FINAL UPPER SCHUYLKILL RIVER WATERSHED TMDL

Schuylkill County

For Acid Mine Drainage Affected Segments

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[1]TMDL
Upper Schuylkill River Watershed
Schuylkill County, Pennsylvania

Table 1. 303(d) Sub-List								
State Water Plan (SWP) Subbasin: 03-A Schuylkill River								
Year	**Miles**	**Segment ID Assessment ID**	**DEP Stream Code**	**Stream Name**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1996	31.7	180	00833	Schuylkill River	CWF	305(b) Report	RE	Metals
1998	34.32	180	00833	Schuylkill River	CWF	SWMP	AMD	Metals
2002	2.2	20000808-1100-CJD	00833	Schuylkill River	CWF	SWMP	AMD	Siltation
2002	2.8	20000808-1220-CJD	00833	Schuylkill River	CWF	SWMP	AMD	Siltation
2002	1.7	20000808-1350-CJD	00833	Schuylkill River	CWF	SWMP	AMD	Siltation
2002	3.1	20000809-0800-CJD	00833	Schuylkill River	CWF	SWMP	AMD	Siltation
2002	10.7	20000831-1000-CJD	00833	Schuylkill River	CWF	SWMP	AMD	Siltation
2002	16.8	20000831-1530-CJD	00833	Schuylkill River	CWF	SWMP	AMD	Siltation
2004	5.0	20000831-0800-CJD	00833	Schuylkill River	CWF	SWMP	AMD	Metals Siltation
2004	7.6	20000831-1000-CJD	00833	Schuylkill River	CWF	SWMP	AMD	Metals Siltation
2004	3.1	20000831-1001-CJD	00833	Schuylkill River	CWF	SWMP	AMD	Metals Siltation
2004	12.0	20000831-1530-CJD	00833	Schuylkill River	CWF	SWMP	AMD	Siltation
2004	12.0	20000831-1532-CJD	00833	Schuylkill River	CWF	SWMP	AMD	Metals

Cold Water Fishery=CWF
Surface Water Monitoring Program = SWMP
Surface Water Assessment Program = SWAP
Resource Extraction = RE
Abandoned Mine Drainage = AMD
See Attachment D, *Excerpts Justifying Changes Between the 1996, 1998 and 2002 Section 303(d) Lists.*
The use designations for the stream segments in this TMDL can be found in PA Title 25 Chapter 93

Introduction

This Total Maximum Daily Load (TMDL) calculation has been prepared for segments in the Schuylkill River Watershed (Attachment A). It was done to address the impairments noted on the 1996 Pennsylvania 303(d) list, required under the Clean Water Act, and covers one segment on this list (shown in Table 1). High levels of metals, and in some areas siltation, caused these

[1] Pennsylvania's 1996, 1998, 2002 and 2004 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.*

impairments. All impairments resulted from acid drainage from abandoned coalmines. The TMDL addresses the three primary metals associated with acid mine drainage (iron, manganese, aluminum) and pH.

Directions to the Upper Schuylkill River Watershed

The Upper Schuylkill River Watershed is approximately 49.4 square miles in area. The watershed is located in central Schuylkill County, Pennsylvania and encompasses many communities that include: Pottsville, Schuylkill Haven, and Port Clinton. The Schuylkill River within the Upper Schuylkill River Watershed flows east-southeast from its headwaters near the small community of Tuscarora to its confluence with the Little Schuylkill River in Port Clinton. The headwaters of the Schuylkill River are accessible from Interstate 81 to S.R. 309 towards Tamaqua to S.R. 209 towards Pottsville.

Segments addressed in this TMDL

The Schuylkill River is affected by pollution from AMD. This pollution has caused high levels of metals in the Schuylkill River. Major sources of AMD occur at twelve (12) known abandoned deep mine discharges.

There are active mining operations in the watershed that are considered remining permits. The twelve (12) major discharges in the watershed are all caused by abandoned mines and are treated as non-point sources. The distinction between non-point and point sources in this case is determined on the basis of whether or not there is a responsible party for the discharge. Where there is no responsible party the discharge is considered to be a non-point source. Each segment on the Section 303(d) list will be addressed as a separate TMDL. These TMDLs will be expressed as long-term, average loadings. Due to the nature and complexity of mining effects on the watershed, expressing the TMDL as a long-term average gives a better representation of the data used for the calculations. See Table 4 for TMDL calculations and see Attachment C for TMDL explanations.

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)[2] reporting process. DEP is now using the Statewide Surface Waters Assessment Protocol (SSWAP), a modification of the EPA's 1989 Rapid Bioassessment Protocol II (RBP-II), as the primary mechanism to assess Pennsylvania's waters. The SSWAP provides a more consistent approach to assessing Pennsylvania's streams.

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

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

Watershed History

A portion of Upper Schuylkill River Watershed lies within the Southern Anthracite Coal Field, which is part of Anthracite Upland Section of the Ridge and Valley Province. The field is the largest of four fields in the entire Anthracite Region and is complexly folded and faulted into an elongated basin. The Anthracite Region ends south of Pottsville.

The headwater of the river begins within this field and flows over 12 miles before flowing past Pottsville. The headwaters have been extensively mined since the early 1800's. The discovery of anthracite fueled the Industrial Revolution, bringing immigration and further development of many boroughs and "patch towns" which may still exist today. Approximately 7.3% of the watershed is developed.

By 1913, 80 million tons of coal was mined from the anthracite region and in 1917 production reached a peak of over 100 million tons. Large amounts of this mined coal came from this watershed because of the abundance of coal and also since the river provided an excellent source of transportation to markets such as Reading and Philadelphia.

Underground or deep mining accounted for the majority of coal extracted. Much of the deep mining extended below the water table, which created openings that were susceptible to flooding after abandonment of the mine workings. Many of the abandoned mines created vast mine pools that overflow on the surface as mine drainage. Although many of these abandoned mine discharges (AMD) are acidic several have significant alkalinity concentrations. Artificial recharge of the mine pools has been created by abandoned surface mining that created depressions or pits that allow water to collect on the surface and infiltrate into the mine pool. Leakage from the streams also provides a source of water that infiltrates and recharges the mine pools (Ash et al 1949).

Although the anthracite boom has come and gone, there is still active mining occurring within the watershed. Approximately 7.5% of the 49.4 square mile watershed has been mined. All the active mining sites are remining permits, as they are mining and reclaiming previously mined areas.

Table 2. Active Mining Permits with NPDES in Upper Schuylkill River Watershed

Permit No.	*Operation and Company Name*	*Operation Status*
54030103	Jett #2 Stripping, Jett Contracting Co.	Active stripping operation. NPDES permit and Subchapter G permit for a pre-existing pollutional discharge (PA0224367)
54011301	Seven Foot Slope Mine, Alfred Brown Coal	Recent phase II underground mining permit. Permitted treatment facility has not been built (PA0224189)
54693031	Eagle Hill West, Joe Kuperavage Coal Co.	Active stripping operation. No recorded discharge for issued NPDES permit (PA0124168)
54713002	Wadesville P-33 Mine Reading Anthracite Co.	Active open pit mine. NPDES permit for pumping deep mine complex (PA0123293)
54830103	Mary Davis Mine, K & K Coal Co.	Active stripping operation. No recorded discharge for issued NPDES permit (PA0613398)
54830109	New Philadelphia Mine, Joe Kuperavage Coal Co.	Active stripping operation. No recorded discharge for issued NPDES permit (PA0613622)
54850104	Bell Mine, Bell Enterprises	Stage I reclamation (PA0614530)
54860102	Silver Creek Mine, Gale Coal Co., Inc.	Active for reclamation purposes only. Stage I reclamation (regraded) completed (PA0593165)
54860108	Wadesville Area Mine Reading Anthracite Co.	Active stripping and support in conjunction with Wadesville P-33 Mine (PA0593508)

54870101	Ohlinger & Bushey Mine, Kuperavage Enterprises, Inc.	Active stripping operation. No recorded discharge for issued NPDES permit (PA0593842)

Many communities within the headwaters still discharge raw sewage to the river. A number of "wildcat" sewers are prevalent in the headwaters with the highest concerns located in the New Philadelphia and Middleport areas (Kimball 2000). However, sewage collection and treatment facilities are scheduled for construction in these areas.

Aquatic life does exist within the headwaters of the Schuylkill River. Recent fish sampling of the Schuylkill River upstream and downstream of Pottsville identified a mixture of warm water species, with blacknose dace, creek chub, white sucker, and green sunfish most abundant. Small numbers of rainbow, brown, or brook trout were collected at the downstream station, evidence of prior stocking by the Pennsylvania Fish and Boat Commission (Normandeau 2004).

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.

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 of interest using Monte Carlo simulation. Monte Carlo simulation is an analytical method meant to imitate real-life systems, especially when other analyses are too mathematically complex or too difficult to reproduce. Monte Carlo simulation calculates multiple scenarios of a model by repeatedly sampling values from the probability distribution of the uncertain variables and using those values to populate a larger data set. Allocations were applied uniformly for the watershed area specified for each allocation point. For each source and pollutant, it was assumed that the observed data were log-normally distributed. Each pollutant source was evaluated separately using @Risk[3] by performing 5,000

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

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

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

PR = required percent reduction for the current iteration

Cc = criterion in mg/l

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

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

Mean = average observed concentration

Standard Deviation = standard deviation of observed data

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

LTA = Mean * (1 – PR99) where (2)

LTA = allowable LTA source concentration in mg/l

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

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

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

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

In low pH TMDLs, acidity is compared to alkalinity as described in Attachment B. Each sample point used in the analysis of pH by this method must have measurements for total alkalinity and total acidity. 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.

The TMDL is expressed as Load Allocations (LAs) and Waste Load Allocations (WLAs). 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 4 contains the TMDL component summary for each point evaluated in the watershed. Refer to the maps in Attachment A.

Allocation Summary

These TMDLs will focus remediation efforts on the identified numerical reduction targets for each watershed. The reduction schemes in Table 4 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 then 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; the total waste load allocation for each segment is included in this table. There are currently ten (10) permitted discharges in the Upper Schuylkill River 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 4. Upper Schuylkill River Watershed Summary Table

Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	% Reduction
S1 – Schuylkill River above Bell Tunnel Discharge						
Aluminum (lbs/day)	27.95	11.15	0.12	11.03	16.80	61%
Iron (lbs/day)	16.47	16.47	0.18	16.29	NA	NA
Manganese (lbs/day)	25.66	13.87	0.12	13.75	11.79	46%
Acidity (lbs/day)	1206.38	147.29	-	147.29	1059.09	88%
S2 – Bell Tunnel Discharge						
Aluminum (lbs/day)	9.22	3.85	0	3.85	5.37	58%
Iron (lbs/day)	39.84	3.95	0	3.95	35.89	90%
Manganese (lbs/day)	13.00	6.11	0	6.11	6.89	53%
Acidity (lbs/day)	559.74	0.00	0	0.00	559.74	100%
S2A – Schuylkill River below Bell Tunnel Discharge						
Aluminum (lbs/day)	25.47	11.10	0	11.10	0.00	0%*
Iron (lbs/day)	42.53	11.56	0	11.58	3.86	24%*
Manganese (lbs/day)	29.51	14.88	0	14.88	0.37	3%*
Acidity (lbs/day)	-	-	-	-	-	-
S3 – Mary D Overflow						
Aluminum (lbs/day)	4.24	1.71	0	1.71	2.53	60%
Iron (lbs/day)	58.63	7.70	0	7.70	50.93	87%
Manganese (lbs/day)	16.84	6.30	0	6.30	10.54	63%
Acidity (lbs/day)	102.19	67.47	0	67.47	34.70	34%
S4 – Mary D Boreholes						
Aluminum (lbs/day)	12.97	3.18	0	3.18	9.79	75%
Iron (lbs/day)	93.84	12.06	0	12.06	81.78	87%
Manganese (lbs/day)	27.12	14.08	0	14.08	13.04	48%
Acidity (lbs/day)	837.93	198.24	0	198.24	639.69	76%
S5 – Big Creek below bridge in Brockton						
Aluminum (lbs/day)	42.31	17.60	0	17.60	24.71	58%
Iron (lbs/day)	3.37	NA	NA	NA	NA	NA
Manganese (lbs/day)	21.26	NA	NA	NA	NA	NA
Acidity (lbs/day)	2156.82	348.71	0	348.71	1808.11	84%
SRM – Schuylkill River in Middleport						

