Final COXES CREEK WATERSHED TMDL

Somerset County

For Abandoned Mine Drainage Affected Segments

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Pennsylvania Department of Environmental Protection

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Introduction

This report presents the Total Maximum Daily Loads (TMDLs) developed for segments in the Coxes Creek Watershed (Attachment A). These were done to address the impairments noted on the 1996 Pennsylvania 303(d) list of impaired waters, required under the Clean Water Act, and covers two segments on this list (Attachment B). High levels of metals, suspended solids, and in some areas depressed pH, caused these impairments. All impairments resulted from drainage from abandoned coalmines. The TMDL addresses the three primary metals associated with abandoned mine drainage (iron, manganese, aluminum) and pH.

Table 1. 303(d) Listed Segments

State Water Plan (SWP) Subbasin: 19F

HUC: 05020006 Youghigheny River

Year	Miles	Use Designation	Assessment ID	Segment ID	DEP Stream Code	Stream Name	Desig-nated Use	Data Source	Source	EPA 305(b) Cause Code
1996	1	*	*	4849	38944	Coxes Creek	WWF	305(b) Report	RE	Suspended Solids
1996	1	*	*	9209	39012	East Branch Coxes Creek	WWF[2] TSF[3]	305(b) Report	RE	Metals
1998	1	*	*	Not in GIS.	38944	Coxes Creek	WWF	SWMP	AMD	Suspended Solids
1998	1	*	*	Not in GIS.	39012	East Branch Coxes Creek	WWF TSF	SWMP	AMD	Metals
2002	Not on list.					Coxes Creek				
2002	Not on list.					East Branch Coxes Creek				
2008	3.14	Aquatic Life	12718	*	38968	Bromm Run	WWF	SWMP	Surface Mining	Siltation
2008	6.37	Aquatic Life	7468	*	38944	Coxes Creek	WWF	SWMP	AMD	Suspended Solids
2008	2.72	Aquatic Life	12722	*	38955	Coxes Creek, Unt	WWF	SWMP	Crop Related Agriculture	Siltation
2008	0.94	Aquatic Life	12722	*	38956	Coxes Creek, Unt	WWF	SWMP	Crop Related Agriculture	Siltation
2008	1.17	Aquatic Life	12722	*	38957	Coxes Creek, Unt	WWF	SWMP	Crop Related Agriculture	Siltation
2008	0.14	Aquatic Life	12722	*	38958	Coxes Creek, Unt	WWF	SWMP	Crop Related Agriculture	Siltation
2008	1.13	Aquatic Life	12722	*	38959	Coxes Creek, Unt	WWF	SWMP	Crop Related Agriculture	Siltation

[1] Pennsylvania's 1996, 1998 and 2002 Section 303(d) lists were approved by the Environmental Protection Agency (EPA). The 1996 Section 303(d) list provides the basis for measuring progress under the 1996 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA.*
[2] Basin, source to PA281
[3] Main stem, PA281 to confluence with West Branch

2008	0.48	Aquatic Life	12722	*	38960	Coxes Creek, Unt	WWF	SWMP	Crop Related Agriculture	Siltation
2008	0.58	Aquatic Life	12720	*	38961	Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.63	Aquatic Life	12720	*	38962	Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.48	Aquatic Life	12720	*	38966	Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.47	Aquatic Life	12720	*	38978	Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	1.39	Aquatic Life	12718	*	38969	Dempsey Run	WWF	SWMP	Surface Mining	Siltation
2008	0.21	Aquatic Life	12720	*	*	Unknown NHD Name: 05020006002767	WWF	SWMP	Agriculture	Siltation
2008	3.79	Aquatic Life	12720	*	38963	Rice Run	WWF	SWMP	Agriculture	Siltation
2008	0.69	Aquatic Life	12720	*	38964	Rice Run, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.20	Aquatic Life	12720	*	38965	Rice Run, Unt	WWF	SWMP	Agriculture	Siltation
2008	3.89 0.7	Aquatic Life	7469 12717	*	39012	East Branch Coxes Creek	WWF TSF	SWMP	AMD Agriculture	Metals Siltation
2008	1.18	Aquatic Life	12717	*	39013	East Branch Coxes Creek, Unt	TSF	SWMP	Agriculture	Siltation
2008	1.28	Aquatic Life	12717	*	39014	East Branch Coxes Creek, Unt	TSF	SWMP	Agriculture	Siltation
2008	0.48	Aquatic Life	12717	*	39015	East Branch Coxes Creek, Unt	TSF	SWMP	Agriculture	Siltation
2008	2.06	Aquatic Life	12058	*	39025	East Branch Coxes Creek, Unt	TSF	SWMP	AMD	Metals Siltation
2008	0.72	Aquatic Life	12714	*	39027	East Branch Coxes Creek, Unt	TSF	SWMP	Road Runoff	Siltation
2008	2.61	Aquatic Life	12716	*	39028	East Branch Coxes Creek, Unt	TSF	SWMP	Road Runoff	Siltation
2008	2.61	Aquatic Life	12716	*	39029	East Branch Coxes Creek, Unt	TSF	SWMP	Road Runoff	Siltation
2008	0.12	Aquatic Life	12716	*	39030	East Branch Coxes Creek, Unt	TSF	SWMP	Road Runoff	Siltation
2008	0.64	Aquatic Life	12716	*	39031	East Branch Coxes Creek, Unt	TSF	SWMP	Road Runoff	Siltation
2008	3.77	Aquatic Life	12713	*	39032	East Branch Coxes Creek, Unt	WWF	SWMP	Road Runoff Urban Runoff/Storm Sewers	Siltation
2008	0.92	Aquatic Life	12713	*	39033	East Branch Coxes Creek, Unt	WWF	SWMP	Road Runoff Urban Runoff/Storm Sewers	Siltation

2008	0.11	Aquatic Life	12713	*	39034	East Branch Coxes Creek, Unt	WWF	SWMP	Road Runoff Urban Runoff/Storm Sewers	Siltation
2008	0.13	Aquatic Life	12713	*	39035	East Branch Coxes Creek, Unt	WWF	SWMP	Road Runoff Urban Runoff/Storm Sewers	Siltation
2008	0.79	Aquatic Life	12713	*	39036	East Branch Coxes Creek, Unt	WWF	SWMP	Road Runoff Urban Runoff/Storm Sewers	Siltation
2008	0.82	Aquatic Life	12713	*	39037	East Branch Coxes Creek, Unt	WWF	SWMP	Road Runoff Urban Runoff/Storm Sewers	Siltation
2008	0.15	Aquatic Life	12713	*	39038	East Branch Coxes Creek, Unt	WWF	SWMP	Road Runoff Urban Runoff/Storm Sewers	Siltation
2008	0.56	Aquatic Life	12713	*	39039	East Branch Coxes Creek, Unt	WWF	SWMP	Road Runoff Urban Runoff/Storm Sewers	Siltation
2008	3.13	Aquatic Life	12713	*	39040	East Branch Coxes Creek, Unt	WWF	SWMP	Road Runoff Urban Runoff/Storm Sewers	Siltation
2008	0.07	Aquatic Life	12713	*	*	Unknown NHD Name: 05020006002494	WWF	SWMP	Road Runoff Urban Runoff/Storm Sewers	Siltation
2008	1.99	Aquatic Life	12092	*	39016	Kimberly Run	CWF	SWMP	Crop Related Agriculture	Siltation
2008	1.70	Aquatic Life	12062	*	39020	Kimberly Run, Unt	CWF	SWMP	AMD	Metals
2008	0.82	Aquatic Life	12092	*	39024	Kimberly Run, Unt	CWF	SWMP	Crop Related Agriculture	Siltation
2008	1.20	Aquatic Life	12715	*	39026	Parson Run	TSF	SWMP	AMD	Metals
2008	7.49	Aquatic Life	12719	*	38979	West Branch Coxes Creek	WWF	SWMP	Agriculture	Siltation
2008	1.01	Aquatic Life	12719	*	38980	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.28	Aquatic Life	12719	*	38981	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	1.36	Aquatic Life	12719	*	38982	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.63	Aquatic Life	12719	*	38983	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation

2008	0.50	Aquatic Life	12719	*	38984	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	1.66	Aquatic Life	12719	*	38985	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.83	Aquatic Life	12719	*	38986	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.53	Aquatic Life	12719	*	38987	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	1.40	Aquatic Life	12719	*	38988	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	1.05	Aquatic Life	12719	*	38989	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.18	Aquatic Life	12719	*	38990	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.20	Aquatic Life	12719	*	38991	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.23	Aquatic Life	12719	*	38992	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.35	Aquatic Life	12719	*	38993	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.82	Aquatic Life	12719	*	38994	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.62	Aquatic Life	12719	*	38995	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	1.59	Aquatic Life	12719	*	38996	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.08	Aquatic Life	12719	*	38997	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	1.79	Aquatic Life	12719	*	38998	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.27	Aquatic Life	12719	*	38999	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.55	Aquatic Life	12719	*	39000	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.47	Aquatic Life	12719	*	39001	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.19	Aquatic Life	12719	*	39002	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.24	Aquatic Life	12719	*	39003	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation

2008	0.76	Aquatic Life	12719	*	39004	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	1.13	Aquatic Life	12719	*	39005	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.65	Aquatic Life	12719	*	39006	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.46	Aquatic Life	12719	*	39007	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	1.30	Aquatic Life	12719	*	39008	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.89	Aquatic Life	12719	*	39009	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.06	Aquatic Life	12719	*	39010	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	1.08	Aquatic Life	12719	*	39011	West Branch Coxes Creek, Unt	WWF	SWMP	Agriculture	Siltation
2008	0.08	Aquatic Life	12719	*	*	Unknown NHD Name: 05020006002553	WWF	SWMP	Agriculture	Siltation
2008	0.01	Aquatic Life	12719	*	*	Unknown NHD Name: 05020006007052	WWF	SWMP	Agriculture	Siltation

RE = Resource Extraction
AMD = Abandoned Mine Drainage
WWF = Warm Water Fishes
TSF = Trout Stocked Fishes
CWF = Cold Water Fishes
SWMP = Surface Water Monitoring Program

Directions to the Coxes Creek Watershed

Coxes Creek is located in Western Pennsylvania and flows through the central portion of Somerset County, from the county seat in Somerset, south to the town of Rockwood. The watershed includes portions of Somerset, Stonycreek, Brothersvalley, Black and Milford Townships. The watershed is located on portions of the Stoystown, Berlin, Somerset, Bakersville, Rockwood and Murdock United States Geological Survey 7.5-Minute Quadrangles. The total area within the watershed consists of approximately 65 square miles. Land uses within the watershed include abandoned mine lands, forestlands, agricultural lands and rural residential properties and small communities.

The Coxes Creek Watershed is located between Somerset and Rockwood. From the north, Somerset can be reached by taking U.S. Route 219 South and then west on SR281 into Somerset. Just south of town, Water Level Road is taken south-southwest into Rockwood.

Watershed Background

The entire watershed has been extensively mined since the late 1940's. Mining focused on the Upper, Middle and Lower Kittanning Coal Seams, as well as the Upper and Lower Freeport Coal

Seams. Limited mining has also occurred on the Mahoning, Clarion and Brookville Coal Seams. These past mining operations have resulted in some scarring of the land within the watershed. However, the overall water quality within the watershed remains good.

The headwaters for Coxes Creek begin in the area surrounding the town of Somerset. From this point, the stream flows south-southeast to the town of Rockwood, where it junctions with the Casselman River. Coxes Creek flows from an elevation of approximately 2,200 feet above sea level at its headwaters to an elevation of approximately 1,800 feet above sea level at its confluence with the Casselman River. The Coxes Creek Watershed lies within the Appalachian Plateau Physiographic Province. The watershed is bounded to the north by the axes of the Boswell Dome and the Somerset Syncline. The watershed is bounded to the west by the axis of the Centerville Dome. The watershed is bounded to the east by the axis of the Negro Mountain Anticline. Strata and geologic structure within the watershed are regionally oriented with a SW to NE trend. The direction of dip is variable, depending on the portion of the watershed in question as related to the associated geologic structure.

The watershed area is comprised of Pennsylvanian aged rocks, which are divided into the Clarion, Kittanning and Freeport Formations of the Allegheny Group. The Glenshaw Formation, of the Conemaugh Group, is also represented within the watershed. The Allegheny Formation includes the Brookville, Clarion, Lower Kittanning, Middle Kittanning, Upper Kittanning, Lower Freeport and Upper Freeport Coal Seams.

Segments addressed in this TMDL

There are active mining operations with NPDES permits in the watershed. The remaining discharges in the watershed are from abandoned mines and will be treated as non-point sources. These TMDLs will be expressed as long-term, average loadings. Due to the nature and complexity of mining effects on the watershed, expressing the TMDL as a long-term average gives a better representation of the data used for the calculations. See Attachment D for TMDL calculations.

This AMD TMDL document contains one or more future mining waste load allocations (WLA). These WLAs were requested by the Cambria 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 the appropriate 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. The inclusion of future mining WLAs does not preclude the amending of this AMD TMDL to accommodate additional NPDES permits.

Table 2. List of facilities receiving waste load allocations in the Coxes Creek TMDL

Mining Permit	*NPDES Permit*	*Permittee*	*Operation*
56841612	PA0588491	Svonavec, Inc.	
56060111	PA0262269	PBS Coals, Inc.	Weaver Mine
56980108	PA0234915	Fieg Brothers	Weyand Mine
56000106	PA0248819	Tomcat Coal	Fundis Strip
4072SM22	PA0248894	Penn Coal Land, Inc.	Menser Strip – Job 8
*	PA0024768	Somerset Borough	Main Sewage Treatment Plant
56061301	PA0235709	Rox Coal	Kimberly Run Deep Mine
56050109	PA0249729	PBS Coals, Inc.	Spoerlein Mine
56910701	PA0213560	PBS Coals, Inc.	Job 10 Refuse
56733038	PA0109088	Geiger/PBS	Highland Resort Estate Job 14
*	PA0216763	Somerset Borough	Coxes Creek Water Treatment Plant
*	PA0030406	State Correctional Institute	SCI Laurel Highlands

Clean Water Act Requirements

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

Additionally, the federal Clean Water Act and the U.S. Environmental Protection Agency's (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 non-point 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 have 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, many 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 non-point source Best Management Practices (BMPs), etc.).

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

Section 303(d) Listing Process

Prior to developing TMDLs for specific waterbodies, there must be sufficient data available to assess which streams are impaired and should be on the Section 303(d) list. With guidance from the 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)[4] 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 stream segment can vary between sites. All the biological

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

surveys included kick-screen sampling of benthic macroinvertebrates, habitat surveys, and measurements of pH, temperature, conductivity, dissolved oxygen, and alkalinity. Benthic macroinvertebrates are identified to the family level in the field.

