FINAL

LITTLE CONNOQUENESSING CREEK WATERSHED TMDL

Butler County

For Acid Mine Drainage Affected Segments

Prepared by:

Pennsylvania Department of Environmental Protection

January 8, 2009

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ATTACHMENTS

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Little Connoquenessing Creek Watershed
Butler County, Pennsylvania

Introduction

This report presents the Total Maximum Daily Loads (TMDLs) developed for segments in the Little Connoquenessing Creek Watershed (Attachment A). These were done to address the impairments noted on the 1996 Pennsylvania Section 303(d) list of impaired waters, required under the Clean Water Act, and covers segments on that list and additional segments on later lists/reports. Little Connoquenessing Creek was originally listed as cause unknown, but subsequent lists have attributed its impairments due to metals. All impairments resulted from acid drainage from abandoned coalmines. The TMDL addresses the three primary metals associated with acid mine drainage (iron, manganese, aluminum) and pH.

Table 1. 303(d) Sub-List

HUC 05030105; State Water Plan (SWP) Subbasin: 20-C

Year	Miles	Segment ID	DEP Stream Code	Stream Name	Desig-nated Use	Data Source	Source	EPA 305(b) Cause Code
1996	1.7	4580	34918	Little Connoquenessing Creek (BASIN)	CWF	303 (d) List	Resource Extraction	Cause Unknown
1998	0.88	4580	34918	Little Connoquenessing Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2002	0.88	990831-1530-JJM	34918	Little Connoquenessing Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	11.6 0.9	990831-1530-JJM 990901-0910-JJM	34918	Little Connoquenessing Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	0.7	990831-1530-JJM	34920	UNT Little Connoquenessing Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	0.7	990831-1530-JJM	63823	UNT Little Connoquenessing Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	4.5	990831-1530-JJM	34927	Little Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	1.6	990824-1040-JJM 990831-1530-JJM	34930	UNT Little Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	0.8	990831-1530-JJM	34932	UNT Little Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	7.3	990824-1245-JJM 990831-1530-JJM	34921	Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals

[1] Pennsylvania's 1996, 1998, and 2002 Section 303(d) lists and the 2004 and 2006 Integrated Water Quality Report were approved by the Environmental Protection Agency (EPA). The 1996 Section 303(d) list provides the basis for measuring progress under the 1997 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA.*

2004	1.0	990831-1530-JJM	34922	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	0.9	990831-1530-JJM	34923	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	0.6	990831-1530-JJM	34924	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	0.6	990831-1530-JJM	34925	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	1.1	990831-1530-JJM	34938	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	0.5	990824-1245-JJM 990831-1530-JJM	34939	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	0.9	990824-1245-JJM 990831-1530-JJM	34940	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	2.8	990824-1245-JJM 990831-1530-JJM	34943	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	0.3	990824-1245-JJM 990831-1530-JJM	34944	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	0.8	990824-1245-JJM 990831-1530-JJM	34946	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	0.6	990824-1245-JJM 990831-1530-JJM	34947	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	0.4	990824-1245-JJM 990831-1530-JJM	34948	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	0.6	990824-1245-JJM 990831-1530-JJM	34949	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	0.9	990824-1245-JJM 990831-1530-JJM	34950	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	0.6	990831-1530-JJM	34951	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	0.5	990831-1530-JJM	34952	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2004	1.8	990824-1245-JJM 990831-1530-JJM	34953	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals

2004	0.5	990824-1245-JJM 990831-1530-JJM	34954	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	3.45	11188	34918	Little Connoquenessing Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	1.78	11190	34918	Little Connoquenessing Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	0.72	11188	34920	UNT Little Connoquenessing Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	0.67	11188	63823	UNT Little Connoquenessing Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	1.62	11134	34930	UNT Little Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	0.83	11188	34932	UNT Little Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	7.6	11137	34921	Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	1.06	11188	34922	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	0.91	11188	34923	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	0.58	11188	34924	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	0.68	11188	34925	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	1.11	11188	34938	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	0.48	11137	34939	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	0.88	11137	34940	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	3.91	11137	34943	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	0.32	11137	34944	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	0.81	11137	34946	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	0.63	11137	34947	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	0.4	11137	34948	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	0.62	11137	34949	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	1.87	11137	34950	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	0.58	11188	34951	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	0.49	11188	34952	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	1.81	11137	34953	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2006	0.46	11137	34954	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals

2008	3.45 1.77	11188 11190	34918	Little Connoquenessing Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	0.72	11188	34920	UNT Little Connoquenessing Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	0.67	11188	63823	UNT Little Connoquenessing Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	1.62	11134	34930	UNT Little Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	0.83	11188	34932	UNT Little Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	7.6	11137	34921	Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	1.06	11188	34922	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	0.91	11188	34923	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	0.58	11188	34924	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	0.68	11188	34925	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	1.11	11188	34938	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	0.48	11137	34939	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	0.88	11137	34940	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	3.91	11137	34943	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	0.32	11137	34944	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	0.81	11137	34946	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	0.63	11137	34947	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	0.4	11137	34948	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	0.62	11137	34949	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	1.87	11137	34950	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	0.58	11188	34951	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	0.49	11188	34952	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	1.81	11137	34953	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals
2008	0.46	11137	34954	UNT Yellow Creek	CWF	SWMP	Abandoned Mine Drainage	Metals

Cold Water Fish = CWF
Surface Water Monitoring Program = SWMP
See Attachment D, *Excerpts Justifying Changes Between the 1996, 1998, and 2002 Section 303(d) Lists and the 2004, 2006 and 2008 Integrated Water Quality Report.*
The use designations for the stream segments in this TMDL can be found in PA Title 25 Chapter 93.

Directions to the Little Connoquenessing Creek Watershed

The Little Connoquenessing Creek Watershed is approximately 64.5 square miles in area. It is located in west central Butler County just west of the city of Butler. Little Connoquenessing Creek flows in a southwestern direction from its headwaters near the town of Unionville to its confluence with Connoquenessing Creek in the town of Harmony Junction. Major tributaries to Little Connoquenessing Creek include Crooked Run, Mulligan Run, Semiconon Run, Crab Run, Yellow Creek and Little Yellow Creek. Little Connoquenessing Creek and its tributaries are classified as Cold Water Fisheries (CWFs) under Title 25 PA Code Chapter 93, Section 93.9r and can be found on the Butler, Evans City, Mount Chestnut, Portersville, Prospect and Zelienople 7-1/2 minute quadrangles. Little Connoquenessing Creek (stream code – 34918) is part of the Hydrologic Unit Code 05030105 – Connoquenessing Creek (formerly State Water Plan 20C).

Little Connoquenessing Creek can be accessed by taking exit 87 Zelienople (Route 68) from Interstate 79 (I-79). Travel east on Route 68 for approximately 0.8 miles and turn left onto Hartman Road. Travel for approximately 0.3 miles and turn left onto Evergreen Mill Road (T323). Travel approximately 0.2 miles and Little Connoquenessing Creek flows under Evergreen Mill Road at this point. Little Connoquenessing Creek flows into Connoquenessing Creek approximately 900 feet downstream from this location. The headwaters of Little Connoquenessing Creek can be accessed by taking exit 99 Portersville/Prospect (Route 422) from I-79 and traveling east on Route 422 for approximately 10.7 miles. The headwaters of Little Connoquenessing Creek flow under Route 422 at this point.

Segments addressed in this TMDL

The Little Connoquenessing Creek Watershed is affected by pollution from AMD. This pollution has caused high levels of metals in Little Connoquenessing Creek, Yellow Creek and Little Yellow Creek. The sources of the AMD are seeps and discharges from areas disturbed by deep and surface mining. Most of the discharges originate from mining on the Lower Freeport and Middle Kittanning coal seams or refuse piles associated with them. All of the discharges are considered to be nonpoint sources of pollution because they are from abandoned Pre-Act mining operations or from coal companies that have settled their bond forfeitures with the Pennsylvania Department of Environmental Protection (PADEP).

There are no active mining operations in the watershed. All of the discharges in the watershed are from abandoned mines and will be treated as non-point sources. The distinction between non-point and point sources in this case is determined on the basis of whether or not there is a responsible party for the discharge. Where there is no responsible party the discharge is considered to be a non-point source. Each segment on the 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.

This AMD TMDL document contains one or more future mining Waste Load Allocations (WLA). These WLA were requested by Knox District Mining Office (DMO) to accommodate one or more future mining operations. This will allow speedier approval of future mining permits without the time consuming process of amending this TMDL document. All comments and questions concerning the future mining WLAs in this TMDL are to be directed to Knox DMO. Future wasteload allocations are calculated using the method described for quantifying pollutant load in Attachment C.

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. Each future mining WLA is intended to accommodate one future mining NPDES permit.
4. The inclusion of future mining WLAs does not preclude the amending of this AMD TMDL to accommodate additional NPDES permits.

Clean Water Act Requirements

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

Additionally, the federal Clean Water Act and the Environmental Protection Agency’s (EPA) implementing regulations (40 CFR Part 130) require:

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

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

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

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

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

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

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

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

Section 303(d) Listing Process

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

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

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

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

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

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

Basic Steps for Determining a TMDL

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

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

Watershed Background

There are limited records available to document mining prior to the 1970's, sometimes referred to as pre-Act mining. Although the date of the earliest mining within this watershed is not known, environmental scars such as unreclaimed pits, spoil piles and post-mining discharges are evidence of a long history of mining in the Little Connoquenessing Creek watershed.

The more recent mining within the Little Connoquenessing Creek Watershed occurred primarily in the 1970's, 1980's and 1990s. The last application for a permit to mine coal in this watershed was submitted to the Department of Environmental Protection in 1998. Although the complete files for the mine sites no longer exist, the following information gathered from microfiche records provides a brief outline of the mining permits issued in the watershed:

Company Name	Permit Number	Mine Name	Date Issued	Acerage	Coal Seam(s)	Status
C.A. Fisher Mining Company	366M27	Kathryn			UF-Deep Mine	
Mary Elizabeth Mining Company	10293	Mary Elizabeth			F-Deep Mine	
Connoquenessing Coal Company	17246 B-604	Farinelli			LK-Deep Mine	
Joseph Rozic	17446 B-617	Rozic			LK-Deep Mine	
Stanford Coal Company	11131 B-128	Stanford			UK - Deep Mine	
Gripo Coal Company Inc.	14293-M	No. 2			UF-Deep Mine	
Mary Elizabeth Mining Company	17809 B-636	Mary Elizabeth #3			LF-Deep Mine	
Stanford Coal Company	10888 B-116				LF-Deep Mine	
Roy Miller Coal Company	10603 B-629	Miller			MK-Deep Mine	
Oswald Magrini Coal Company	16086	Livingstone			MK-Deep Mine	
Mary Elizabeth Mining Company	16580	Mary Elizabeth #2			MK-Deep Mine	
Raymond Burry	364M6	Burry			MK-Deep Mine	
R.W. Kerry & Sons Coal Company	10305	Rovella			F-Deep Mine	
Edwin R. Thompson	14213				UF-Deep Mine	
Frank M. Moculski	18620	Moculski			UF-Deep Mine	
List Mining Company	2866BSM64	List	11/1/1966	53.0	LF	Canceled
Colcani Construction	3075SM7	Castellano	7/17/1975	94.0	LK-Deep Mine	Abandoned - Bond Forfeited
Kerry Coal Company	3076SM15	Kerry #23	8/24/1976	209.0	LF, MK	Reclamation Completed
Duncan Coal Company	3077SM2	Duncan #2	6/10/1977	255.0	MK, LF	Reclamation Completed
Kerry Coal Company	3077SM28	Kerry #24	12/29/1977	77.0	UF	Reclamation Completed
Duncan Coal Company	1079102	Mushinski	7/9/1979	59.0	LF	Bond Forfeited
Amerikohl Mininig Inc.	1079110	Humphrey	8/20/1979	370.0	LF	Reclamation Completed
Amerikohl Mininig Inc.	1079109	Montgomery	8/26/1979	239.0	LF	Reclamation Completed
Amerikohl Mininig Inc.	1079108	Ceasar	8/31/1979	156.0	LF	Reclamation Completed
Kerry Coal Company	10800111	Kerry #32	10/17/1980	156.0	LF, MK	Reclamation Completed
Amerikohl Mininig Inc.	10800120	Finner	4/7/1981	80.0	LF	Reclamation Completed
Amerikohl Mininig Inc.	10810102	Wise	10/23/1981	190.0	LF	Reclamation Completed
H&D Coal Company	10810106	Portersville	12/15/1981	173.0	LF	Reclamation Completed
Kerry Coal Company	10820137	Kerry #15	9/23/1983	154.0	MK, LF	Reclamation Completed
Amerikohl Mininig Inc.	10820128	Castellano	11/28/1983	278.0	LF	Reclamation Completed
Amerikohl Mininig Inc.	10820128	Castellano	11/28/1983	278.0	LF	Reclamation Completed
Kerry Coal Company	10803005	Kerry #30	2/13/1984	1087.2	M, LF, UF	Reclamation Completed
Amerikohl Mininig Inc.	10900112	Guiher	4/23/1991	122.0	UF	Reclamation Completed
Amerikohl Mininig Inc.	10900112	Guiher	4/23/1991	122.0	UF	Reclamation Completed
Dutch Run Coal Company	10950106	Pfeiffes	9/9/1996	72.9	LF	Reclamation Completed
Ben Hal Mining Company	10980109	Smith	6/4/1999	141.2	LF, UF	Reclamation Completed

