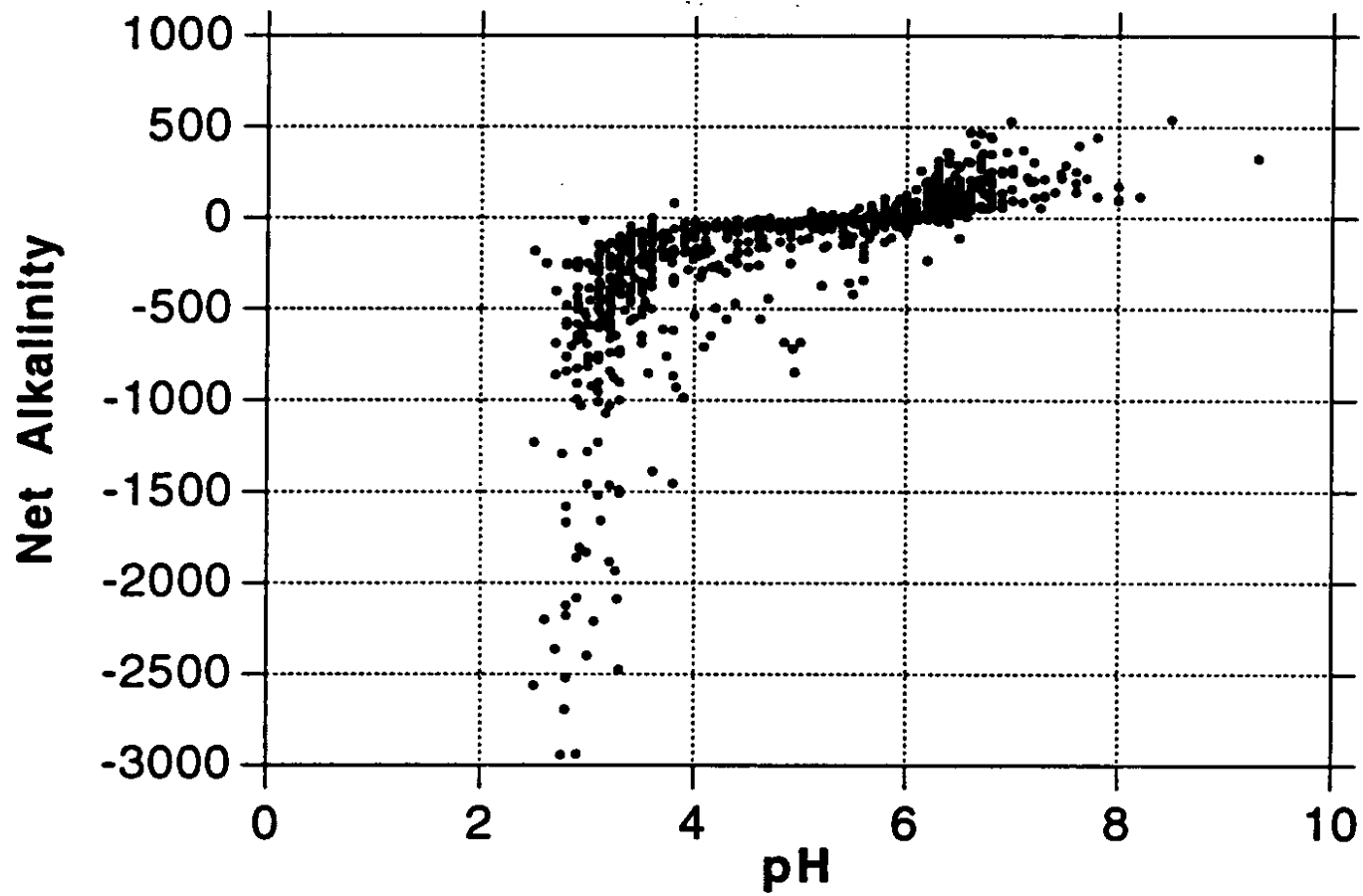
# Method for Addressing 303(d) Listings for pH

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)  $\text{CaCO}_3$ . The same statistical procedures that have been described for use in the evaluation of the metals is applied, using the average value for total alkalinity at that point as the target to specify a reduction in the acid concentration. By maintaining a net alkaline stream, the pH value will be in the range between six and eight. This method negates the need to specifically compute the pH value, which for mine waters is not a true reflection of acidity. This method assures that Pennsylvania's standard for pH is met when the acid concentration reduction is met.

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



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

# *Attachment C*

## **TMDLs By Segment**

## **Licking Creek**

The TMDL for Licking Creek consists of load allocations for seventeen sampling sites along Licking Creek, Cherry Run, Anderson Run and various unnamed tributaries.

Licking Creek is listed for metals and pH from AMD as being the cause of the degradation to the stream. The method and rationale for addressing pH is contained in Attachment B.

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

### **25 N.E. Headwaters Branch of Licking Creek (49329)**

The TMDL for this sample point on Licking Creek consists of a load allocation to the segment upstream. The load allocation for this segment was computed using water-quality sample data collected at point 25. The average flow, measured at the sampling point 25 (0.89 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point 25 shows pH ranging between 6.6 and 7.7, pH will not be addressed in this TMDL because the segment is net alkaline.

Allocations were not calculated for aluminum because WQS were met, a TMDL for aluminum is not necessary. Although a TMDL is not necessary, the measured load is considered at the next downstream point 24.

Parameter	Measured Sample Data		Allowable	
	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Al	0.25	1.9	0.25	1.9
Fe	0.34	2.5	0.32	2.4
Mn	0.58	4.3	0.14	1.0
Acid	0.36	2.7	0.36	2.7
Alk	70.80	523.6		

	Al (lbs/day)	(Fe lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	1.9	2.5	4.3	2.7
Allowable Load = TMDL	1.9	2.4	1.0	2.7
Load Reduction	0.0	0.1	3.3	0.0
% Reduction Segment	0%	6%	76%	0%

### **26 S.E. Headwaters Unt (49336) of Licking Creek**

The TMDL for this sample point on Licking Creek consists of a load allocation to all of the area upstream of sample point 26. The load allocation for this segment was computed using water-quality sample data collected at point 26. The average flow, measured at the sampling point 26 (2.35 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point 26 shows pH ranging between 6.5 and 7.7, pH will not be addressed in this TMDL because the segment is net alkaline.

Allocations were not calculated for aluminum and acidity because WQS were met and there was no acidity present, TMDLs for aluminum and acidity are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point 24.