Aluminum (lbs/day)	ND	3.17	3.17	ND	ND	NA
Iron (lbs/day)	52.88	33.93	4.76	29.17	0.00	0%*
Manganese (lbs/day)	78.04	35.98	3.17	32.81	10.58	23%*
Acidity (lbs/day)	1429.11	292.94	-	292.94	0.00	0%*
S6 – Kaska Outfall						
Aluminum (lbs/day)	14.41	1.71	0	1.71	12.70	88%
Iron (lbs/day)	14.55	3.35	0	3.35	11.20	77%
Manganese (lbs/day)	10.32	2.44	0	2.44	7.88	76%
Acidity (lbs/day)	205.94	19.71	0	19.71	186.23	90%
S7 – Silver Creek Discharge						
Aluminum (lbs/day)	31.88	8.63	0	8.63	23.25	73%
Iron (lbs/day)	436.99	20.00	0	20.00	415.99	95%
Manganese (lbs/day)	65.26	15.29	0	15.29	49.97	77%
Acidity (lbs/day)	1138.83	185.78	0	185.78	953.05	84%
SRNP – Schuylkill River in New Philadelphia						
Aluminum (lbs/day)	ND	5.40	5.40	ND	ND	NA
Iron (lbs/day)	240.04	118.98	8.12	110.86	0.00	0%*
Manganese (lbs/day)	135.64	74.52	5.40	69.12	0.00	0%*
Acidity (lbs/day)	2718.54	615.02	-	615.02	0.00	0%*
S8 – Eagle Hill Discharge						
Aluminum (lbs/day)	8.15	3.83	0	3.83	4.32	53%
Iron (lbs/day)	148.86	9.90	0	9.90	138.96	93%
Manganese (lbs/day)	35.05	7.25	0	7.25	27.80	79%
Acidity (lbs/day)	NA	NA	NA	NA	NA	NA
S9 – Lucianna Tunnel						
Aluminum (lbs/day)	6.15	1.48	0	1.48	4.67	76%
Iron (lbs/day)	55.30	4.90	0	4.90	50.40	91%
Manganese (lbs/day)	14.95	5.00	0	5.00	9.95	67%
Acidity (lbs/day)	85.90	47.56	0	47.56	38.34	45%
S10 – Randolph Discharge						
Aluminum (lbs/day)	NA	NA	0	NA	NA	NA
Iron (lbs/day)	150.75	11.10	0	11.10	139.65	93%
Manganese (lbs/day)	23.88	7.80	0	7.80	16.08	67%
Acidity (lbs/day)	NA	NA	0	NA	NA	NA
SR2 – Schuylkill River in Port Carbon upstream of Mill Creek						
Aluminum (lbs/day)	NA	NA	0	NA	NA	NA
Iron (lbs/day)	349.42	128.07	0	128.07	0.00	0%*
Manganese (lbs/day)	197.11	117.79	0	117.79	0.00	0%*
Acidity (lbs/day)	3143.54	1426.44	0	1426.44	0.00	0%*
Mill Creek at mouth						
Aluminum (lbs/day)	394.56	138.10	0	-	-	-

Iron (lbs/day)	1083.54	325.06	0	-	-	-
Manganese (lbs/day)	628.36	201.08	0	-	-	-
Acidity (lbs/day)	10045.07	1305.86	0	-	-	-
S11 – Salem Hill Discharge						
Aluminum (lbs/day)	NA	NA	0	NA	NA	NA
Iron (lbs/day)	1.47	1.20	0	1.20	0.27	18%
Manganese (lbs/day)	1.02	1.02	0	NA	NA	NA
Acidity (lbs/day)	NA	NA	0	NA	NA	NA
S12 – Sherman Colliery at end of pipe						
Aluminum (lbs/day)	NA	NA	0	NA	NA	NA
Iron (lbs/day)	2.83	0.93	0	0.93	1.90	67%
Manganese (lbs/day)	0.98	0.56	0	0.56	0.42	43%
Acidity (lbs/day)	NA	NA	0	NA	NA	NA
SR4 – Schuylkill River in Cressona						
Aluminum (lbs/day)	86.18	41.82	35.03	6.79	0.00	0%*
Iron (lbs/day)	702.38	232.93	140.11	92.82	0.00	0%*
Manganese (lbs/day)	427.52	259.16	93.41	165.75	0.00	0%*
Acidity (lbs/day)	NA	NA	0	ND	ND	NA
West Branch Schuylkill River						
Aluminum (lbs/day)	637.23	235.77	0	-	-	-
Iron (lbs/day)	1592.63	366.30	0	-	-	-
Manganese (lbs/day)	1029.30	442.60	0	-	-	-
Acidity (lbs/day)	0.00	0.00	0	-	-	-
S14 - Schuylkill River at USGS gaging station at Landingville						
Aluminum (lbs/day)	980.48	610.68	0	610.68	0.00	0%*
Iron (lbs/day)	4823.22	1349.57	0	1349.57	1777.87	57%
Manganese (lbs/day)	2704.84	1388.41	0	1388.41	561.37	29%
Acidity (lbs/day)	NA	NA	0	NA	NA	NA
S15 –Schuylkill River at railroad bridge upstream of confluence with Little Schuylkill River						
Aluminum (lbs/day)	NA	NA	0	NA	NA	NA
Iron (lbs/day)	1962.81	1434.10	0	1434.10	0.00	0%*
Manganese (lbs/day)	2142.49	1781.72	0	1781.72	0.00	0%*
Acidity (lbs/day)	NA	NA	0	NA	NA	NA

* Total of loads affecting this segment is less than the allowable load calculated at this point, therefore no reduction is necessary.
ND = non detection NA = not applicable

In the instance that the allowable load is equal to the measured load (e.g. manganese S11, Table 4), 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 "ND" and "NA" in the above table.

Waste load allocations were assigned to ten permitted mine drainage discharges contained in the Upper Schuylkill River Watershed. Derivation of average flow rates used in calculating each WLA is given in the TMDLs by Segment Section (Attachment D). All waste load allocations are evaluated at the next downstream point. No required reductions of permit limits are needed at this time. All necessary reductions are assigned to non-point sources.

Table 5 Waste Load Allocations at Discharges

Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Seven Foot Slope Mine			
Al	2.0	0.1000	1.67
Fe	3.0	0.1000	2.50
Mn	2.0	0.1000	1.67
Eagle Hill West			
Al	2.0	0.045	0.75
Fe	3.0	0.045	1.13
Mn	2.0	0.045	0.75
Wadesville P-33 Mine			
Al	0.75	5.60	35.03
Fe	3.0	5.60	140.11
Mn	2.0	5.60	93.41
New Philadelphia Mine			
Outfall 001 - Al	2.0	0.045	0.75
Fe	3.0	0.045	1.13
Mn	2.0	0.045	0.75
Outfall 005 – Al	2.0	0.045	0.75
Fe	3.0	0.045	1.13
Mn	2.0	0.045	0.75
Bell Mine			
Al	2.0	0.0072	0.12
Fe	3.0	0.0072	0.18
Mn	2.0	0.0072	0.12
Ohlinger & Bushey Mine			
Al	2.0	0.045	0.75
Fe	3.0	0.045	1.13
Mn	2.0	0.045	0.75
Mary Davis Tract			
Al	2.0	0.045	0.75
Fe	3.0	0.045	1.13
Mn	2.0	0.045	0.75
Silver Creek Stripping			
Al	2.0	0.045	0.75
Fe	3.0	0.045	1.13
Mn	2.0	0.045	0.75
Jett #2 Stripping			
Al	2.0	0.144	2.40
Fe	3.0	0.144	3.60
Mn	2.0	0.144	2.40
Wadesville Area			
Al	2.0	0.045	0.75
Fe	3.0	0.045	1.13

Mn	2.0	0.045	0.75

Following is an example of how the allocations, presented in Table 4, for a stream segment are calculated. For this example, iron allocations for S2A of the Upper Schuylkill River Watershed are shown. As demonstrated in the example, all upstream contributing loads are accounted for at each point. Attachment C contains the TMDLs by segment analysis for each allocation point in a detailed discussion. These analyses follow the example. Attachment A contains maps of the sampling point locations for reference.

Allocations S1	
S1	Fe (Lbs/day)
Existing Load @ S1	16.47
Allowable Load @ S1	16.47

Load = 16.47

Allocations S2	
S2	Fe (Lbs/day)
Existing Load @ S2	39.84
Allowable Load @ S2	3.95

Load = 3.95

Load output = 13.78 lbs/day
(Difference between existing loads
at S2A and S2/S1)

Allocations S2A	
S2A	Fe (Lbs/day)
Existing Load @ S2A	42.53
Difference in measured Loads between upstream loads and existing S2A	-13.78
Percent loss due calculated at S2A	24.5%
Additional load tracked from above samples	20.42
Percentage of upstream loads that reach the S2A	75.5%
Total load tracked between S1/S2 and S2A	15.42
Allowable Load @ S2A	11.56
Load Reduction @ S2A	3.86
% Reduction required at S2A	25%

The existing load at S2A was subtracted from the existing loads from S1/S2 to show the actual measured decrease of iron load that has left the stream between these three sample points (13.78 lbs/day). The percentage of iron load that actually reached S2A was calculated to be 75.5%. The additional load tracked from the above sample (S1 and S2) is the sum of their calculated allowable loads (20.42 lbs/day). The percentage of upstream iron loads that reached S2A (75.5%) was multiplied with the additional load tracked from the above samples (20.42 lbs/day) to determine the total load at S2A. This value was found to be 15.42 lbs/day; it was 3.86 lbs/day greater then the calculated allowable iron load of 11.56 lbs/day. Therefore, a 25% reduction at S2A is necessary. From this point, the allowable load at S2A will be tracked to the next downstream point, SRM.

Recommendations

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

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

- Partnerships between the DEP, watershed associations, local governments, environmental groups, other state agencies, federal agencies and other groups organized to reclaim abandoned mine lands are essential to achieving reclamation and abating acid mine drainage in an efficient and effective manner.

- Partnerships between AML interests and active mine operators are important and essential in reclaiming abandoned mine lands.

- Preferential consideration for the development of AML reclamation or AMD abatement projects will be given to watersheds or areas for which there is an approved rehabilitation plan. (guidance is given in Appendix B to the Comprehensive Plan).

- Preferential consideration for the use of designated reclamation moneys will be given to projects that have obtained other sources or means to partially fund the project or to projects that need the funds to match other sources of funds.

- Preferential consideration for the use of available moneys from federal and other sources will be given to projects where there are institutional arrangements for any necessary long-term operation and maintenance costs.

- Preferential consideration for the use of available moneys from federal and other sources will be given to projects that have the greatest worth.

- Preferential consideration for the development of AML projects will be given to AML problems that impact people over those that impact property.

- No plan is an absolute; occasional deviations are to be expected.

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

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

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

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

Citizen and stakeholder involvement is critical to watershed reclamation in Pennsylvania and is strongly encouraged through the TMDL program and process. The Schuylkill Headwaters Association, Inc. (SHA) is a watershed group formed to tackle the huge AMD problems in the headwaters of the Schuylkill River. SHA maintains active all-volunteer membership with monthly work sessions, regular public meetings and implementation of group projects. A recent project, funded by a Section 319(h) Nonpoint Source Management Grant, constructed large treatment cells and wetlands to remediate the Bell Mine Discharge, which is the first major source of AMD in the headwaters and was listed as a priority site for remediation in a 2000 assessment report prepared for the Schuylkill Conservation District. The SHA is also actively collecting flow and sample data on several other discharges in the headwaters for planning of future projects. In 2003, the Schuylkill Action Network (SAN) formed. SAN is a group of watershed organizations, water suppliers, industry representatives, and government agencies that work collectively to improve water quality of the Schuylkill River. The SAN established the Acid Mine Drainage Workgroup to reduce large sources of AMD. The workgroup is working within the Pine Knot Tunnel drainage area. The Pine Knot Tunnel is the single largest contributor of AMD in the entire Upper Schuylkill River Watershed (Kimball 2000). Efforts in the drainage area are aimed at restoration of infiltration sites and passive treatment.
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.

Public Participation

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* on February 3, 2007 and the Pottsville Republican on January 12, 2007 to foster public comment on the allowable loads calculated. A public meeting was held on February 20, 2007 at the Pottsville District Mining Office in Pottsville, PA to discuss the proposed TMDL.