In 1975, the Department of Environmental Resources contracted with the Green Engineering Company to perform an acid mine drainage abatement study on the Yellow Creek Watershed, located in Lancaster and Muddy Creek Townships, Butler County under the "Operation Scarlift" land reclamation program. The ensuing report, called the Yellow Creek Watershed Mine Drainage Abatement Survey, Operation ScarLift Project No. SL-158, established 261 sampling and flow measurement stations in the Yellow Creek Watershed in order to determine the extent of pollution due to acid mine drainage and to determine the abatement measures necessary to reduce the pollution load. The report recommended a two phase abatement program, with the first phase consisting of installation of deep mine seals and initiating the second phase of reclaiming of abandoned strip mine and refuse areas after the results of the deep mine sealing was evaluated. A copy of this report can be found on the Abandoned Mine Reclamation Clearing House Website at the following link:
http://www.amrclearinghouse.org/Sub/SCARLIFTReports/

In 2002, Camp Lutherlyn received a $60,000.00 Growing Greener grant from the Department of Environmental Protection in order to construct a passive treatment wetland to treat an acidic deep mine discharge in the Semiconon Run Watershed. Construction of the wetland was completed in 2004 and has resulted in improved water quality in Semiconon Run. Recent reassessment of the watershed revealed that Semiconon Run was no longer being impacted by AMD and the Watershed was removed from the Integrated List. The treatment wetland is also used as a demonstration and educational component for Camp Lutherlyn.

The Connoquenessing Creek Watershed Conservation Plan was completed in October 2008 by the Western Pennsylvania Conservancy (WPC) in cooperation with the Connoquenessing Watershed Alliance (CWA) through funding received from the Pennsylvania Department of Conservation and Natural Resources (DCNR) in 2005. The Plan consists of a comprehensive study of the cultural and natural resources located within the Connoquenessing Creek Watershed and serves as an educational tool for the conservation of natural resources, monitoring and improvement of water quality and advocates sound community-planning practices.

AMD Methodology

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

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

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

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

PR = required percent reduction for the current iteration

Cc = criterion in mg/l

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

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

Mean = average observed concentration

Standard Deviation = standard deviation of observed data

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

LTA = Mean * (1 – PR99) where (2)

LTA = allowable LTA source concentration in mg/l

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

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

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

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

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

For pH TMDLs, acidity is compared to alkalinity as described in Attachment B. Each sample point used in the analysis of pH by this method must have measurements for total alkalinity and hot acidity. Statistical procedures are applied, using the average value for total alkalinity at that point as the target to specify a reduction in the acid concentration. By maintaining a net alkaline stream, the pH value will be in the range between six and eight. This method negates the need to specifically compute the pH value, which for streams affected by low pH from AMD may not 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.

TMDL Endpoints

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

Because most of the pollution sources in the watershed are nonpoint sources, the TMDLs' component makeup will be load allocations (LAs) with waste load allocations (WLAs) for permitted discharges. All allocations will be specified as long-term average daily concentrations. These long-term average concentrations are expected to meet water-quality criteria 99% of the time as required in PA Title 25 Chapter 96.3(c). Table 2 shows the water quality criteria for the selected parameters.

Table 2 Applicable Water Quality Criteria

Parameter	***Criterion Value (mg/l)***	***Total Recoverable/Dissolved***
Aluminum (Al)	0.75	Total Recoverable
Iron (Fe)	1.50	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)

$$TMDL = WLA + LA + MOS$$

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

Allocation Summary

These TMDLs will focus remediation efforts on the identified numerical reduction targets for each watershed. The reduction schemes in Table 3 for each segment are based on the assumption that all upstream allocations are implemented and take into account all upstream reductions. Attachment D 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 average flow and a conversion factor at each sample point. The allowable load is the TMDL at that point.

Each permitted discharge in a segment is assigned a waste load allocation and the total waste load allocation for each segment is included in this table. Waste load allocations have also been included at some points for future mining operations. The difference between the TMDL and the WLA at each point is the load allocation (LA) at the point. The LA at each point includes all loads entering the segment, including those from upstream allocation points. The percent reduction is calculated to show the amount of load that needs to be reduced from nonpoint sources within a segment in order for water quality standards to be met at the point.

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

Table 3. Little Connoquenessing Creek Watershed Summary Table

Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	NPS Load Reduction (lbs/day)	NPS % Reduction
YC16 - NW Headwater Tributary to Yellow Creek @ Stanford Road						
Aluminum (lbs/day)	1.06	0.32	-	0.32	0.74	70%
Iron (lbs/day)	1.41	0.66	-	0.66	0.75	53%
Manganese(lbs/day)	3.34	0.86	-	0.86	2.48	74%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%
YC15 - NW Headwater Tributary to Yellow Creek Along Stanford Road						
Aluminum (lbs/day)	0.90	0.45	-	0.45	0.00	0%*
Iron (lbs/day)	0.90	0.69	-	0.69	0.00	0%*
Manganese(lbs/day)	2.81	0.88	-	0.88	0.00	0%*
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%
YC14 - NW Tributary to Yellow Creek alongside Stanford Road						
Aluminum (lbs/day)	1.03	1.03	-	1.03	0.00	0%
Iron (lbs/day)	0.62	0.62	-	0.62	0.00	0%
Manganese(lbs/day)	1.28	1.04	-	1.04	0.00	0%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%
YC13 - Mouth of NW Tributary to Yellow Creek						
Aluminum (lbs/day)	6.73	1.69	*0.56*	1.13	5.04	75%
Iron (lbs/day)	7.56	4.28	*2.25*	2.03	3.28	43%
Manganese(lbs/day)	8.73	3.48	*1.50*	1.98	5.01	59%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%
YC12 - Northern Headwater Tributary to Yellow Creek @ Kelly Road						
Aluminum (lbs/day)	1.74	0.14	-	0.14	1.60	92%
Iron (lbs/day)	1.16	0.99	-	0.99	0.17	15%
Manganese(lbs/day)	0.44	0.44	-	0.44	0.00	0%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%
YC11 - Yellow Creek @ Kelly Road						
Aluminum (lbs/day)	0.53	0.53	-	0.53	0.00	0%
Iron (lbs/day)	1.20	1.20	-	1.20	0.00	0%
Manganese(lbs/day)	0.57	0.57	-	0.57	0.00	0%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%

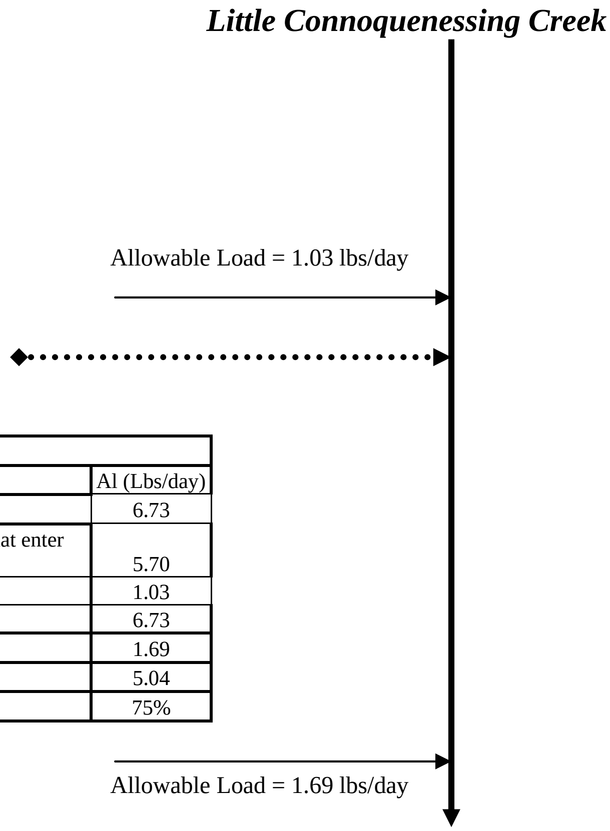
Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	NPS Load Reduction (lbs/day)	NPS % Reduction
YC10 - Yellow Creek along Yellow Creek Road						
Aluminum (lbs/day)	6.20	0.84	*0.56*	0.28	3.76	82%
Iron (lbs/day)	16.44	3.87	*2.25*	1.62	12.40	76%
Manganese(lbs/day)	5.58	1.77	*1.50*	0.27	3.81	68%
Acidity (lbs/day)	42.28	16.88	-	16.88	25.40	60%
YC09 - Yellow Creek @ Stanford Road						
Aluminum (lbs/day)	2.99	1.20	-	1.20	0.00	0%*
Iron (lbs/day)	9.75	1.86	-	1.86	0.44	19%*
Manganese(lbs/day)	6.22	2.69	-	2.69	0.00	0%*
Acidity (lbs/day)	8.62	8.13	-	8.13	0.00	0%*
YC08 - UNT to Yellow Creek @ Woody Wilson Road						
Aluminum (lbs/day)	0.14	0.11	-	0.11	0.03	21%
Iron (lbs/day)	0.14	0.11	-	0.11	0.03	21%
Manganese(lbs/day)	0.111	0.105	-	0.105	0.006	5%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%
YC07 - UNT to Yellow Creek @ Yellow Creek Road						
Aluminum (lbs/day)	0.46	0.18	-	0.18	0.28	61%
Iron (lbs/day)	0.95	0.29	-	0.29	0.66	69%
Manganese(lbs/day)	0.37	0.37	-	0.37	0.00	0%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%
YC06 - Yellow Creek upstream LYCO1 confluence @ Lancaster Road						
Aluminum (lbs/day)	3.19	3.19	-	3.19	0.00	0%
Iron (lbs/day)	1.91	1.91	-	1.91	0.00	0%
Manganese(lbs/day)	3.75	3.75	-	3.75	0.00	0%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%
LYC02 – UNT to Little Yellow Creek off Little Yellow Creek Road						
Aluminum (lbs/day)	0.74	0.74	-	0.74	0.00	0%
Iron (lbs/day)	0.45	0.45	-	0.45	0.00	0%
Manganese(lbs/day)	0.24	0.24	-	0.24	0.00	0%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%
LYC01 - Mouth of Little Yellow Creek @ Lancaster Road						
Aluminum (lbs/day)	1.41	1.41	-	1.41	0.00	0%
Iron (lbs/day)	1.91	1.91	-	1.91	0.00	0%
Manganese(lbs/day)	1.36	1.36	-	1.36	0.00	0%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%
YC05 - Yellow Creek downstream from LYC01 and YC06 confluence						
Aluminum (lbs/day)	4.80	4.80	0.56	4.24	0.00	0%
Iron (lbs/day)	2.88	2.88	2.25	0.63	0.00	0%
Manganese(lbs/day)	3.48	3.48	1.5	1.98	0.00	0%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%
YC04 - UNT to Yellow Creek Downstream from YC05						
Aluminum (lbs/day)	0.20	0.10	-	0.10	0.10	50%

Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	NPS Load Reduction (lbs/day)	NPS % Reduction
Iron (lbs/day)	0.47	0.19	-	0.19	0.28	60%
Manganese(lbs/day)	0.07	0.07	-	0.07	0.00	0%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%
YC01 - Mouth of Yellow Creek						
Aluminum (lbs/day)	6.06	6.06	*0.56*	5.50	0.00	0%
Iron (lbs/day)	3.64	3.64	*2.25*	1.39	0.00	0%
Manganese(lbs/day)	1.89	1.89	*1.50*	0.39	0.00	0%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%
LCC05 - Little Connoquenessing Creek Upstream from Semiconon Run Confluence @ Dick Road						
Aluminum (lbs/day)	7.93	7.93	*0.56*	7.37	0.00	0%
Iron (lbs/day)	7.07	7.07	*2.25*	4.82	0.00	0%
Manganese(lbs/day)	2.70	2.70	*1.50*	1.20	0.00	0%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%
LCC04 - Little Connoquenessing Creek @ Welsh Road						
Aluminum (lbs/day)	16.48	16.48	*1.68*	14.80	0.00	0%
Iron (lbs/day)	77.86	12.77	*6.75*	6.02	65.09	84%
Manganese(lbs/day)	5.79	5.79	*4.50*	1.29	0.00	0%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%
LCC03 - Little Connoquenessing Creek Upstream from RT 528						
Aluminum (lbs/day)	12.69	12.69	*2.80*	9.89	0.00	0%
Iron (lbs/day)	26.90	26.90	*11.25*	15.65	0.00	0%
Manganese(lbs/day)	17.03	17.03	*7.50*	9.53	0.00	0%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%
LCC02 - Little Connoquenessing Creek upstream from Yellow Creek @ Little Yellow Creek Rd						
Aluminum (lbs/day)	19.23	19.23	*2.80*	16.43	0.00	0%
Iron (lbs/day)	40.18	40.18	*11.25*	28.93	0.00	0%
Manganese(lbs/day)	12.27	12.27	*7.50*	4.77	0.00	0%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%
LCC01 - Mouth of Little Connoquenessing Creek @ Evergreen Mill Road						
Aluminum (lbs/day)	28.14	28.14	2.24	25.90	0.00	0%
Iron (lbs/day)	16.88	16.88	9.00	7.88	0.00	0%
Manganese(lbs/day)	7.51	7.51	6.00	1.51	0.00	0%
Acidity (lbs/day)	0.00	0.00	-	0.00	0.00	0%

NA = not applicable
* Takes into account load reductions from upstream sources.
Numbers in italics are set aside for future mining operations.

In the instance where all samples were calculated to be at less than detection limits (e.g. aluminum point LCC04, Table 3), the simulation determined that water quality standards are being met instream 99% of the time and no TMDL is necessary for the parameter at that point. Although no TMDL is necessary, the loading at the point is considered at the next downstream point.

Following is an example of how the allocations, presented in Table 3, for a stream segment are calculated. For this example, aluminum allocations for YC13 of Yellow Creek are shown. As demonstrated in the example, all upstream contributing loads are accounted for at each point. Attachment D contains the TMDLs by segment analysis for each allocation point in a detailed discussion. These analyses follow the example. Attachment A contains maps of the sampling point locations for reference.



Allocations YC14	
YC14	Al (Lbs/day)
Existing Load @ YC14	1.03
Allowable Load @ YC14	1.03

ALLOCATIONS YC13	
YC13	Al (Lbs/day)
Existing Load @ YC13	6.73
Difference in measured Loads between the loads that enter and existing YC13 (YC14– YC13)	5.70
Additional load tracked from above samples	1.03
Total load tracked between YC14 and YC13	6.73
Allowable Load @ YC13	1.69
Load Reduction @ YC13	5.04
% Reduction required at YC13	75%

The allowable aluminum load tracked from YC14 was 1.03 lbs/day. The existing load at YC14 was subtracted from the existing load at YC13 to show the actual measured increase of aluminum load that has entered the stream between these upstream sites and YC13 (5.70 lbs/day). This increased value was then added to the calculated allowable load from YC14 to calculate the total load that was tracked between YC14 and YC13 (allowable loads @ YC14 + the difference in existing load between YC14 and YC13). This total load tracked was then subtracted from the calculated allowable load at YC13 to determine the amount of load to be reduced at YC13. This total load value was found to be 6.73 lbs/day; it was 5.04 lbs/day greater than the YC13 allowable load of 1.69 lbs/day. Therefore, a 75% aluminum reduction at YC13 is necessary.

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). 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).

The Connoquenessing Watershed Alliance (CWA) is a watershed group interested in improving and protecting the quality of water within the Connoquenessing Creek Watershed area. The CWA is encouraged 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 Saturday, November 1, 2008 to foster public comment on the allowable loads calculated. A public meeting was held on November 10, 2008 beginning at 9:00 a.m. at the Knox District Mining Office in Knox, Pennsylvania, to discuss the proposed TMDL.

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 TMDLs 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

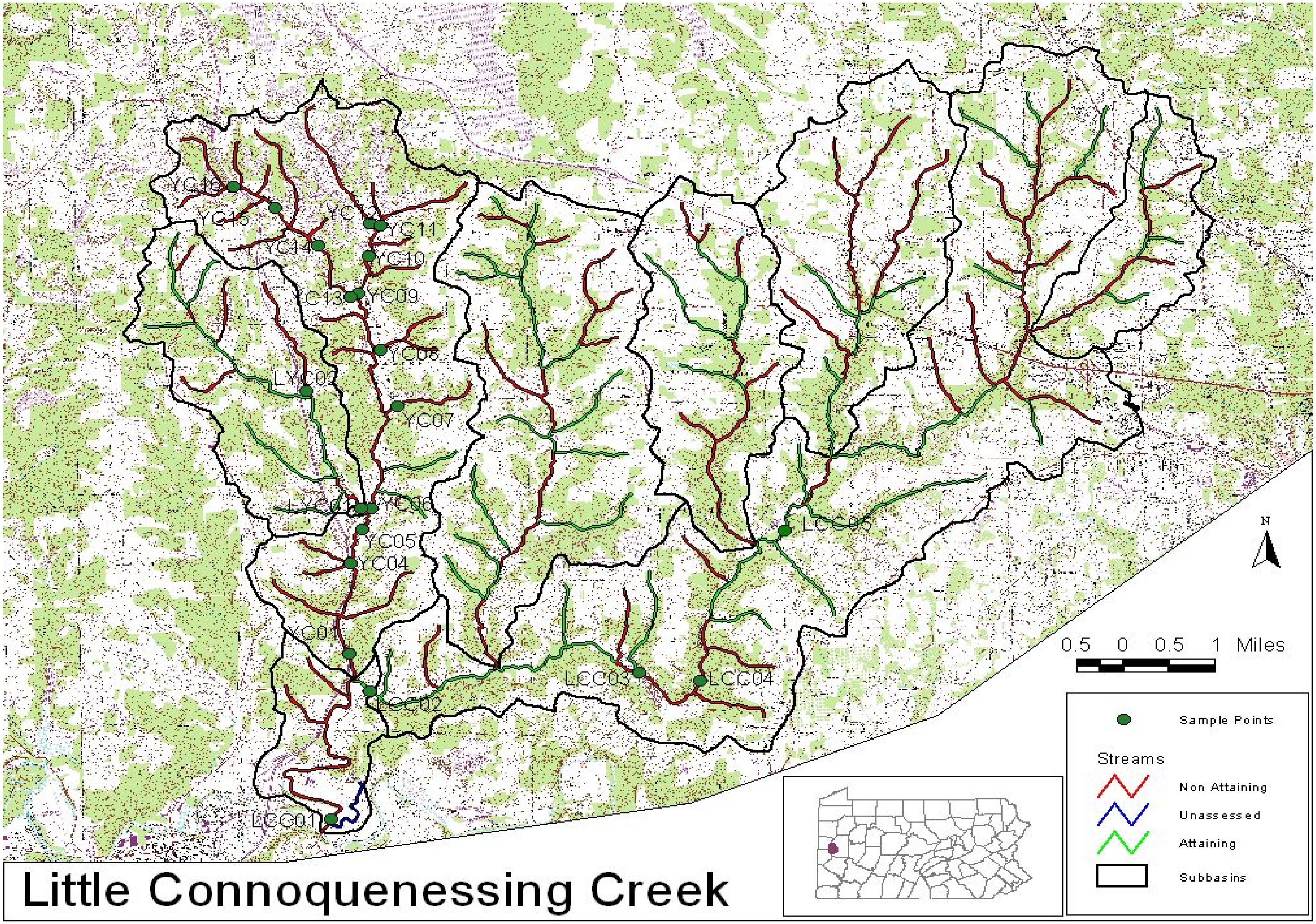
- Increase in total load capacity.
- Transfer of load between point (WLA) and nonpoint (LA) sources.
- Modification of the margin of safety (MOS).
- Change in water quality standards (WQS).
- Non-attainment of WQS with implementation of the TMDL.
- Allocations in trading programs.

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.

Attachment A

Little Connoquenessing Creek Watershed Map


Little Connoquenessing Creek
0.5 0 0.5 1 Miles
Sample Points
Streams
Non Attaining
Unassessed
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Subbasins
N
LCC01
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LCC03
LCC04
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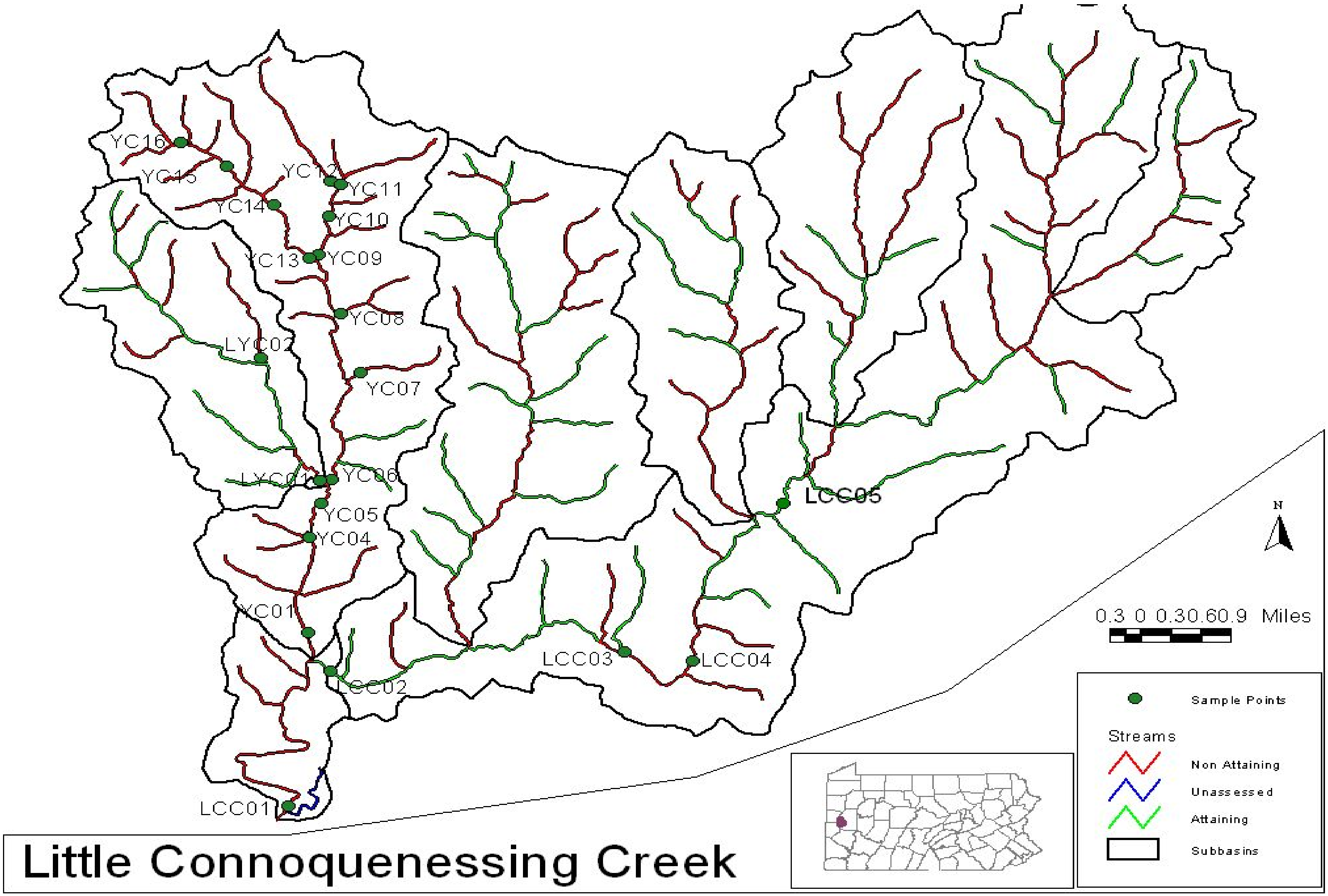
YC14
LYC01
LYC02