<b>Table C3. Load Allocations for Point 26</b>				
Parameter	Measured Sample Data		Allowable	
	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Al	0.25	4.9	0.25	4.9
Fe	0.62	12.2	0.50	9.9
Mn	2.57	50.5	0.44	8.6
Acid	0.0	0.0	0.0	0.0
Alk	60.36	1183.2		

<b>Table C4. Calculation of Load Reductions Necessary at Point 26</b>				
	Al (lbs/day)	(Fe lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	4.9	12.2	50.5	0.0
Allowable Load = TMDL	4.9	9.9	8.6	0.0
Load Reduction	0.0	2.3	41.9	0.0
% Reduction Segment	0%	19%	83%	0%

A waste load allocation for future mining was included for this segment of Licking Creek (24) allowing for five operations with two active pits (1500' x 300') to be permitted in the future on this segment (page 15 for the method used to quantify treatment pond load).

<b>Table C5. Waste Load Allocations for future mining operations</b>			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 3			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 4			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 5			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

#### **24 Licking Creek (49269) Upstream of Confluence with Craggs Run**

The TMDL for this sample point on Licking Creek consists of a load allocation to all of the area between sample points 25, 26 and 24. The load allocation for this segment was computed using water-quality sample data collected at point 24. The average flow, measured at the sampling point 24 (4.68 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point 24 shows pH ranging between 6.5 and 7.0, pH will not be addressed in this TMDL because the segment is net alkaline.

Allocations were not calculated for iron, manganese and acidity because WQS were met and there was little acidity present, TMDLs for iron, manganese and acidity are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point 18.

Parameter	Measured Sample Data		Allowable	
	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Al	0.36	14.0	0.27	10.5
Fe	0.40	15.5	0.40	15.5
Mn	0.75	29.5	0.75	29.5
Acid	4.40	171.8	4.40	171.8
Alk	53.53	2090.5		

The calculated load reductions for all the loads that enter point 24 must be accounted for in the calculated reductions at sample point 24 shown in Table C7. A comparison of measured loads between points 25, 26 and 24 shows that there is no additional loading entering the segment for manganese. For manganese and acidity the percent decrease in existing loads are applied to the allowable upstream loads entering the segment. There is additional loading entering the segment for aluminum, iron and acidity. The total segment aluminum, iron and acidity loads are the sum of the upstream allocated loads and any additional loading within the segment.

	Al	Fe	Mn	Acidity
Existing Load	14.0	15.5	29.5	171.8
Difference in Existing Load between 25, 26 & 24	7.3	0.8	-25.3	169.2
Load tracked from 25 & 26	6.8	12.3	9.6	2.7
Percent loss due to instream process	-	-	46	-
Percent load tracked from 25 & 26	-	-	54	-
Total Load tracked from 25 & 26	14.0	13.0	5.2	171.8
Allowable Load at 24	10.5	15.5	29.5	171.8
Load Reduction at 24	3.5	0.0	0.0	0.0
% Reduction required at 24	25	0	0	0

A waste load allocation for future mining was included for this segment of Licking Creek (23) allowing for one operation with two active pits (1500' x 300') to be permitted in the future on this segment (page 15 for the method used to quantify treatment pond load).

Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

### 23 Craggs Run (49320)

The TMDL for this sample point on Craggs Run consists of a load allocation to all of the area upstream of sample point 23. The load allocation for this segment was computed using water-quality sample data collected at point 23. The average flow, measured at the sampling point 23 (1.51 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point 23 shows pH ranging between 6.6 and 7.6; pH will not be addressed in this TMDL. The method and rationale for addressing pH is contained in Attachment B.

Allocations were not calculated for iron and acidity because WQS were met and there was no acidity present, TMDLs for iron and acidity are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point 18.

Parameter	Measured Sample Data		Allowable	
	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Al	0.48	6.0	0.32	4.0
Fe	0.21	2.6	0.21	2.6
Mn	0.65	8.1	0.25	3.2
Acid	0.00	0.0	0.00	0.0
Alk	74.00	931.1		

	Al (lbs/day)	(Fe lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	6.0	2.6	8.1	0.0
Allowable Load = TMDL	4.0	2.6	3.2	0.0
Load Reduction	2.0	0.0	4.9	0.0
% Reduction Segment	34%	0%	61%	0%

A waste load allocation for future mining was included for this segment of Licking Creek (18) allowing for five operations with two active pits (1500' x 300') to be permitted in the future on this segment (page 15 for the method used to quantify treatment pond load).

<b>Table C11. Waste Load Allocations for future mining operations</b>			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 3			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 4			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 5			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

### **18 Licking Creek (49269) Upstream of Confluence with Little Licking Creek**

The TMDL for this unnamed tributary of Licking Creek consists of a load allocation to the watershed area between sample points 24, 23 and 18. The load allocation for this segment was computed using water-quality sample data collected at point 18. The average flow, measured at the sampling point 18 (7.17 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point 18 shows pH ranging between 6.3 and 7.0; pH will not be addressed in this TMDL. The method and rationale for addressing pH is contained in Attachment B.

Parameter	Measured Sample Data		Allowable	
	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.57	34.1	0.17	9.9
Fe	7.00	418.7	0.42	25.1
Mn	4.41	263.7	0.31	18.5
Acid	6.72	401.8	6.72	401.8
Alk	46.72	2793.2		

The calculated load reductions for all the loads that enter point 18 must be accounted for in the calculated reductions at sample point 18 shown in Table C13. A comparison of measured loads between points 24, 23 and 18 shows that there is additional loading entering the segment for aluminum iron, manganese and acidity. The total segment aluminum, iron, manganese and acidity loads are the sum of the upstream allocated loads and any additional loading within the segment.

	Al	Fe	Mn	Acidity
Existing Load	34.1	418.7	263.7	401.8
Difference in Existing Load between 24, 23 & 18	14.1	400.5	226.0	229.9
Load tracked from 24 & 23	14.5	18.2	32.6	171.8
Percent loss due to instream process	-	-	-	-
Percent load tracked from 24 & 23	-	-	-	-
Total Load tracked from 24 & 23	28.6	418.7	258.7	401.8
Allowable Load at 18	9.9	25.1	18.5	401.8
Load Reduction at 18	18.7	393.6	240.2	0.0
% Reduction required at 18	65	94	93	0

### **27 Headwaters of Little Licking Creek (49310)**

The TMDL for sampling point 27 consists of a load allocation to the area upstream of point 27. The load allocation for this tributary was computed using water-quality sample data collected at point 27. The average flow, measured at the sampling point 27 (0.82 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point 27 shows pH ranging between 6.9 and 7.9; pH will not be addressed in this TMDL. The method and rationale for addressing pH is contained in Attachment B.

Allocations were not calculated for aluminum and acidity because WQS were met and there was not acidity present, TMDLs for aluminum and acidity are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point 12.