References

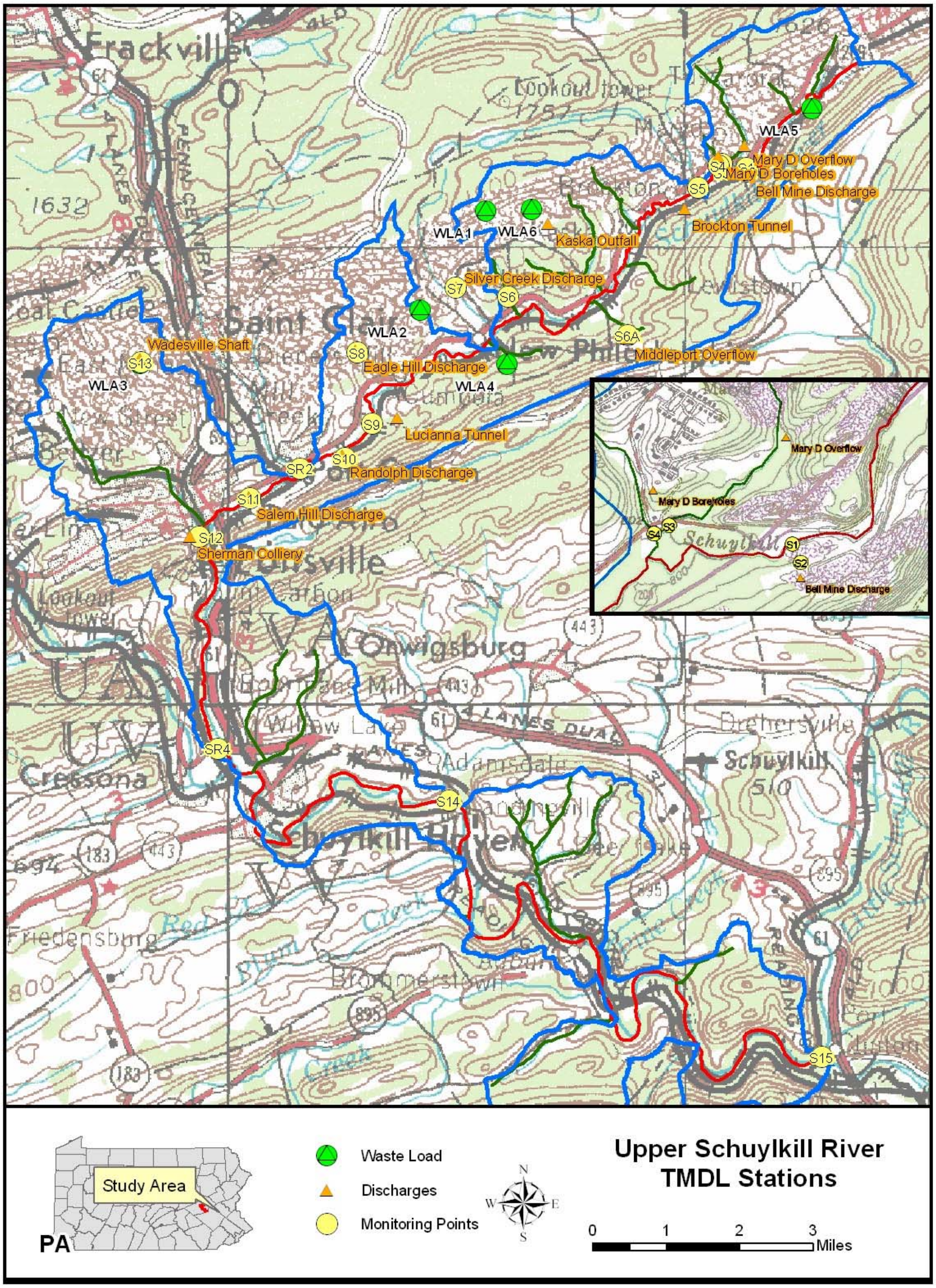
Ash et al. 1949. Water Pools in Pennsylvania Anthracite Mines. U.S. Bureau of Mines. Technical Paper 727.

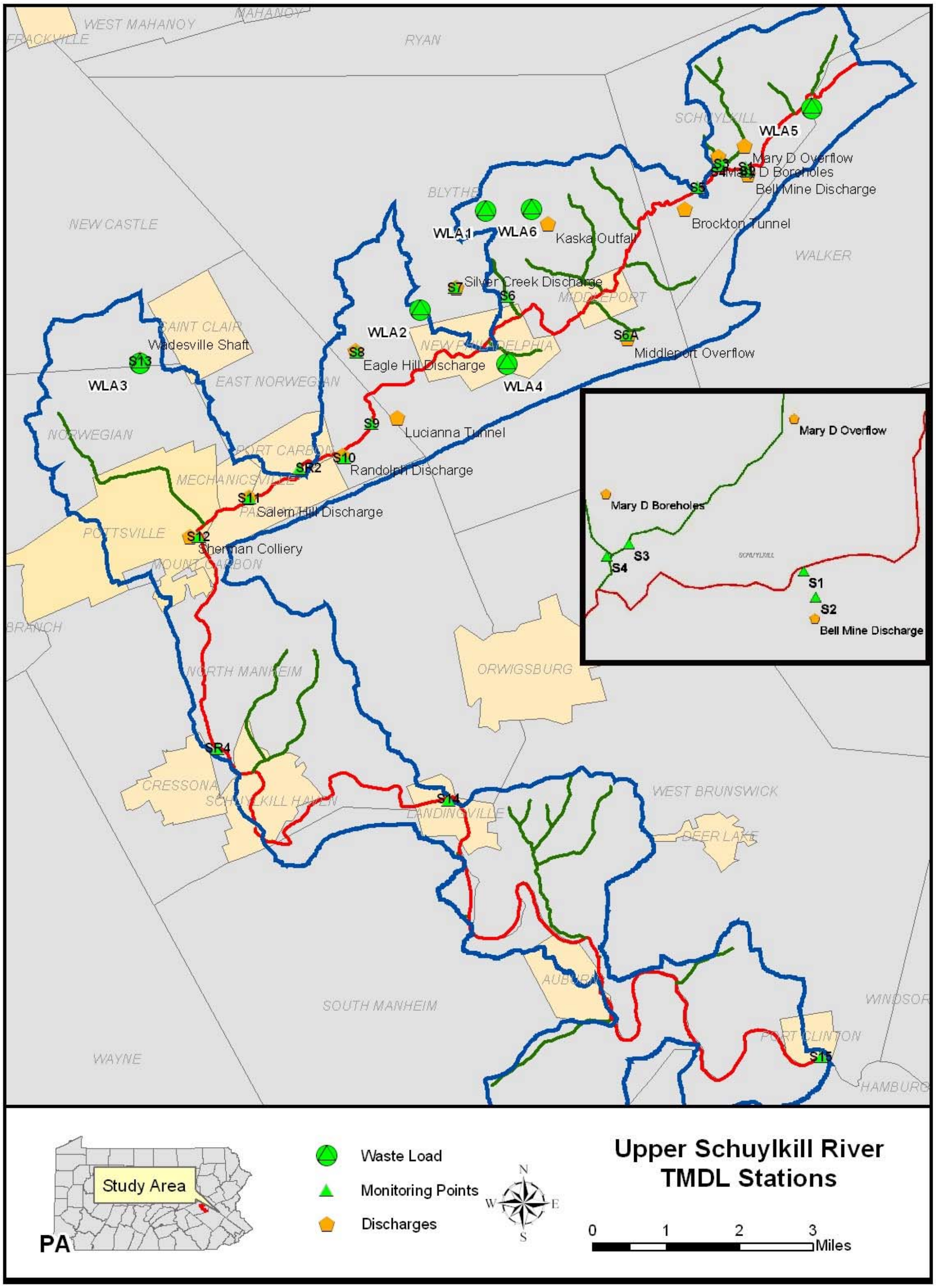
L. Robert Kimball & Associates for Schuylkill Conservation District. 2000. Upper Schuylkill River Tributaries Assessment Report.

Normandeau Associates, Inc. and URS Corporation for Exelon Generation Company LLC. Unpublished. Year One (2003) Interim Report for the Wadesville Mine Water Demonstration Project.

Attachment A

Upper Schuylkill River Watershed Maps


Upper Schuylkill River
TMDL Stations
Waste Load
Discharges
Monitoring Points
Study Area
PA
0
1
2
3
Miles
WLA1
WLA2
WLA3
WLA4
WLA5
WLA6
Mary D Overflow
Mary D Boreholes
Bell Mine Discharge
Brockton Tunnel
Kaska Outfall
Silver Creek Discharge
Middleport Overflow
Wadesville Shaft
Eagle Hill Discharge
Lucianna Tunnel
Randolph Discharge
Salem Hill Discharge
Sherman Colliery
S1
S2
S3
S4
S5
S6
S6A
S7
S8
S9
S10
S11
S12
S13
S14
S15
SR2
SR4
Frackville
Saint Clair
Orwigsburg
Cressona
Schuylkill Haven
Friedensburg
Brommerstown
Schuylkill



WEST MAHANOY
MAHANOY
FRACKVILLE
RYAN
SCHUYLKILL
WLA5
Mary D Overflow
Mary D Boreholes
Bell Mine Discharge
S5
BLYTHE
NEW CASTLE
WLA1
WLA6
Kaska Outfall
Brockton Tunnel
WALKER
S7
Silver Creek Discharge
S6
MIDDLEPORT
WLA2
SAINT CLAIR
Wadesville Shaft
S6A
Middleport Overflow
S8
Eagle Hill Discharge
NEW PHILADELPHIA
S13
WLA3
WLA4
EAST NORWEGIAN
S9
Lucianna Tunnel
NORWEGIAN
PORT CARBON
SR2
S10
Randolph Discharge
MECHANICSVILLE
S11
Salem Hill Discharge
POTTSVILLE
S12
Sherman Colliery
MOUNT CARBON
BRANCH
S3
S4
S1
S2
NORTH MANHEIM
ORWIGSBURG
SR4
CRESSONA
SCHUYLKILL HAVEN
S14
LANDINGVILLE
WEST BRUNSWICK
DEER LAKE
AUBURN
SOUTH MANHEIM
WINDSOR
PORT CLINTON
WAYNE
S15
HAMBURG
Study Area
PA
Waste Load
Monitoring Points
Discharges
N
W
E
S
Upper Schuylkill River
TMDL Stations
0
1
2
3
Miles

Attachment B

Method for Addressing Section 303(d) Listings for pH and *Surface Mining Control and Reclamation Act*

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.*

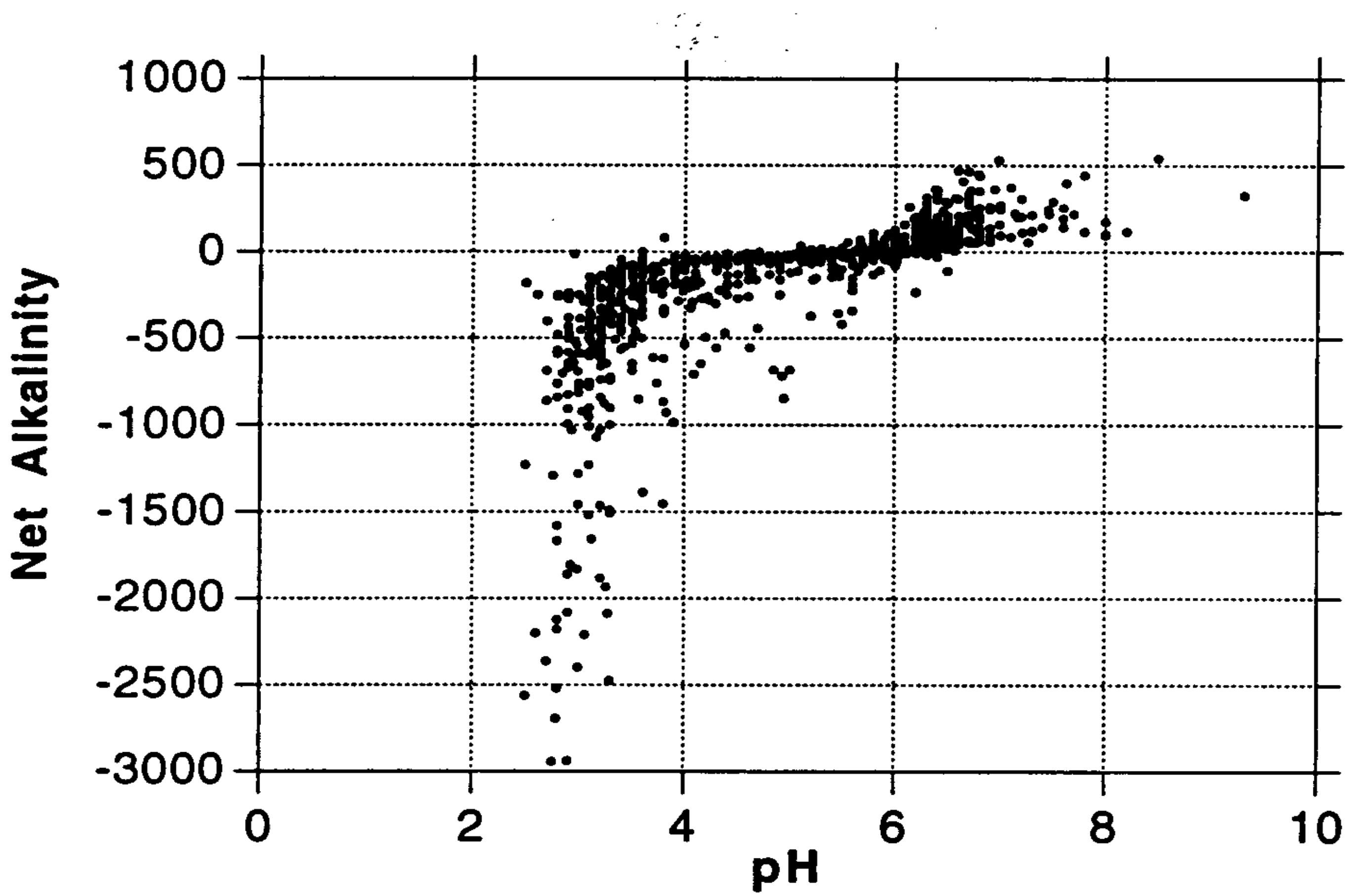


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

Attachment C

Method to Quantify Treatment Pond Pollutant Load

Method to Quantify Treatment Pond Pollutant Load

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

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

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

Total Measured Load = Allowed Load + Reduced Load

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

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

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

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

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

Discharge from treatment ponds on a mine site is intermittent and often varies as a result of precipitation events. Measured flow rates are almost never available. If accurate flow data are available, they can be used to quantify the WLA. The following is an approach that can be used to determine a waste load allocation for an active mining operation when treatment pond flow rates are not available. The methodology involves quantifying the hydrology of the portion of a surface mine site that contributes flow to the pit and then calculating waste load allocation using NPDES treatment pond effluent limits.