YC16
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Sample Points
Streams
Non Attaining
Unassessed
Attaining
Subbasins
Little Connoquenessing Creek

Attachment B

Method for Addressing Section 303(d) Listings for pH

Method for Addressing Section 303(d) Listings for pH

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

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

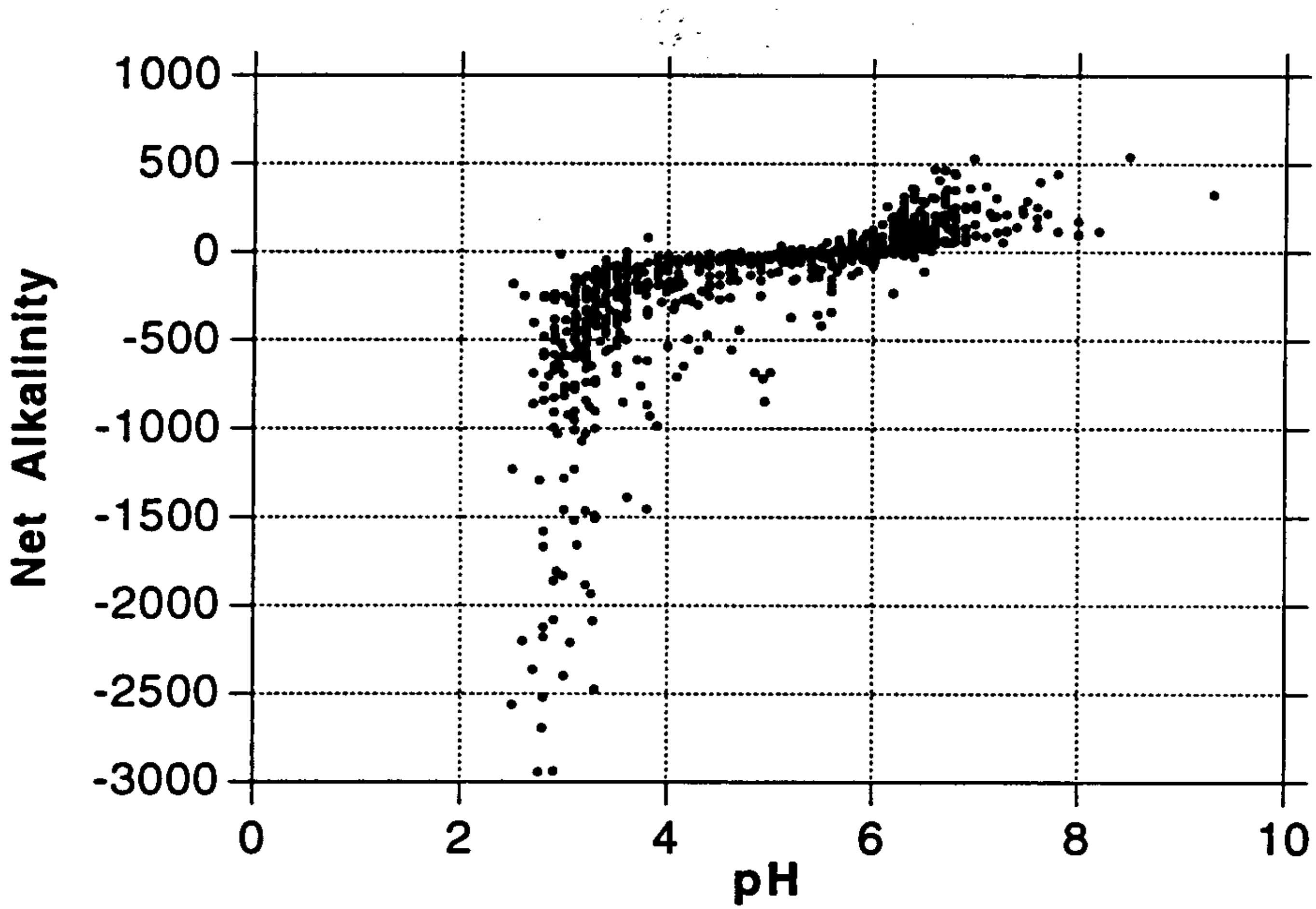


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

Attachment C

Method for Calculating Loads from Mine Drainage Treatment Facilities from Surface Mines

Method to Quantify Treatment Pond Pollutant Load

Calculating Waste Load Allocations for Active Mining in the TMDL Stream Segment.

The end product of the TMDL report is to develop Waste Load Allocations (WLA) and Load Allocations (LA) that represent the amount of pollution the stream can assimilate while still achieving in-stream limits. The LA is the load from abandoned mine lands where there is no NPDES permit or responsible party. The WLA is the pollution load from active mining that is permitted through NPDES.

In preparing the TMDL, calculations are done to determine the allowable load. The actual load measured in the stream is equal to the allowable load plus the reduced load.

Total Measured Load = Allowed Load + Reduced Load

If there is active mining or anticipated mining in the near future in the watershed, the allowed load must include both a WLA and a LA component.

Allowed Load (lbs/day) = WLA (lbs/day) + LA (lbs/day)

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

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

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

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

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

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

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

Pit water can also result from runoff from the unregraded and revegetated area following the pit. In the case of roughly backfilled and highly porous spoil, there is very little surface runoff. It is estimated that 80 percent of precipitation on the roughly regarded 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. DEP 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. DEP uses three pit widths as an area representing potential flow to the pit when reviewing the NPDES permit application and calculating effluent limits based on best available treatment technology and insuring that in-stream limits are met. The same approach is used in the following equation, which represents the average flow reporting to the pit from the unregraded and unrevegetated spoil area.

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

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

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

Total Average Flow = Direct Pit Precipitation + Spoil Runoff

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

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

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

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

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

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

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

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

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

The allowable load for the stream segment is determined by modeling of flow and water quality data. The allowable load has a potential Waste Load Allocation (WLA) component if there is active mining or anticipated future mining and a Load Allocation (LA). So, the sum of the Load Allocation and the Waste Load Allocation is equal to the allowed load. The WLA is determined by the above calculations and the LA is determined by the difference between the allowed load and the WLA.

Allowed Load = Waste Load Allocation + Load Allocation
Or
Load Allocation = Allowed Load – Waste Load Allocation

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

Derivation of the flow used in the future mining WLAs:

30.9 gal/min X 2 (assume two pits) X 0.00144 = 0.09 MGD

Attachment D

TMDLs By Segment

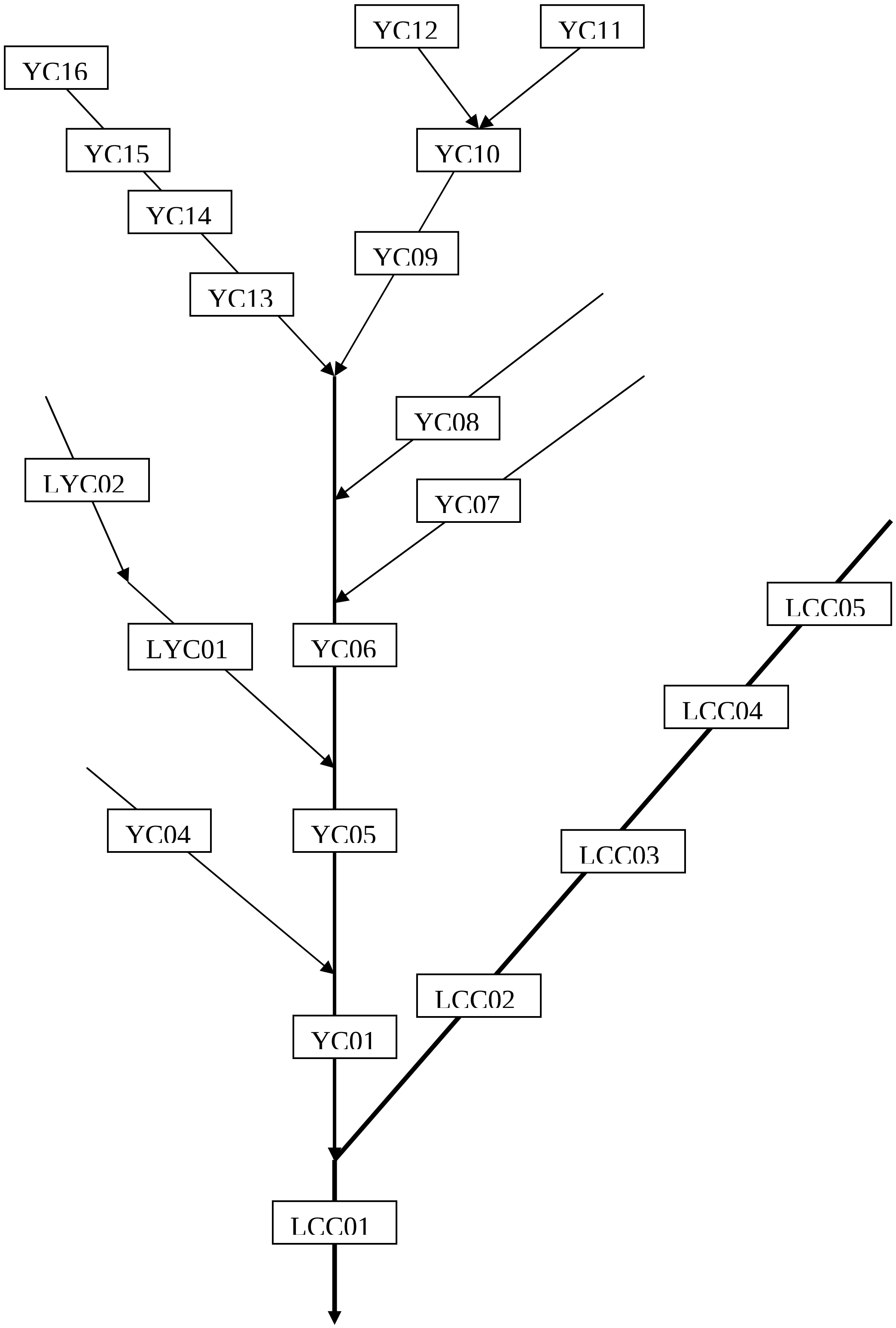
Little Connoquenessing Creek

The TMDL for Little Connoquenessing Creek consists of load allocations to fourteen sampling sites on Yellow Creek (YC16, YC15, YC14, YC13, YC12, YC11, YC10, YC09, YC08, YC07, YC06, YC5, YC04 and YC01), two sites on Little Yellow Creek (LYC02 and LYC01) and five sites on Little Connoquenessing Creek (LCC05, LCC04, LCC03, LCC02 and LCC01). Sample data sets were collected in 2007 and 2008. All sample points are shown on the maps included in Attachment A as well as on the loading schematic presented on the following page.

Little Connoquenessing Creek is listed on the 1996 PA Section 303(d) list for cause unknown (metals) from AMD as being the cause of the degradation to this stream. This TMDL will focus primarily on metal loading to the Little Connoquenessing Creek Watershed, acid loading analysis will also be considered. The objective is to reduce acid loading to the stream, which will in turn raise the pH to the desired range (between 6 and 9) 99% of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 2). The method and rationale for addressing pH is contained in Attachment B.