Parameter	Measured Sample Data		Allowable	
	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.25	1.7	0.25	1.7
Fe	0.63	4.3	0.60	4.1
Mn	1.15	7.9	0.32	2.2
Acid	0.00	0.0	0.00	0.7
Alk	108.6	743.4		

	Al	Fe	Mn	Acidity
	(#/day)	(#/day)	(#/day)	(#/day)
Existing Load	1.7	4.3	7.6	0.0
Allowable Load=TMDL	1.7	4.1	2.2	0.0
Load Reduction	0.0	0.2	5.4	0.0
Total % Reduction	0	4	72	0

### **20 Unt (49311) to Little Licking Creek**

The TMDL for sampling point 20 consists of a load allocation to all of the area upstream of point 20. The load allocation for this tributary was computed using water-quality sample data collected at point 20. The average flow, measured at the sampling point 20 (0.43 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point 20 shows pH ranging between 6.7 and 7.8, pH will not be addressed in this TMDL because of this segment is net alkaline. The method and rationale for addressing pH is contained in Attachment B.

Allocations were not calculated for aluminum and acidity because WQS were met and there was no acidity present, TMDLs for aluminum and acidity are not necessary. Although TMDLs are not necessary, the measured load is considered at the next downstream point 12.

Parameter	Measured Sample Data		Allowable	
	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.25	0.9	0.25	0.9
Fe	1.57	5.6	0.63	2.3
Mn	2.81	10.1	0.59	2.1
Acid	0.00	0.0	0.0	0.0
Alk	93.20	333.3		

	Al	Fe	Mn	Acidity
	(#/day)	(#/day)	(#/day)	(#/day)
Existing Load	0.9	5.6	10.1	0.0
Allowable Load=TMDL	0.9	2.3	2.1	0.0
Load Reduction	0.0	3.3	8.0	0.0
Total % Reduction	0	60	79	0

A waste load allocation for future mining was included for this segment of Licking Creek (17) allowing for four operations with two active pits (1500' x 300') to be permitted in the future on this segment (page 15 for the method used to quantify treatment pond load).

<b>Table C18. Waste Load Allocations for future mining operations</b>			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 3			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 4			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

### **17 Mouth of Mineral Run (49308)**

The TMDL for sampling point 17 consists of a load allocation to the all of the area upstream of point 17. The load allocation for this tributary was computed using water-quality sample data collected at point 17. The average flow, measured at the sampling point 17 (1.48 MGD), is used for these computations.

There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point 17 shows pH ranging between 3.4 and 3.9; pH will be addressed in this TMDL because of the mining inpairment. The method and rationale for addressing pH is contained in Attachment B.

<b>Table C19. Load Allocations at Point 17</b>				
Parameter	Measured Sample Data		Allowable	
	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	3.97	49.1	0.36	4.4
Fe	26.00	321.3	0.76	9.6
Mn	17.37	214.6	0.69	8.6
Acid	115.7	1429.8	0.00	0.0
Alk	0.12	1.48		

<b>Table C20. Calculation of Load Reduction Necessary at Point 17</b>				
	Al	Fe	Mn	Acidity
	(#/day)	(#/day)	(#/day)	(#/day)
Existing Load	49.1	321.3	214.6	1429.8
Allowable Load=TMDL	4.4	9.6	8.6	0.0
Load Reduction	44.7	311.7	206.0	1429.8
Total % Reduction	91	97	96	100

A waste load allocation for future mining was included for this segment of Licking Creek (14) allowing for five operations with two active pits (1500' x 300') to be permitted in the future on this segment (page 15 for the method used to quantify treatment pond load).

<b>Table C21. Waste Load Allocations for future mining operations</b>			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 3			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 4			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 5			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

**14 Mouth of Anderson Run (49308)**

The TMDL for this segment of Scrubgrass Creek consists of a load allocation to the area upstream of sample point 14. The load allocation for this segment was computed using water-quality sample data collected at point 14. The average flow, measured at the sampling point 14 (2.21 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point 14 shows pH ranging between 4.3 and 5.4; pH will be addressed in this TMDL because of the mining impacts. The method and rationale for addressing pH is contained in Attachment B.

Parameter	Measured Sample Data		Allowable	
	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	4.34	79.9	0.35	6.4
Fe	29.76	547.7	0.89	16.4
Mn	20.76	382.2	0.62	11.5
Acid	120.52	2218.3	6.03	110.9
Alk	8.68	159.8		

	Al	Fe	Mn	Acidity
	(#/day)	(#/day)	(#/day)	(#/day)
Existing Load	79.9	547.7	382.2	2218.3
Allowable Load=TMDL	6.4	16.4	11.5	110.9
Load Reduction	73.5	531.3	370.7	2107.4
Total % Reduction	92	97	97	95

A waste load allocation for future mining was included for this segment of Licking Creek (12) allowing for five operations with two active pits (1500' x 300') to be permitted in the future on this segment (page 15 for the method used to quantify treatment pond load).

<b>Table C24. Waste Load Allocations for future mining operations</b>			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 3			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 4			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 5			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

**12 Licking Creek Upstream of Confluence with Unt (49301)**

The TMDL for this portion of Licking Creek consists of a load allocation to the all of the area between sample points 18, 27, 20, 17, 14, and 12. The load allocation for this segment was computed using water-quality sample data collected at point 12. The average flow, measured at the sampling point 12 (14.67 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point 12 shows pH ranging between 6.2 and 6.8, pH will not be addressed in this TMDL because this segment is net alkaline. The method and rationale for addressing pH is contained in Attachment B.

Parameter	Measured Sample Data		Allowable	
	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	1.10	135.1	0.24	29.7
Fe	8.14	995.7	0.98	119.5
Mn	8.27	1012.0	0.50	60.7
Acid	15.00	1835.7	7.20	881.1
Alk	31.08	3803.6		

The calculated load reductions for all the loads that enter point12 must be accounted for in the calculated reductions at sample point 12 shown in Table C26. A comparison of measured loads between points 18, 27, 20, 17, 14 and 12 shows that there is no additional loading entering the segment for aluminum, iron, manganese and acidity. For aluminum, iron, manganese and acidity the percent decrease in existing loads are applied to the allowable upstream loads entering the segment.

	Al	Fe	Mn	Acidity
Existing Load	135.1	995.7	1012.0	1835.7
Difference in Existing Load between 18, 27, 20, 17, 14 & 12	-30.6	-301.9	133.7	-2214.1
Load tracked from 18, 27, 20, 17, & 14	23.3	57.6	42.8	512.7
Percent loss due to instream process	18	23	-	55
Percent load tracked from 18, 27, 20, 17, & 14	82	77	-	45
Total Load tracked from 18, 27, 20, 17, & 14	19.0	44.2	176.5	232.4
Allowable Load at 12	29.7	119.5	60.7	881.1
Load Reduction at 12	0.0	0.0	115.8	0.0
% Reduction required at 12	0	0	66	0

A waste load allocation for future mining was included for this segment of Licking Creek (11) allowing for five operations with two active pits (1500' x 300') to be permitted in the future on this segment (page 15 for the method used to quantify treatment pond load).