After the survey is completed, the biologist determines the status of the stream segment. The decision is based on the performance of the segment using a series of biological metrics. If the stream is determined to be impaired, the source and cause of the impairment is documented. An impaired stream must be listed on the state's Section 303(d) list with the 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 segments with the same source and cause listing are addressed collectively, and on a watershed basis.

Basic Steps for Determining a TMDL

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

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

AMD Methodology

A two-step approach is used for the TMDL analysis of 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 unless otherwise indicated.

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, 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 (NPS) 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[5] by performing 5,000 iterations to determine the required percent reduction so that the water quality criteria, as defined in the *Pennsylvania Code. Title 25 Environmental Protection, Department of Environmental Protection, Chapter 93, Water Quality Standards*, will be met instream at least 99 percent of the time. For each iteration, the required percent reduction is:

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

PR = required percent reduction for the current iteration

Cc = criterion in mg/l

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

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

Mean = average observed concentration

Standard Deviation = standard deviation of observed data

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

LTA = Mean * (1 – PR99) where (2)

LTA = allowable LTA source concentration in mg/l

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

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

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

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

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

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

For the pollution sources in the watershed that are nonpoint sources, the TMDL is expressed as Load Allocations (LAs). The TMDL is expressed as a Waste Load Allocation (WLA) for the point sources of pollution in the watershed. All allocations will be specified as long-term average daily concentrations. These long-term average concentrations are expected to meet water-quality criteria 99% of the time as required in PA Title 25 Chapter 96.3(c). The following table shows the applicable water-quality criteria for the selected parameters.

Table 3. Applicable Water Quality Criteria

Parameter	***Criterion Value (mg/l)***	***Total Recoverable/Dissolved***
Aluminum (Al)	0.75	Total Recoverable
Iron (Fe)	1.50	30-day average; Total
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 wasteload allocation, load allocation and a margin of safety. The wasteload allocation is the portion of the load assigned to point sources. The load allocation is the portion of the load assigned to 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. Table 6 contains the TMDL component summary for each point evaluated in the watershed. Refer to the maps in Attachment A.

Impairment due to suspended solids/siltation

The suspended solids, or siltation, impairment noted in Coxes Creek and its tributaries is due to runoff from large refuse piles (culm banks) from historic mining, active mining operations and croplands located throughout the watershed. An existing sediment load was computed using the Generalized Watershed Loading Function (GWLF) model. This model is being used by the Department to address sedimentation/siltation/suspended solids problems in other watersheds throughout the Commonwealth.

The "Reference Watershed Approach" is used to determine the sediment load reduction needed for this watershed. The Reference Watershed Approach compares two watersheds, one attaining its designated uses and one that is impaired based on biological assessments. Both watersheds must have similar land use/cover distributions. Other features such as base geologic formation should be matched to the extent possible; however, most variations can be adjusted in the model. The objective of the process is to reduce the loading rate of pollutants in the impaired stream segment to a level equivalent to, or slightly lower than, the loading rate in the non-impaired, reference segment. This load reduction will result in conditions favorable to the return of a healthy biological community to the impaired stream segments.

In general, three factors are considered when selecting a suitable reference watershed. The first factor is to use a watershed that the Department has assessed and determined to be attaining water quality standards. The second factor is to find a watershed that closely resembles the impaired watershed in physical properties such as land cover/land use, physiographic province, and geology. Finally, the size of the reference watershed should be within 20-30% of the impaired watershed area. The search for a reference watershed for Coxes Creek that would satisfy the above characteristics was done by means of a desktop screening using several GIS coverages, including the Multi-Resolution Land Characteristics (MRLC), Landsat-derived land cover/use grid, the Pennsylvania's 305(b) assessed streams database, and geologic rock types.

South Fork Tenmile Creek Watershed was selected for use as the reference watershed. The watershed is located in State Water Plan subbasin 19G; the protected use is aquatic life. Couth Fork Tenmile Creek Basin is designated as Warm Water Fishes (CWF) and High Quality Warm Water Fishes (HQ-WWF) under §93.9v in Title 25 of the Pa. Code (Commonwealth of Pennsylvania, 2007). Based on the Department's 305(b) report database, South Fork Tenmile Creek Watershed is currently attaining its designated uses. The attainment of designated uses is based on sampling done by the Department, using the Statewide Surface Water Assessment protocol. A map of the South Fork Tenmile Creek Watershed is located in Attachment A.

Drainage area, location, land use and other physical characteristics such as geology and rock types of the Coxes Creek Watershed were compared to the South Fork Tenmile Creek Watershed. An analysis of the available characteristics revealed that while land cover/use distributions are not an exact match, the watersheds are similar.

A suspended solids/siltation TMDL for the Coxes Creek Watershed was developed using the ArcView Generalized Watershed Loading Function (AVGWLF) model as described in Attachment E. The AVGWLF model was used to establish existing loading conditions for the Coxes Creek Watershed and the South Fork Tenmile Creek Reference Watershed. All modeling outputs have been included in Attachment G.

The sediment reduction goal for the TMDL is based on setting the watershed-loading rate of the impaired Coxes Creek equal to the watershed-loading rate in the un-impaired South Fork Tenmile Creek Watershed. The load reduction for suspended solids in Coxes Creek was assigned to the land use categories coal mines/quarry and croplands.

The TMDL for sediment results in a 34% reduction in loading from croplands and 39% from coal mine/quarry. A more detailed explanation of sediment calculations is contained in Attachment D. The individual components of the TMDL are summarized in Table 4 and the load allocation summary is given in Table 5.

Table 4. TMDL, WLA, MOS, LA, LNR, and ALA for Coxes Creek Watershed		
Component	Sediment (lbs/yr.)	Sediment (lbs/day)
TMDL (Total Maximum Daily Load)	96205299	263576.2
WLA (Waste Load Allocation)	705434	1932.7
MOS (Margin of Safety)	9620529.9	26357.6
LA (Load Allocation)	85879334	235285.9
LNR (Loads Not Reduced)	16497140	45197.6
ALA (Adjusted Load Allocation)	69382193.6	190088.2

Table 5. Sediment Source Load Allocation Summary for Coxes Creek Watershed					
Source	Current Loading (lbs/yr.)	Current Loading (lbs/day)	Allowable Loading (lbs/yr.)	Allowable Loading (lbs/day)	Percent Reduction
CROPLAND	35847600	98212.6	23635750	64755.5	34%
COAL_MINES/QUARRY	74456180	203989.5	45746443	125332.7	39%
NPS Loads Not Reduced	16497140	45197.6	16497140	45197.6	-
Total	126800920	347399.7	85879334	235285.8	37%

Allocation Summary for Metals & pH

These TMDLs will focus remediation efforts on the identified numerical reduction targets for each watershed. The reduction schemes in Table 6 for each segment are based on the assumption that all upstream allocations are achieved and also take into account all upstream reductions. Attachment C contains the TMDLs by segment analysis for each allocation point in a detailed discussion. As changes occur in the watershed, the TMDLs may be re-evaluated to reflect current conditions. An implicit margin of safety (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 determined by multiplying the allowable concentration by the flow and a conversion factor at each sample point. The allowable load is the TMDL and each TMDL includes upstream loads.

Each permitted discharge in a segment is assigned a waste load allocation and the total waste load allocation for each segment is included in this table. There is currently one necessary waste load allocation (WLA) in the Coxes Creek Watershed. The difference between the TMDL and the WLA 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 to the area upstream of the point 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 6. Coxes Creek Watershed Summary Table

Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	NPS Load Reduction (lbs/day)	% Reduction
COX12 – East Branch Coxes Creek in Somerset						
Aluminum (lbs/day)	7.64	7.64	*0.56*	NA	NA	NA
Iron (lbs/day)	24.83	17.63	*2.25*	15.38	7.20	29%
Manganese(lbs/day)	8.97	5.20	*1.50*	3.70	3.77	42%
Acidity (lbs/day)	-841.52	-841.52	-	NA	NA	NA
COX11 – Unnamed tributary to Coxes Creek at mouth						
Aluminum (lbs/day)	0.81	0.81	-	NA	NA	NA
Iron (lbs/day)	2.47	0.84	-	0.84	1.63	66%
Manganese(lbs/day)	0.41	0.41	-	NA	NA	NA
Acidity (lbs/day)	-93.84	-93.84	-	NA	NA	NA
COX10 – Kimberly Run at mouth[1]						
Aluminum (lbs/day)	13.60	13.60	6.62	NA	NA	NA
Iron (lbs/day)	13.68	13.68	21.44	NA	NA	NA
Manganese(lbs/day)	6.12	6.12	13.85	NA	NA	NA
Acidity (lbs/day)	-2276.54	-2276.54	-	NA	NA	NA
COX9 – East Branch Coxes Creek at mouth[1]						
Aluminum (lbs/day)	31.72	31.72	3.75	NA	NA	NA
Iron (lbs/day)	53.64	53.64	67.22	NA	NA	NA
Manganese(lbs/day)	23.12	23.12	24.61	NA	NA	NA
Acidity (lbs/day)	-4434.19	-4434.19	-	NA	NA	NA
COX8 – West Branch Coxes Creek at mouth						
Aluminum (lbs/day)	9.46	9.46	1.45	NA	NA	NA
Iron (lbs/day)	23.62	23.62	2.24	NA	NA	NA
Manganese(lbs/day)	8.55	8.55	1.12	NA	NA	NA
Acidity (lbs/day)	-912.01	-912.01	-	NA	NA	NA
COX7 – Coxes Creek near Murdock						
Aluminum (lbs/day)	47.02	37.14	*0.56*	36.58	9.88*	21%*
Iron (lbs/day)	94.69	87.11	*2.25*	84.85	7.58*	8%*
Manganese(lbs/day)	22.16	22.16	*1.50*	NA	NA	NA
Acidity (lbs/day)	-4154.57	-4154.57	-	NA	NA	NA
COX6 – Coxes Creek near Bando						
Aluminum (lbs/day)	46.41	46.41	*0.56*	NA	NA	NA

Iron (lbs/day)	57.74	57.74	*2.25*	NA	NA	NA
Manganese(lbs/day)	25.16	25.16	*1.50*	NA	NA	NA
Acidity (lbs/day)	-3731.53	-3731.53	-	NA	NA	NA
COX5 – Rice Run near mouth						
Aluminum (lbs/day)	2.62	2.62	-	NA	NA	NA
Iron (lbs/day)	5.93	3.50	-	3.50	2.43	41%
Manganese(lbs/day)	0.44	0.44	-	NA	NA	NA
Acidity (lbs/day)	-28.26	-28.26	-	NA	NA	NA
COX4 – Unnamed tributary to Coxes Creek near mouth						
Aluminum (lbs/day)	0.33	0.33	-	NA	NA	NA
Iron (lbs/day)	0.51	0.38	-	0.38	0.13	26%
Manganese(lbs/day)	0.03	0.03	-	NA	NA	NA
Acidity (lbs/day)	0.52	0.52	-	NA	NA	NA
COX3 – Unnamed tributary to Coxes Creek at mouth[1]						
Aluminum (lbs/day)	2.25	2.25	0.47	NA	NA	NA
Iron (lbs/day)	3.08	2.49	1.88	0.61	0.59	19%
Manganese(lbs/day)	0.85	0.85	1.25	NA	NA	NA
Acidity (lbs/day)	0.52	0.52	-	NA	NA	NA
COX2 – Coxes Creek upstream of Wilson Creek						
Aluminum (lbs/day)	56.73	56.73	0.84	NA	NA	NA
Iron (lbs/day)	104.66	104.66	3.56	NA	NA	NA
Manganese(lbs/day)	40.11	40.11	2.25	NA	NA	NA
Acidity (lbs/day)	-5343.74	-5343.74	-	NA	NA	NA
COX1 – Coxes Creek at mouth						
Aluminum (lbs/day)	180.84	86.80	*0.56*	86.24	0*	0%*
Iron (lbs/day)	156.25	148.44	*2.25*	146.19	0*	0%*
Manganese(lbs/day)	102.11	102.11	*1.50*	NA	NA	NA
Acidity (lbs/day)	-2024.45	-2024.45	-	NA	NA	NA

* Takes into account loads from upstream points.
NA = not applicable
1. Although the permitted WLA is larger than the total allowable load (TMDL) at this point, the stream is meeting water quality standards as shown by no reductions being necessary. Therefore, no reductions in the WLA are necessary at this point.

In the instance that the allowable load is equal to the measured load (e.g. manganese COX1, Table 6), the simulation determined that water quality standards are being met instream and therefore 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. This is denoted as "NA" in the above table. "ND" was used to represent sample data which was found to be below detection levels or where no data was measured at a sample point.

Recommendations

Despite the extensive mining within the watershed, the overall quality of Coxes Creek, as measured at the assigned twelve locations is good, with very little evidence of mining related impact. The pH levels are approximate 7.0, with low metals levels less than 1.0 mg/L. The sulfate levels are slightly elevated in the more downstream samples, approximating 100 mg/L; however, this is still below the Commonwealth water quality criterion for sulfates (250 mg/L).

The Department does plan to provide treatment for one abandoned mine discharge from the H&H Coal Company, SMP No. 56783046. This is a Primacy Bond Forfeiture Site and the treatment will not involve a NPDES Permit. The Department is not aware of any other projects in-place, or planned, to address abandoned mine lands and discharges within the Coxes Creek Watershed. Any such efforts may be addressed either by the Bureau of Abandoned Mine Reclamation (BAMR), or through other programs within District Mining Operations (DMO), such as remining and Government Financed Construction Contracts (GFCC's).

Statewide Reclamation Efforts

Since the 1960s, Pennsylvania has been a national leader in establishing laws and regulations to ensure mine reclamation and well plugging occur after active operation is completed. Mine reclamation and well plugging refer to the process of cleaning up environmental pollutants and safety hazards associated with a site and returning the land to a productive condition, similar to PADEP's Brownfields Program. Pennsylvania is striving for complete reclamation of its abandoned mines and plugging of its orphan wells. These concepts include legislative, policy, and land management initiatives designed to enhance mine operator/volunteer/PADEP reclamation efforts.

Various methods to eliminate or treat pollutant sources provide a reasonable assurance that the proposed TMDLs can be met. 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 that are currently being used for projects designed to achieve TMDL reductions include the USEPA 319 grant program and Pennsylvania's Growing Greener Program. Federal funding is through the Department of the Interior's Office of Surface Mining (OSM) for reclamation and mine drainage treatment through the Appalachian Clean Streams Initiative and through Watershed Cooperative Agreements.