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

Little Connoquenessing Creek Sampling Station Diagram
Arrows represent direction of flow
Diagram not to scale



TMDL calculations- YC16 – Most NW Headwater Tributary 34943 to Yellow Creek @ Stanford Road

The TMDL for sample point YC16 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this upstream segment of UNT Yellow Creek was computed using water-quality sample data collected at point YC16. The average flow, measured at the sampling point YC16 (0.16 MGD), is used for these computations. The allowable load allocations calculated at YC16 will directly affect the downstream point YC15.

Sample data at point YC16 shows that the headwaters segment of UNT Yellow Creek has a pH ranging between 6.5 and 7.3. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH. However, because water quality standards for pH are being met, a TMDL for acidity will not be necessary. A TMDL for aluminum, iron and manganese has been calculated at this site.

Table D1 shows the measured and allowable concentrations and loads at YC16. Table D2 shows the percent reductions for aluminum, iron and manganese.

Table D1		Measured		Allowable	
Flow (gpm)=	109.78	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.80	1.06	0.24	0.32
	Iron	1.07	1.41	0.50	0.66
	Manganese	2.53	3.34	0.65	0.86
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	51.70	68.16		

Table D2. Allocations YC16			
YC16	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ YC16	1.06	1.41	3.34
Allowable Load @ YC16	0.32	0.66	0.86
Load Reduction @ YC16	0.74	0.75	2.48
% Reduction required @ YC16	70%	53%	74%

TMDL calculations- YC15 – NW Headwater Tributary 34943 to Yellow Creek Along Stanford Road

The TMDL for sampling point YC15 consists of a load allocation to all of the area between YC15 and YC16 as shown in Attachment A. The load allocation for this segment of UNT Yellow Creek was computed using water-quality sample data collected at point YC15. The average flow, measured at the sampling point YC15 (0.27 MGD), is used for these computations.

Sample data at point YC15 shows pH ranging between 7.2 and 7.5. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH. However, because water quality standards for pH are being met, a TMDL for acidity is not necessary. A TMDL for aluminum, iron and manganese at YC15 has been calculated.

Table D3 shows the measured and allowable concentrations and loads at YC15. Table D4 shows the percent reduction for aluminum, iron and manganese needed at YC15.

Table D3		Measured		Allowable	
Flow (gpm)=	187.50	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.40	0.90	0.20	0.45
	Iron	0.40	0.90	0.31	0.69
	Manganese	1.25	2.81	0.39	0.88
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	51.20	115.29		

The measured and allowable loading for point YC15 for aluminum, iron and manganese was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from point YC16 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points YC16 and YC15 to determine a total load tracked for the segment of stream between YC16 and YC15. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at YC15.

Table D4. Allocations YC15			
YC15	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ YC15	0.90	0.90	2.81
Difference in measured Loads between the loads that enter and existing YC15	-0.16	-0.51	-0.53
Percent loss due calculated at YC15	15.1%	36.2%	15.9%
Additional load tracked from above samples	0.32	0.66	0.86
Percentage of upstream loads that reach the YC15	84.9%	63.8%	84.1%
Total load tracked between YC16 and YC15	0.27	0.42	0.72
Allowable Load @ YC15	0.45	0.69	0.88
Load Reduction @ YC15	-0.18	-0.27	-0.16
% Reduction required @ YC15	0%	0%	0%

TMDL calculations- YC14- NW Tributary 34943 to Yellow Creek alongside Stanford Road

The TMDL for sampling point YC14 consists of a load allocation to all of the area between YC14 and YC15 shown in Attachment A. The load allocation for this segment of UNT Yellow Creek was computed using water-quality sample data collected at point YC14. The average flow, measured at the sampling point YC14 (0.49 MGD), is used for these computations.

Sample data at point YC14 shows that this UNT Yellow Creek segment has a pH ranging between 7.2 and 7.7. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH; however, because water quality standards are being met for pH, a TMDL for acidity is not necessary. A TMDL for manganese has been calculated at this site.

Table D5 shows the measured and allowable concentrations and loads at YC14.

Table D5		Measured		Allowable	
Flow (gpm)=	343.27	Concentration	Load	Concentration	Load
		Mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	1.03	0.25	1.03
	Iron	0.15	0.62	0.15	0.62
	Manganese	0.31	1.28	0.25	1.04
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	65.80	271.26		

The measured and allowable loading for point YC14 for aluminum, iron and manganese was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from point YC15 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points YC15 and YC14 to determine a total load tracked for the segment of stream between YC15 and YC14. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at YC14.

Table D6. Allocations YC14	
YC14	Mn (Lbs/day)
Existing Load @ YC14	1.28
Difference in measured Loads between the loads that enter and existing YC14	-1.53
Percent loss due calculated at YC14	54.4%
Additional load tracked from above samples	0.88
Percentage of upstream loads that reach the YC14	45.6%
Total load tracked between YC15 and YC14	0.40
Allowable Load @ YC14	1.04
Load Reduction @ YC14	-0.64
% Reduction required @ YC14	0%

TMDL calculations- YC13 – Mouth of NW Tributary 34943 to Yellow Creek

The TMDL for sample point YC13 consists of a load allocation to all of the area between YC14 and YC13 shown in Attachment A. The load allocation for this segment of UNT Yellow Creek was computed using water-quality sample data collected at point YC13. The average flow, measured at the sampling point YC13 (0.70 MGD), is used for these computations.

Sample data at point YC13 shows that this UNT Yellow Creek segment has a pH ranging between 7.0 and 7.5. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH; however, because water quality standards are being met for pH, a TMDL for acidity is not necessary. A TMDL for aluminum, iron and manganese has been calculated at this site.

Table D7 shows the measured and allowable concentrations and loads at YC13. Table D8 shows the percent reductions for aluminum, iron and manganese.

Table D7		Measured		Allowable	
Flow (gpm)=	486.31	Concentration	Load	Concentration	Load
		Mg/L	lbs/day	mg/L	lbs/day
	Aluminum	1.15	6.73	0.29	1.69
	Iron	1.29	7.56	0.73	4.28
	Manganese	1.49	8.73	0.60	3.48
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	60.70	354.51		

The measured and allowable loading for point YC13 for aluminum, iron and manganese was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from point YC14 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points YC14 and YC13 to determine a total load tracked for the segment of stream between YC14 and YC13. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at YC13.

Table D8. Allocations YC13			
YC13	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ YC13	6.73	7.56	8.73
Difference in measured Loads between the loads that enter and existing YC13	5.70	6.94	7.45
Additional load tracked from above samples	1.03	0.62	1.04
Total load tracked between YC14 and YC13	6.73	7.56	8.49
Allowable Load @ YC13	1.69	4.28	3.48
Load Reduction @ YC13	5.04	3.28	5.01
% Reduction required @ YC13	75%	43%	59%

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

Table D9. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow	Allowable Load
		(MGD)	(lbs/day)
Future Operation 1			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5

<u>TMDL calculations- YC12– Northern Headwater Tributary 34953 to Yellow Creek @ Kelly Road</u>

The TMDL for sample point YC12 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this upstream segment of UNT Yellow Creek was computed using water-quality sample data collected at point YC12. The average flow, measured at the sampling point YC12 (0.15 MGD), is used for these computations. The allowable load allocations calculated at YC12 will directly affect the downstream point YC10.

Sample data at point YC12 shows that the headwaters segment of UNT Yellow Creek has a pH ranging between 7.0 and 7.4. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH. However, because water quality standards for pH are being met, a TMDL for acidity will not be necessary. A TMDL for aluminum and iron has been calculated at this site.

Table D10 shows the measured and allowable concentrations and loads at YC12. Table D11 shows the percent reductions for aluminum and iron.

Table D10		Measured		Allowable	
Flow (gpm)=	104.81	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	1.39	1.74	0.11	0.14
	Iron	0.92	1.16	0.79	0.99
	Manganese	0.35	0.44	0.35	0.44
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	60.25	75.84		

Table D11. Allocations YC12		
YC12	Al (Lbs/day)	Fe (Lbs/day)
Existing Load @ YC12	1.74	1.16
Allowable Load @ YC12	0.14	0.99
Load Reduction @ YC12	1.60	0.17
% Reduction required @ YC12	92%	15%

TMDL calculations- YC11–Yellow Creek @ Kelly Road

The TMDL for sample point YC11 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this upstream segment of Yellow Creek was computed using water-quality sample data collected at point YC11. The average flow, measured at the sampling point YC11 (0.26 MGD), is used for these computations. The allowable load allocations calculated at YC11 will directly affect the downstream point YC10.

Sample data at point YC11 shows that the headwaters segment of Yellow Creek has a pH ranging between 7.0 and 7.5. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH. However, because water quality standards for pH are being met, a TMDL for acidity will not be necessary. No reductions are necessary at YC11.

Table D12 shows the measured and allowable concentrations and loads at YC12.

Table D12		Measured		Allowable	
Flow (gpm)=	177.54	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	0.53	0.25	0.53
	Iron	0.56	1.20	0.56	1.20
	Manganese	0.27	0.57	0.27	0.57
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	64.00	136.46		

TMDL calculations- YC10 –Yellow Creek along Yellow Creek Road

The TMDL for sample point YC10 consists of a load allocation to all of the area between YC12/YC11 and YC10 shown in Attachment A. The load allocation for this segment of Yellow Creek was computed using water-quality sample data collected at point YC10. The average flow, measured at the sampling point YC10 (0.49 MGD), is used for these computations.

Sample data at point YC10 shows that this Yellow Creek segment has a pH ranging between 5.5 and 6.8. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH; however, because water quality standards are not being met for pH, a TMDL for acidity has been calculated. A TMDL for aluminum, iron and manganese has also been calculated at this site.

Table D13 shows the measured and allowable concentrations and loads at YC10. Table D14 shows the percent reductions for aluminum, iron, manganese and acidity.

Table D13		Measured		Allowable	
Flow (gpm)=	343.49	Concentration	Load	Concentration	Load
		Mg/L	lbs/day	mg/L	lbs/day
	Aluminum	1.50	6.20	0.20	0.84
	Iron	3.98	16.44	0.94	3.87
	Manganese	1.35	5.58	0.43	1.77
	Acidity	10.25	42.28	4.09	16.88
	Alkalinity	17.60	72.60		

The measured and allowable loading for point YC10 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points YC12/YC11 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points YC12/YC11 and YC10 to determine a total load tracked for the segment of stream between YC12/YC11 and YC10. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at YC10.

Table D14. Allocations YC10				
YC10	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ YC10	6.20	16.44	5.58	42.28
Difference in measured Loads between the loads that enter and existing YC10	3.93	14.08	4.57	42.28
Additional load tracked from above samples	0.67	2.19	1.01	0.00
Total load tracked between YC12/YC11 and YC10	4.60	16.27	5.58	42.28
Allowable Load @ YC10	0.84	3.87	1.77	16.88
Load Reduction @ YC10	3.76	12.40	3.81	25.40
% Reduction required @ YC10	82%	76%	68%	60%

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

Table D15. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow	Allowable Load
		(MGD)	(lbs/day)
Future Operation 1			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5

TMDL calculations- YC09 –Yellow Creek @ Stanford Road

The TMDL for sample point YC09 consists of a load allocation to all of the area between YC10 and YC09 shown in Attachment A. The load allocation for this segment of Yellow Creek was computed using water-quality sample data collected at point YC09. The average flow, measured at the sampling point YC09 (0.67 MGD), is used for these computations.

Sample data at point YC09 shows that this Yellow Creek segment has a pH ranging between 6.5 and 7.1. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH; however, because water quality standards are not being met for pH, a TMDL for acidity has been calculated. A TMDL for aluminum, iron and manganese has also been calculated at this site.

Table D16 shows the measured and allowable concentrations and loads at YC09. Table D17 shows the percent reductions for iron.

Table D16		Measured		Allowable	
Flow (gpm)=	463.20	Concentration	Load	Concentration	Load
		Mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.54	2.99	0.22	1.20
	Iron	1.75	9.75	0.33	1.86
	Manganese	1.12	6.22	0.48	2.69
	Acidity	1.55	8.62	1.46	8.13
	Alkalinity	19.90	110.70		

The measured and allowable loading for point YC09 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from point YC10 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points YC10 and YC09 to determine a total load tracked for the segment of stream between YC10 and YC09. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at YC09.