<b>Table C27. Waste Load Allocations for future mining operations</b>			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 3			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 4			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 5			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

### **11 Licking Creek Upstream of Confluence with Cherry Run (49270)**

The TMDL for this segment of Licking Creek consists of a load allocation to the area between sample points 12 & 11. The load allocation for this segment was computed using water-quality sample data collected at point 11. The average flow, measured at the sampling point 11 (19.13 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point 11 shows pH ranging between 6.8 and 8.0, pH will not be addressed in this TMDL because this segment is net alkaline. The method and rationale for addressing pH is contained in Attachment B.

Parameter	Measured Sample Data		Allowable	
	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.96	152.4	0.15	24.4
Fe	3.96	631.7	0.55	88.4
Mn	6.33	1009.7	0.51	80.8
Acid	6.16	982.6	6.16	982.6
Alk	41.80	6667.4		

The calculated load reductions for all the loads that enter point11 must be accounted for in the calculated reductions at sample point 11 shown in Table C29. A comparison of measured loads between points 12 and 11 shows that there is no additional loading entering the segment for iron, manganese and acidity. For iron manganese and acidity the percent decrease in existing loads are applied to the allowable upstream loads entering the segment. There is additional loading entering the segment for aluminum. The total segment aluminum loads are the sum of the upstream allocated loads and any additional loading within the segment.

	Al	Fe	Mn	Acidity
Existing Load	152.4	631.7	1009.7	982.6
Difference in Existing Load between 12 & 11	17.3	-364.1	-2.3	-853.1
Load tracked from 12	29.7	119.5	60.7	887.1
Percent loss due to instream process	-	37	0.23	46
Percent load tracked from 12	-	63	99.77	54
Total Load tracked from 12	47.0	75.8	60.6	471.6
Allowable Load at 11	24.4	88.4	80.8	982.6
Load Reduction at 11	22.6	0.0	0.0	0.0
% Reduction required at 11	48	0	0	0

### **7 Unt (49289) Cherry Run Upstream of Confluence with Cherry Run**

The TMDL for this segment of a Unt to Cherry Run consists of a load allocation to the area upstream of sample point 7. The load allocation for this segment was computed using water-quality sample data collected at point 7. The average flow, measured at the sampling point 7 (3.91 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point 7 shows pH ranging between 6.9 and 8.0, pH will not be addressed in this TMDL because this segment is net alkaline. The method and rationale for addressing pH is contained in Attachment B.

Allocations were not calculated for aluminum and acidity because WQS were met and there was no acidity present, TMDLs for aluminum and acidity are not necessary. Although TMDLs are not necessary, the measured load is considered at the next downstream point 6.

Parameter	Measured Sample Data		Allowable	
	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.25	8.2	0.25	8.2
Fe	4.36	142.0	0.61	19.9
Mn	2.92	92.3	0.70	22.9
Acid	0.00	0.0	0.00	0.0
Alk	98.40	3207.7		

	Al (#/day)	Fe (#/day)	Mn (#/day)	Acidity (#/day)
Existing Load	8.2	142.0	92.3	0.0
Allowable Load=TMDL	8.2	19.9	22.9	0.0
Load Reduction	0.0	122.1	69.4	0.0
Total % Reduction	0	86	76	0

### **6 Cherry Run (49270)**

The TMDL for this unnamed tributary of Licking Creek consists of a load allocation to all of the watershed area upstream of sample point 6. The load allocation for this segment was computed using water-quality sample data collected at point 6. The average flow, measured at the sampling point 6 (8.74 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point 6 shows pH ranging between 7.9 and 8.2, pH will not be addressed in this TMDL because this segment is net alkaline. The method and rationale for addressing pH is contained in Attachment B.

Allocations were not calculated for aluminum and acidity because WQS were met and there was no acidity present. Because WQS were met, TMDLs for aluminum and acidity are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point 2.

Parameter	Measured Sample Data		Allowable	
	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.25	18.2	0.25	18.2
Fe	1.20	87.4	0.32	23.6
Mn	1.77	128.6	0.53	38.6
Acid	0.00	0.0	0.0	0.0
Alk	204.56	14904.2		

The calculated load reductions for all the loads that enter point 6 must be accounted for in the calculated reductions at sample point 6 shown in Table C33. A comparison of measured loads between points 7 and 6 shows that there is no additional loading entering the segment for iron. For iron, the percent decrease in existing load is applied to the allowable upstream load entering the segment. There is additional loading entering the segment for aluminum, manganese and acidity. The total segment aluminum, manganese and acidity loads are the sum of the upstream allocated loads and any additional loading within the segment.

	Al	Fe	Mn	Acidity
Existing Load	18.2	87.4	128.6	0.0
Difference in Existing Load between 7 & 6	10.1	-54.7	33.4	0.0
Load tracked from 7	8.2	19.9	22.9	0.0
Percent loss due to instream process	-	38	-	-
Percent load tracked from 7	-	62	-	-
Total Load tracked from 7	18.2	12.2	56.2	0.0
Allowable Load at 6	18.2	23.6	38.6	0.0
Load Reduction at 6	0.0	0.0	17.6	0.0
% Reduction required at 6	0	0	31	0

### **5 Cherry Run (49270) Upstream of Confluence with Unt (49278)**

The TMDL for this segment of Cherry Run consists of a load allocation to the area between sample points 6 and 5. The load allocation for this segment was computed using water-quality sample data collected at point 5. The average flow, measured at the sampling point 5 (11.12 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point 5 shows pH ranging between 8.0 and 8.2, pH will not be addressed in this TMDL because this segment is net alkaline. The method and rationale for addressing pH is contained in Attachment B.

Allocations were not calculated for aluminum and acidity because WQS were met and there was no acidity present. Because WQS were met, TMDLs for aluminum and acidity are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point 2.

Parameter	Measured Sample Data		Allowable	
	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.25	23.2	0.25	23.2
Fe	0.60	55.2	0.30	28.2
Mn	1.13	104.7	0.38	35.6
Acid	0.00	0.0	0.00	0.0
Alk	171.84	15942.7		

The calculated load reductions for all the loads that enter point 6 must be accounted for in the calculated reductions at sample point 6 shown in Table C33. A comparison of measured loads between points 7 and 6 shows that there is no additional loading entering the segment for iron and manganese. For iron and manganese the percent decrease in existing loads are applied to the allowable upstream loads entering the segment. There is additional loading entering the segment for aluminum and acidity. The total segment aluminum and acidity loads are the sum of the upstream allocated loads and any additional loading within the segment.