The PADEP Bureau of District Mining Operations (DMO) administers an environmental regulatory program for all mining activities, including mine subsidence regulation, mine subsidence insurance, and coal refuse disposal. PADEP DMO also conducts a program to ensure safe underground bituminous mining and protect certain structures from subsidence; administers a mining license and permit program; administers a regulatory program for the use, storage, and handling of explosives; and provides for training, examination, and certification of applicants' blaster's licenses. In addition, PADEP Bureau of Mining & Reclamation administers a loan program for bonding anthracite underground mines and for mine subsidence, the Small

Operator's Assistance Program (SOAP), and the Remining Operator's Assistance Program (ROAP).

Regulatory programs 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 that have the potential for reclaiming abandoned mine lands, at no cost to the Commonwealth or the federal government. Long-term agreements were initialized for facilities/operators that need to assure treatment of post-mining discharges or discharges they degraded. These agreements 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." Acidity loads from abandoned discharges have been observed to decrease by an average of 61 percent when remined (Smith, Brady, and Hawkins, 2002. "Effectiveness of Pennsylvania's remining program in abating abandoned mine drainage: water quality impacts" in Transactions of the Society for Mining, Metallurgy, and Exploration, Volume 312, p. 166-170).

PADEP BAMR, which administers the program to address the Commonwealth's abandoned mine reclamation program, 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 PADEP, 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 Attachment G).

- 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.

The Commonwealth is exploring all identified 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:

- 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 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 into the Upper West Branch Susquehanna River), and the Wadesville Deep Mine Pool (Exelon Generation in Schuylkill County).

There currently isn't a watershed organization interested in the Coxes Creek Watershed, although there is a watershed group for the larger Casselman River Watershed. It is recommended that agencies work with local interests to form a watershed group that will be dedicated to the remediation and preservation of these watersheds through public education, monitoring and assessment, and improvement projects. Information on formation of a watershed group is available through websites for the PADEP (www.dep.state.pa.us), the AMR Clearinghouse (www.amrclearinghouse.com), the EPA (www.epa.gov), the Susquehanna River Basin Commission (www.srbc.net) and others. In addition, each DEP Regional Office (6) and each District Mining Office (5) have watershed managers to assist stakeholder groups interested in restoration in their watershed. Most Pennsylvania county conservation districts have a watershed specialist who can also provide assistance to stakeholders (www.pacd.org). Potential funding sources for AMR projects can be found at www.dep.state.pa.us/dep/subject/pubs/water/wc/FS2205.pdf.

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

Public Participation

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* on September 27, 2008 to foster public comment on the allowable loads calculated. A public meeting was held on October 28, 2008 at the Ebensburg District Mining Office in Ebensburg, PA, to discuss the proposed TMDL. The public comment period for the Coxes Creek TMDL was open from September 27, 2008 through November 27, 2008.

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

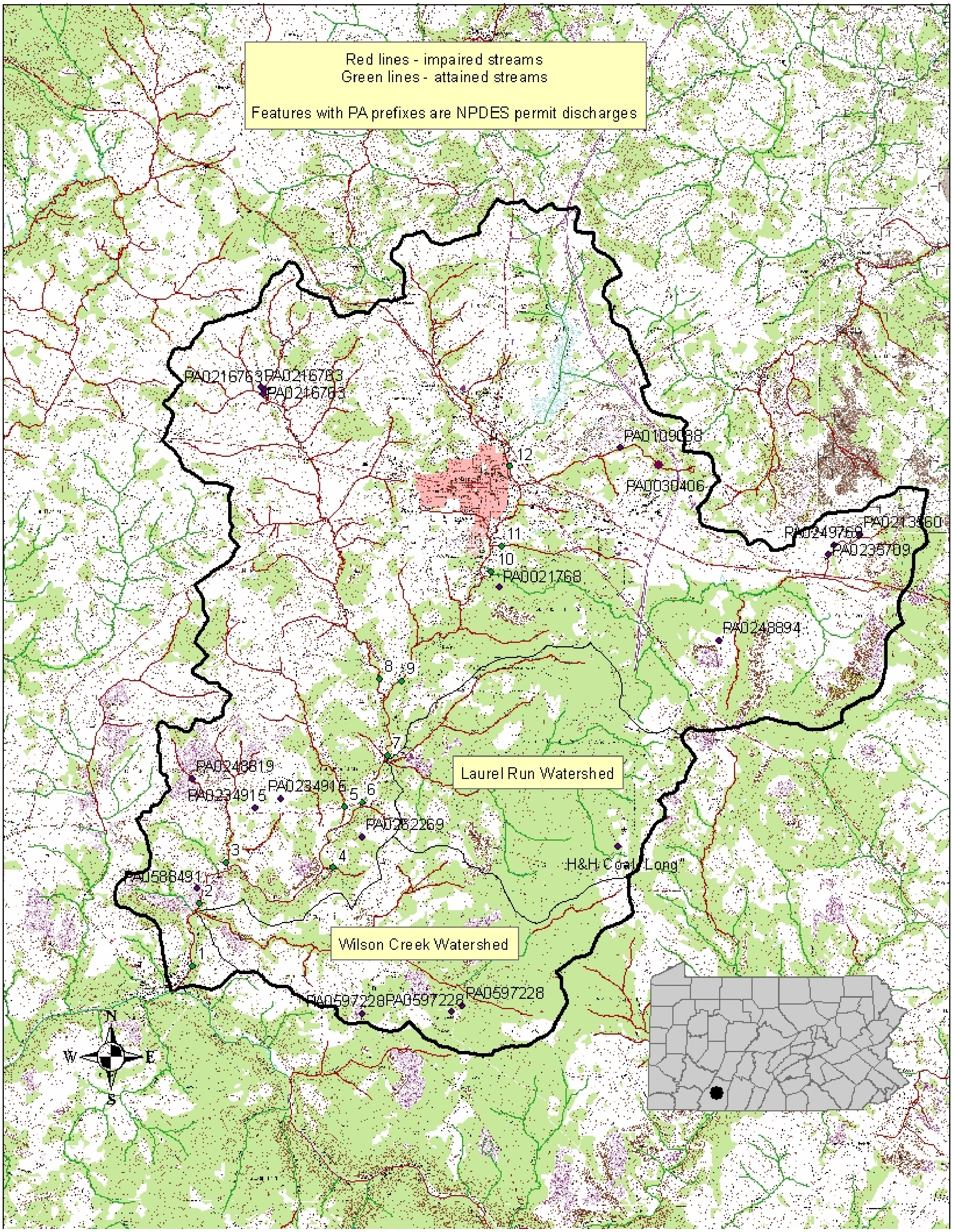
- Increase in total load capacity.
- Transfer of load between point (WLA) and nonpoint (LA) sources.
- Modification of the margin of safety (MOS).
- Change in water quality standards (WQS).
- Non-attainment of WQS with implementation of the TMDL.
- Allocations in trading programs.

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

Coxes Creek Watershed Map


Red lines - impaired streams
Green lines - attained streams
Features with PA prefixes are NPDES permit discharges
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PA0030406
12
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PA0021768
PA0249769
PA0213560
PA0235709
PA0248894
8
9
7
Laurel Run Watershed
PA0248819
PA0234915
PA0234915
5
6
PA0262269
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4
H&H Coal "Long"
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Wilson Creek Watershed
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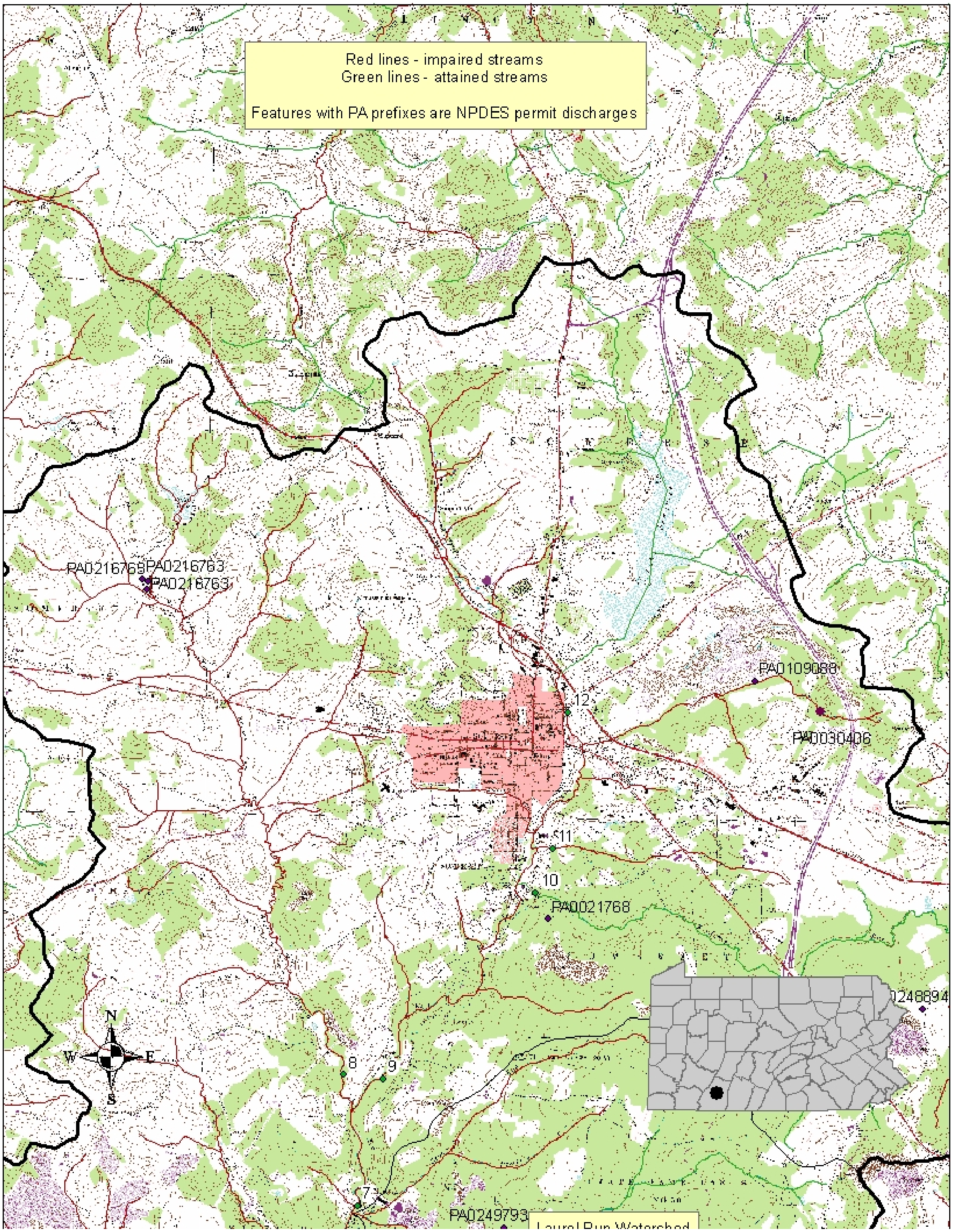
Red lines - impaired streams
Green lines - attained streams
Features with PA prefixes are NPDES permit discharges
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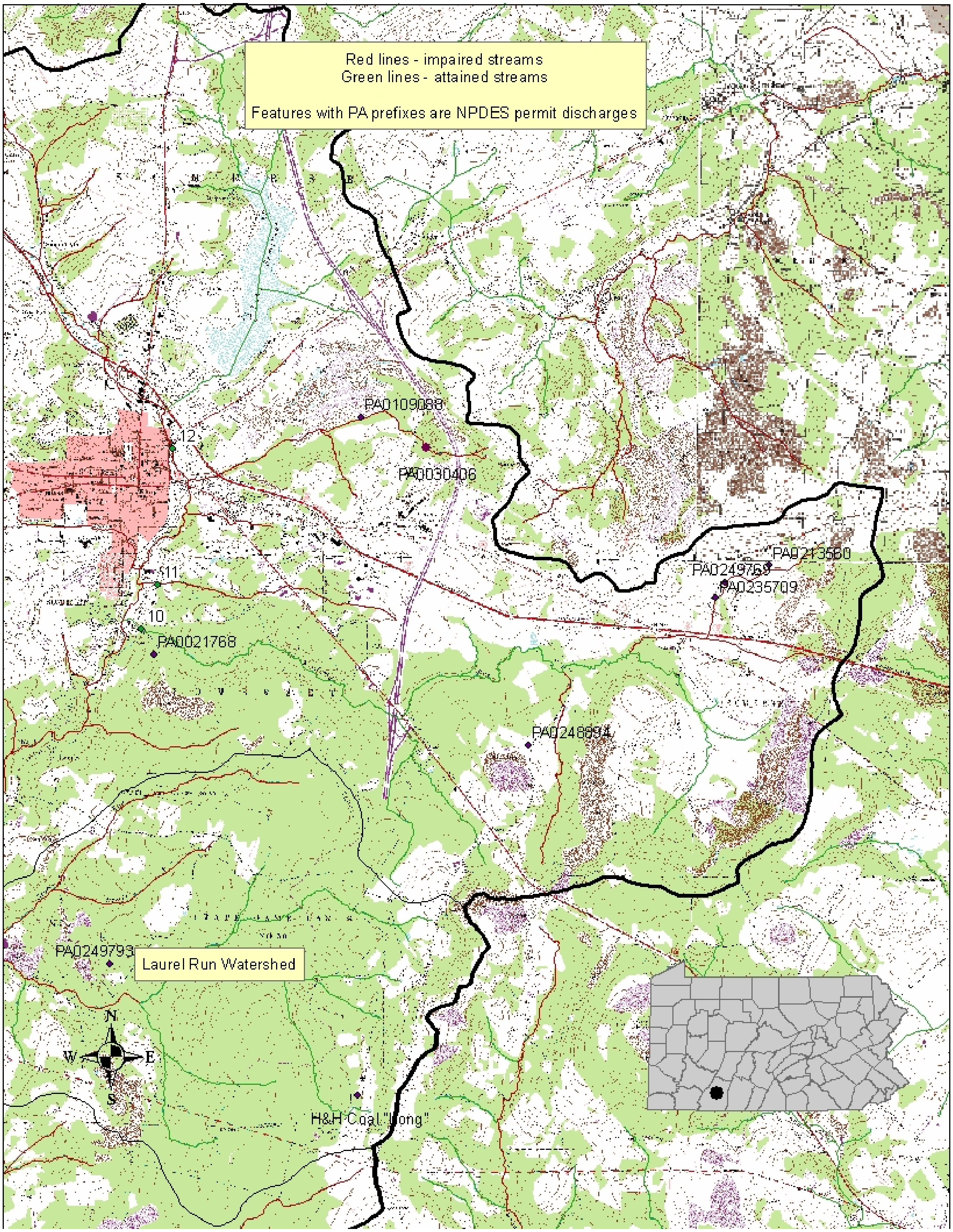
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PA0030406
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PA0021768
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PA0235709
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PA0249793
Laurel Run Watershed
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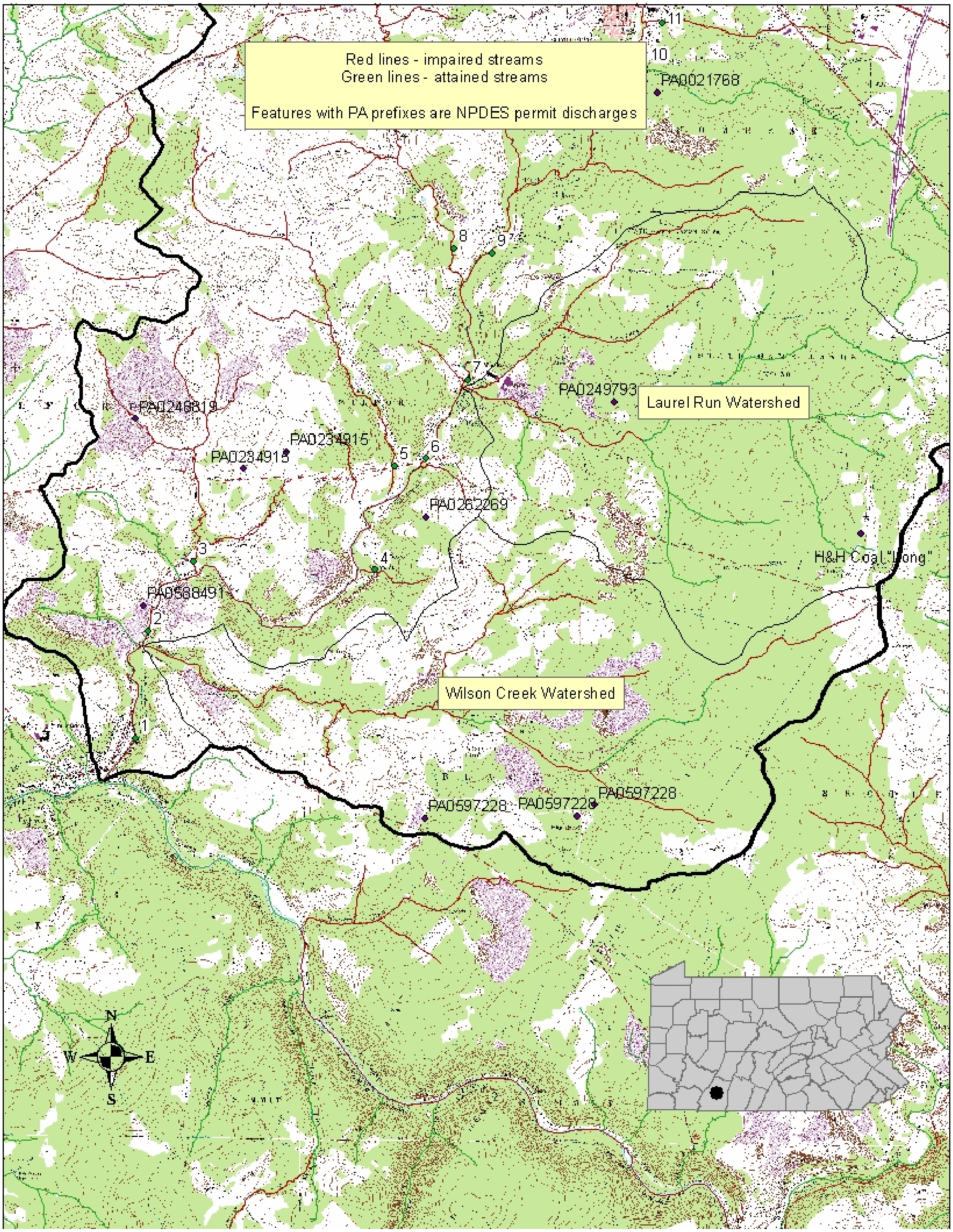
H&H Coal "Long"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Laurel Run Watershed
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PA0234915
PA0234915
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PA0262269
3
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H&H Coal "Long"
PA0588491
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Wilson Creek Watershed
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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 EPA'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 Section 303(d) list due to pH. The concentration of acidity in a stream is at least partially chemically dependent upon metals. For this reason, it is extremely difficult to predict the exact pH values, which would result from treatment of abandoned mine drainage. Therefore, net alkalinity will be used to evaluate pH in these TMDL calculations. This methodology assures that the standard for pH will be met because net alkalinity is a measure of the reduction of acidity. When acidity in a stream is neutralized or is restored to natural levels, pH will be acceptable. Therefore, the measured instream alkalinity at the point of evaluation in the stream will serve as the goal for reducing total acidity at that point. The methodology that is applied for alkalinity (and therefore pH) is the same as that used for other parameters such as iron, aluminum, and manganese that have numeric water quality criteria.