Table D17. Allocations YC09				
YC09	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ YC09	2.99	9.75	6.22	8.62
Difference in measured Loads between the loads that enter and existing YC09	-3.21	-6.69	0.64	-33.66
Percent loss due calculated at YC09	51.8%	40.7%	NA	79.6%
Additional load tracked from above samples	0.84	3.87	1.77	16.88
Percentage of upstream loads that reach the YC09	48.2%	59.3%	NA	20.4%
Total load tracked between YC10 and YC09	0.41	2.30	2.41	3.44
Allowable Load @ YC09	1.20	1.86	2.69	8.13
Load Reduction @ YC09	-0.79	0.44	-0.28	-4.69
% Reduction required @ YC09	0%	19%	0%	0%

TMDL calculations- YC08– UNT 34940 to Yellow Creek @ Woody Wilson Road

The TMDL for sample point YC08 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this UNT Yellow Creek was computed using water-quality sample data collected at point YC08. The average flow, measured at the sampling point YC08 (0.05 MGD), is used for these computations. The allowable load allocations calculated at YC08 will directly affect the downstream point YC06.

Sample data at point YC08 shows that this segment of UNT Yellow Creek has a pH ranging between 7.4 and 7.6. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH. However, because water quality standards for pH are being met, a TMDL for acidity will not be necessary. A TMDL for aluminum, iron and manganese has been calculated at this site.

Table D18 shows the measured and allowable concentrations and loads at YC08. Table D19 shows the percent reductions for aluminum, iron and manganese.

Table D18		Measured		Allowable	
Flow (gpm)=	34.58	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.34	0.14	0.27	0.11
	Iron	0.35	0.14	0.27	0.11
	Manganese	0.27	0.111	0.25	0.105
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	71.15	29.55		

Table D19. Allocations YC08			
YC08	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ YC08	0.14	0.14	0.111
Allowable Load @ YC08	0.11	0.11	0.105
Load Reduction @ YC08	0.03	0.03	0.006
% Reduction required @ YC08	21%	21%	5%

TMDL calculations- YC07– UNT 34938 to Yellow Creek @ Yellow Creek Road

The TMDL for sample point YC07 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this UNT Yellow Creek was computed using water-quality sample data collected at point YC07. The average flow, measured at the sampling point YC07 (0.10 MGD), is used for these computations. The allowable load allocations calculated at YC07 will directly affect the downstream point YC06.

Sample data at point YC07 shows that this segment of UNT Yellow Creek has a pH ranging between 7.5 and 7.6. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH. However, because water quality standards for pH are being met, a TMDL for acidity will not be necessary. A TMDL for aluminum and iron has been calculated at this site.

Table D20 shows the measured and allowable concentrations and loads at YC07. Table D21 shows the percent reductions for aluminum and iron.

Table D20		Measured		Allowable	
Flow (gpm)=	69.60	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.55	0.46	0.22	0.18
	Iron	1.13	0.95	0.35	0.29
	Manganese	0.44	0.367	0.44	0.367
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	113.60	94.96		

Table D21. Allocations YC07		
YC07	Al (Lbs/day)	Fe (Lbs/day)
Existing Load @ YC07	0.46	0.95
Allowable Load @ YC07	0.18	0.29
Load Reduction @ YC07	0.28	0.66
% Reduction required @ YC07	61%	69%

TMDL calculations- YC06 –Yellow Creek upstream LYCO1 confluence @ Lancaster Road

The TMDL for sample point YC06 consists of a load allocation to all of the area between YC13/YC09/YC08/YC07 and YC06 shown in Attachment A. The load allocation for this segment of Yellow Creek was computed using water-quality sample data collected at point YC06. The average flow, measured at the sampling point YC06 (1.53 MGD), is used for these computations.

Sample data at point YC06 shows that this Yellow Creek segment has a pH ranging between 7.5 and 7.8. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH; however, because water quality standards are being met for pH, a TMDL for acidity is not necessary. No reductions are necessary at this site.

Table D22 shows the measured and allowable concentrations and loads at YC06.

Table D22		Measured		Allowable	
Flow (gpm)=	1060.98	Concentration	Load	Concentration	Load
		Mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	3.19	0.25	3.19
	Iron	0.15	1.91	0.15	1.91
	Manganese	0.29	3.75	0.29	3.75
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	54.00	688.06		

The measured and allowable loading for point YC06 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points YC13/YC09/YC08/YC07 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points YC13/YC09/YC08/YC07 and YC06 to determine a total load tracked for the segment of stream between YC13/YC09/YC08/YC07 and YC06. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at YC06.

Table D23. Allocations YC06			
YC06	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ YC06	3.19	1.91	3.75
Difference in measured Loads between the loads that enter and existing YC06	-4.14	-6.74	-5.09
Percent loss due calculated at YC06	56.5%	77.9%	57.6%
Additional load tracked from above samples	1.98	4.68	3.59
Percentage of upstream loads that reach the YC06	43.5%	22.1%	42.4%
Total load tracked between YC13/YC09/YC08/YC07 and YC06	0.86	1.03	1.52
Allowable Load @ YC09	3.19	1.91	3.75
Load Reduction @ YC09	-2.33	-0.88	-2.23
% Reduction required @ YC09	0%	0%	0%

TMDL calculations- LYC02– UNT to Little Yellow Creek off Little Yellow Creek Road

The TMDL for sample point LYC02 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this UNT to Little Yellow Creek was computed using water-quality sample data collected at point LYC02. The average flow, measured at the sampling point LYC02 (0.36 MGD), is used for these computations. The allowable load allocations calculated at LYC02 will directly affect the downstream point LYC01.

Sample data at point LYC02 shows that this segment of UNT Little Yellow Creek has a pH ranging between 7.9 and 8.1. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH. However, because water quality standards for pH are being met, a TMDL for acidity will not be necessary. No reductions are necessary at this sample site.

Table D24 shows the measured and allowable concentrations and loads at LYC02.

Table D24		Measured		Allowable	
Flow (gpm)=	248.05	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	0.74	0.25	0.74
	Iron	0.15	0.45	0.15	0.45
	Manganese	0.08	0.24	0.08	0.24
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	135.45	403.49		

TMDL calculations- LYC01 – Mouth of Little Yellow Creek @ Lancaster Road

The TMDL for sample point LYC01 consists of a load allocation to all of the area between LYC02 and LYC01 shown in Attachment A. The load allocation for this segment of Little Yellow Creek was computed using water-quality sample data collected at point LYC01. The average flow, measured at the sampling point LYC01 (0.67 MGD), is used for these computations.

Sample data at point LYC01 shows that this Little Yellow Creek segment has a pH ranging between 7.9 and 8.2. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH; however, because water quality standards are being met for pH, a TMDL for acidity is not necessary. No reductions are necessary at this site.

Table D25 shows the measured and allowable concentrations and loads at LYC01.

Table D25		Measured		Allowable	
Flow (gpm)=	468.14	Concentration	Load	Concentration	Load
		Mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	1.41	0.25	1.41
	Iron	0.34	1.91	0.34	1.91
	Manganese	0.24	1.36	0.24	1.36
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	140.35	789.07		

The measured and allowable loading for point LYC01 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from point LYC02 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points LYC02 and LYC01 to determine a total load tracked for the segment of stream between LYC02 and LYC01. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at LYC01.

Table D26. Allocations LYC01			
LYC01	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ LYC01	1.41	1.91	1.36
Difference in measured Loads between the loads that enter and existing LYC01	0.67	1.46	1.12
Additional load tracked from above samples	0.74	0.45	0.24
Total load tracked between LYC02 and LYC01	1.41	1.91	1.36
Allowable Load @ LYC01	1.41	1.91	1.36
Load Reduction @ LYC01	0.00	0.00	0.00
% Reduction required @ LYC01	0%	0%	0%

TMDL calculations- YC05 – Yellow Creek downstream from LYC01 and YC06 confluence

The TMDL for sample point YC05 consists of a load allocation to all of the area between LYC01/YC06 and YC05 shown in Attachment A. The load allocation for this segment of Yellow Creek was computed using water-quality sample data collected at point YC05. The average flow, measured at the sampling point YC05 (2.30 MGD), is used for these computations.

Sample data at point YC05 shows that this Yellow Creek segment has a pH ranging between 7.8 and 7.9. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH; however, because water quality standards are being met for pH, a TMDL for acidity is not necessary. No reductions are necessary at this site.

Table D27 shows the measured and allowable concentrations and loads at YC05.

Table D27		Measured		Allowable	
Flow (gpm)=	1597.40	Concentration	Load	Concentration	Load
		Mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	4.80	0.25	4.80
	Iron	0.15	2.88	0.15	2.88
	Manganese	0.18	3.48	0.18	3.48
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	73.65	1412.91		

The measured and allowable loading for point YC05 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points LYC01/YC06 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points LYC01/YC06 and YC05 to determine a total load tracked for the segment of stream between LYC01/YC06 and YC05. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at YC05.

Table D28. Allocations YC05			
YC05	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ YC05	4.80	2.88	3.48
Difference in measured Loads between the loads that enter and existing YC05	0.20	-0.94	-1.63
Percent loss due calculated at YC05	NA	24.6%	31.9%
Additional load tracked from above samples	4.60	3.82	5.11
Percentage of upstream loads that reach the YC05	NA	75.4%	68.1%
Total load tracked between LYC01/YC06 and YC05	4.80	2.88	3.48
Allowable Load @ YC05	4.80	2.88	3.48
Load Reduction @ YC05	0.00	0.00	0.00
% Reduction required @ YC05	0%	0%	0%

TMDL calculations- YC04– UNT 34924 to Yellow Creek Downstream from YC05

The TMDL for sample point YC04 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this UNT Yellow Creek was computed using water-quality sample data collected at point YC04. The average flow, measured at the sampling point YC04 (0.05 MGD), is used for these computations. The allowable load allocations calculated at YC04 will directly affect the downstream point YC01.

Sample data at point YC04 shows that this segment of UNT Yellow Creek has a pH ranging between 7.6 and 8.1. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH. However, because water quality standards for pH are being met, a TMDL for acidity will not be necessary. A TMDL for aluminum and iron has been calculated at this site.

Table D29 shows the measured and allowable concentrations and loads at YC07. Table D30 shows the percent reductions for aluminum and iron.

Table D29		Measured		Allowable	
Flow (gpm)=	34.46	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.48	0.20	0.25	0.10
	Iron	1.14	0.47	0.47	0.19
	Manganese	0.18	0.07	0.18	0.07
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	90.35	37.39		

Table D30. Allocations YC04		
YC04	Al (Lbs/day)	Fe (Lbs/day)
Existing Load @ YC04	0.20	0.47
Allowable Load @ YC04	0.10	0.19
Load Reduction @ YC04	0.10	0.28
% Reduction required @ YC04	50%	60%

TMDL calculations- YC01 – Mouth of Yellow Creek

The TMDL for sample point YC01 consists of a load allocation to all of the area between YC04/YC05 and YC01 shown in Attachment A. The load allocation for this segment of Yellow Creek was computed using water-quality sample data collected at point YC01. The average flow, measured at the sampling point YC01 (2.91 MGD), is used for these computations.

Sample data at point YC01 shows that this Yellow Creek segment has a pH ranging between 7.9 and 8.1. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH; however, because water quality standards are being met for pH, a TMDL for acidity is not necessary. No reductions are necessary at this site.

Table D31 shows the measured and allowable concentrations and loads at YC01.

Table D31		Measured		Allowable	
Flow (gpm)=	2019.38	Concentration	Load	Concentration	Load
		Mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	6.06	0.25	6.06
	Iron	0.15	3.64	0.15	3.64
	Manganese	0.08	1.89	0.08	1.89
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	73.80	1789.80		

The measured and allowable loading for point YC01 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points YC04/YC05 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points YC04/YC05 and YC01 to determine a total load tracked for the segment of stream between YC04/YC05 and YC01. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at YC01.