	Al	Fe	Mn	Acidity
Existing Load	23.2	55.2	104.7	0.0
Difference in Existing Load between 6 & 5	5.0	-32.1	-23.9	0.0
Load tracked from 6	18.2	23.6	38.6	0.0
Percent loss due to instream process	-	37	19	-
Percent load tracked from 6	-	63	81	-
Total Load tracked from 6	23.2	14.9	31.4	0.0
Allowable Load at 5	23.2	28.2	35.6	0.0
Load Reduction at 5	0.0	0.0	0.0	0.0
% Reduction required at 5	0	0	0	0

**Waste Load Allocations– Permitted Discharges**

The RFI Energy, Inc., Mine #225 (permit SMP 16940107), has two permitted treatment ponds, TF-4 and TF-7, that discharges to Unt (49271) of Cherry Run. The waste load allocation for the discharge is calculated with average monthly permit limits and average flow, which is estimated with permitted pit areas and average rainfall. There are two permitted pits in the permit with a total combined pit area of 900,000 square feet.

**Table 36. Waste Load Allocation of Permitted Discharges**

Parameter	Allowable Average Monthly Conc. (mg/l)	Calculated Average Flow (MGD)	WLA (lbs/day)
<b>RFI Energy, Inc., Mine #225 (SMP#16940107)</b>			
<b>TF1</b>			
Al	0.75	0.09	0.56
Fe	3.0	0.09	2.23
Mn	2.0	0.09	1.49
<b>TF2</b>			
Al	0.75	0.09	0.56
Fe	3.0	0.09	2.23
Mn	2.0	0.09	1.49
<b>ATF1</b>			
Al	0.75	0.09	0.56
Fe	3.0	0.09	2.23
Mn	2.0	0.09	1.49

The RFI Energy, Inc., Mine #230 (permit SMP 16920107), has three permitted treatment ponds, TF1, TF2 and ATF1, that discharges to Unt (49271) of Cherry Run. The waste load allocation for the discharge is calculated with average monthly permit limits and average flow, which is estimated with permitted pit areas and average rainfall. There are two permitted pits in the permit with a total combined pit area of 270,000 square feet.

**Table 37. Waste Load Allocation of Permitted Discharges**

Parameter	Allowable Average Monthly Conc. (mg/l)	Calculated Average Flow (MGD)	WLA (lbs/day)
<b>RFI Energy, Mine # 230 (SMP#16920107)</b>			
<b>TF-4</b>			
Al	0.75	0.37	2.3
Fe	3.0	0.37	9.3
Mn	2.0	0.37	6.2
<b>TF-7</b>			
Al	0.75	0.37	2.3
Fe	3.0	0.37	9.3
Mn	2.0	0.37	6.2

**3 Unt (49271) to Cherry Run**

The TMDL for sampling point 3 consists of a load allocation to segment upstream of the sample point. The load allocation for this tributary was computed using water-quality sample data collected at point 3. The average flow, measured at the sampling point 3 (3.10 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point 3 shows pH ranging between 8.0 and 8.2, pH will not be addressed in this TMDL because this segment is net alkaline. The method and rationale for addressing pH is contained in Attachment B.

Allocations were not calculated for aluminum, iron, manganese and acidity because WQS were met and there was no acidity present, TMDLs for aluminum, iron, manganese and acidity are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point 2.

Waste load allocations for the existing mining operations were incorporated into the calculations at sample point 3. This is the first downstream monitoring point that receives all the potential flow of treated water from the two treatment sites RFI Energy, Inc., Mine #225 (SMP#16940107) and RFI Energy, Mine # 230 (SMP#16920107). No required reductions of these permits are necessary at this time because there are upstream non-point sources that when reduced will meet the TMDL or there is available assimilation capacity.

The load allocations (LA) at sample point 3 are less than the total waste load allocations (WLA) for each of the metals. The treatment systems are effective as shown by the metals concentrations well under criteria at sample point 3. This is evidence that there is enough assimilation capacity at sample point 3 to accommodate the RFI Energy, Inc., Mine #225 and RFI Energy, Mine # 230 discharges. The assimilative load is the water quality standard times the

flow and a conversion factor at the sample point. For sample point 3 this equals 19.39 lbs/day for aluminum, 38.78 lbs/day for iron and 25.85 lbs/day for manganese. The total WLAs for aluminum of 6.28 lbs/day, iron of 25.29 lbs/day and manganese of 15.38 lbs/day for the above segment is acceptable and does not have a negative impact on water quality within the segment.

Parameter	Measured Sample Data		Allowable	
	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.25	6.5	0.25	6.5
Fe	0.15	3.9	0.15	3.9
Mn	0.26	6.6	0.26	6.6
Acid	0.00	0.0	0.0	0.0
Alk	130.33	3367.9		

	Al	Fe	Mn	Acidity
	(#/day)	(#/day)	(#/day)	(#/day)
Existing Load	6.5	3.9	6.6	0.0
Allowable Load=TMDL	6.5	3.9	6.6	0.0
Load Reduction	0.0	0.0	0.0	0.0
Total % Reduction	0	0	0	0

## 2 Mouth of Cherry Run

The TMDL for this segment of Cherry Run consists of a load allocation to all of the watershed area between sample points 2 and 3. The load allocation for this segment was computed using water-quality sample data collected at point 2. The average flow, measured at the sampling point 2 (15.57 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point 2 shows pH ranging between 8.1 and 8.3, pH not be addressed in this TMDL because this segment is net alkaline. The method and rationale for addressing pH is contained in Attachment B.

Allocations were not calculated for aluminum, iron and acidity because WQS were met and there was no acidity present, TMDLs for aluminum, iron and acidity are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point 1.

Parameter	Measured Sample Data		Allowable	
	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.25	32.5	0.25	32.5
Fe	0.30	39.1	0.30	39.1
Mn	0.73	94.9	0.28	36.1
Acid	0.00	0.0	0.00	0.0
Alk	154.8	20097.7		

The calculated load reductions for all the loads that enter point 2 must be accounted for in the calculated reductions at sample point 2 shown in Table C39. A comparison of measured loads between points 5, 3 and 2 shows that there is no additional loading entering the segment for iron and manganese. For iron and manganese the percent decrease in existing loads are applied to the allowable upstream loads entering the segment. There is additional loading entering the segment for aluminum. The total segment aluminum load is the sum of the upstream allocated load and any additional loading within the segment.

	Al	Fe	Mn	Acidity
Existing Load	32.5	39.1	94.9	0.0
Difference in Existing Load between 5, 3 & 2	2.8	-20.0	-16.4	0.0
Load tracked from 5 & 3	29.7	32.0	42.2	0.0
Percent loss due to instream process	-	34	15	-
Percent load tracked from 5 & 3	-	66	85	-
Total Load tracked from 5 & 3	32.5	21.2	36.0	0.00
Allowable Load at 2	32.5	39.1	36.1	0.00
Load Reduction at 2	0.0	0.0	0.0	0.0
% Reduction required at 2	0	0	0	0.0

A waste load allocation for future mining was included for this segment of Licking Creek (1) allowing for five operations with two active pits (1500' x 300') to be permitted in the future on this segment (page 15 for the method used to quantify treatment pond load).