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

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

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

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

Pit water can also result from runoff from the unregraded and revegetated area following the pit. In the case of roughly backfilled and highly porous spoil, there is very little surface runoff. It is estimated that 80 percent of precipitation on the roughly regraded mine spoil infiltrates, 5 percent evaporates, and 15 percent may run off to the pit for pumping and potential treatment (Jay Hawkins, Office of Surface Mining, Department of the Interior, Personal Communications 2003). Regrading and revegetation of the mine spoil is conducted as the mining progresses. DEP encourages concurrent backfilling and revegetation through its compliance efforts and it is in the interest of the mining operator to minimize the company's reclamation bond liability by keeping the site reclaimed and revegetated. Experience has shown that reclamation and revegetation is accomplished two to three pit widths behind the active mining pit area. DEP uses three pit widths as an area representing potential flow to the pit when reviewing the NPDES permit application and calculating effluent limits based on best available treatment technology and insuring that in-stream limits are met. The same approach is used in the following equation, which represents the average flow reporting to the pit from the unregraded and unrevegetated spoil area.

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

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

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

Total Average Flow = Direct Pit Precipitation + Spoil Runoff

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

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

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

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

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

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

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

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

While most mining operations are permitted and allowed to have a standard, 1500’ x 300’ pit, most are well below that size and have a corresponding decreased flow and load. Where pit dimensions are greater than the standard size or multiple pits are present, the calculations to define the potential pollution load can be adjusted accordingly. Hence, the above calculated

Waste Load Allocation is very generous and likely high compared to actual conditions that are generally encountered. A large margin of safety is included in the WLA calculations.

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

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

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

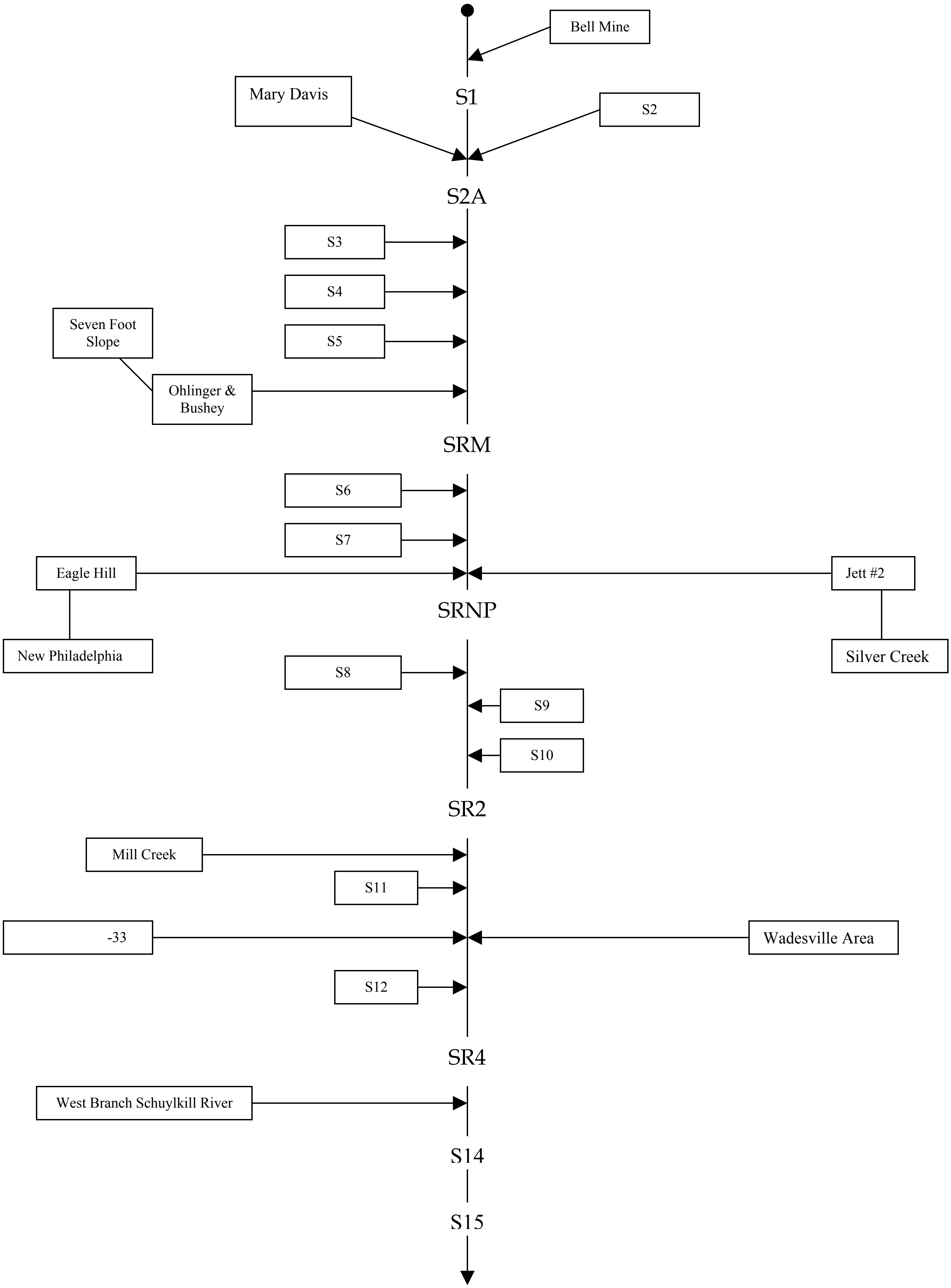
Attachment D
TMDLs By Segment

Upper Schuylkill River

The TMDL for Upper Schuylkill River consists of load allocations to eight sampling sites along the river (S1, S2A, SRM, SRNP, SR2, SR4, S14, and S15); ten sites are discharges, boreholes and outfalls (S2, S3, S4, S6, S7, S8, S9, S10, S11 and S12); one sampling site on Big Creek (S5); and ten waste load allocations to permitted discharges. All sample points are shown on the maps included in Attachment A as well as on the loading schematic drawn on the following page.

Upper Schuylkill River is listed on the 1996 PA Section 303(d) list for metals from AMD as being the cause of the degradation to the stream. Although this TMDL will focus primarily on metals analysis to the Upper Schuylkill River watershed, pH and reduced acid loading will be performed as well. The objective is to reduce acid loading to the stream, which will in turn raise the pH to the desired range and keep a net alkalinity above zero, 99% of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 3). The method and rationale for addressing pH is contained in Attachment B.

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


Bell Mine
Mary Davis
S1
S2
S2A
S3
S4
S5
Seven Foot Slope
Ohlinger & Bushey
SRM
S6
S7
Eagle Hill
Jett #2
SRNP
New Philadelphia
Silver Creek
S8
S9
S10
SR2
Mill Creek
S11
-33
Wadesville Area
S12
SR4
West Branch Schuylkill River
S14
S15

Waste Load Allocation – Bell Corporation, Bell Mine Discharge, Outfall 001

The Bell Corporation (SMP 54850104, NPDES PA0614530) has Outfall 001 into the Upper Schuylkill River Watershed. The Waste Load Allocation for Outfall 001 is determined by using the average discharge rate (0.0072 MGD) multiplied by the monthly average permit limits for iron and manganese. There are currently no permit limits for aluminum for this discharge; 2 mg/L was used as the effluent limit for aluminum. The following table shows the waste load allocation for this discharge.

Table C1. Waste Load Allocation at Bell Mine Discharge			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Discharge 001			
Fe	3.0	0.0072	0.18
Mn	2.0	0.0072	0.12
Al	2.0	0.0072	0.12

TMDL calculations- S1-Headwaters of Schuylkill R. above Bell Tunnel Discharge

The TMDL for sample point S1 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 was computed using water-quality sample data collected at point S1. The average flow, measured at the sampling point S1 (3.03 MGD), is used for these computations. Because this is the most upstream point of this segment, the allowable load allocations calculated at S1 is equal to the actual load that will directly affect the downstream point S2A.

Sample data at point S1 shows that the headwaters of the Upper Schuylkill River have a pH ranging between 5.5 and 6.5. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for aluminum, manganese and acidity at S1 have been calculated. Table C2 shows the measured and allowable concentrations and loads at S1. Table C3 shows percent reductions for aluminum, manganese and acidity required at this point.

Table C2		Measured		Allowable	
Flow (gpm)=	2107.00	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	1.10	27.95	0.44	11.15
	Iron	0.65	16.47	0.65	16.47
	Manganese	1.01	25.66	0.55	13.87
	Acidity	47.68	1206.38	5.82	147.29
	Alkalinity	9.75	246.72		

Table C3. Allocations S1			
S1	Al (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ S1	27.95	25.66	1206.38
Allowable Load @ S1	11.15	13.87	147.29
Load Reduction @ S1	16.80	11.79	1059.09
% Reduction required @ S1	60%	46%	88%

TMDL calculations - S2 -Bell Tunnel Discharge above confluence with Schuylkill River

The TMDL for sample point S2 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 was computed using water-quality sample data collected at point S2. The average flow, measured at the sampling point S2 (1.05 MGD), is used for these computations. Because this is the most upstream point of this segment, the allowable load allocations calculated at S2 is equal to the actual load that will directly affect the downstream point S2A.

Sample data at point S2 shows that this discharge of the Upper Schuylkill River has a pH ranging between 3.6 and 5.0. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for aluminum, iron, manganese and acidity at S2 has been calculated.
Table C4 shows the measured and allowable concentrations and loads at S2. Table C5 shows percent reductions for aluminum, iron, manganese and acidity required at this point.

Table C4		Measured		Allowable	
Flow (gpm)=	729.00	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	1.05	9.22	0.44	3.85
	Iron	4.55	39.84	0.45	3.95
	Manganese	1.49	13.00	0.70	6.11
	Acidity	63.93	559.74	0.00	0.00
	Alkalinity	0.00	0.00		

Table C5. Allocations S2				
S2	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ S2	9.22	39.84	13.00	559.74
Allowable Load @ S2	3.85	3.95	6.11	0.00
Load Reduction @ S2	5.37	35.89	6.89	559.74
% Reduction required @ S2	58%	90%	53%	100.0%

TMDL calculations- S2A - Schuylkill River below Bell Tunnel Discharge

The TMDL for sampling point S2A 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 S2A. The average flow, measured at the sampling point S2A (2.84 MGD), is used for these computations. The allowable loads calculated at S2A will directly affect the downstream point SRM.

Sample data at point S2A shows pH ranging between 3.8 and 5.5; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point S2A for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points S1/S2 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points S1/S2 and S2A to determine a total load tracked for the segment of stream between S2A and S1/S2. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at S2A.

A TMDL for aluminum, iron and manganese at S2A has been calculated. There was no acidic sample data measured at this sample site. However, it is likely that acidity reductions would need to be taken based on the low recorded alkalinity values.