Table D32. Allocations YC01			
YC01	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ YC01	6.06	3.64	1.89
Difference in measured Loads between the loads that enter and existing YC01	1.06	0.29	-1.66
Percent loss due calculated at YC01	NA	NA	46.8%
Additional load tracked from above samples	4.90	3.07	3.55
Percentage of upstream loads that reach the YC01	NA	NA	53.2%
Total load tracked between YC05/YC04 and YC01	5.96	3.36	1.89
Allowable Load @ YC01	6.06	3.64	1.89
Load Reduction @ YC01	-0.10	-0.28	0.00
% Reduction required @ YC01	0%	0%	0%

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

Table D33. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow	Allowable Load
		(MGD)	(lbs/day)
Future Operation 1			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5

TMDL calculations- LCC05– Little Connoquenessing Creek Upstream from Semiconon Run Confluence @ Dick Road

The TMDL for sample point LCC05 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this Little Connoquenessing Creek was computed using water-quality sample data collected at point LCC05. The average flow, measured at the sampling point LCC05 (3.80 MGD), is used for these computations. The allowable load allocations calculated at LCC05 will directly affect the downstream point LCC04.

Sample data at point LCC05 shows that this segment of Little Connoquenessing Creek has a pH ranging between 7.6 and 8.0. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH. However, because water quality standards for pH are being met, a TMDL for acidity will not be necessary. No reductions have been calculated at this site.

Table D34 shows the measured and allowable concentrations and loads at LCC05.

Table D34		Measured		Allowable	
Flow (gpm)=	2641.75	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	7.93	0.25	7.93
	Iron	0.22	7.07	0.22	7.07
	Manganese	0.09	2.70	0.09	2.70
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	74.50	2363.62		

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

Table D35. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow	Allowable Load
		(MGD)	(lbs/day)
Future Operation 1			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5

TMDL calculations- LCC04 – Little Connoquenessing Creek @ Welsh Road

The TMDL for sample point LCC04 consists of a load allocation to all of the area between LCC05 and LCC04 shown in Attachment A. The load allocation for this segment of Little Connoquenessing Creek was computed using water-quality sample data collected at point LCC04. The average flow, measured at the sampling point LCC04 (7.89 MGD), is used for these computations.

Sample data at point LCC04 shows that this Little Connoquenessing Creek segment has a pH ranging between 7.6 and 7.9. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH; however, because water quality standards are being met for pH, a TMDL for acidity is not necessary. A TMDL for iron has also been calculated at this site.

Table D36 shows the measured and allowable concentrations and loads at LCC04. Table D37 shows the percent reductions for iron.

Table D36		Measured		Allowable	
Flow (gpm)=	5482.33	Concentration	Load	Concentration	Load
		Mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	16.46	0.25	16.46
	Iron	1.18	77.86	0.19	12.77
	Manganese	0.09	5.79	0.09	5.79
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	66.40	4371.82		

The measured and allowable loading for point LCC04 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from point LCC05 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points LCC05 and LCC04 to determine a total load tracked for the segment of stream between LCC05 and LCC04. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at LCC04.

Table D37. Allocations LCC04			
LCC04	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ LCC04	16.48	77.86	5.79
Difference in measured Loads between the loads that enter and existing LCC04	8.55	70.79	3.09
Additional load tracked from above samples	7.93	7.07	2.70
Total load tracked between LCC05 and LCC04	16.48	77.86	5.79
Allowable Load @ LCC04	16.48	12.77	5.79
Load Reduction @ LCC04	0.00	65.09	0.00
% Reduction required @ LCC04	0%	84%	0%

A waste load allocation for future mining was included for this segment of Little Connoquenessing Creek allowing for three operations with two active pits (1500' x 300') to be permitted in the future on this segment (Attachment C for the method used to quantify treatment pond load).

Table D38. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow	Allowable Load
		(MGD)	(lbs/day)
Future Operation 1			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5
Future Operation 2			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5
Future Operation 3			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5

TMDL calculations- LCC03 – Little Connoquenessing Creek Upstream from RT 528

The TMDL for sample point LCC03 consists of a load allocation to all of the area between LCC04 and LCC03 shown in Attachment A. The load allocation for this segment of Little Connoquenessing Creek was computed using water-quality sample data collected at point LCC03. The average flow, measured at the sampling point LCC03 (6.09 MGD), is used for these computations.

Sample data at point LCC03 shows that this Little Connoquenessing Creek segment has a pH ranging between 7.4 and 7.6. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH; however, because water quality standards are being met for pH, a TMDL for acidity is not necessary. No reductions are calculated at LCC03.

Table D39 shows the measured and allowable concentrations and loads at LCC03.

Table D39		Measured		Allowable	
Flow (gpm)=	4227.58	Concentration	Load	Concentration	Load
		Mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	12.69	0.25	12.69
	Iron	0.53	26.90	0.53	26.90
	Manganese	0.34	17.03	0.34	17.03
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	71.10	3609.86		

The measured and allowable loading for point LCC03 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from point LCC04 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points LCC04 and LCC03 to determine a total load tracked for the segment of stream between LCC04 and LCC03. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at LCC03.

Table D40. Allocations LCC03			
LCC03	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ LCC03	12.69	26.90	17.03
Difference in measured Loads between the loads that enter and existing LCC03	-3.79	-50.96	11.24
Percent loss due calculated at LCC03	23.0%	65.5%	NA
Additional load tracked from above samples	16.48	12.77	5.79
Percentage of upstream loads that reach the LCC03	77.0%	34.5%	NA
Total load tracked between LCC04 and LCC03	12.69	4.41	17.03
Allowable Load @ LCC03	12.69	26.90	17.03
Load Reduction @ LCC03	0.00	-22.49	0.00
% Reduction required @ LCC03	0%	0%	0%

A waste load allocation for future mining was included for this segment of Little Connoquenessing Creek allowing for five operations with two active pits (1500’ x 300’) to be permitted in the future on this segment (Attachment C for the method used to quantify treatment pond load).

Table D41. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5
Future Operation 2			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5
Future Operation 3			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5
Future Operation 4			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5
Future Operation 5			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5

TMDL calculations- LCC02 – Little Connoquenessing Creek upstream from Yellow Creek @ Little Yellow Creek Rd

The TMDL for sample point LCC02 consists of a load allocation to all of the area between LCC03 and LCC02 shown in Attachment A. The load allocation for this segment of Little Connoquenessing Creek was computed using water-quality sample data collected at point LCC02. The average flow, measured at the sampling point LCC02 (9.22 MGD), is used for these computations.

Sample data at point LCC02 shows that this Little Connoquenessing Creek segment has a pH ranging between 7.6 and 8.0. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH; however, because water quality standards are being met for pH, a TMDL for acidity is not necessary. No reductions are calculated at LCC02.

Table D42 shows the measured and allowable concentrations and loads at LCC02.

Table D42		Measured		Allowable	
Flow (gpm)=	6403.57	Concentration	Load	Concentration	Load
		Mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	19.23	0.25	19.23
	Iron	0.52	40.18	0.52	40.18
	Manganese	0.16	12.27	0.16	12.27
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	65.70	5052.61		

The measured and allowable loading for point LCC02 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from point LCC03 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points LCC03 and LCC02 to determine a total load tracked for the segment of stream between LCC03 and LCC02. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at LCC02.

Table D43. Allocations LCC02			
LCC02	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ LCC02	19.23	40.18	12.27
Difference in measured Loads between the loads that enter and existing LCC02	6.54	13.28	-4.76
Percent loss due calculated at LCC02	NA	NA	28.0%
Additional load tracked from above samples	12.69	26.90	17.03
Percentage of upstream loads that reach the LCC02	NA	NA	72.0%
Total load tracked between LCC03 and LCC02	19.23	40.18	12.27
Allowable Load @ LCC02	19.23	40.18	12.27
Load Reduction @ LCC02	0.00	0.00	0.00
% Reduction required @ LCC02	0%	0%	0%

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

Table D44. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow	Allowable Load
		(MGD)	(lbs/day)
Future Operation 1			
Al	0.75	0.09	0.56

Fe	3	0.09	2.25
Mn	2	0.09	1.5
Future Operation 2			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5
Future Operation 3			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5
Future Operation 4			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5
Future Operation 5			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5

TMDL calculations- LCC01 – Mouth of Little Connoquenessing Creek @ Evergreen Mill Road

The TMDL for sample point LCC01 consists of a load allocation to all of the area between LCC02/YC01 and LCC01 shown in Attachment A. The load allocation for this segment of Little Connoquenessing Creek was computed using water-quality sample data collected at point LCC01. The average flow, measured at the sampling point LCC01 (13.50 MGD), is used for these computations.

Sample data at point LCC01 shows that this Little Connoquenessing Creek segment has a pH ranging between 7.6 and 8.0. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH; however, because water quality standards are being met for pH, a TMDL for acidity is not necessary. No reductions are calculated at LCC01.

Table D45 shows the measured and allowable concentrations and loads at LCC01.

Table D45		Measured		Allowable	
Flow (gpm)=	9371.46	Concentration	Load	Concentration	Load
		Mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	28.14	0.25	28.14
	Iron	0.15	16.88	0.15	16.88
	Manganese	0.07	7.51	0.07	7.51
	Acidity	0.00	0.00	0.00	0.00
	Alkalinity	68.30	7686.99		

The measured and allowable loading for point LCC01 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points LCC02/YC01 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points LCC02/YC01 and LCC01 to determine a total load tracked for the segment of stream between LCC02/YC01 and LCC01. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at LCC01.

Table D46. Allocations LCC01			
LCC01	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ LCC01	28.14	16.88	7.51
Difference in measured Loads between the loads that enter and existing LCC01	2.85	-26.94	-6.65
Percent loss due calculated at LCC01	NA	61.5%	47.0%
Additional load tracked from above samples	25.29	43.82	14.16
Percentage of upstream loads that reach the LCC01	NA	38.5%	53.0%
Total load tracked between YC01/LCC02 and LCC01	28.14	16.88	7.51
Allowable Load @ LCC01	28.14	16.88	7.51
Load Reduction @ LCC01	0.00	0.00	0.00
% Reduction required @ LCC01	0%	0%	0%

A waste load allocation for future mining was included for this segment of Little Connoquenessing Creek allowing for four operations with two active pits (1500’ x 300’) to be permitted in the future on this segment (Attachment C for the method used to quantify treatment pond load).

Table D47. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow	Allowable Load
		(MGD)	(lbs/day)
Future Operation 1			
Al	0.75	0.09	0.56

Fe	3	0.09	2.25
Mn	2	0.09	1.5
Future Operation 2			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5
Future Operation 3			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5
Future Operation 4			
Al	0.75	0.09	0.56
Fe	3	0.09	2.25
Mn	2	0.09	1.5

Margin of Safety

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

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

Seasonal Variation

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

Critical Conditions

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

Attachment E

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 F

Water Quality Data Used In TMDL Calculations

YC16 *NW Headwater Tributary to Yellow Creek @ Stanford Road*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/24/2007	47	7.1	55.6	-15.2	1.46	2.5	0.25
5/5/2008	222	7.2	40.6	-19	1.386	2.202	1.426
7/15/2008	108.55	7.29	58.8	-43.8	0.15	2.184	0.749
8/12/2008	61.57	6.49	51.8	-60.2	1.283	3.239	0.791
AVERAGE	**109.78**	**7.02**	**51.70**	**-34.55**	**1.07**	**2.53**	**0.80**
ST DEV	**79.29**	**0.36**	**7.93**	**21.29**	**0.62**	**0.49**	**0.48**

YC15 *NW Headwater Tributary to Yellow Creek Along Stanford Road*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/24/2007	100	7.4	51.4	-12.6	0.15	1.88	0.25
5/5/2008	359	7.5	39.2	-19	0.984	1.54	0.852
7/15/2008	178.79	7.47	60	-46.6	0.306	1.006	0.25
8/12/2008	112.22	7.18	54.2	-45.6	0.15	0.559	0.25
AVERAGE	**187.50**	**7.39**	**51.20**	**-30.95**	**0.40**	**1.25**	**0.40**
ST DEV	**119.46**	**0.14**	**8.77**	**17.69**	**0.40**	**0.58**	**0.30**