<b>Table C42. Waste Load Allocations for future mining operations</b>			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 3			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Mn	2.0	0.090	1.50
Future Operation 4			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 5			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Mn	2.0	0.090	1.50

### **1 Mouth of Licking Creek**

The TMDL for this segment of Licking Creek consists of a load allocation to all of the watershed area between sample points 11, 2 and 1. The load allocation for this segment was computed using water-quality sample data collected at point 1. The average flow, measured at the sampling point 1 (35.44 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point 7 shows pH ranging between 7.4 and 8.1, pH not be addressed in this TMDL because this segment is net alkaline. The method and rationale for addressing pH is contained in Attachment B.

Parameter	Measured Sample Data		Allowable	
	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.42	124.8	0.16	48.7
Fe	2.19	645.9	0.50	148.6
Mn	3.71	1095.7	0.56	164.4
Acid	0.00	0.0	0.0	0.0
Alk	92.44	27319.4		

The calculated load reductions for all the loads that enter point 1 must be accounted for in the calculated reductions at sample point 1 shown in Table C42. A comparison of measured loads between points 11, 2 and 1 shows that there is no additional loading entering the segment for aluminum, iron and manganese. For aluminum, iron and manganese the percent decrease in existing loads are applied to the allowable upstream loads entering the segment.

	Al	Fe	Mn	Acidity
Existing Load	124.8	645.9	1095.7	0.0
Difference in Existing Load between 11, 2 & 1	-60.1	-24.9	-9.0	0.0
Load tracked from 11 & 2	56.8	127.6	116.8	0.0
Percent loss due to instream process	33	4	1	-
Percent load tracked from 11 & 2	67	96	99	-
Total Load tracked from 11 & 2	37.4	122.9	115.9	0.00
Allowable Load at 1	48.7	148.6	164.4	0.00
Load Reduction at 1	0.0	0.0	0.0	0.0
% Reduction required at 1	0	0	0	0.0

### Margin of Safety (MOS)

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

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

would be less variable than an uncontrolled system. This implicitly builds in a margin of safety.

- A MOS is added when 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 represent all seasons.

### **Critical Conditions**

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

# *Attachment D*

**Excerpts Justifying Changes Between the 1996, 1998, and 2002  
Section 303(d) Lists and Integrated Report/List (2004, 2006)**

*The following are excerpts from the Pennsylvania DEP Section 303(d) narratives that justify changes in listings between the 1996, 1998, 2002, 2004 and 2006 303(d) Lists and Integrated Report/List (2006). The Section 303(d) listing process has undergone an evolution in Pennsylvania since the development of the 1996 list.*

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

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

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

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

#### Migration to National Hydrography Data (NHD)

New to the 2006 report is use of the 1/24,000 National Hydrography Data (NHD) streams GIS layer. Up until 2006 the Department relied upon its own internally developed stream layer. Subsequently, the United States Geologic Survey (USGS) developed 1/24,000 NHD streams layer for the Commonwealth based upon national geodatabase standards. In 2005, DEP contracted with USGS to add missing streams and correct any errors in the NHD. A GIS contractor transferred the old DEP stream assessment information to the improved NHD and the old DEP streams layer was archived. Overall, this marked an improvement in the quality of the streams layer and made the stream assessment data compatible with national standards but it necessitated a change in the Integrated Listing format. The NHD is not attributed with the old DEP five digit stream codes so segments can no longer be listed by stream code but rather only by stream name or a fixed combination of NHD fields known as reachcode and ComID. The NHD is aggregated by Hydrologic Unit Code (HUC) watersheds so HUCs rather than the old State Water Plan (SWP) watersheds are now used to group streams together. The map in

Appendix E illustrates the relationship between the old SWP and new HUC watershed delineations. A more basic change was the shift in data management philosophy from one of “dynamic segmentation” to “fixed segments”. The dynamic segmentation records were proving too difficult to manage from an historical tracking perspective. The fixed segment methods will remedy that problem. The stream assessment data management has gone through many changes over the years as system requirements and software changed. It is hoped that with the shift to the NHD and OIT’s (Office of Information Technology) fulltime staff to manage and maintain SLIMS the systems and formats will now remain stable over many Integrated Listing cycles.

***Attachment E***  
**Water Quality Data Used In TMDL Calculations**

25 N.E. HW BRANCH OF LICKING CREEK @ T682 CROSSING

Coll ID Seq	Date Collected	Initial Flow	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4251 503	9/9/2005	57	57	7.7	177.6	0	0.902	2.23	0.25
4251 666	2/7/2006	925	925	6.7	33.4	1.8	0.15	0.126	0.25
4251 811	5/23/2006	815	815	6.6	40.4	0	0.352	0.244	0.25
4251 939	8/10/2006	211	211	7.6	59	0	0.15	0.11	0.25
4251 060	11/15/2006	1071	1071	7.5	43.6	0	0.15	0.166	0.25
	avg=		615.8	7.22	70.8	0.36	0.34	0.58	0.25
	stdev=					0.80	0.33	0.93	0.00

26 S.E. HW BRANCH OF LICKING CREEK

Coll ID Seq	Date Collected	Initial Flow	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4251 502	9/9/2005	246	246	7.4	102.6	0	0.15	4	0.25
4251 665	2/7/2006	2233	2233	6.6	37.8	0	0.86	1.45	0.25
4251 810	5/23/2006	1288	1288	6.5	47.2	0	0.585	1.68	0.25
4251 938	8/10/2006	969	969	7.7	71.4	0	0.456	3.173	0.25
4251 059	11/15/2006	3425	3425	7.3	42.8	0	1.062	2.568	0.25
	avg=		1632.2	7.1	60.36	0	0.62	2.57	0.25
	stdev=					0	0.35	1.06	0

24 LITTLE LICKING CREEK ABOVE CONFLUENCE W/CRAGGS RUN

Coll ID Seq	Date Collected	Initial Flow	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4251 501	9/9/2005	423	423	7	82.2	0	0.5	0.704	0.25
4251 664	2/7/2006	5769	5769	6.6	35.6	13.2	0.15	0.732	0.25
4251 808	5/23/2006	3563	3563	6.5	42.8	0	0.542	0.827	0.577
avg=		3251.7		6.7	53.53	4.4	0.40	0.75	0.36
stdev=						7.62	0.22	0.06	0.19

23 CRAGGS RUN @ RT 854 BRIDGE

Coll ID Seq	Date Collected	Initial Flow	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4251 500	9/9/2005	222	222	7.6	131.6	0	0.15	0.06	0.25
4251 663	2/7/2006	1337	1337	6.7	39.8	0	0.15	0.914	0.64
4251 809	5/26/2006	1584	1584	6.6	50.6	0	0.328	0.967	0.551
avg=		1047.7		6.97	74.00	0	0.21	0.65	0.48
stdev=						0	0.10	0.51	0.20