Table C6 shows the measured and allowable concentrations and loads at S2A. Table C7 shows the percent reduction for acidity needed at S2A.

Table C6		Measured		Allowable	
Flow (gpm)=	1974.61	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	1.07	25.47	0.47	11.10
	Iron	1.79	42.53	0.49	11.56
	Manganese	1.24	29.51	0.63	14.88
	Acidity	-	-	-	-
	Alkalinity	1.69	40.12		

Table C7. Allocations S2A			
S2A	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ S2A	25.47	42.53	29.51
Difference in measured Loads between upstream loads and existing S2A	-11.70	-13.78	-9.15
Percent loss due calculated at S2A	31.5%	24.5%	23.7%
Additional load tracked from above samples	15.00	20.42	19.98
Percentage of upstream loads that reach the S2A	68.5%	75.5%	76.3%
Total load tracked between S1/S2 and S2A	10.28	15.42	15.25
Allowable Load @ S2A	11.10	11.56	14.88
Load Reduction @ S2A	-0.82	3.86	0.37
% Reduction required at S2A	0%	25%	3%

There is an 11.70 lbs/day decrease of aluminum at this sample point compared to the sum of measured load from upstream segments. This decrease in this segment of stream between S2/S1 and S2A can be attributed to dilution or other natural stream processes. The total aluminum load measured was less than the calculated allowable aluminum load of 11.10 lbs/day, resulting in no reduction. The iron load reduction required at S2A was 3.86 lbs/day. A 25% reduction is required to achieve the calculated allowable iron loading. A 3% acidic reduction has been calculated at S2A to attain the calculated allowable acidic load of 14.88 lbs/day.

Waste Load Allocation – K & K Coal Company Mary Davis Tract

The K & K Coal Company Mary Davis Tract (SMP 54830103, NPDES PA0613398) has Outfall 002 which discharges into an unnamed tributary to the East Branch Schuylkill River. The Waste Load Allocation for both discharges is determined by calculating the proposed treatment for a default pit size of 1500' X 300' multiplied by the monthly average permit limits for iron and manganese. There are currently no effluent limits for aluminum for this discharge; 2.0 mg/L was used as the effluent limit for aluminum. The following table shows the waste load allocation for this discharge.

Table C37. Waste Load Allocation at Mary Davis Tract Discharge			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Outfall 002			
Fe	3.0	0.045	1.13
Mn	2.0	0.045	0.75
Al	2.0	0.045	0.75

TMDL calculations- S3- Mary D Overflow below discharge @ weir

The TMDL for sample point S3 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this overflow into the Upper Schuylkill River Watershed was computed using water-quality sample data collected at point S3. The average flow, measured at the sampling point S3 (1.56 MGD), is used for these computations. The allowable loads calculated at S3 will directly affect the downstream point SRM.

Sample data at point S3 shows that this overflow to the Upper Schuylkill River Watershed has a pH ranging between 6.2 and 6.9. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

TMDLs for aluminum, iron and manganese have been calculated.

Table C8 shows the measured and allowable concentrations and loads at S3. Table C9 shows the percent reduction for aluminum, iron and manganese needed at S3.

Table C8		Measured		Allowable	
Flow (gpm)=	1086.25	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.33	4.24	0.13	1.71
	Iron	4.49	58.63	0.59	7.70
	Manganese	1.29	16.84	0.48	6.30
	Acidity	7.83	102.19	5.17	67.47
	Alkalinity	37.30	486.59		

Table C9. Allocations S3				
S3	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acid (Lbs/day)
Existing Load @ S3	4.24	58.63	16.84	102.19
Allowable Load @ S3	1.71	7.70	6.30	67.49
Load Reduction @ S3	2.53	50.93	10.54	34.70
% Reduction required @ S3	60%	87%	63%	34%

TMDL calculations- S4- Mary D Boreholes below discharge @ weir

The TMDL for sample point S4 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for these boreholes into the Upper Schuylkill River Watershed was computed using water-quality sample data collected at point S4. The average flow, measured at the sampling point S4 (2.85 MGD), is used for these computations. The allowable loads calculated at S4 will directly affect the downstream point SRM.

Sample data at point S4 shows that these boreholes to the Upper Schuylkill River Watershed have a pH ranging between 6.0 and 6.7. There currently is not an entry for this segment on the Pa. Section 303(d) list for impairment due to pH.

A TMDL for aluminum, iron, manganese and acidity has been calculated.

Table C10 shows the measured and allowable concentrations and loads at S4. Table C11 shows the percent reduction for aluminum, iron and manganese needed at S4.

Table C10		Measured		Allowable	
Flow (gpm)=	1980.75	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.55	12.97	0.13	3.18
	Iron	3.95	93.84	0.51	12.06
	Manganese	1.14	27.12	0.59	14.08
	Acidity	35.23	837.93	8.33	198.24
	Alkalinity	17.13	407.37		

Table C11. Allocations S4				
S4	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ S4	12.97	93.84	27.12	837.93
Allowable Load @ S4	3.18	12.06	14.08	198.24
Load Reduction @ S4	9.79	81.78	13.04	639.69
% Reduction required @ S4	75%	87%	48%	76%

TMDL calculations- S5- Big Creek below bridge in Brockton

The TMDL for sample point S5 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this tributary to the Upper Schuylkill River Watershed was computed using water-quality sample data collected at point S5. The average flow, measured at the sampling point S5 (9.39 MGD), is used for these computations. The allowable loads calculated at S5 will directly affect the downstream point SRM.

Sample data at point S5 shows that this tributary to the Upper Schuylkill River Watershed has a pH ranging between 4.4 and 4.8. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for aluminum and acidity has been calculated. All iron sample data were collected at less than detection limits, manganese data were above detection limits but less than water quality standards. Since water quality criteria are met, a TMDL for these parameters is not necessary and therefore not calculated.

Table C12 shows the measured and allowable concentrations and loads at S5. Table C13 shows the percent reduction for aluminum and acidity needed at S5.

Table C12		Measured		Allowable	
Flow (gpm)=	6518.75	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.54	42.31	0.22	17.60
	Iron	0.04	3.37	NA	NA
	Manganese	0.27	21.26	NA	NA
NA = not applicable	Acidity	27.55	2156.82	4.45	348.71
	Alkalinity	5.93	463.85		

Table C13. Allocations S5		
S5	Al (Lbs/day)	Acidity (Lbs/day)
Existing Load @ S5	42.31	2156.82
Allowable Load @ S5	17.60	348.71
Load Reduction @ S5	24.71	1808.11
% Reduction required @ S5	58%	84%

Waste Load Allocation – Alfred Brown Coal, Seven Foot Slope Mine, Outfall 001

Alfred Brown Coal (UMP 54011301, NPDES PA0224189) has Outfall 001 which discharges into an unnamed tributary to the Upper Schuylkill River. This discharge is treated with lime and settled, then discharged. The Waste Load Allocation for Outfall 001 is determined by calculating the proposed average discharge rate of 0.1 MGD multiplied by the monthly average effluent limits for iron and manganese. There are currently no permit limits for aluminum; 2.0 mg/L was used as the effluent limit for aluminum. The following table shows the waste load allocation for this discharge.

Table C14. Waste Load Allocation at Seven Foot Slop Mine discharge			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Outfall 001			
Fe	3.0	0.1000	2.50
Mn	2.0	0.1000	1.67
Al	2.0	0.1000	1.67

Waste Load Allocation – Kuperavage Enterprises, Inc. Ohlinger & Bushey Mine, Outfall 001

Kuperavage Enterprises, Inc. Ohlinger & Bushey Mine (SMP 54870101, NPDES PA0593842) has Outfall 001 which discharges into an unnamed tributary to the Upper Schuylkill River. The Waste Load Allocation for Outfall 001 is determined by obtaining the flow for the proposed treatment for a default pit size (1500 X 300 ft^2) multiplied by the monthly average effluent limits for iron and manganese. There are currently no limits for aluminum for the discharge; 2.0 mg/L was used as the effluent limit. The following table shows the waste load allocation for this discharge.

Table C15. Waste Load Allocation at Ohlinger & Bushey Mine discharge			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Outfall 001			
Fe	3.0	0.045	1.13
Mn	2.0	0.045	0.75
Al	2.0	0.045	0.75

TMDL calculations- SRM- Schuylkill River in Middleport

The TMDL for sampling point SRM 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 SRM. The average flow, measured at the sampling point SRM (9.92 MGD), is used for these computations. The allowable loads calculated at SRM will directly affect the downstream point SRNP.

Sample data at point SRM shows pH ranging between 6.3 and 6.9; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point SRM for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points S2A/S3/S4/S5 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points S2A/S3/S4/S5 and SRM to determine a total load tracked for the segment of stream between SRM and S2A/S3/S4/S5. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at SRM.

A TMDL for iron, manganese and acidity at SRM has been calculated. All measured sample data for aluminum was below detection limits. Because water quality standards are met, a TMDL for this parameter isn't necessary and is not calculated. The existing and allowable loads for the aluminum parameter at SRM in Table C16 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C16 shows the measured and allowable concentrations and loads at SRM. Table C17 shows the percent reduction for acidity needed at SRM.

Table C16		Measured		Allowable	
Flow (gpm)=	6886.40	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA	ND	NA
	Iron	0.64	52.88	0.41	33.93
ND = non detection	Manganese	0.94	78.04	0.44	35.98
NA = not applicable	Acidity	17.28	1429.11	3.54	292.94
	Alkalinity	17.16	1419.18		

Table C17. Allocations SRM			
SRM	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ SRM	52.88	78.04	1429.11
Difference in measured Loads between upstream loads and existing SRM	-142.12	-16.69	-1565.64
Percent loss due calculated at SRM	72.9%	17.6%	52.3%
Additional load tracked from above samples	31.32	56.52	546.95
Percentage of upstream loads that reach the SRM	27.1%	82.4%	47.7%
Total load tracked between S2A, S3, S4 and S5 and SRM	8.49	46.56	261.01
Allowable Load @ SRM	33.93	35.98	292.94
Load Reduction @ SRM	-25.44	10.58	-31.93
% Reduction required at SRM	0%	23%	0%

There is a 142.12 lbs/day decrease of iron at SRM compared to the sum of measured loads from upstream segments. This decrease of iron loading in this segment of stream between S2A/S3/S4/S5 and SRM can be a result of dilution or other natural stream processes. The total iron load measured was 25.44 lbs/day less than the calculated allowable iron load of 33.93 lbs/day, resulting in no iron reduction at this point. The manganese load reduction required at SRM was 10.58 lbs/day. A 23% reduction is required to achieve the calculated allowable manganese loading. The total acidic load tracked from upstream was 261.01 lbs/day, which was 31.93 lbs/day less than the calculated allowable acidic load. Since the total load tracked was less than the allowable load, no acidic reduction is necessary at SRM.

TMDL calculations- S6- Kaska Outfall below discharge @ weir

The TMDL for sample point S6 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this outfall to the Upper Schuylkill River Watershed was computed using water-quality sample data collected at point S6. The average flow, measured at the sampling point S6 (0.56 MGD), is used for these computations. The allowable loads calculated at S6 will directly affect the downstream point SRNP.

Sample data at point S6 shows that this outfall to the Upper Schuylkill River Watershed has a pH ranging between 4.7 and 5.2. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for aluminum, iron, manganese and acidity has been calculated.

Table C18 shows the measured and allowable concentrations and loads at S6. Table C19 shows the percent reduction for aluminum, iron, manganese and acidity needed at S6.

Table C18		Measured		Allowable	
Flow (gpm)=	391.50	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	3.07	14.41	0.36	1.71
	Iron	3.09	14.55	0.71	3.35
	Manganese	2.20	10.32	0.52	2.44
	Acidity	43.80	205.94	4.19	19.71
	Alkalinity	8.00	37.6		

Table C19. Allocations S6				
S6	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ S6	14.41	14.55	10.32	205.94
Allowable Load @ S6	1.71	3.35	2.44	19.71
Load Reduction @ S6	12.70	11.20	7.88	186.23
% Reduction required @ S6	88%	77%	76%	90%

TMDL calculations- S7- Silver Creek Discharge below discharge @ weir

The TMDL for sample point S7 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this discharge to the Upper Schuylkill River Watershed was computed using water-quality sample data collected at point S7. The average flow, measured at the sampling point S7 (2.34 MGD), is used for these computations. The allowable loads calculated at S7 will directly affect the downstream point SRNP.

Sample data at point S7 shows that this outfall to the Upper Schuylkill River Watershed has a pH ranging between 4.5 and 6.1. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for aluminum, iron, manganese and acidity has been calculated.