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

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

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

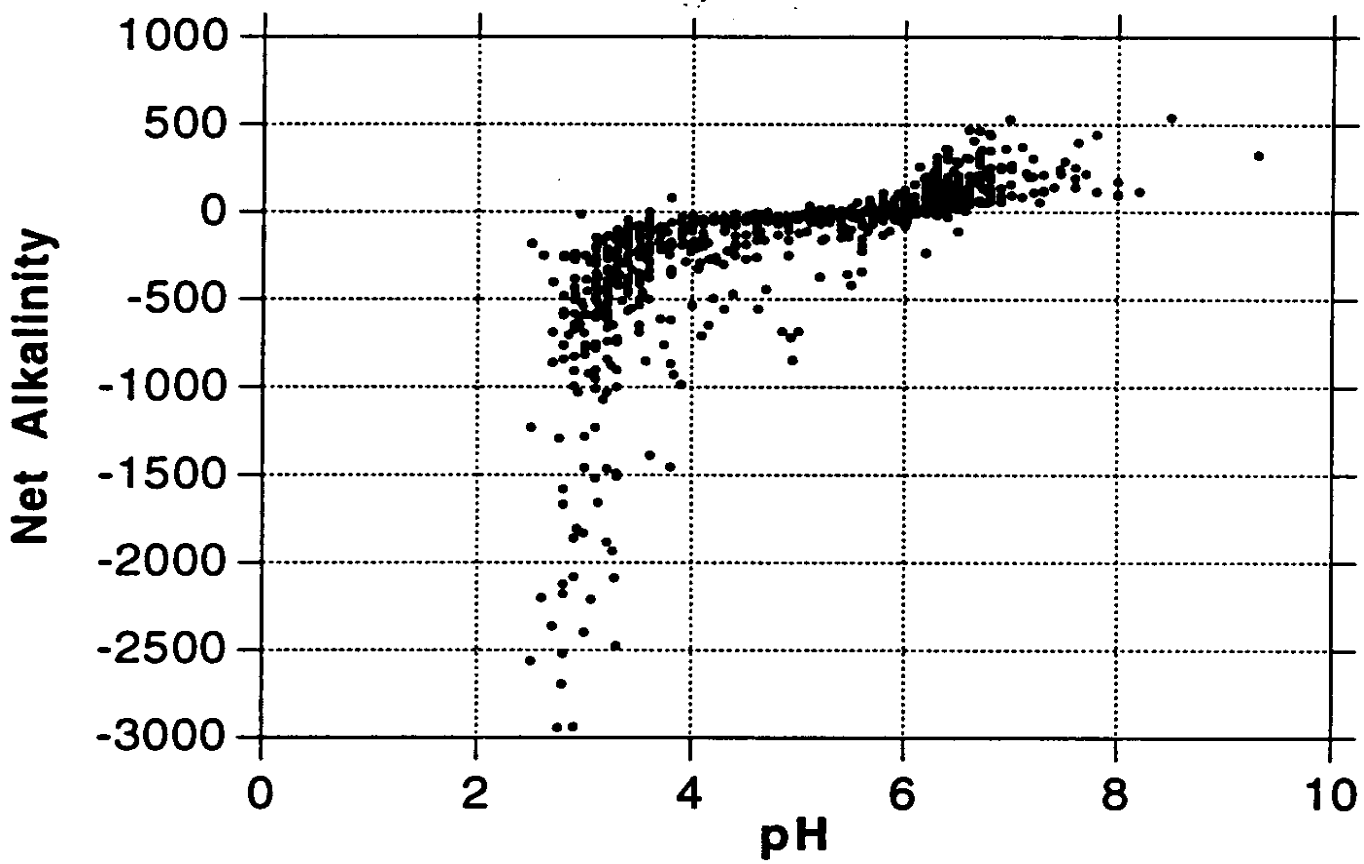


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

Attachment C

TMDLs By Segment

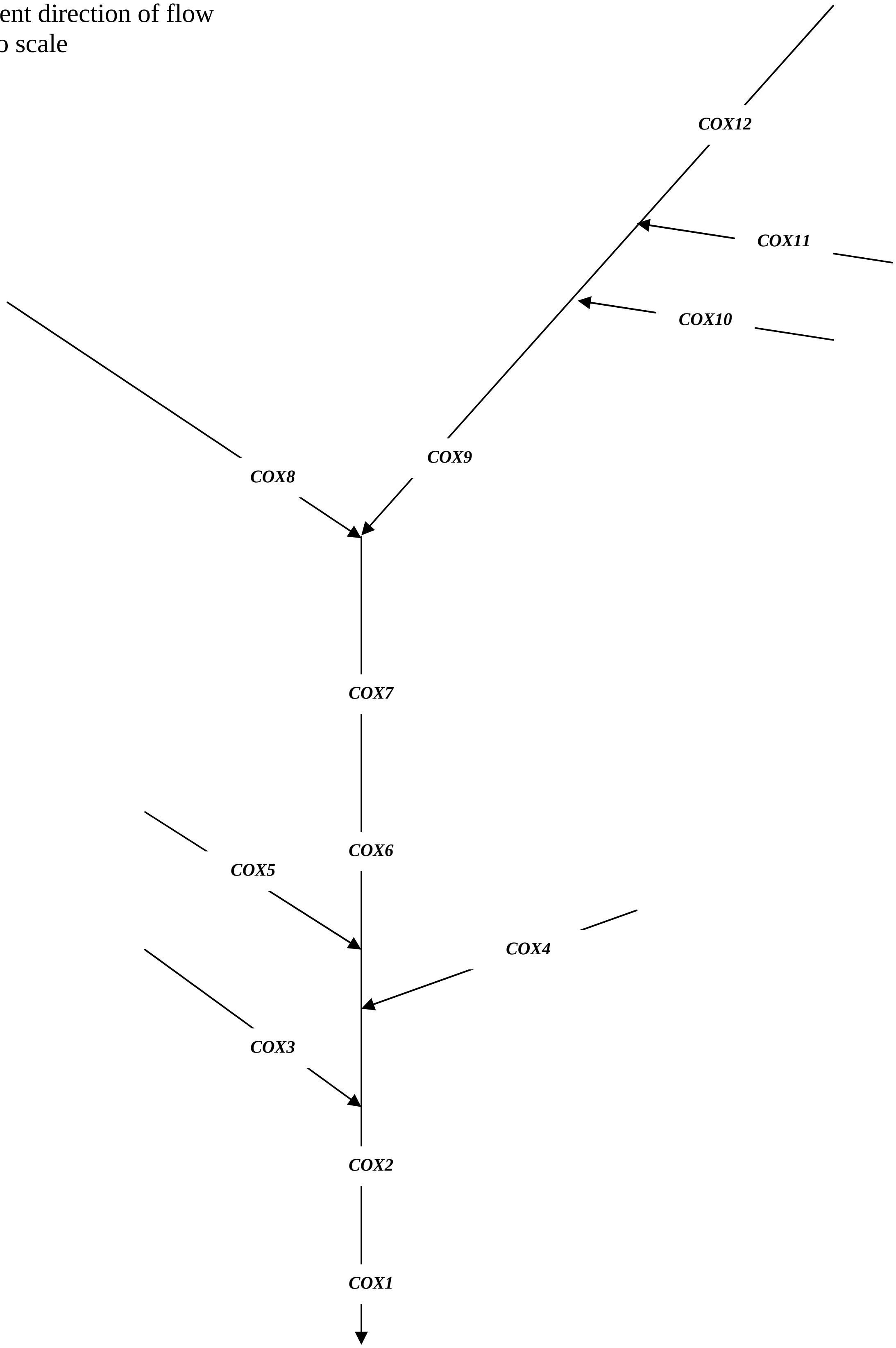
Coxes Creek

The TMDL for Coxes Creek consists of load allocations to four sampling sites on Coxes Creek (COX1, COX2, COX6 and COX7), two sites on unnamed tributaries to Coxes Creek (COXES3-4), one site on Rice Run (COX5), one site on West Branch Coxes Creek (COX8), two sites on East Branch Coxes Creek (COX9, COX12), one site on Kimberly Run (COX10) and one site on an unnamed tributary to East Branch Coxes Creek (COX11). 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.

East Branch Coxes Creek is listed on the 1996 PA Section 303(d) list for metals from AMD as being the cause of the degradation to this stream. Although this TMDL will focus primarily on metal loading to the Coxes Creek Watershed, acid loading analysis will be performed. The objective is to reduce acid loading to the stream, which will in turn raise the pH to the desired range (between 6 & 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.

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



A waste load allocation for future mining was included at COX12 allowing for one operation with two active pits (1500’ x 300’) to be permitted in the future on this segment.

Table C1. Waste load allocations for future mining operations			
Parameter	Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

TMDL calculations- COX12 – East Branch Coxes Creek in Somerset

The TMDL for sample point COX12 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this headwaters segment of the East Branch Coxes Creek was computed using water-quality sample data collected at point COX12. The average flow, calculated using sampling data collected at COX12 (3.66 MGD), is used for these computations. Because this is the most upstream point of this segment, the allowable load allocations calculated at COX12 is equal to the actual load that will directly affect the downstream point COX9.

Sample data at point COX12 shows that the headwaters segment has a pH ranging between 7.6 and 7.8. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH; pH will not be addressed as water quality standards are being met.

A TMDL for aluminum, iron, manganese and acidity at COX12 has been calculated. Table C2 shows the measured and allowable concentrations and loads at COX12. Table C3 shows percent reductions for aluminum, iron, manganese and acidity required at this point.