YC14 *NW Tributary to Yellow Creek alongside Stanford Road*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/24/2007	211	7.7	88.4	-34.4	0.15	0.179	0.25
5/5/2008	848	7.7	56.2	-36	0.15	0.647	0.25
7/15/2008	202.48	7.64	61.8	-50.8	0.15	0.321	0.25
8/12/2008	111.58	7.16	56.8	-46	0.15	0.092	0.25
AVERAGE	**343.27**	**7.55**	**65.80**	**-41.80**	**0.15**	**0.31**	**0.25**
ST DEV	**339.48**	**0.26**	**15.27**	**7.90**	**0.00**	**0.24**	**0.00**

YC13 *Mouth of NW Tributary to Yellow Creek*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/24/2007	276	7.4	72.4	-35.2	1.06	1.48	0.614
5/5/2008	1143	7.5	50.4	-29	0.799	1.01	0.754
7/15/2008	314.92	7.44	61	-46.6	1.553	1.639	1.515
8/12/2008	211.31	7.02	59	-42.6	1.763	1.848	1.726

AVERAGE	**7.34**	**60.70**	**-38.35**	**1.29**	**1.49**	**1.15**	**1.15**
ST DEV	**0.22**	**9.05**	**7.82**	**0.44**	**0.36**	**0.55**	**0.55**

YC12 *Northern Headwater Tributary to Yellow Creek @ Kelly Road*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/24/2008	27	7.4	70.4	-34.4	0.742	0.258	0.25
5/5/2008	256	7.4	49.8	-30.8	0.694	0.355	4.466
7/15/2008	80.53	7.15	60.4	-41.8	0.934	0.352	0.25
8/13/2008	55.71	7.00	60.4	-47.4	1.304	0.446	0.574
AVERAGE	**104.81**	**7.24**	**60.25**	**-38.60**	**0.92**	**0.35**	**1.39**
ST DEV	**103.14**	**0.20**	**8.41**	**7.44**	**0.28**	**0.08**	**2.06**

YC11 *Yellow Creek @ Kelly Road*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/24/2007	18	7.5	73.4	-37.6	0.353	0.28	0.25
5/5/2008	498	7.5	51.4	-31.2	0.591	0.163	0.25
7/15/2008	128.38	6.97	65.4	-50.2	0.874	0.308	0.25
8/13/2008	65.78	7.36	65.8	-52.2	0.424	0.311	0.25
AVERAGE	**177.54**	**7.33**	**64.00**	**-42.80**	**0.56**	**0.27**	**0.25**
ST DEV	**218.37**	**0.25**	**9.17**	**10.08**	**0.23**	**0.07**	**0.00**

YC10 *Yellow Creek along Yellow Creek Road*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/24/2007	164	6.5	18.4	19.2	3.18	1.55	0.74
5/5/2008	945	6.8	28.2	-2	4.69	0.541	0.943
7/15/2008	209.25	5.51	11	12.4	3.319	1.497	3.114
8/12/2008	55.71	5.93	12.8	11.4	4.749	1.821	1.216
AVERAGE	**343.49**	**6.19**	**17.60**	**10.25**	**3.98**	**1.35**	**1.50**
ST DEV	**406.15**	**0.58**	**7.74**	**8.87**	**0.85**	**0.56**	**1.09**

YC09 *Yellow Creek @ Stanford Road*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/24/2007	174	6.5	17.2	14.4	1.24	1.46	0.25

5/5/2008	1161	6.8	22.4	2	4.086	0.574	1.01
7/15/2008	350.52	6.91	25.2	-8.2	1.205	1.129	0.638
8/12/2008	167.27	7.08	14.8	-2	0.48	1.31	0.25
AVERAGE	**463.20**	**6.82**	**19.90**	**1.55**	**1.75**	**1.12**	**0.54**
ST DEV	**472.88**	**0.24**	**4.75**	**9.54**	**1.59**	**0.39**	**0.36**

YC08 *UNT to Yellow Creek @ Woody Wilson Road*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/24/2007	5	7.4	74.8	-50.6	0.15	0.174	0.25
5/5/2008	97	7.6	53	-35	0.15	0.119	0.25
7/15/2008	16.11	7.53	72	-54.4	0.15	0.195	0.25
8/13/2008	20.21	7.55	84.8	-73.2	0.939	0.58	0.603
AVERAGE	**34.58**	**7.52**	**71.15**	**-53.30**	**0.35**	**0.27**	**0.34**
ST DEV	**42.11**	**0.09**	**13.29**	**15.70**	**0.39**	**0.21**	**0.18**

YC07 *UNT to Yellow Creek @ Yellow Creek Road*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/24/2007	15	7.6	126.2	-78.4	0.15	0.36	0.25
5/5/2008	186	7.5	89.2	-76.8	0.593	0.237	0.25
7/15/2008	59.23	7.51	115	-100.6	2.378	0.541	1.007
8/13/2008	18.18	7.48	124	-112.6	1.403	0.62	0.702
AVERAGE	**69.60**	**7.52**	**113.60**	**-92.10**	**1.13**	**0.44**	**0.55**
ST DEV	**80.17**	**0.05**	**16.97**	**17.46**	**0.98**	**0.17**	**0.37**

YC06 *Yellow Creek upstream LYCO1 confluence @ Lancaster Road*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/20/2007	753	7.8	63	-29.4	0.15	0.3	0.25
5/5/2008	2322	7.7	51.8	-30.2	0.15	0.409	0.25
7/15/2008	791.31	7.51	54.4	-39.6	0.15	0.256	0.25
8/13/2008	377.59	7.46	46.8	-35	0.15	0.211	0.25
AVERAGE	**1060.98**	**7.62**	**54.00**	**-33.55**	**0.15**	**0.29**	**0.25**
ST DEV	**861.16**	**0.16**	**6.78**	**4.73**	**0.00**	**0.08**	**0.00**

LYC02 *UNT to Little Yellow Creek off Little Yellow Creek Road*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/24/2007	112	8	138.6	-112.2	0.15	0.025	0.25
5/7/2008	862	8.1	76.6	-53.6	0.15	0.025	0.25
7/15/2008	6.26	7.87	126.6	-110.6	0.15	0.097	0.25
8/13/2008	11.92	7.96	200	-171.2	0.15	0.176	0.25
AVERAGE	**248.05**	**7.98**	**135.45**	**-111.90**	**0.15**	**0.08**	**0.25**
ST DEV	**412.17**	**0.10**	**50.72**	**48.02**	**0.00**	**0.07**	**0.00**

LYC01 *Mouth of Little Yellow Creek @ Lancaster Road*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/20/2007	156	8.2	165.6	-131.2	0.354	0.368	0.25
5/5/2008	1405	8.1	92.8	-75.4	0.15	0.147	0.25
7/15/2008	225.47	8.01	138.8	-120.2	0.513	0.236	0.25
8/13/2008	86.09	7.90	164.2	-150	0.344	0.217	0.25
AVERAGE	**468.14**	**8.05**	**140.35**	**-119.20**	**0.34**	**0.24**	**0.25**
ST DEV	**627.16**	**0.13**	**34.01**	**31.69**	**0.15**	**0.09**	**0.00**

YC05 *Yellow Creek downstream from LYC01 and YC06 confluence*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/24/2007	722	7.8	85.8	-30.6	0.15	0.107	0.25
5/7/2008	4074	7.8	65.6	-39.8	0.15	0.29	0.25
7/15/2008	1139.41	7.91	75	-59.2	0.15	0.174	0.25
8/13/2008	454.17	7.79	68.2	-52.6	0.15	0.155	0.25
AVERAGE	**1597.40**	**7.83**	**73.65**	**-45.55**	**0.15**	**0.18**	**0.25**
ST DEV	**1674.97**	**0.06**	**9.02**	**12.81**	**0.00**	**0.08**	**0.00**

YC04 *UNT to Yellow Creek Downstream from YC05*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/24/2007	20	7.8	97.4	85.6	1.99	0.186	0.793
5/7/2008	74	7.6	54.8	-31.4	0.492	0.145	0.25
7/15/2008	31.34	7.84	93.2	-75	1.435	0.305	0.622
8/13/2008	12.49	8.08	116	-99.6	0.634	0.078	0.25
AVERAGE	**34.46**	**7.83**	**90.35**	**-30.10**	**1.14**	**0.18**	**0.48**

ST DEV	27.48	0.20	25.69	82.13	0.70	0.10	0.27

YC01 *Mouth of Yellow Creek*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/20/2007	1059	8	84	-65	0.15	0.025	0.25
5/7/2008	5175	7.9	62.8	-41.4	0.15	0.208	0.25
7/15/2008	1318.12	8.1	74.2	-56.8	0.15	0.054	0.25
8/13/2008	525.41	7.97	74.2	-57.8	0.15	0.025	0.25
AVERAGE	**2019.38**	**7.99**	**73.80**	**-55.25**	**0.15**	**0.08**	**0.25**
ST DEV	**2129.47**	**0.08**	**8.67**	**9.93**	**0.00**	**0.09**	**0.00**

LCC05 *Little Connoquenessing Creek Upstream from Semiconon Run Confluence @ Dick Road*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/25/2007	342	7.8	88.4	-22.8	0.15	0.06	0.25
5/20/2008	8593	7.6	41.8	-19.8	0.15	0.061	0.25
7/16/2008	1195.96	7.74	81.2	-67.8	0.15	0.088	0.25
8/13/2008	436.05	7.97	86.6	-76.4	0.441	0.131	0.25
AVERAGE	**2641.75**	**7.78**	**74.50**	**-46.70**	**0.22**	**0.09**	**0.25**
ST DEV	**3985.88**	**0.15**	**22.01**	**29.56**	**0.15**	**0.03**	**0.00**

LCC04 *Little Connoquenessing Creek @ Welsh Road*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/26/2007	827	7.8	74.8	-47.8	4.28	0.086	0.25
5/20/2008	18843	7.6	40.8	-16.6	0.15	0.082	0.25
7/16/2008	1655.66	7.74	74	-59.6	0.15	0.108	0.25
8/13/2008	603.66	7.92	76	-65.4	0.15	0.076	0.25
AVERAGE	**5482.33**	**7.77**	**66.40**	**-47.35**	**1.18**	**0.09**	**0.25**
ST DEV	**8918.60**	**0.13**	**17.09**	**21.77**	**2.07**	**0.01**	**0.00**

LCC03 *Little Connoquenessing Creek Upstream from RT 528*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/25/2007	916	7.4	82	-51.8	0.519	0.354	0.25
5/20/2008	13637	7.6	42.6	-12.6	0.347	0.148	0.25

7/16/2008	1727.47	7.55	75.2	-62.2	0.701	0.317	0.25
8/13/2008	629.85	7.55	84.6	-74.8	0.552	0.523	0.25
AVERAGE	**4227.58**	**7.53**	**71.10**	**-50.35**	**0.53**	**0.34**	**0.25**
ST DEV	**6290.15**	**0.09**	**19.41**	**26.87**	**0.15**	**0.15**	**0.00**

LCC02 *Little Connoquenessing Creek upstream from Yellow Creek @ Little Yellow Creek Rd*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/19/2007	1849	8	68.4	-34.6	0.631	0.105	0.25
5/20/2008	20354	7.6	42	-21.6	0.406	0.132	0.25
7/15/2008	2499.83	7.95	72.2	-53.4	0.551	0.199	0.25
8/13/2008	911.45	7.91	80.2	-67	0.502	0.202	0.25
AVERAGE	**6403.57**	**7.87**	**65.70**	**-44.15**	**0.52**	**0.16**	**0.25**
ST DEV	**9323.11**	**0.18**	**16.55**	**20.06**	**0.09**	**0.05**	**0.00**

LCC01 *Mouth of Little Connoquenessing Creek @ Evergreen Mill Road*

Date Collected	Initial Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
9/19/2007	3218	7.9	74.2	-41.4	0.15	0.025	0.25
5/20/2008	29428	7.8	47.4	-25.4	0.15	0.11	0.25
7/16/2008	3546.68	7.76	75.2	-60.6	0.15	0.069	0.25
8/13/2008	1293.14	8.23	76.4	-64	0.15	0.063	0.25
AVERAGE	**9371.46**	**7.92**	**68.30**	**-47.85**	**0.15**	**0.07**	**0.25**
ST DEV	**13407.92**	**0.21**	**13.96**	**17.97**	**0.00**	**0.03**	**0.00**

Underlined data are included at one half the detection limit.

Attachment G

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 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 H
Comment and Response

No official comments were received.