18 LICKING CREEK ABOVE CONFLUENCE W/LITTLE LICKING CREEK

Coll ID Seq	Date Collected	Initial Flow	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4251 498	9/9/2005	1192	1192	6.5	60.8	6	15.7	9.01	0.668
4251 661	2/2/2006	7289	7289	6.7	37.6	14.8	4.493	2.916	0.25
4251 806	5/23/2006	6668	6668	6.3	39.2	12.8	3.46	2.23	0.25
4251 936	8/10/2006	3411	3411	7	50.6	0	6.33	3.992	0.25
4251 057	11/15/2006	6331	6331	6.9	45.4	0	5.031	3.901	1.437
avg=		4978.2		6.68	46.72	6.72	7.00	4.41	0.57
stdev=						6.95	4.97	2.67	0.52

27 HW OF LITTLE LICKING CREEK @ SR2011  
CROSSING

Coll ID Seq	Date Collected	Initial Flow	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4251 504	9/9/2005	102	102	7.4	92.8	0	0.15	0.081	0.25
4251 668	2/8/2006	931	931	6.9	86.2	0	0.69	1.12	0.25
4251 812	5/23/2006	618	618	7	107.2	0	0.604	1.06	0.25
4251 940	8/10/2006	323	323	7.9	148.8	0	0.855	1.784	0.25
4251 061	11/15/2006	875	875	7.6	108.2	0	0.839	1.709	0.25
avg=		569.8		7.36	108.64	0	0.63	1.15	0.25
stdev=						0	0.29	0.68	0

20 UNT 49311 TO LITTLE LICKING CREEK

Coll ID Seq	Date Collected	Initial Flow	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4251 499	9/9/2005	44	44	7.4	100	0	0.674	2.12	0.25
4251 662	2/7/2006	474	474	7.2	93	0	2.25	2.23	0.25
4251 807	5/23/2006	320	320	6.7	73.2	0	1.79	3.19	0.25
4251 937	8/10/2006	283	283	7.8	101.4	0	1.078	2.77	0.25
4251 058	11/15/2006	368	368	7.6	98.4	0	2.061	3.762	0.25
avg=		297.8		7.34	93.2	0	1.57	2.81	0.25
stdev=						0	0.67	0.68	0

17 MINERAL RUN @ RT 58 BRIDGE

Coll ID Seq	Date Collected	Initial Flow	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4251 497	9/7/2005	318	318	3.4	0	138.4	34.7	21.1	2.83
4251 660	2/2/2006	1276	1276	3.9	0	97.6	30.46	15.76	3.853
4251 805	5/23/2006	928	928	3.9	0.6	111.2	23.3	12.9	2.94
4251 935	8/10/2006	1120	1120	3.4	0	121.4	20.84	17.55	4.178
4251 056	11/15/2006	1502	1502	3.4	0	110	20.71	19.52	6.068
avg=		1028.8		3.6	0.12	115.72	26.00	17.37	3.97
stdev=						15.23	6.27	3.21	1.31

14 ANDERSON RUN @ RT 58 BRIDGE

Coll ID Seq	Date Collected	Initial Flow	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4251 496	9/7/2005	772	772	4.3	7.8	148.2	38.7	24.8	2.93
4251 659	2/2/2006	1438	1438	5.4	11.8	112	40.23	21.22	4.112
4251 804	5/23/2006	1310	1310	5.2	11.4	110.8	18.8	15.5	3.07
4251 934	8/10/2006	1433	1433	4	2.4	129.8	27.03	22.92	5.088
4251 055	11/15/2006	2710	2710	4.8	10	101.8	24.03	19.38	6.503
avg=		1532.6		4.74	8.68	120.52	29.758	20.76	4.34
stdev=						18.51	9.35	3.56	1.49

12 LICKING CREEK UPSTRM FROM 49301 TRIB

Coll ID Seq	Date Collected	Initial Flow	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4251 495	9/7/2005	3473	3473	6.5	20	35	8.96	12.3	0.551
4251 658	2/2/2006	11583	11583	6.6	32.8	18.4	10.18	6.739	1.028
4251 803	5/23/2006	12734	12734	6.2	33.2	13.6	6.33	4.98	0.669
4251 933	8/10/2006	9485	9485	6.3	36.2	8	6.872	9.13	1.091
4251 054	11/15/2006	16376	13676	6.8	33.2	0	8.339	8.199	2.182
	avg=		10190	6.48	31.08	15.0	8.14	8.27	1.10
	stdev=					13.11	1.56	2.75	0.64

11 Licking Creek Above Confluence With Cherry Run

Coll ID Seq	Date Collected	Initial Flow	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4251 490	9/6/2005	3581	3581	7.2	33.2	13.4	1.47	9.06	0.25
4251 652	1/31/2006	16067	16067	8	37.4	14.6	5.08	4.3	2.13
4251 798	5/22/2006	16442	16442	6.8	37.8	2.8	3.58	4.4	0.25
4251 929	8/9/2006	11265	11265	7.3	57	0	2.95	6.27	0.25
4251 050	11/15/2006	19053	19053	7	43.6	0	6.72	7.622	1.898
	avg=		13282	7.26	41.80	6.16	3.96	6.33	0.96
	stdev=					7.26	2.01	2.06	0.97

7 CHERRY RUN UPSTRM FROM 49270 TRIB

Coll ID Seq	Date Collected	Initial Flow	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4251 494	9/7/2005	899	899	8	132.6	0	2.3	2.91	0.25
4251 657	2/2/2006	2997	2997	7.1	82.4	0	6.457	3.122	0.25
4251 802	5/23/2006	3481	3481	6.7	82	0	3.74	2.12	0.25
4251 932	8/10/2006	2253	2253	6.9	94.4	0	2.911	3.36	0.25
4251 053	11/15/2006	3942	3942	7.3	100.6	0	6.374	3.098	0.25
	avg=		2714.4	7.2	98.4	0	4.36	2.92	0.25
	stdev=					0	1.95	0.48	0

6 CHERRY RUN IN TOBY UPSTRM FROM CALLENSBURG ROAD

Coll ID Seq	Date Collected	Initial Flow	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4251 493	9/6/2005	1932	1932	8.2	280.6	0	0.15	1	0.25
4251 656	2/2/2006	6072	6072	7.9	174	0	2.502	2.253	0.25
4251 801	5/22/2006	7639	7639	8.1	155.6	0	0.677	1.46	0.25
4251 931	8/10/2006	5943	5943	8	210	0	0.336	2	0.25
4251 052	11/15/2006	8748	8748	7.9	202.6	0	2.33	2.114	0.25
	avg=		6066.8	8.02	204.56	0	1.20	1.77	0.25
	stdev=					0	1.13	0.52	0