Table C2		Measured		Allowable	
		Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	7.64	0.25	7.64
	Iron	0.81	24.83	0.58	17.63
	Manganese	0.29	8.97	0.17	5.20
	Acidity	-27.55	-841.52	-27.55	-841.52
	Alkalinity	64.25	1962.53		

Table C3. Allocations COX12		
COX12	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ COX12	24.83	8.97
Allowable Load @ COX12	17.63	5.20
Load Reduction @ COX12	7.20	3.77
% Reduction required @ COX12	29%	42%

TMDL Calculation – COX11 – Unnamed tributary to East Branch Coxes Creek at mouth

The TMDL for sample point COX11 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for the unnamed tributary to East Branch Coxes Creek was computed using water-quality sample data collected at point COX11. The average flow, calculated using water quality data collected at sampling point COX11 (0.39 MGD), is used for these computations.

Sample data at point COX11 shows a pH ranging between 7.4 and 7.7. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH; pH will not be addressed because water quality standards are being met.

A TMDL for aluminum, iron, manganese and acidity at COX11 has been calculated. Table C4 shows the measured and allowable concentrations and loads at COX11. Table C5 shows percent reductions for aluminum, iron, manganese and acidity required at this point.

Table C4		Measured		Allowable	
		Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	0.81	0.25	0.81
	Iron	0.76	2.47	0.26	0.84
	Manganese	0.13	0.41	0.13	0.41
	Acidity	-28.85	-93.84	-28.85	-93.84
	Alkalinity	50.60	164.58		

Table C5. Allocations COX11	
COX11	Iron (Lbs/day)
Existing Load @ COX11	2.47
Allowable Load @ COX11	0.84
Load Reduction @ COX11	1.63
% Reduction required @ COX11	66%

Waste Load Allocation – Penn Coal Land Menser Strip – Job 8 (4072SM22)

Penn Coal Land (4072SM22; NPDES PA0248894) Menser Strip – Job 8 has one post-mining discharge requiring treatment. Outfall 001 is a discharge from a passive treatment facility.

There are no effluent limits for aluminum and manganese from the treatment system. The following table shows the waste load allocation for this discharge.

Table C6. Waste load allocation PA0248894			
Parameter	Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
001			
Fe	3.0	0.024	0.60

Waste Load Allocation – Rox Coal Kimberly Run Deep Mine (CMAP56061301)

Rox Coal (CMAP56061301; NPDES PA0235709) Kimberly Run Deep Mine has one mine drainage treatment facility requiring treatment. Outfall 003(TP4) is a discharge from a treatment pond treated with lime or caustic soda. The following table shows the waste load allocation for this discharge.

Table C7. Waste load allocation PA0235709			
Parameter	Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
003(TP4)			
Al	0.52	1.44	6.25
Fe	1.61	1.44	19.34
Mn	1.07	1.44	12.85

Waste Load Allocation – PBS Coals, Inc. Job 10 Refuse (CMAP56910701)

PBS Coals, Inc. (CMAP56910701; NPDES PA0213560) Job 10 Refuse has one mine drainage treatment facility requiring treatment. Outfall 001 (T-2) is a discharge from a treatment facility. The following table shows the waste load allocation for this discharge.

Table C8. Waste load allocation PA0213560			
Parameter	Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
001 (T-2)			
Al	0.75	0.05	0.31
Fe	3.0	0.05	1.25
Mn	2.0	0.05	0.83

Waste Load Allocation – PBS Coals, Inc. Spoerlein Mine (SMP56050109)

PBS Coals, Inc. (SMP56050109; NPDES PA0249769) Spoerlein Mine has a mine drainage treatment facility. TP-1 is a discharge from a mine drainage treatment facility. The following table shows the waste load allocation for this discharge.

Table C9. Waste load allocation PA0249769			
Parameter	Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
TP-1			
Al	0.75	0.01	0.06
Fe	3.0	0.01	0.25
Mn	2.0	0.01	0.17

TMDL Calculation – COX10 – Kimberly Run at mouth

The TMDL for sampling point COX10 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for the Kimberly Run watershed was computed using water-quality sample data collected at point COX10. The average flow, calculated using water quality data collected at sampling point COX10 (6.52 MGD), is used for these computations.

Sample data at point COX10 shows pH ranging between 7.5 and 8.2. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH; pH will not be addressed as water quality standards are being met.

Table C10 shows the measured and allowable concentrations and loads at COX10. TMDLs for aluminum, iron, manganese and acidity at COX10 are not necessary as water quality standards are being met.

Table C10		Measured		Allowable	
		Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	13.60	0.25	13.60
	Iron	0.25	13.68	0.25	13.68
	Manganese	0.11	6.12	0.11	6.12
	Acidity	-41.85	-2276.54	-41.85	-2276.54
	Alkalinity	63.70	3465.13		

Waste Load Allocation – State Correctional Institution at Laurel Highlands

The State Correctional Institution at Laurel Highlands (NPDES PA0030406) has a sewage treatment facility that receives metals-containing wastes via the pre-treatment program from the

WSI – Mosteller Landfill, Inc. Outfall 001 is a discharge from treatment plant. There are no effluent limits for aluminum for this facility. The following table shows the waste load allocation for this discharge.

Table C11. Waste load allocation PA0030406			
Parameter	Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
001			
Fe	3.0	0.50	12.51
Mn	3.5	0.50	14.60

Waste Load Allocation – PBS Coals Geiger Highland Resort Estate Job 14 (SMP56733038)

PBS Coals, Inc. (SMP56733038; NPDES PA0109088) Highland Resort Estate Job 14 has one post mining discharge requiring treatment. Outfall 001 is a discharge from a treatment facility. The following table shows the waste load allocation for this discharge.

Table C12. Waste load allocation PA0109088			
Parameter	Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
001			
Al	0.75	0.6	3.75
Fe	3.0	0.6	15.01
Mn	2.0	0.6	10.01

Waste Load Allocation – Somerset Borough Main Sewage Treatment Plant

Borough of Somerset (NPDES PA0021768) has a sewage treatment facility that receives metals-containing wastes via the pre-treatment program. Outfall 001 is a discharge from treatment plant. There are no effluent limits for aluminum and manganese for this facility. The following table shows the waste load allocation for this discharge.

Table C13. Waste load allocation PA0021768			
Parameter	Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
001			
Fe	2.2	2.0	36.70

TMDL Calculation – COX9 – East Branch Coxes Creek near mouth

The TMDL for sample point COX9 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point COX9. The average flow, calculated using data collected at sampling point COX9 (15.21 MGD), is used for these computations.

Sample data at point COX9 shows a pH ranging between 7.4 and 8.0. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH; pH will not be addressed as water quality standards are being met.

Table C14 shows the measured and allowable concentrations and loads at COX9. TMDLs for aluminum, iron, manganese and acidity at COX9 are not necessary as water quality standards are being met.

Table C14		Measured		Allowable	
		Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	31.72	0.25	31.72
	Iron	0.42	53.64	0.42	53.64
	Manganese	0.18	23.12	0.18	23.12
	Acidity	-34.95	-4434.19	-34.95	-4434.19
	Alkalinity	60.15	7631.37		

<u>Waste Load Allocation – Somerset Borough Coxes Creek Water Treatment Plant</u>

Somerset Borough (NPDES PA0216763) has a water treatment facility requiring treatment. Outfall 001 is a discharge of treated process water; outfalls 002&003 are from the lagoon underdrain and finished water; and outfall 005 is from the floor drain and finished water. The following table shows the waste load allocation for these discharges.

Table C15. Waste load allocation PA0216763			
Parameter	Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
001			
Al	1.3	0.026	0.28
Fe	2.0	0.026	0.43
Mn	1.0	0.026	0.22
002&003			
Al	1.3	0.108	1.17
Fe	2.0	0.108	1.80
Mn	1.0	0.108	0.90
005			
Al	1.3	0.0003	0.0033
Fe	2.0	0.0003	0.0050
Mn	1.0	0.0003	0.0025

TMDL Calculation – COX8 – West Branch Coxes Creek at mouth

The TMDL for sampling point COX8 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point COX8. The average flow, calculated using data collected at COX8 (4.54 MGD), is used for these computations.

Sample data at point COX8 shows pH ranging between 7.3 and 7.7. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH; pH will not be addressed as water quality standards are being met.

Table C16 shows the measured and allowable concentrations and loads at COX8. TMDLs for aluminum, iron, manganese and acidity at COX8 are not necessary as water quality standards are being met.

Table C16		Measured		Allowable	
		Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	9.46	0.25	9.46
	Iron	0.62	23.62	0.62	23.62
	Manganese	0.23	8.55	0.23	8.55
	Acidity	-24.10	-912.01	-24.10	-912.01
	Alkalinity	58.15	2200.56		

A waste load allocation for future mining was included at COX7 allowing for one operation with two active pits (1500’ x 300’) to be permitted in the future on this segment.

Table C17. Waste load allocations for future mining operations			
Parameter	Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.26
Mn	2.0	0.090	1.50

TMDL Calculation – COX7 – Coxes Creek near Murdock

The TMDL for sampling point COX7 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point COX7. The average flow, calculated using data collected at COX7 (16.61 MGD), is used for these computations.

Sample data at point COX7 shows pH ranging between 7.4 and 8.3. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH; pH will not be addressed as water quality standards are being met.

A TMDL for aluminum, iron, manganese and acidity at COX7 have been calculated. Table C18 shows the measured and allowable concentrations and loads at COX7. Table C19 shows the percent reduction for aluminum, iron, manganese and acidity needed at COX7.

Table C18		Measured		Allowable	
		Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.34	47.02	0.27	37.14
	Iron	0.68	94.69	0.63	87.11
	Manganese	0.16	22.16	0.16	22.16
	Acidity	-30.00	-4154.57	-30.00	-4154.57
	Alkalinity	55.95	7748.27		

The measured and allowable loading for point COX7 for all parameters 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 existing load for each parameter from point COX8/9 was subtracted from the actual load at point COX7 to determine a remaining load that was added to the allowable load from COX7 to calculate the total load for the segment of stream between COX8/9 and COX7. This total load will be compared to the calculated allowable load at COX7 to determine if further reductions are needed to meet the calculated TMDL at COX7.

Table C19. Allocations COX7		
COX7	Al (Lbs/day)	Fe (Lbs/day)
Existing Load @ COX7	47.02	94.69
Difference in measured loads between upstream loads and existing COX7	5.84	17.43
Percent loss due calculated at COX7	0%	0%
Additional load tracked from above samples	41.18	77.26
Percentage of upstream loads that reach COX7	100%	100%
Total load tracked between COX8/9 and COX7	47.02	94.69
Allowable Load @ COX7	37.14	87.11
Load Reduction @ COX7	9.88	7.58
% Reduction required at COX7	21%	8%

Laurel Run TMDL Calculation

A TMDL was completed on the Laurel Run Watershed. Laurel Run enters Coxes Creek above sample point COX6. The allowable loads from the last sample point (1) for Laurel Run are used in the calculation of the Coxes Creek TMDL.

Table C20. Laurel Run Contributions				
Loading Point 1	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ 1	26.50	16.07	5.25	262.53
Allowable Load @	20.14	16.07	5.25	81.38

A waste load allocation for future mining was included at COX6 allowing for one operation with two active pits (1500’ x 300’) to be permitted in the future on this segment.

Table C21. Waste load allocations for future mining operations			
Parameter	Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

TMDL Calculation – COX6 – Coxes Creek near Bando

The TMDL for sampling point COX6 on the Coxes Creek consists of a load allocation of the entire area above point COX6 as shown in Attachment A. The load allocation for this stream segment was computed using water-quality sample data collected at point COX6. The average flow, using data collected at COX6 (22.26 MGD), is used for these computations.

Sample data at point COX6 shows pH ranging between 7.5 and 8.5. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH; pH will not be addressed as water quality standards are being met.

Table C22 shows the measured and allowable concentrations and loads at COX6. TMDLs for aluminum, iron, manganese and acidity at COX6 are not necessary as water quality standards are being met.

Table C22		Measured		Allowable	
		Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	46.41	0.25	46.41
	Iron	0.31	57.74	0.31	57.74
	Manganese	0.14	25.16	0.14	25.16
	Acidity	-20.10	-3731.53	-20.10	-3731.53
	Alkalinity	47.95	8901.84		

TMDL Calculation – COX5 – Rice Run near mouth

The TMDL for sampling point COX5 on the Coxes Creek consists of a load allocation of the entire area above point COX5 as shown in Attachment A. The load allocation for this stream segment was computed using water-quality sample data collected at point COX5. The average flow, using the unit area method at COX5 (1.26 MGD), is used for these computations.

There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point COX5 shows pH ranging between 7.4 and 7.6; pH will be not addressed as water quality standards are being met.

Table C23 shows the measured and allowable concentrations and loads at COX5. Table C24 shows the percent reduction required for iron at sample point COX5.

Table C23		Measured		Allowable	
		Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	2.62	0.25	2.62
	Iron	0.57	5.93	0.33	3.50
	Manganese	0.04	0.44	0.04	0.44
	Acidity	-2.70	-28.26	-2.70	-28.26
	Alkalinity	42.85	448.50		

Table C24. Allocations COX5	
COX5	Iron (Lbs/day)
Existing Load @ COX5	5.93
Allowable Load @ COX5	3.50
Load Reduction @ COX5	2.43
% Reduction required @ COX5	41%

TMDL Calculation – COX4 – Unnamed tributary to Coxes Creek near mouth

The TMDL for sampling point COX4 on the Coxes Creek consists of a load allocation of the entire area above point COX4 as shown in Attachment A. The load allocation for this stream segment was computed using water-quality sample data collected at point COX4. The average flow, measured at the sampling point COX4 (0.16 MGD), is used for these computations.

There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point COX4 shows pH ranging between 6.8 and 7.1; pH will not be addressed as water quality standards are being met.

Table C25 shows the measured and allowable concentrations and loads at COX4. Table C26 shows the percent reduction required for acidity at sample point COX4.

Table C25		Measured		Allowable	
		Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	0.33	0.25	0.33
	Iron	0.39	0.51	0.29	0.38
	Manganese	0.03	0.03	0.03	0.03
	Acidity	0.40	0.52	0.40	0.52
	Alkalinity	15.53	20.30		

Table C26. Allocations COX4	
COX4	Iron (Lbs/day)
Existing Load @ COX4	0.51
Allowable Load @ COX4	0.38
Load Reduction @ COX4	0.13
% Reduction required @ COX4	26%

Waste Load Allocation – Fieg Brothers Weyand Mine (SMP56980108)

Fieg Brothers (SMP56980108; NPDES PA0234915) Weyand Mine has two mine drainage treatment facilities requiring treatment. Outfalls 001 (TP1) and 002 (TP2) are discharges from treatment ponds treated with soda ash. The operation may discharge from only one pond a time. The following table shows the waste load allocation for these discharges.