Table C20 shows the measured and allowable concentrations and loads at S7. Table C21 shows the percent reduction for aluminum, iron, manganese and acidity needed at S7.

Table C20		Measured		Allowable	
Flow (gpm)=	1626.93	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	1.63	31.88	0.44	8.63
	Iron	22.31	436.99	1.02	20.00
	Manganese	3.34	65.26	0.78	15.29
	Acidity	58.29	1138.83	9.51	185.78
	Alkalinity	43.16	843.24		

Table C21. Allocations S7				
S7	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ S7	31.88	435.99	65.26	1138.83
Allowable Load @ S7	8.63	20.00	15.29	185.78
Load Reduction @ S7	23.25	415.99	49.97	953.05
% Reduction required @ S7	73%	95%	77%	84%

Waste Load Allocation – Joe Kuperavage Coal Co. Eagle Hill West

Joe Kuperavage Coal Co. Eagle Hill West (SMP 54693031, NPDES PA0124168) has Outfall 003 which discharges into an unnamed tributary to Silver Creek. The Waste Load Allocation for Outfall 003 is determined by calculating the proposed pit dimension (1500 X 300 ft^2) by the monthly average effluent limits for iron and manganese. There are currently no aluminum limits for this discharge; 2.0 mg/L was used as the effluent limit for aluminum. The following table shows the waste load allocation for this discharge.

Table C22. Waste Load Allocation at Eagle Hill West discharge			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Outfall 003			
Fe	3.0	0.045	1.13
Mn	2.0	0.045	0.75
Al	2.0	0.045	0.75

Waste Load Allocation – Joe Kuperavage Coal Co. New Philadelphia Mine, Outfalls 001, 005

The Joe Kuperavage Coal Company New Philadelphia Mine (SMP 54830109, NPDES PA0613622) has both the Outfall 005 and Outfall 001 which discharge into the Schuylkill River. The Waste Load Allocation for both discharges is determined by calculating the proposed treatment for a default pit size (1500 X 300 ft^2) multiplied by the monthly average effluent limits for iron and manganese. There are currently no effluent limits for aluminum for this discharge;

2.0 mg/L was used as the effluent limit for aluminum. The following table shows the waste load allocation for this discharge.

Table C23. Waste Load Allocation at New Philadelphia Mine discharge			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Outfall 001			
Fe	3.0	0.045	1.13
Mn	2.0	0.045	0.75
Al	2.0	0.045	0.75
Outfall 005			
Fe	3.0	0.045	1.13
Mn	2.0	0.045	0.75
Al	2.0	0.045	0.75

Waste Load Allocation – Gale Coal Company, Inc. Silver Creek Stripping discharge

Gale Coal Company, Inc. Silver Creek Stripping (SMP 54860102, NPDES PA0593165) has Outfall 001 which discharges into an unnamed tributary to the Schuylkill River. The Waste Load Allocation for both discharges is determined by calculating the proposed treatment for a default pit size of 1500' X 300' multiplied by the monthly average permit limits for iron and manganese. There are currently no effluent limits for aluminum for this discharge; 2.0 mg/L was used as the effluent limit for aluminum. The following table shows the waste load allocation for this discharge.

Table C37. Waste Load Allocation at Silver Creek Stripping			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Outfall 001			
Fe	3.0	0.045	1.13
Mn	2.0	0.045	0.75
Al	2.0	0.045	0.75

Waste Load Allocation – Jett Contracting Company, Jett 2 Stripping

The Jett Contracting Company Jett 2 Stripping (SMP54030103, NPDES PA0224367) has Outfall 001 which discharges into Morgans Run, a tributary to the Schuylkill River. The Jett 2 Stripping operation also contains a pre-existing Subchapter G discharge (MP-3D) that is in compliance with its discharge limits and, thus, does not need a waste load allocation. The Waste Load Allocation for both discharges is determined by using the average discharge rate 0.144

MGD multiplied by the monthly average effluent limits for iron and manganese. There are currently no effluent limits for aluminum for this discharge; 2.0 mg/L was used as the effluent limit for aluminum. The following table shows the waste load allocation for this discharge.

Table C37. Waste Load Allocation at Jett 2 Stripping Discharge			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Outfall 001			
Fe	3.0	0.144	3.6
Mn	2.0	0.144	2.4
Al	2.0	0.144	2.4

TMDL calculations- SNRP- Schuylkill River in New Philadelphia

The TMDL for sampling point SNRP 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 SNRP. The average flow, measured at the sampling point SNRP (15.52 MGD), is used for these computations. The allowable loads calculated at SNRP will directly affect the downstream point SR2.

Sample data at point SNRP shows pH ranging between 6.2 and 6.7; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point SNRP for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points SRM/S6/S7 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points SRM/S6/S7 and SNRP to determine a total load tracked for the segment of stream between SNRP and SRM/S6/S7. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at SNRP.

A TMDL for iron, manganese and acidity at SNRP has been calculated. All measured sample data for aluminum was below detection limits. Because water quality standards are met, a TMDL for this parameter isn’t necessary and is not calculated. The existing and allowable loads for the aluminum parameter at SNRP in Table C24 will be denoted as “NA”. The concentrations will be denoted as “ND”.

Table C24 shows the measured and allowable concentrations and loads at SNRP. Table C25 shows the percent reduction for acidity needed at SNRP.

Table C24		Measured		Allowable	
Flow (gpm)=	10779.25	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA	ND	NA
	Iron	1.85	240.04	0.92	118.98
ND = non detection	Manganese	1.05	135.64	0.58	74.52
NA = not applicable	Acidity	21.00	2718.54	4.75	615.02
	Alkalinity	16.85	2181.31		

Table C25. Allocations SRNP			
SRNP	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ SRNP	240.04	135.64	2718.54
Difference in measured Loads between upstream loads and existing SRNP	-263.38	-17.98	-55.34
Percent loss due calculated at SRNP	52.3%	11.7%	2.0%
Additional load tracked from above samples	57.28	53.71	498.43
Percentage of upstream loads that reach the SRNP	47.7%	88.3%	98.0%
Total load tracked between SRM, S6 and S7 and SRNP	27.31	47.42	488.49
Allowable Load @ SRNP	118.98	74.52	615.02
Load Reduction @ SRNP	-91.67	-27.10	-126.53
% Reduction required at SRNP	0%	0%	0%

There is a 263.38 lbs/day decrease of iron at SNRP compared to the sum of measured loads from upstream segments. This decrease of iron loading in this segment of stream between SRM/S6/S7 and SNRP can be a result of dilution or other natural stream processes. The total iron load measured was 91.67 lbs/day less than the calculated allowable iron load of 118.98 lbs/day, resulting in no iron reduction at this point. There was no manganese load reduction required at SNRP. The total manganese load tracked at SRNP is less than the calculated allowable load. The total acidic load tracked from upstream was 488.49 lbs/day, which was 126.53 lbs/day less than the calculated allowable acidic load. Since the total load tracked was less than the allowable load, no acidic reduction is necessary at SNRP.

TMDL calculations- S8- Eagle Hill Discharge below haul road

The TMDL for sample point S8 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this discharge of the Upper Schuylkill River was computed using water-quality sample data collected at point S8. The average flow, measured at the sampling point S8 (1.51 MGD), is used for these computations. The allowable loads calculated at S8 will directly affect the downstream point SR2.

Sample data at point S8 shows that this discharge of the Upper Schuylkill River has a pH ranging between 5.4 and 7.0. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for aluminum, iron and manganese has been calculated. No acidity was measured at S8. Because water quality standards are met, a TMDL for this parameter isn't necessary and is not calculated. The existing and allowable loads for the acidic parameter at S8 in Table C26 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C26 shows the measured and allowable concentrations and loads at S8. Table C27 shows the percent reduction for aluminum, iron and manganese needed at S8.

Table C26		Measured		Allowable	
Flow (gpm)=	1047.85	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.65	8.15	0.30	3.83
	Iron	11.83	148.86	0.79	9.90
ND = non detection	Manganese	2.79	35.05	0.58	7.25
NA = not applicable	Acidity	ND	NA	ND	NA
	Alkalinity	181.69	2286.45		

Table C27. Allocations S8			
S8	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ S8	8.15	148.86	35.05
Allowable Load @ S8	3.83	9.90	7.25
Load Reduction @ S8	4.32	138.96	27.80
% Reduction required @ S8	53%	93%	79%

TMDL calculations- S9- Lucianna Tunnel above confluence with Schuylkill River

The TMDL for sample point S9 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this discharge of the Upper Schuylkill River was computed using water-quality sample data collected at point S9. The average flow, measured at the sampling point S9 (0.87 MGD), is used for these computations. The allowable loads calculated at S9 will directly affect the downstream point SR2.

Sample data at point S9 shows that this discharge of the Upper Schuylkill River has a pH ranging between 6.2 and 7.1. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for aluminum, iron, manganese and acidity has been calculated.

Table C28 shows the measured and allowable concentrations and loads at S9. Table C29 shows the percent reduction for aluminum, iron, manganese and acidity needed at S9.

Table C28		Measured		Allowable	
Flow (gpm)=	603.63	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.85	6.15	0.20	1.48
	Iron	7.63	55.30	0.68	4.90
	Manganese	2.06	14.95	0.69	5.00
	Acidity	11.85	85.90	6.56	47.56
	Alkalinity	38.78	281.09		

Table C29. Allocations S9				
S9	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ S9	6.15	55.30	14.95	85.90
Allowable Load @ S9	1.48	4.90	5.00	47.56
Load Reduction @ S9	4.67	50.40	9.95	38.34
% Reduction required @ S9	76%	91%	67%	45%

TMDL calculations- S10- Randolph Discharge 100 meter below discharge

The TMDL for sample point S10 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this discharge of the Upper Schuylkill River was computed using water-quality sample data collected at point S10. The average flow, measured at the sampling point S10 (1.23 MGD), is used for these computations. The allowable loads calculated at S10 will directly affect the downstream point SR2.

Sample data at point S10 shows that this discharge of the Upper Schuylkill River has a pH ranging between 6.3 and 7.0. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for iron and manganese has been calculated. All measured sample data for aluminum was below detection limits. There was no acidity measured at S10. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. The existing and allowable loads for the aluminum and acidic parameters at S10 in Table C30 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C30 shows the measured and allowable concentrations and loads at S10. Table C31 shows the percent reduction for iron and manganese needed at S10.

Table C30		Measured		Allowable	
Flow (gpm)=	851.00	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA	ND	NA
	Iron	14.75	150.75	1.09	11.10
ND = non detection	Manganese	2.34	23.88	0.76	7.80
NA = not applicable	Acidity	ND	NA	ND	NA
	Alkalinity	86.30	882.00		

Table C31. Allocations S10		
S10	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ S10	150.75	23.88
Allowable Load @ S10	11.10	7.80
Load Reduction @ S10	139.65	16.08
% Reduction required @ S10	93%	67%

TMDL calculations- SR2- Schuylkill River in Port Carbon above Mill Creek confluence

The TMDL for sampling point SR2 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 SR2. The average flow, measured at the sampling point SR2 (20.71 MGD), is used for these computations. The allowable loads calculated at SR2 will directly affect the downstream point SR4.

Sample data at point SR2 shows pH ranging between 6.3 and 6.9; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point SR2 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points SRNP/S8/S9/S10 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points SRNP/S8/S9/S10 and SR2 to determine a total load tracked for the segment of stream between SR2 and SRNP/S8/S9/S10. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at SR2.

A TMDL for iron, manganese and acidity at SR2 has been calculated. The measured sample data for aluminum was below detection limits. Because water quality standards are met, a TMDL for this parameter isn’t necessary and is not calculated. The existing and allowable loads for the aluminum parameter at SR2 in Table C32 will be denoted as “NA”. The concentrations will be denoted as “ND”.

Table C32 shows the measured and allowable concentrations and loads at SR2. Table C33 shows the percent reduction for iron, manganese and acidity needed at SR2.