5 CHERRY RUN UPSTRM FROM CONFLUENCE W/49271 TRIB

Coll ID Seq	Date Collected	Initial Flow	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4251 492	9/6/2005	2030	2030	8.2	233.4	0	0.15	0.291	0.25
4251 655	1/31/2006	9281	9281	8.1	138.2	0	0.795	1.29	0.25
4251 800	5/22/2006	10442	10442	8.2	124.8	0	0.315	1.06	0.25
4251 930	8/10/2006	7134	7134	8	183.4	0	0.15	1.232	0.25
4251 051	11/15/2006	9739	9739	8.1	179.4	0	1.567	1.771	0.25
	avg=		7725.2	8.12	171.84	0	0.60	1.13	0.25
	stdev=					0	0.60	0.54	0

3 UNT 49271 TO CHERRY RUN

Coll ID Seq	Date Collected	Initial Flow	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4251 491	9/6/2005	487	487	8.2	167.2	0	0.15	0.174	0.25
4251 654	1/31/2006	2769	2769	8	115	0	0.15	0.361	0.25
4251 799	5/22/2006	3199	3199	8	108.8	0	0.15	0.233	0.25
	avg=		2151.7	8.07	130.333	0	0.15	0.26	0.25
	stdev=					0	0.00	0.10	0.00

2 Mouth of Cherry  
Run

Coll ID Seq	Date Collected	Initial Flow	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4251 489	9/6/2005	2671	2671	8.3	199.6	0	0.15	0.058	0.25
4251 653	1/30/2006	12963	12963	8.1	130.4	0	0.347	0.917	0.25
4251 797	5/22/2006	14050	14050	8.2	117.6	0	0.15	0.67	0.25
4251 049	11/15/2006	13558	13558	8.1	171.6	0	0.559	1.279	0.25
	avg=		10811	8.175	154.8	0	0.30	0.73	0.25
	stdev=					0	0.20	0.51	0

1 Mouth of Licking Creek

Coll ID Seq	Date Collected	Initial Flow	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4251 488	9/6/2005	6388	6388	8.1	106.4	0	0.684	4.73	0.25
4251 651	1/31/2006	30250	30250	7.4	75.8	0	2.97	2.84	0.25
4251 796	5/22/2006	31077	31077	7.5	74.8	0	1.9	2.59	0.25
4251 928	8/9/2006	22716	22716	8	108	0	1.47	3.54	0.25
4251 048	11/15/2006	32611	32611	7.6	97.2	0	3.904	4.837	1.111
	avg=	24608	24608	7.72	92.44	0	2.1856	3.7074	0.4222
	stdev=					0	1.2666	1.0429	0.3851

*Attachment F*  
**TMDLs and NPDES Permitting Coordination**

NPDES permitting is unavoidably linked to TMDLs through waste load allocations and their translation, through the permitting program, to effluent limits. Primary responsibility for NPDES permitting rests with the District Mining Offices (for mining NPDES permits) and the Regional Offices (for industrial NPDES permits). Therefore, the DMOs and Regions will maintain tracking mechanisms of available waste load allocations, etc. in their respective offices. The TMDL program will assist in this effort. However, the primary role of the of the TMDL program is TMDL development and revision/amendment (the necessity for which is as defined in the Future Modifications section) at the request of the respective office. All efforts will be made to coordinate public notice periods for TMDL revisions and permit renewals/reissuances.

### **Load Tracking Mechanisms**

The Department has developed tracking mechanisms that will allow for accounting of pollution loads in TMDL watersheds. This will allow permit writers to have information on how allocations have been distributed throughout the watershed in the watershed of interest while making permitting decisions. These tracking mechanisms will allow the Department to make minor changes in WLAs without the need for EPA to review and approve a revised TMDL. Tracking will also allow for the evaluation of loads at downstream points throughout a watershed to ensure no downstream impairments will result from the addition, modification or movement of a permit.

### **Options for Permittees in TMDL Watersheds**

The Department is working to develop options for mining permits in watersheds with approved TMDLs.

#### **Options identified**

- Build excess WLA into the TMDL for anticipated future mining. This could then be used for a new permit. Permittee must show that there has been actual load reduction in the amount of the proposed permit or must include a schedule to guarantee the reductions using current data referenced to the TMDL prior to permit issuance.
- Use WLA that is freed up from another permit in the watershed when that site is reclaimed. If no permits have been recently reclaimed, it may be necessary to delay permit issuance until additional WLA becomes available.
- Re-allocate the WLA(s) of existing permits. WLAs could be reallocated based on actual flows (as opposed to design flows) or smaller than approved pit/spoil areas (as opposed to default areas). The "freed-up" WLA could be applied to the new permit. This option would require the simultaneous amendment of the permits involved in the reallocation.
- Non-discharge alternative.

#### **Other possible options**

The following two options have also been identified for use in TMDL watersheds. However, before recommendation for use as viable implementation options, a thorough regulatory (both state and federal) review must be completed. These options should not be implemented until the completion of the regulatory review and development of any applicable administrative mechanisms.

- Issue the permit with in-stream water quality criteria values as the effluent limits. The in-stream criteria value would represent the monthly average, with the other limits adjusted accordingly (e.g., for Fe, the limits would be 1.5 mg/L monthly average, 3.0 mg/L daily average and 4.0 instantaneous max mg/L).
- The applicant would agree to treat an existing source (point or non-point) where there is no responsible party and receive a WLA based on a portion of the load reduction to be achieved. The result of using these types of offsets in permitting is a net improvement in long-term water quality through the reclamation or treatment of an abandoned source.

***Attachment G***  
**Comment and Response**

Region III EPA comments:

1. Pages 6, 7 – Highlighted stream segments are located in a different watershed and should be removed from this TMDL.  
*Corrected.*
2. Page 14 – RFI Energy Inc. Permit # 16831604 is listed as an active mine but not mentioned anywhere in the TMDL or given any allocations.  
*This permit is for a preparation plant. There are no permitted discharges. There is an erosion and sediment pond. Wasteload allocations are not required for E&S ponds. A not was added to page 24.*
3. The Summary Table on pages 23-24 has a number of errors listed. A revised table with corrected values has been created to compare with the existing table found in the TMDL document. Corrected values have been highlighted in yellow.  
*Corrected.*
4. Point 3 (UNT 49271 to Cherry Run) has negative Load Allocations assigned to it. Why, if treatment ponds are effective at removing metals, do the WLAs have to be so high? Shouldn't the permit limits be reduced? (See p.67)  
*An explanation is noted in the first paragraph on page 25.*
5. Page 52 Table C13 – To calculate reductions at point 18, comparison is made with points 23 and 24. The table lists point 19, which is incorrect.  
*Corrected.*
6. Page 55 – WLA for future operations should be 6.0 for Manganese since there are 4 operations anticipated. The Summary Table contains a WLA of 7.5. The LA should also be changed to 2.6 as well.  
*Corrected.*
7. Page 62 – First paragraph should remove reference to Scrubgrass Creek.  
*Corrected.*
8. Page 69 Table C41 – Load tracked and Total load numbers for Point 2 do not match Summary Table values for Fe and Mn.  
*Corrected.*