Table C27. Waste load allocation PA0234915			
Parameter	Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
001 (TP1) or 002 (TP2)			
Al	0.75	0.03	0.19
Fe	3.0	0.03	0.75
Mn	2.0	0.03	0.50

Waste Load Allocation – Tomcat Coal Fundis Strip (SMP56000106)

Tomcat Coal (SMP56000106; NPDES PA0248819) Fundis Strip has a mine drainage treatment facility. Outfall 001 (TP1) is a discharge from treatment facility. The operation may discharge from only one pit at a time. The following table shows the waste load allocation for this discharge.

Table C28. Waste load allocation PA0248819			
Parameter	Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
001			
Al	0.75	0.045	0.28
Fe	3.0	0.045	1.13
Mn	2.0	0.045	0.75

TMDL Calculation – COX3 – Unnamed tributary to Coxes Creek at mouth

The TMDL for sampling point COX3 on the Coxes Creek consists of a load allocation of the entire area above point COX3 as shown in Attachment A. The load allocation for this stream segment was computed using water-quality sample data collected at point COX3. The average flow, calculated using the unit area method at the sampling point COX3 (1.08 MGD), is used for these computations.

There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point COX3 shows pH ranging between 7.9 and 8.3; pH will not be addressed as water quality standards are being met.

A TMDL for each parameter at COX3 has been calculated. Table C29 shows the measured and allowable concentrations and loads at COX3. Table C30 shows the percent reduction required for aluminum, iron, manganese and acidity at sample point COX3.

Table C29		Measured		Allowable	
		Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	2.25	0.25	2.25
	Iron	0.34	3.08	0.28	2.49
	Manganese	0.09	0.85	0.09	0.85
	Acidity	-104.85	-944.40	-104.85	-944.40
	Alkalinity	124.20	1118.69		

Table C30. Allocations COX3	
COX3	Iron (Lbs/day)
Existing Load @ COX3	3.08
Allowable Load @ COX3	2.49
Load Reduction @ COX3	0.59
% Reduction required @ COX3	19%

Waste Load Allocation – Svonavec, Inc. (CMAP56841612)

Svonavec, Inc. (CMAP56841612; NPDES PA0588491) has one mine drainage treatment facility requiring treatment. Sediment Pond No. 2 is a discharge from a treatment pond that provides detention time before discharge. The following table shows the waste load allocation for this discharge.

Table C31. Waste load allocation PA0588491			
Parameter	Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Sediment Pond No.2			
Al	0.75	0.045	0.28
Fe	3.5	0.045	1.31
Mn	2.0	0.045	0.75

Waste Load Allocation – PBS Coals, Inc. (SMP56060111)

PBS Coals, Inc. (SMP56060111; NPDES PA0262269) has one mine drainage treatment facility requiring treatment. Outfall 004 is a discharge from a treatment pond that provides detention time before discharge. The following table shows the waste load allocation for this discharge.

Table C32. Waste load allocation PA0262269			
Parameter	Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
004			
Al	0.75	0.09	0.56
Fe	3.5	0.09	2.25
Mn	2.0	0.09	1.50

TMDL Calculation – COX2 – Coxes Creek upstream of Wilson Creek

The TMDL for sampling point COX2 on the Coxes Creek consists of a load allocation of the area between points COX6 and COX2 as shown in Attachment A. The load allocation for this stream segment was computed using water-quality sample data collected at point COX2. The average flow, using the unit area method at the sampling point COX2 (27.21 MGD), is used for these computations.

There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point COX2 shows pH ranging between 7.3 and 8.2; pH will not be addressed as water quality standards are being met.

Table C33 shows the measured and allowable concentrations and loads at COX2.

Table C33		Measured		Allowable	
		Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.25	56.73	0.25	56.73
	Iron	0.46	104.66	0.46	104.66
	Manganese	0.18	40.11	0.18	40.11
	Acidity	-23.55	-5343.74	-23.55	-5343.74
	Alkalinity	46.90	10642.10		

Wilson Creek TMDL Calculation

A TMDL was completed on the Wilson Creek Watershed. Wilson Creek enters Coxes Creek above sample point COX1. The allowable loads from the last sample point (WILSON6) for Wilson Creek were used in the calculation of the Coxes Creek TMDL.

Table C34. Wilson Creek Contributions				
Loading Point WILSON6	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ WILSON6	305.33	147.97	108.17	3257.38
Allowable Load @ WILSON6	15.27	62.15	35.70	0.00

A waste load allocation for future mining was included at COX1 allowing for one operation with two active pits (1500' x 300') to be permitted in the future on this segment.

Table C35. Waste load allocations for future mining operations			
Parameter	Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

TMDL Calculation – COX1 – mouth of Coxes Creek

The TMDL for sampling point COX1 consists of a load allocation of the entire area between points COX2 and COX1 as shown in Attachment A. The load allocation for this stream segment was computed using water-quality sample data collected at point COX1. The average flow, calculated using data collected at sampling point COX1 (32.58 MGD), is used for these computations.

There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point COX1 shows pH ranging between 6.9 and 8.0; pH will not be addressed as water quality standards are being met.

Table C36 shows the measured and allowable concentrations and loads at COX1. Table C37 shows the percent reduction required for aluminum and iron at sample point COX1.

Table C36		Measured		Allowable	
		Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.67	180.84	0.32	86.80
	Iron	0.58	156.25	0.55	148.44
	Manganese	0.38	102.11	0.38	102.11
	Acidity	-7.45	-2024.45	-7.45	-2024.45
	Alkalinity	33.15	9008.12		

Table C37. Allocations COX1		
COX1	Al (Lbs/day)	Fe (Lbs/day)
Existing Load @ COX1	180.84	156.25
Difference in measured Loads between upstream loads and existing COX1	-124.49	8.28
Percent loss due calculated at COX1	41%	0%
Additional load tracked from above samples	15.27	62.15
Percentage of upstream loads that reach COX1	59%	100%
Total load tracked between COX1/WilsonCr. and COX1	9.01	70.43
Allowable Load @ COX1	86.80	148.44
Load Reduction @ COX1	0	0
% Reduction required at COX1	0%	0%

Margin of Safety

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

- A MOS is also the fact that the calculations were performed with a daily iron average instead of the 30-day average.

Seasonal Variation

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

Critical Conditions

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

Attachment D
Coxes Creek Sediment Calculations

Coxes Creek Sediment TMDL Calculations

The AVGWLF model produced information on watershed size, land use, and sediment loading. The sediment loads represent an annual average over the 22 years simulated by the model (1975 to 1996). This information was then used to calculate existing unit area loading rates for the Coxes Creek and Upper South Fork Tenmile Creek Watersheds.

Table A. Existing Loading Values for Coxes Creek (impaired)			
Source	Area (ac)	Sediment (lbs)	Unit Area Load (lbs/ac/yr)
HAY/PAST	12,659	607,000	48
CROPLAND	4,104	2,518,800	614
FOREST	16,203	49,800	3
WETLAND	346	400	1
COAL_MINES	924	7,022,800	7,599
TURF_GRASS	94	6,200	66
UNPAVED_RD	40	90,600	2,294
TRANSITION	1,693	12,862,600	7,599
LO_INT_DEV	4,455	236,800	53
HI_INT_DEV	536	48,200	90
Stream Bank		12,690,200	
total	41,054	36,133,400	880

Table B. Existing Loading Values for Upper South Fork Tenmile Creek (reference)			
Source	Area (ac)	Sediment (lbs.)	Unit Area Load (lb/ac/yr)
HAY/PAST	4,764	599,600	126
CROPLAND	4,438	17,178,200	3,871
FOREST	34,083	671,200	20
WETLAND	25	200	8
COAL_MINES	37	1,250	34
UNPAVED_RD	161	4,236,800	26,381
TRANSITION	131	2,351,600	17,951
LO_INT_DEV	697	325,400	467
HI_INT_DEV	10	3,000	303
Stream Bank		6,051,400	
total	44,346	31,418,650	708

The TMDL target sediment load for Coxes Creek is the product of the unit area sediment-loading rate in the reference watershed (Upper South Fork Tenmile Creek) and the total area of the impaired watershed (Coxes Creek). These numbers and the resulting TMDL target load are shown in Table C on the following page.

Table C. TMDL Total Load Computation			
Pollutant	Unit Area Loading Rate in Upper South Fork Tenmile Creek (lbs/acre/yr)	Total Watershed Area in Coxes Creek (acres)	TMDL Total Load (lbs/year)
Sediment	708	41,054	29,086,632

Targeted TMDL values were used as the basis for load allocations and reductions in the Coxes Creek Watershed, using the following equation

1. TMDL = LA+WLA+MOS
2. LA = ALA-LNR

Where:

TMDL = Total Maximum Daily Load
LA = Load Allocation
ALA = Adjusted Load Allocation
LNR = Loads Not Reduced
WLA = Waste Load Allocation
MOS = Margin of Safety

Margin of Safety

The margin of safety (MOS) is that portion of the pollution loading that is reserved to account for any uncertainty in the data and computational methodology used for the analysis. The Margin of Safety (MOS) for this analysis is explicit. Ten percent of the TMDL was reserved as the MOS.

MOS = 0.1 * 29,086,632

MOS = 2,908,663 lbs/yr

Load Allocation

The Load Allocation (LA), the portion of the load consisting of all nonpoint sources in the watershed, was computed by subtracting the Margin of Safety from the TMDL total load.

LA = TMDL – MOS - WLA

LA = 29,086,632 – 2,908,663 – 252,402

LA = 25,925,568 lbs/year

Adjusted Load Allocation

The adjusted load allocation (ALA) is the actual portion of the LA distributed among those non-point sources receiving reductions. It is computed by subtracting those non-point source loads that are not being considered for reductions (loads not reduced or LNR) from the LA. Reductions in the Coxes Creek Watershed were applied to COAL_MINES, TRANSITION LAND and CROPLAND sources for sediment. Those land uses/sources for which existing loads were not reduced (HAY/PAST, FOREST, WETLAND, TURF_GRASS, UNPAVED_RD, LO_INT_DEV, HI_INT_DEV and Stream bank) kept their current loading values, Table D. The ALA for sediment is 12,196,368 lbs/yr.

Table D. Load Allocation, Loads Not Reduced and Adjusted Load Allocations for the Coxes Creek Sediment TMDL	
	Sediment (lbs./yr)
Load Allocation	25,925,568
Loads Not Reduced	13,729,200
Hay/past	607,000
FOREST	49,800
Wetland	400
Turf_grass	6,200
unpaved_rd	90,600
lo_int_dev	236,800
hi_int_dev	48,200
stream bank	12,690,200
Adjusted load allocation	12,196,368

TMDL

The sediment TMDL for the Coxes Creek Watershed consists of a Load Allocation and a Margin of Safety (MOS). The individual components of the TMDL are summarized in Table E.

Table E. TMDL, WLA, MOS, LA, LNR and ALA for Coxes Creek Sediment TMDL	
Component	Sediment (lbs/yr)
TMDL (Total Maximum Daily Load)	29,086,632
WLA (Waste Load Allocation)	252,402
MOS (Margin of Safety)	2,908,663
LA (Load Allocation)	25,925,568
LNR (Loads Not Reduced)	13,729,200
ALA (Adjusted Load Allocation)	12,196,368

Calculation of Sediment Load Reductions

Adjusted Load Allocations established in the previous section represents the sediment load that is available for allocation between contributing sources in the Coxes Creek Watershed. Data needed for load reduction analysis, including land use distribution, were obtained by GIS analysis. The Equal Marginal Percent Reduction (EMPR) allocation method (Attachment F) was used to distribute the ALA between the appropriate contributing land uses.

Table F contains the results of the sediment EMPR analysis for the appropriate contributing land uses in the Coxes Creek Watershed. The load allocation for each land use is shown, along with the percent reduction of current loads necessary.

Table F. Sediment Load Allocations & Reductions for the Coxes Creek Watershed						
Pollutant Source	Acres	Unit Area Loading Rate (lbs/ac/yr)		Pollutant Loading (lbs/yr)		Percent Reduction
		Current	Allowable	Current	Allowable	
COAL MINES	924	7598.79	4263.40	7,022,800	3,940,233	44%
TRANSITION	1693	7598.87	4042.61	12,862,600	6,842,930	47%
CROPLAND	4104	613.68	344.31	2,518,800	1,413,205	44%
TOTAL				22,404,200	12,196,368	46%

Consideration of Critical Conditions

The AVGWLF model is a continuous simulation model, which uses daily time steps for weather data and water balance calculations. Monthly calculations are made for sediment loads based on the daily water balance accumulated to monthly values. Therefore, all flow conditions are taken into account for loading calculations. Because there is generally a significant lag time between the introduction of sediment to a waterbody and the resulting impact on beneficial uses, establishing these TMDLs using average annual conditions is protective of the waterbody.

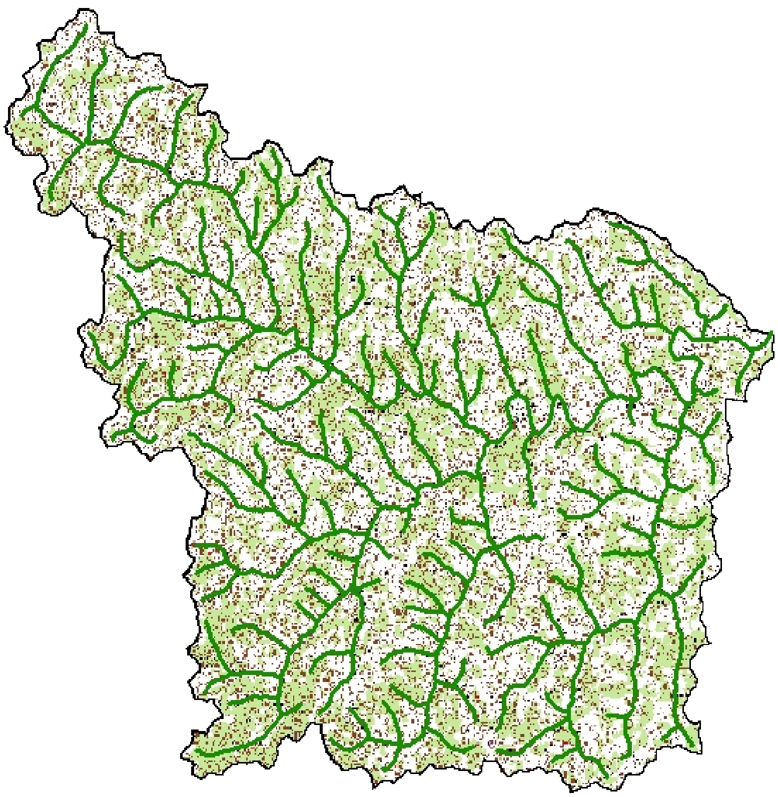
Consideration of Seasonal Variations

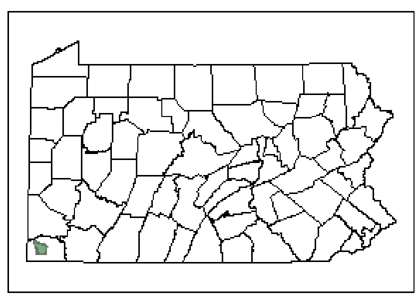
The continuous simulation model used for this analysis considers seasonal variation through a number of mechanisms. Daily time steps are used for weather data and water balance calculations. The model requires specification of the growing season and hours of daylight for each month. The model also considers the months of the year when manure is applied to the land. The combination of these actions by the model accounts for seasonal variability.