Table C32		Measured		Allowable	
Flow (gpm)=	14382.00	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA	ND	NA
	Iron	2.02	349.42	0.74	128.07
ND = non detection	Manganese	1.14	197.11	0.68	117.79
NA = not applicable	Acidity	18.20	3143.54	8.26	1426.44
	Alkalinity	24.92	4304.23		

Table C33. Allocations SR2			
SR2	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ SR2	349.42	197.11	3143.54
Difference in measured Loads between upstream loads and existing SR2	-245.53	-12.41	339.10
Percent loss due calculated at SR2	41.3%	5.9%	NA
Additional load tracked from above samples	144.88	94.57	662.58
Percentage of upstream loads that reach the SR2	58.7%	94.1%	NA
Total load tracked between SRNP, S8, S9, S10 and SR2	85.09	88.97	1001.68
Allowable Load @ SR2	128.07	117.79	1426.44
Load Reduction @ SR2	-42.98	-28.82	-424.76
% Reduction required at SR2	0%	0%	0%

There is a 245.53 lbs/day decrease of iron at SR2 compared to the sum of measured loads from upstream segments. This decrease of iron loading in this segment of stream between SRNP/S8/S9/S10 and SR2 can be a result of dilution or other natural stream processes. The total iron load measured was 42.98 lbs/day less than the calculated allowable iron load of 128.07 lbs/day, therefore, no iron reduction is necessary at this point. The total manganese load tracked at SR2 was 28.82 lbs/day less than the calculated allowable manganese load of 117.79 lbs/day. Therefore no reduction is required to achieve the calculated allowable manganese loading. The total acidic load tracked from upstream was 1001.68 lbs/day, which was 424.76 lbs/day less than the calculated allowable acidic load. Therefore, no acidic reduction is necessary to meet water quality standards at SR2.

Mill Creek TMDL Calculation

A TMDL was completed for the Mill Creek Watershed. Mill Creek enters the Schuylkill River below sample point SR2. The allowable loads calculated at M6 (the mouth segment of Mill Creek) will directly affect the calculations at the downstream point SR4.

Table C34. Allocations M6				
M6 Mill Creek	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ M6	394.56	1083.54	628.36	10045.07
Allowable Load @ M6	138.10	325.06	201.08	1305.86

TMDL calculations- S11- Salem Hill discharge below R209 bridge

The TMDL for sample point S11 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this discharge of the Upper Schuylkill River was computed using water-quality sample data collected at point S11. The average flow, measured at the sampling point S11 (0.17 MGD), is used for these computations. The allowable loads calculated at S11 will directly affect the downstream point SR4.

Sample data at point S11 shows that this discharge of the Upper Schuylkill River has a pH ranging between 7.0 and 7.6. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for iron has been calculated. All measured sample data for aluminum was below detection limits. Manganese data was above detection limits but below water quality standards. There was no acidity measured at S11. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. The existing and allowable loads for the aluminum and acidic parameters at S11 in Table C35 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C35 shows the measured and allowable concentrations and loads at S11. Table C36 shows the percent reduction for iron needed at S11.

Table C35		Measured		Allowable	
Flow (gpm)=	118.38	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA	ND	NA
	Iron	1.03	1.47	0.85	1.20
ND = non detection	Manganese	0.72	1.02	0.72	1.02
NA = not applicable	Acidity	ND	NA	ND	NA
	Alkalinity	241.90	343.89		

Table C36. Allocations S11	
S11	Fe (Lbs/day)
Existing Load @ S11	1.47
Allowable Load @ S11	1.20
Load Reduction @ S11	0.27
% Reduction required @ S11	18%

Waste Load Allocation – Reading Anthracite Co., Wadesville P-33 Mine discharge

The Reading Anthracite Company (SMP 54713002, NPDES PA0123293) has Outfall 001 which discharges into an unnamed tributary to the East Branch Norwegian Creek. This discharge is from the Wadesville Mine Pool and is currently being used by Excelon Generation Company, LLC for augmentation of streamflow to the Schuylkill River. This is part of a demonstration project conducted under the Delaware River Basin Commission Docket D-69-210 CP (Final) to allow reduction of water diverted from the Delaware River into East Branch Perkiomen Creek via the Point Pleasant Pumping Station for cooling water used at the Limerick Generation Station. This demonstration project was approved in 2003 and will continue through 2007 and possibly into 2008. The Waste Load Allocation for Outfall 001 is determined by calculating the average discharge rate for the most current year available (2005) multiplied with the monthly average permit limits for iron and manganese. There are currently no effluent limits for aluminum for the discharge; 0.75 mg/L was used as the effluent limit for aluminum. The following table shows the waste load allocation for this discharge.

Table C37. Waste Load Allocation at Wadesville P-33 Mine

Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Outfall 001			
Fe	3.0	5.60	140.11
Mn	2.0	5.60	93.41
Al	0.75	5.60	35.03

Waste Load Allocation – Reading Anthracite Co., Wadesville Area Mine Discharge

The Reading Anthracite Company (SMP 54860108, NPDES PA0593508) has Outfall 001 which discharges into an unnamed tributary to East Branch Norwegian Creek. The Waste Load Allocation for both discharges is determined by calculating the proposed treatment for a default pit size of 1500’ X 300’ multiplied by the monthly average effluent limits for iron and manganese. There are currently no effluent limits for aluminum for this discharge; 2.0 mg/L was used as the effluent limit for aluminum. The following table shows the waste load allocation for this discharge.

Table C37. Waste Load Allocation at Wadesville Area Mine

Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Outfall 001			
Fe	3.0	0.045	1.13
Mn	2.0	0.045	0.75
Al	2.0	0.045	0.75

TMDL calculations- S12- Sherman Colliery @ end of pipe

The TMDL for sample point S12 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this discharge of the Upper Schuylkill River was computed using water-quality sample data collected at point S12. The average flow, measured at the sampling point S12 (0.14 MGD), is used for these computations. The allowable loads calculated at S12 will directly affect the downstream point SR4.

Sample data at point S12 shows that this discharge of the Upper Schuylkill River has a pH ranging between 6.7 and 6.9. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for iron and manganese has been calculated. All measured sample data for aluminum was below detection limits. There was no acidity measured at S12. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. The existing and allowable loads for the aluminum and acidic parameters at S12 in Table C38 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C38 shows the measured and allowable concentrations and loads at S12. Table C39 shows the percent reduction for iron and manganese needed at S12.

Table C38		Measured		Allowable	
Flow (gpm)=	94.75	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA	ND	NA
	Iron	2.49	2.83	0.82	0.93
ND = non detection	Manganese	0.86	0.98	0.50	0.56
NA = not applicable	Acidity	ND	NA	ND	NA
	Alkalinity	229.43	261.06		

Table C39. Allocations S12		
S12	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ S12	2.83	0.98
Allowable Load @ S12	0.93	0.56
Load Reduction @ S12	1.90	0.42
% Reduction required @ S12	67%	43%

TMDL calculations- SR4- Schuylkill River in Cressona, PA

The TMDL for sampling point SR4 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 SR4. The average flow, measured at the sampling point SR4 (61.21 MGD), is used for these computations. The allowable loads calculated at SR4 will directly affect the downstream point S14.

Sample data at point SR4 shows pH ranging between 6.6 and 7.4; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point SR4 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points SR2/M6/S11/S12 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points SR2/M6/S11/S12 and SR4 to determine a total load tracked for the segment of stream between SR4 and SR2/M6/S11/S12. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at SR4.

A TMDL for iron and manganese at SR4 has been calculated. The measured sample data for aluminum was below detection limits. There was no acidity measured at SR4. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. The existing and allowable loads for the aluminum and acidic parameters at SR4 in Table C40 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C40 shows the measured and allowable concentrations and loads at SR4. Table C41 shows the percent reduction for iron and manganese needed at SR4.

Table C40		Measured		Allowable	
Flow (gpm)=	42510.00	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.17	86.18	0.08	41.82
	Iron	1.38	702.38	0.46	232.93
ND = non detection	Manganese	0.84	427.52	0.51	259.16
NA = not applicable	Acidity	ND	NA	ND	NA
	Alkalinity	71.48	36492.55		

Table C41. Allocations SR4			
SR4	Fe (Lbs/day)	Mn (Lbs/day)	Al (Lbs/day)
Existing Load @ SR4	702.38	427.52	86.18
Difference in measured Loads between upstream loads and existing SR4	-734.88	-399.95	-308.38
Percent loss due calculated at SR4	51.1%	48.3%	78.2%
Additional load tracked from above samples	455.26	320.45	138.10
Percentage of upstream loads that reach the SR4	48.9%	51.7%	21.8%
Total load tracked between SR2, M6, S11, S12 and SR4	222.48	165.56	30.11
Allowable Load @ SR4	232.93	259.16	41.82
Load Reduction @ SR4	-10.45	-93.60	-11.71
% Reduction required at SR4	0%	0%	0%

There is a 734.88 lbs/day decrease of iron at SR4 compared to the sum of measured loads from upstream segments. This decrease of iron loading in this segment of stream between SR2/M6/S11/S12 and SR4 can be a result of dilution or other natural stream processes. The total iron load measured was 10.45 lbs/day less than the calculated allowable iron load of 232.93 lbs/day; therefore, no iron reduction is necessary at this point. The total manganese load tracked at SR4 was 93.60 lbs/day less than the calculated allowable manganese load of 259.16 lbs/day. Therefore no reduction is required to achieve the calculated allowable manganese loading.

West Branch Schuylkill River TMDL Calculation

A TMDL was completed for the West Branch Schuylkill River Watershed. West Branch Schuylkill River enters the Schuylkill River below sample point SR4. The allowable loads calculated at WB6 (the mouth segment of West Branch Schuylkill River) will directly affect the calculations at the downstream point S14.

Table C42. Allocations WB6				
WB6	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ WB6	637.23	1592.63	1029.30	0.00
Allowable Load @ WB6	235.77	366.30	442.60	0.00

TMDL calculations- S14- Landingville @ USGS gage station

The TMDL for sampling point S14 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 S14. The average flow, measured at the sampling point S14 (292.08 MGD), is used for these computations. The allowable loads calculated at S14 will directly affect the downstream point S15.

Sample data at point S14 shows pH ranging between 6.6 and 7.7; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point S14 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points SR4/WB6 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points SR4/WB6 and S14 to determine a total load tracked for the segment of stream between S14 and SR4/WB6. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at S14.

A TMDL for aluminum, iron and manganese at S14 has been calculated. There was no acidity measured at S14. Because water quality standards are met, a TMDL for this parameter isn't necessary and is not calculated. The existing and allowable loads for the acidic parameters at S14 in Table C43 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C43 shows the measured and allowable concentrations and loads at S14. Table C44 shows the percent reduction for aluminum, iron and manganese needed at S14.

Table C43		Measured		Allowable	
Flow (gpm)=	202835.00	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.40	980.48	0.25	610.68
	Iron	1.98	4823.22	0.55	1349.57
ND = non detection	Manganese	1.11	2704.84	0.57	1388.41
NA = not applicable	Acidity	ND	NA	ND	NA
	Alkalinity	35.23	85806.95		

Table C44. Allocations S14			
S14	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ S14	980.48	4823.22	2704.84
Difference in measured Loads between upstream loads and existing S14	343.25	2528.21	1248.02
Percent loss due calculated at S14	NA	NA	NA
Additional load tracked from above samples	235.77	599.23	701.76
Percentage of upstream loads that reach the S14	NA	NA	NA
Total load tracked between SR4, WB6 and S14	579.02	3127.44	1949.78
Allowable Load @ S14	610.68	1349.57	1388.41
Load Reduction @ S14	-31.66	1777.87	561.37
% Reduction required at S14	0%	57%	29%

There is a 343.25 lbs/day increase of aluminum at S14 compared to the sum of measured loads from upstream segments. The total aluminum load measured was 31.66 lbs/day less than the calculated allowable aluminum load of 610.68 lbs/day; therefore, no aluminum reduction is necessary at this point. The total iron load tracked at S14 was 1777.87 lbs/day greater than the calculated allowable iron load of 1349.57 lbs/day. Therefore a 57% reduction is required to achieve the calculated allowable iron loading. The total manganese load tracked between SR4/WB6 and S14 was found to be 1949.78 lbs/day. This was 561.37 lbs/day greater then the calculated allowable load of 1388.41 lbs/day. Therefore a 29% reduction is necessary at S14 for manganese.

TMDL calculations- S15- Schuylkill River above confluence with Little Schuylkill River @ RR bridge

The TMDL for sampling point S15 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 S15. The average flow, calculated with a unit area method for S15 (451.19 MGD), is used for these computations.

Sample data at point S15 shows pH ranging between 6.4 and 7.6; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point S15 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from point S14 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between point S14 and S15 to determine a total load tracked for the segment of stream between S15 and S14. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at S15.

A TMDL for iron and manganese at S15 has been calculated. The measured sample data for aluminum was below detection limits. There was no acidity measured at S15. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. The existing and allowable loads for the aluminum and acidic parameters at S15 in Table C45 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C45 shows the measured and allowable concentrations and loads at S15. Table C46 shows the percent reduction for iron and manganese needed at S15.