Attachment E

Map of Reference Watershed Upper South Fork Tenmile Creek

South Fork Tenmile Creek





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Attachment F

AVGWLF Model Overview & GIS-Based Derivation of Input Data

TMDLs for the Coxes Creek Watershed were developed using the Generalized Watershed Loading Function or GWLF model. The GWLF model provides the ability to simulate runoff, sediment, and nutrient (N and P) loadings from watershed given variable-size source areas (e.g., agricultural, forested, and developed land). It also has algorithms for calculating septic system loads, and allows for the inclusion of point source discharge data. It is a continuous simulation model, which uses daily time steps for weather data and water balance calculations. Monthly calculations are made for sediment and nutrient loads, based on the daily water balance accumulated to monthly values.

GWLF is a combined distributed/lumped parameter watershed model. For surface loading, it is distributed in the sense that it allows multiple land use/cover scenarios. Each area is assumed to be homogenous in regard to various attributes considered by the model. Additionally, the model does not spatially distribute the source areas, but aggregates the loads from each area into a watershed total. In other words, there is no spatial routing. For sub-surface loading, the model acts as a lumped parameter model using a water balance approach. No distinctly separate areas are considered for sub-surface flow contributions. Daily water balances are computed for an unsaturated zone as well as a saturated sub-surface zone, where infiltration is computed as the difference between precipitation and snowmelt minus surface runoff plus evapotranspiration.

GWLF models surface runoff using the Soil Conservation Service Curve Number (SCS-CN) approach with daily weather (temperature and precipitation) inputs. Erosion and sediment yield are estimated using monthly erosion calculations based on the Universal Soil Loss Equation (USLE) algorithm (with monthly rainfall-runoff coefficients) and a monthly composite of KLSCP values for each source area (e.g., land cover/soil type combination). The KLSCP factors are variables used in the calculations to depict changes in soil loss erosion (K), the length slope factor (LS) the vegetation cover factor (C) and conservation practices factor (P). A sediment delivery ratio based on watershed size and transport capacities based on average daily runoff are applied to the calculated erosion to determine sediment yield for each source area. Surface nutrient losses are determined by applying dissolved N and P coefficients to surface runoff and a sediment coefficient to the yield portion for each agricultural source area. Point source discharges can also contribute to dissolved losses to the stream and are specified in terms of kilograms per month. Manured areas, as well as septic systems, can also be considered. Urban nutrient inputs are all assumed to be solid-phase, and the model uses an exponential accumulation and washoff function for these loadings. Sub-surface losses are calculated using dissolved N and P coefficients for shallow groundwater contributions to stream nutrient loads, and the sub-surface sub-model only considers a single, lumped-parameter contributing area. Evapotranspiration is determined using daily weather data and a cover factor dependent upon land use/cover type. Finally, a water balance is performed daily using supplied or computed precipitation, snowmelt, initial unsaturated zone storage, maximum available zone storage, and evapotranspiration values. All of the equations used by the model can be viewed in GWLF Users Manuel, available from the Department’s Bureau of Watershed Management.

For execution, the model requires three separate input files containing transport-, nutrient-, and weather-related data. The transport (TRANSPRT.DAT) file defines the necessary parameters for each source area to be considered (e.g., area size, curve number, etc.) as well as global parameters (e.g., initial storage, sediment delivery ratio, etc.) that apply to all source areas. The nutrient (NUTRIENT.DAT) file specifies the various loading parameters for the different source areas identified (e.g., number of septic systems, urban source area accumulation rates, manure concentrations, etc.). The weather (WEATHER.DAT) file contains daily average temperature and total precipitation values for each year simulated.

The primary sources of data for this analysis were geographic information system (GIS) formatted databases. A specially designed interface was prepared by the Environmental Resources Research Institute of the Pennsylvania State University in ArcView (GIS software) to generate the data needed to run the GWLF model, which was developed by Cornell University. The new version of this model has been named AVGWLF (ArcView Version of the Generalized Watershed Loading Function).

In using this interface, the user is prompted to identify required GIS files and to provide other information related to "non-spatial" model parameters (e.g., beginning and end of the growing season, the months during which manure is spread on agricultural land and the names of nearby weather stations). This information is subsequently used to automatically derive values for required model input parameters, which are then written to the TRANSPRT.DAT, NUTRIENT.DAT and WEATHER.DAT input files needed to execute the GWLF model. For use in Pennsylvania, AVGWLF has been linked with statewide GIS data layers such as land use/cover, soils, topography, and physiography; and includes location-specific default information such as background N and P concentrations and cropping practices. Complete GWLF-formatted weather files are also included for eighty weather stations around the state. The following table lists the statewide GIS data sets and provides an explanation of how they were used for development of the input files for the GWLF model.

GIS Data Sets	
DATASET	DESCRIPTION
Censustr	Coverage of Census data including information on individual homes septic systems. The attribute *usew_sept* includes data on conventional systems, and *sew_other* provides data on short-circuiting and other systems.
County	The County boundaries coverage lists data on conservation practices, which provides C and P values in the Universal Soil Loss Equation (USLE).
Gwnback	A grid of background concentrations of N in groundwater derived from water well sampling.
Landuse5	Grid of the MRLC that has been reclassified into five categories. This is used primarily as a background.
Majored	Coverage of major roads. Used for reconnaissance of a watershed.
MCD	Minor civil divisions (boroughs, townships and cities).
Npdespts	A coverage of permitted point discharges. Provides background information and cross check for the point source coverage.
Padem	100-meter digital elevation model. This used to calculate landslope and slope length.
Palumrlc	A satellite image derived land cover grid that is classified into 15 different landcover categories. This dataset provides landcover loading rate for the different categories in the model.
Pasingle	The 1:24,000 scale single line stream coverage of Pennsylvania. Provides a complete network of streams with coded stream segments.
Physprov	A shapefile of physiographic provinces. Attributes *rain_cool* and *rain_warm* are used to set recession coefficient
Pointsrc	Major point source discharges with permitted N and P loads.
Refwater	Shapefile of reference watersheds for which nutrient and sediment loads have been calculated.
Soilphos	A grid of soil phosphorous loads, which has been generated from soil sample data. Used to help set phosphorus and sediment values.
Smallsheds	A coverage of watersheds derived at 1:24,000 scale. This coverage is used with the stream network to delineate the desired level watershed.
Statsgo	A shapefile of generalized soil boundaries. The attribute *mu_k* sets the k factor in the USLE. The attribute *mu_awc* is the unsaturated available capacity., and the *muhsg_dom* is used with landuse cover to derive curve numbers.
Strm305	A coverage of stream water quality as reported in the Pennsylvania's 305(b) report. Current status of assessed streams.
Surfgeol	A shapefile of the surface geology used to compare watersheds of similar qualities.
T9sheds	Data derived from a DEP study conducted at PSU with N and P loads.
Zipcode	A coverage of animal densities. Attribute *aeu_acre* helps estimate N & P concentrations in runoff in agricultural lands and over manured areas.
Weather Files	Historical weather files for stations around Pennsylvania to simulate flow.

Attachment G

Equal Marginal Percent Reduction (EMPR)

Equal Marginal Percent Reduction (EMPR) (An Allocation Strategy)

The Equal Marginal Percent Reduction (EMPR) allocation method was used to distribute Adjusted Load Allocations (ALAs) between the appropriate contributing nonpoint sources. The load allocation and EMPR procedures were performed using a MS Excel spreadsheet. The 5 major steps identified in the spreadsheet are summarized below:

Step 1: Calculation of the TMDL based on impaired watershed size and unit area loading rate of reference watershed.

Step 2: Calculation of Adjusted Load Allocation based on TMDL, Margin of Safety, and existing loads not reduced.

Step 3: Actual EMPR Process:

a. Each land use/source load is compared with the total ALA to determine if any contributor would exceed the ALA by itself. The evaluation is carried out as if each source is the only contributor to the pollutant load of the receiving waterbody. If the contributor exceeds the ALA, that contributor would be reduced to the ALA. If a contributor is less than the ALA, it is set at the existing load. This is the baseline portion of EMPR.

b. After any necessary reductions have been made in the baseline, the multiple analyses are run. The multiple analyses will sum all of the baseline loads and compare them to the ALA. If the ALA is exceeded, an equal percent reduction will be made to all contributors' baseline values. After any necessary reductions in the multiple analyses, the final reduction percentage for each contributor can be computed.

Step 4: Calculation of total loading rate of all sources receiving reductions.

Step 5: Summary of existing loads, final load allocations, and % reduction for each pollutant source.

Equal Marginal Percent Reduction Calculations in Lbs. for Coxes Creek

Microsoft Excel - EMPRCOXES.xls

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Step 1:	TMDL Total Load				Step 2:	Adjusted LA = (MDL total load - ((MOS) - loads not reduced)						
2		Load = TP loading rate in ref. * Acres in Impaired					12196368	12196368					
3		29086632											
4													
5													
6			Annual Average					% reduction				Allowable	
7	Step 3:		Load	Load Sum	Check	Initial Adjust	Recheck	allocation	Load Redu(	Initial LA	Acres	Loading Rat	% Reduction
8		COAL MINES	7022800.0	22404200.0	good	7022800	ADJUST	0.32	3082567	3940233	924	4263.40	43.9%
9							9541600						
10		TRANSITION	12862600.0		bad	12196368		0.56	5353438	6842930	1693	4042.61	46.8%
11													
12													
13		CROPLAND	2518800.0		good	2518800		0.12	1105595	1413205	4104	344.31	43.9%
14													
15						21737968		1.00		12196368			
16													
17		All Ag. Loadin(	1814.58										
18	Step 4:												
19				Allowable (Target)		Current							
20			Acres	loading rate	Final LA	Loading Rates	Current Load	% Red.					
21	Step 5:	COAL MINES	924	4263.40	3940233	7598.79	7022800	44%					
22													
23		TRANSITION	1693	4042.61	6842930	7598.87	12862600	47%					
24													
25		CROPLAND	4104	344.31	1413205	613.68	2518800	44%					
26													
27					12196368		22404200	46%					
28													
29													
30													
31													
32													

lbs. | EMPR

Attachment H
AVGWLF OUTPUT

AVGWLF Transport File and Model Output for Coxes Creek

Rural LU	Area (ha)	CN	K	LS	C	P
Hay/Past	5123	75	0.331	0.676	0.03	0.45
Cropland	1661	82	0.337	0.607	0.42	0.45
Forest	6557	73	0.281	0.663	0.002	0.52
Wetland	140	87	0.291	0.272	0.01	0.1
Coal_Mines	374	87	0.34	2.2	0.8	0.8
Turf_Grass	38	71	0.34	0.758	0.08	0.2
	0	0	0	0	0	0
	0	0	0	0	0	0
Bare Land	**Area (ha)**	**CN**	**K**	**LS**	**C**	**P**
Unpaved_Rd	16	87	0.308	0.586	0.8	1
Transition	685	87	0.34	2.2	0.8	0.8
Urban LU	**Area (ha)**	**CN**	**K**	**LS**	**C**	**P**
Lo_Int_Dev	1803	83	0.33	0.634	0.08	0.2
Hi_Int_Dev	217	93	0.34	1.042	0.08	0.2

Month	Ket	Day Hours	Season	Eros Coef	Stream Extract	Ground Extract
Jan	0.72	9.4	0	0.08	0	0
Feb	0.78	10.4	0	0.08	0	0
Mar	0.81	11.8	0	0.08	0	0
Apr	0.83	13.2	0	0.26	0	0
May	0.96	14.3	1	0.26	0	0
Jun	1.04	14.8	1	0.26	0	0
Jul	1.09	14.6	1	0.26	0	0
Aug	1.11	13.6	1	0.26	0	0
Sep	1.13	12.2	1	0.08	0	0
Oct	1.01	10.8	0	0.08	0	0
Nov	0.95	9.7	0	0.08	0	0
Dec	0.91	9.2	0	0.08	0	0

Init Unsat Stor (cm)	10	Initial Snow (cm)	0	Recess Coefficient	0.1
Init Sat Stor (cm)	0	Sed Delivery Ratio	0.098	Seepage Coefficient	0
Unsat Avail Wat (cm)	15.7583	Tile Drain Ratio	0.5	Sediment A Factor	4.3764E-05
		Tile Drain Density	0		

Load File | Save File | Export to JPEG | Close

GWLF Total Loads for file: coxes8-28#8-1

Period of analysis: 22 years from 1975 to 1996

Source	Area (Acres)	Runoff (in)	Tons: Erosion	Tons: Sediment	Total Loads (Pounds): Dis N	Total N	Dis P	Total P
Hay/Past	12659.2	2.4	3097.0	303.5	18129.9	19950.9	2050.3	2333.2
Cropland	4104.4	4.5	12851.4	1259.4	541333.2	548889.9	704672.3	705846.1
Forest	16202.7	2.0	254.2	24.9	1425.4	1574.9	45.0	68.2
Wetland	345.9	7.1	2.2	0.2	105.2	106.5	3.3	3.5
Coal_Mines	924.2	7.1	35830.7	3511.4	17.7	21086.2	2.8	3275.4
Turf_Grass	93.9	1.7	31.4	3.1	90.4	108.8	5.6	8.4
Unpaved_Rd	39.5	7.1	462.3	45.3	183.6	455.4	12.7	54.9
Transition	1692.7	7.1	65625.8	6431.3	32.5	38620.5	4.3	5998.3
Lo_Int_Dev	4455.3	4.9	1207.9	118.4	0.0	18443.3	0.0	2045.2
Hi_Int_Dev	536.2	13.1	246.2	24.1	0.0	92495.8	0.0	14405.1
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				6345.1		634.5		279.2
Groundwater					214283.8	214283.8	3414.3	3414.3
Point Sources					0.0	0.0	4620.0	4620.0
Septic Systems					0.0	0.0	0.0	0.0
Totals	41054.0	3.20	119609.0	18066.8	775601.8	956650.5	714830.6	742351.9

Go Back | Pathogen Loads | Export to JPEG | Print | Close

AVGWLF Transport File and Model Output for Upper South Fork Tenmile Creek

Rural LU	Area (ha)	CN	K	LS	C	P
Hay/Past	1928	75	0.364	1.649	0.03	0.45
Cropland	1796	82	0.364	3.624	0.42	0.45
Forest	13793	73	0.368	3.314	0.002	0.52
Wetland	10	87	0.377	1.482	0.01	0.1
Coal_Mines	15	87	0.381	0.187	0.8	0.1
	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
Bare Land	**Area (ha)**	**CN**	**K**	**LS**	**C**	**P**
Unpaved_Rd	65	87	0.367	5.787	0.8	1
Transition	53	87	0.362	0.691	0.8	0.8
Urban LU	**Area (ha)**	**CN**	**K**	**LS**	**C**	**P**
Lo_Int_Dev	282	83	0.346	0.411	0.08	0.2
Hi_Int_Dev	4	93	0.32	3.872	0.08	0.2

Month	Ket	Day Hours	Season	Eros Coef	Stream Extract	Ground Extract
Jan	0.61	9.4	0	0.08	0	0
Feb	0.66	10.4	0	0.08	0	0
Mar	0.69	11.8	0	0.08	0	0
Apr	0.7	13.2	0	0.26	0	0
May	0.87	14.3	1	0.26	0	0
Jun	0.97	14.9	1	0.26	0	0
Jul	1.02	14.6	1	0.26	0	0
Aug	1.05	13.6	1	0.26	0	0
Sep	1.07	12.2	1	0.08	0	0
Oct	0.93	10.8	0	0.08	0	0
Nov	0.84	9.7	0	0.08	0	0
Dec	0.79	9.1	0	0.08	0	0

Init Unsat Stor (cm)	10	Initial Snow (cm)	0	Recess Coefficient	0.1
Init Sat Stor (cm)	0	Sed Delivery Ratio	0.096	Seepage Coefficient	0
Unsat Avail Wat (cm)	19.682	Tile Drain Ratio	0.5	Sediment A Factor	3.2144E-04
		Tile Drain Density	0		

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GWLF Total Loads for file: southforktenmile8-28-1

Period of analysis: 24 years from 1975 to 1998

Source	Area (Acres)	Runoff (in)	Tons: Erosion	Tons: Sediment	Total Loads (Pounds): Dis N	Total N	Dis P	Total P
Hay/Past	4764.2	1.4	3122.4	299.8	4043.3	5841.8	389.2	572.7
Cropland	4438.0	2.7	89470.3	8589.1	7234.4	58769.3	704.9	5961.4
Forest	34083.2	1.2	3495.6	335.6	1725.8	3739.3	54.5	259.9
Wetland	24.7	4.5	1.1	0.1	4.8	5.4	0.2	0.2
Coal_Mines	37.1	4.5	17.1	1.6	0.5	10.3	0.1	1.1
Unpaved_Rd	160.6	4.5	22066.3	2118.4	474.1	13184.4	32.7	1329.1
Transition	131.0	4.5	1695.3	162.7	386.6	1363.1	26.7	126.3
Lo_Int_Dev	696.8	3.0	128.4	12.3	0.0	271.0	0.0	36.1
Hi_Int_Dev	9.9	9.1	15.8	1.5	0.0	63.6	0.0	7.1
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				3025.7		302.6		133.1
Groundwater					156475.9	156475.9	2571.1	2571.1
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					1037.6	1037.6	189.7	189.7
Totals	44345.5	1.40	120012.3	14546.9	171383.1	241064.3	3969.0	11187.8

Go Back | Pathogen Loads | Export to JPEG | Print | Close

Attachment I

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

The following are excerpts from the Pennsylvania DEP Section 303(d) narratives that justify changes in listings between the 1996, 1998, 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).

<u>Migration to National Hydrography Data (NHD)</u>

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 mange 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 J
Water Quality Data Used In TMDL Calculations

Point	Date	Flow, MGD	pH	Alkalinity, mg/L	Acid, mg/L	Fe, mg/L	Mn, mg/L	Al, mg/L	TSS, mg/L
1	10/9/2007	4.94	8	57.8	-15.2	0.15	0.301	0.25	8
1	12/18/2007	63.55	6.9	22.2	-6.6	0.674	0.294	0.762	8
1	3/26/2008	38.05	7.2	24	-5.4	0.774	0.424	0.834	1.5
1	4/10/2008	23.79	7.2	28.6	-2.6	0.702	0.484	0.816	4
	Average	*32.58*	*7.33*	*33.15*	*-7.45*	*0.58*	*0.38*	*0.67*	*5.38*
	StDev	*24.70*	*0.47*	*16.65*	*5.43*	*0.29*	*0.09*	*0.28*	*3.20*

Point	Date	Flow, MGD	pH	Alkalinity, mg/L	Acid, mg/L	Fe, mg/L	Mn, mg/L	Al, mg/L	TSS, mg/L
2	10/9/2007	4.81	8.2	76.8	-41.2	0.413	0.115	0.25	8
2	12/18/2007	48.37	7.3	30.8	-16.4	0.505	0.17	0.25	1.5
2	3/26/2008	33.56	7.5	36	-18.6	0.522	0.213	0.25	1.5
2	4/10/2008	22.09	7.8	44	-18	0.405	0.209	0.25	1.5
	Average	*27.21*	*7.70*	*46.90*	*-23.55*	*0.46*	*0.18*	*0.25*	*3.13*
	StDev	*18.40*	*0.39*	*20.66*	*11.80*	*0.06*	*0.05*	*0.00*	*3.25*

Point	Date	Flow, MGD	pH	Alkalinity, mg/L	Acid, mg/L	Fe, mg/L	Mn, mg/L	Al, mg/L	TSS, mg/L
3	10/9/2007	0.19	8.3	198.4	-157.6	0.15	0.025	0.25	12
3	12/18/2007	1.74	7.8	77.2	-65.6	0.15	0.124	0.25	1.5
3	3/26/2008	1.12	7.9	106.6	-7.4	0.916	0.204	0.25	1.5
3	4/10/2008	1.27	8.3	114.6	-188.8	0.15	0.025	0.25	1.5
	Average	*1.08*	*8.08*	*124.20*	*-104.85*	*0.34*	*0.09*	*0.25*	*4.13*
	StDev	*0.65*	*0.26*	*52.01*	*83.40*	*0.38*	*0.09*	*0.00*	*5.25*

Point	Date	Flow, MGD	pH	Alkalinity, mg/L	Acid, mg/L	Fe, mg/L	Mn, mg/L	Al, mg/L	TSS, mg/L
4	10/9/2007	*							
4	12/18/2007	0.27	7.1	15.6	-4.2	0.15	0.025	0.25	1.5
4	3/26/2008	0.14	7.1	15.8	-2.4	0.15	0.025	0.25	1.5
4	4/10/2008	0.06	6.8	15.2	7.8	0.865	0.025	0.25	1.5
	Average	*0.16*	*7.00*	*15.53*	*0.40*	*0.39*	*0.03*	*0.25*	*1.50*
	StDev	*0.11*	*0.17*	*0.31*	*6.47*	*0.41*	*0.00*	*0.00*	*0.00*

Point	Date	Flow, MGD	pH	Alkalinity, mg/L	Acid, mg/L	Fe, mg/L	Mn, mg/L	Al, mg/L	TSS, mg/L
5	10/9/2007	0.15	7.6	91.2	-1.2	1.3	0.092	0.25	6
5	12/18/2007	2.25	7.4	24.2	-12	0.375	0.025	0.25	1.5
5	3/26/2008	1.54	7.4	26.2	-9.8	0.15	0.025	0.25	1.5
5	4/10/2008	1.08	7.6	29.8	12.2	0.441	0.025	0.25	1.5
	Average	*1.26*	*7.50*	*42.85*	*-2.70*	*0.57*	*0.04*	*0.25*	*2.63*
	StDev	*0.88*	*0.12*	*32.32*	*10.97*	*0.50*	*0.03*	*0.00*	*2.25*

Point	Date	Flow, MGD	pH	Alkalinity, mg/L	Acid, mg/L	Fe, mg/L	Mn, mg/L	Al, mg/L	TSS, mg/L
6	10/9/2007	308	8.5	83.6	-36.6	0.15	0.025	0.25	6
6	12/18/2007	39.65	7.5	31.4	-17.6	0.408	0.168	0.25	1.5
6	3/26/2008	27.02	7.5	35.6	-20	0.318	0.193	0.25	1.5
6	4/10/2008	19.29	8.4	41.2	-6.2	0.368	0.156	0.25	1.5
	Average	*98.49*	*7.98*	*47.95*	*-20.10*	*0.31*	*0.14*	*0.25*	*2.63*
	StDev	*139.93*	*0.55*	*24.10*	*12.54*	*0.11*	*0.08*	*0.00*	*2.25*

Point	Date	Flow, MGD	pH	Alkalinity, mg/L	Acid, mg/L	Fe, mg/L	Mn, mg/L	Al, mg/L	TSS, mg/L
7	10/9/2007	3.56	8.3	91	-44.4	0.378	0.025	0.25	8
7	12/18/2007	32.16	7.6	38.6	-25.4	1.05	0.223	0.608	16
7	3/26/2008	18.96	7.4	41.2	-28	0.77	0.21	0.25	1.5
7	4/10/2008	11.74	7.6	53	-22.2	0.537	0.182	0.25	1.5
	Average	*16.61*	*7.73*	*55.95*	*-30.00*	*0.68*	*0.16*	*0.34*	*6.75*
	StDev	*12.13*	*0.39*	*24.19*	*9.89*	*0.29*	*0.09*	*0.18*	*6.89*

Point	Date	Flow, MGD	pH	Alkalinity, mg/L	Acid, mg/L	Fe, mg/L	Mn, mg/L	Al, mg/L	TSS, mg/L
8	10/10/2007	0.18	7.6	104	-22	0.941	0.427	0.25	1.5
8	12/18/2007	8.22	7.3	37	-27.6	0.457	0.11	0.25	1.5
8	3/26/2008	6.1	7.5	39	-22.8	0.432	0.143	0.25	1.5
8	4/10/2008	3.65	7.7	52.6	-24	0.667	0.224	0.25	4
	Average	*4.54*	*7.53*	*58.15*	*-24.10*	*0.62*	*0.23*	*0.25*	*2.13*
	StDev	*3.45*	*0.17*	*31.34*	*2.47*	*0.24*	*0.14*	*0.00*	*1.25*

Point	Date	Flow, MGD	pH	Alkalinity, mg/L	Acid, mg/L	Fe, mg/L	Mn, mg/L	Al, mg/L	TSS, mg/L
9	10/10/2007	3.36	8	99.8	-63.8	0.15	0.025	0.25	26
9	12/18/2007	22.27	7.6	41.4	-26.4	0.681	0.241	0.25	1.5
9	3/26/2008	20.9	7.5	43.8	-31.2	0.41	0.238	0.25	1.5
9	4/10/2008	14.32	7.4	55.6	-18.4	0.45	0.225	0.25	1.5
	Average	*15.21*	*7.63*	*60.15*	*-34.95*	*0.42*	*0.18*	*0.25*	*7.63*
	StDev	*8.63*	*0.26*	*27.15*	*19.94*	*0.22*	*0.11*	*0.00*	*12.25*

Point	Date	Flow, MGD	pH	Alkalinity, mg/L	Acid, mg/L	Fe, mg/L	Mn, mg/L	Al, mg/L	TSS, mg/L
10	10/10/2007	0.99	8.2	118.6	-90.8	0.15	0.025	0.25	1.5
10	12/18/2007	12.33	7.5	31.6	-18.2	0.15	0.163	0.25	1.5
10	3/26/2008	6.97	7.6	47.8	-34.2	0.325	0.144	0.25	1.5
10	4/10/2008	5.8	7.8	56.8	-24.2	0.381	0.118	0.25	1.5
	Average	*6.52*	*7.78*	*63.70*	*-41.85*	*0.25*	*0.11*	*0.25*	*1.50*
	StDev	*4.66*	*0.31*	*38.06*	*33.29*	*0.12*	*0.06*	*0.00*	*0.00*

Point	Date	Flow, MGD	pH	Alkalinity, mg/L	Acid, mg/L	Fe, mg/L	Mn, mg/L	Al, mg/L	TSS, mg/L
11	10/10/2007	0.02	7.6	76.2	-49.6	0.343	0.179	0.25	1.5
11	12/18/2007	0.68	7.4	43	-28.6	0.439	0.132	0.25	1.5
11	3/26/2008	0.49	7.5	38.4	-25	2.103	0.137	0.25	1.5
11	4/10/2008	0.37	7.7	44.8	-12.2	0.15	0.06	0.25	1.5
	Average	*0.39*	*7.55*	*50.60*	*-28.85*	*0.76*	*0.13*	*0.25*	*1.50*
	StDev	*0.28*	*0.13*	*17.28*	*15.52*	*0.90*	*0.05*	*0.00*	*0.00*

Point	Date	Flow, MGD	pH	Alkalinity, mg/L	Acid, mg/L	Fe, mg/L	Mn, mg/L	Al, mg/L	TSS, mg/L
12	10/10/2007	0.18	7.8	111	-25.2	1.38	0.824	0.25	1.5
12	12/18/2007	7.26	7.6	51.4	-38.4	0.562	0.109	0.25	8
12	3/26/2008	4.81	7.6	44.4	-26.8	0.572	0.105	0.25	1.5
12	4/10/2008	2.4	7.7	50.2	-19.8	0.738	0.136	0.25	4
	Average	*3.66*	*7.68*	*64.25*	*-27.55*	*0.81*	*0.29*	*0.25*	*3.75*
	StDev	*3.05*	*0.10*	*31.32*	*7.83*	*0.39*	*0.35*	*0.00*	*3.07*

Underlined values are included at one half the detection limit.

Attachment K

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 L
Comment and Response

No public comments were received for the Coxes Creek Watershed TMDL.