Table C45		Measured		Allowable	
Flow (gpm)=	313322.73	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	ND	NA	ND	NA
	Iron	0.52	1962.81	0.38	1434.10
ND = non detection	Manganese	0.57	2142.49	0.47	1781.72

NA = not applicable	Acidity	ND	NA	ND	NA
	Alkalinity	28.25	106301.38		

Table C46. Allocations S15		
S15	Fe (Lbs/day)	Mn (Lbs/day)
Existing Load @ S15	1962.81	2142.49
Difference in measured Loads between upstream loads and existing S15	-2860.41	-562.35
Percent loss due calculated at S15	59.3%	20.8%
Additional load tracked from above samples	1349.57	1388.41
Percentage of upstream loads that reach the S15	40.7%	79.2%
Total load tracked between S14 and S15	549.21	1099.75
Allowable Load @ S15	1434.10	1781.72
Load Reduction @ S15	-884.89	-681.97
% Reduction required at S15	0%	0%

There is a 2860.41 lbs/day decrease of iron at S15 compared to the sum of measured loads from upstream segments. This decrease of iron loading in this segment of stream between S14 and S15 can be a result of dilution or other natural stream processes. The total iron load measured was 884.89 lbs/day less than the calculated allowable iron load of 1434.10 lbs/day; therefore, no iron reduction is necessary at this point. The total manganese load tracked at S15 was 681.97 lbs/day less than the calculated allowable manganese load of 1781.72 lbs/day. Therefore no reduction is required to achieve the calculated allowable manganese loading.

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:

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

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

Seasonal Variation

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

Critical Conditions

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

Attachment E

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

The following are excerpts from the Pennsylvania DEP 303(d) narratives that justify changes in listings between the 1996, 1998, and 2002 lists. The 303(d) listing process has undergone an evolution in Pennsylvania since the development of the 1996 list.

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

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

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

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

Attachment F
Water Quality Data Used In TMDL Calculations

Date	MP Id	Latitude	Longitude	Flow (gpm)	pH L	Hot A (mg/l)	Alk (mg/l)	Al (MG/L)	Fe (mg/l)	Mn (mg/l))
11/14/2002	S15	40.578600	-76.026770		7.0	0.00	30.0	0.00	0.00	0.34
12/30/2002	S15	40.578600	-76.026770		7.0	0.00	26.4	0.00	0.44	0.81
3/19/2003	S15	40.578600	-76.026770		7.6	0.00	18.2	0.00	0.89	0.44
4/23/2003	S15	40.578600	-76.026770		7.1	0.00	28.6	0.00	0.41	0.87
5/21/2003	S15	40.578600	-76.026770		6.4	0.00	39.2	0.00	0.42	0.51
6/30/2003	S15	40.578600	-76.026770		7.2	0.00	32.0	0.00	0.00	0.75
10/16/2003	S15	40.578600	-76.026770		7.1	0.00	28.8	0.00	1.02	0.42
4/16/2004	S15	40.578600	-76.026770		7.7	39.40	22.8	1.13	0.99	0.42
average				313322.73	7.1	4.9	28.3	0.1	0.5	0.6
st dev					0.4	13.93	6.228735	0.399515	0.4107136	0.204012
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (mG/L)**	**Fe (mg/l)**	**Mn (mg/l))**
11/14/2002	S14	40.62843	-76.12423	128,365	6.8	0.00	28.0	0.00	1.01	0.80
12/30/2002	S14	40.62843	-76.12423	169,658	7.0	0.00	30.2	0.64	2.21	1.37
3/19/2003	S14	40.62843	-76.12423	525,132	7.7	0.00	20.4	1.33	4.20	0.90
4/23/2003	S14	40.62843	-76.12423	151,256	6.9	0.00	39.6	0.55	1.95	1.49
5/21/2003	S14	40.62843	-76.12423	83,514	6.6	0.00	53.6	0.00	1.17	1.09
6/30/2003	S14	40.62843	-76.12423	180,950	7.2	0.00	40.2	0.70	1.89	1.41
10/16/2003	S14	40.62843	-76.12423	143,680	7.1	0.00	40.4	0.00	1.33	1.09
4/16/2004	S14	40.62843	-76.12423	240,125	7.3	36.60	29.4	0.00	2.08	0.73
AVERAGE				202835.00	7.08	4.58	35.23	0.40	1.98	1.11
ST DEV				137730.87	0.34	12.94	10.28	0.49	1.00	0.29
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (mG/L)**	**Fe (mg/l)**	**Mn (mg/l))**
5/6/2005	SR4	40-38-16	076-11-00	53,987	7.6	-41.40	82.0	0.00	1.01	1.18
6/30/2005	SR4	40-38-16	076-11-00	30,024	7.9	-47.20	80.6	0.84	2.80	0.96
9/9/2005	SR4	40-38-16	076-11-00	14,745	8.2	-83.60	140.6	0.00	0.49	0.51
4/26/2006	SR4	40-38-16	076-11-00	95,764	6.4	33.00	23.8	0.00	1.56	0.63
6/7/2006	SR4	40-38-16	076-11-00	18,030	6.5	-18.80	30.4	0.00	1.02	0.91
AVERAGE				42510.00	7.32	-31.60	71.48	0.17	1.38	0.84
ST DEV				33517.82	0.82	42.95	47.26	0.38	0.88	0.27
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (UG/L)**	**Fe (ug/l)**	**Mn (ug/l))**
11/14/2002	S12	40.67974	-76.19025	60	6.7	0.00	256.0	0.00	1.91	0.97
12/30/2002	S12	40.67974	-76.19025	58	6.9	0.00	255.8	0.00	2.43	1.07
3/19/2003	S12	40.67974	-76.19025	70	6.9	0.00	235.8	0.00	2.48	0.97
4/24/2003	S12	40.67974	-76.19025	120	6.8	0.00	211.2	0.00	1.69	0.89
5/21/2003	S12	40.67974	-76.19025	120	6.7	0.00	223.8	0.00	2.16	0.87
6/30/2003	S12	40.67974	-76.19025	120	6.9	0.00	195.0	0.00	2.16	0.78
10/16/2003	S12	40.67974	-76.19025	120	6.9	0.00	229.2	0.00	3.43	1.15
4/16/2004	S12	40.67974	-76.19025	90	6.7	<-100	228.6	0.00	3.66	0.21
AVERAGE				94.75	6.81	0.00	229.43	0.00	2.49	0.86
ST DEV				28.64	0.10	0.00	20.67	0.00	0.70	0.29
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (mG/L)**	**Fe (mg/l)**	**Mn (mg/l))**
11/7/2002	S11	40.68740	-76.17731	140	7.1	0.00	258.0	0.00	1.30	0.72
12/30/2002	S11	40.68740	-76.17731	82	7.6	0.00	250.4	0.00	1.08	0.78

3/19/2003	S11	40.68740	-76.17731	205	7.2	0.00	244.0	0.00	1.44	0.58
4/24/2003	S11	40.68740	-76.17731	91	7.0	0.00	242.0	0.00	0.93	0.74
5/21/2003	S11	40.68740	-76.17731	53	7.0	0.00	246.0	0.00	1.00	0.63
6/30/2003	S11	40.68740	-76.17731	188	7.1	0.00	215.2	0.00	1.16	0.77
10/16/2003	S11	40.68740	-76.17731	58	7.3	0.00	246.2	0.00	0.58	0.74
4/16/2004	S11	40.68740	-76.17731	130	7.1	<-100	233.4	0.00	0.79	0.77
AVERAGE				118.38	7.18	0.00	241.90	0.00	1.03	0.72
ST DEV				57.25	0.20	0.00	12.85	0.00	0.28	0.07
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (mG/L)**	**Fe (mg/l)**	**Mn (mg/l))**
5/10/2005	SR2	40-41-37	076-09-52	17,270	6.6	26.60	26.6	0.00	1.68	1.09
6/30/2005	SR2	40-41-37	076-09-52	11,773	6.9	24.00	25.2	0.77	3.08	1.47
9/9/2005	SR2	40-41-37	076-09-52	3,774	6.6	20.40	26.6	0.00	1.54	1.13
4/26/2006	SR2	40-41-37	076-09-52	30,542	6.3	20.00	21.8	0.00	2.33	0.94
6/7/2006	SR2	40-41-37	076-09-52	8,551	6.4	0.00	24.4	0.00	1.49	1.07
AVERAGE				14382.00	6.56	18.20	24.92	0.15	2.02	1.14
ST DEV				10281.33	0.23	10.53	1.98	0.34	0.68	0.20
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (MG/L)**	**Fe (mg/l)**	**Mn (mg/l))**
11/7/2002	S10	40.69557	-76.15282	396	6.8	0.00	118.0	0.00	14.30	2.32
12/30/2002	S10	40.69557	-76.15282	1,101	6.8	0.00	92.8	0.00	14.30	2.13
3/19/2003	S10	40.69557	-76.15282	758	6.6	0.00	93.4	0.00	16.20	2.16
4/24/2003	S10	40.69557	-76.15282	978	6.7	0.00	76.8	0.00	13.20	2.25
5/21/2003	S10	40.69557	-76.15282	599	6.3	0.00	76.6	0.00	12.90	2.07
6/30/2003	S10	40.69557	-76.15282	1,657	6.6	0.00	78.6	0.00	12.00	2.22
10/16/2003	S10	40.69557	-76.15282	647	6.7	0.00	83.6	0.00	17.50	2.71
4/16/2004	S10	40.69557	-76.15282	672	7.0	0.00	70.6	0.00	17.60	2.83
AVERAGE				851.00	6.69	0.00	86.30	0.00	14.75	2.34
ST DEV				392.99	0.20	0.00	15.09	0.00	2.12	0.28
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (mG/L)**	**Fe (mg/l)**	**Mn (mg/l))**
11/7/2002	S9	40.70243	-76.14583	301	6.8	0.00	44.0	0.89	8.33	2.02
12/30/2002	S9	40.70243	-76.14583	203	6.8	0.00	43.0	1.12	8.43	1.96
3/19/2003	S9	40.70243	-76.14583	1,608	7.1	17.60	34.0	1.29	0.50	1.33
4/24/2003	S9	40.70243	-76.14583	695	7.0	16.20	39.4	0.66	9.02	2.35
5/21/2003	S9	40.70243	-76.14583	426	6.2	20.60	42.6	0.00	9.39	2.21
6/30/2003	S9	40.70243	-76.14583	714	6.6	0.00	34.8	1.80	9.17	2.39
10/16/2003	S9	40.70243	-76.14583	279	6.7	0.00	40.0	0.00	8.79	2.30
4/16/2004	S9	40.70243	-76.14583	603	6.9	40.40	32.4	1.04	7.40	1.94
AVERAGE				603.63	6.76	11.85	38.78	0.85	7.63	2.06
ST DEV				450.13	0.28	14.66	4.49	0.62	2.95	0.34
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (MG/L)**	**Fe (mg/l)**	**Mn (mg/l))**
4/22/1975	S8	40.71655	-76.14993	808	5.4	90.00	16.0		5.80	4.00
4/16/1997	S8	40.71655	-76.14993	1,770	6.6	0.00	174.0	0.41	7.40	1.97
6/12/1997	S8	40.71655	-76.14993	443	6.6	0.00	216.0	0.31	11.10	1.81
7/8/1997	S8	40.71655	-76.14993	518	6.8	0.00	218.0	0.47	9.24	1.94
10/7/1901	S8	40.71655	-76.14993	646	6.7	0.00	268.0	0.40	11.70	1.88

11/7/2002	S8	40.71655	-76.14993	707	6.6	0.00	260.0	0.58	18.70	3.65
12/30/2002	S8	40.71655	-76.14993	1,015	6.9	0.00	167.6	0.55	13.90	3.24
3/19/2003	S8	40.71655	-76.14993	2,333	6.8	0.00	178.8	1.28	16.20	3.37
4/24/2003	S8	40.71655	-76.14993	814	6.9	0.00	167.4	0.71	10.40	2.67
5/21/2003	S8	40.71655	-76.14993	462	6.9	0.00	164.8	0.59	12.70	3.06
6/30/2003	S8	40.71655	-76.14993	1,977	6.9	0.00	165.8	0.99	8.74	2.87
10/16/2003	S8	40.71655	-76.14993	795	7.0	0.00	215.2	0.97	13.90	2.81
4/16/2004	S8	40.71655	-76.14993	1,334	6.8	0.00	150.4	0.54	14.00	2.94
AVERAGE				1047.85	6.68	6.92	181.69	0.65	11.83	2.79
STDEV				616.64	0.41	24.96	62.34	0.29	3.60	0.71
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (mG/L)**	**Fe (mg/l)**	**Mn (mg/l))**
5/10/2005	SRNP									
6/30/2005	SRNP	40-43-08	076-06-56	8,678	6.7	33.60	17.0	0.00	2.28	1.44
9/9/2005	SRNP	40-43-08	076-06-56	2,490	6.5	27.40	18.6	0.00	1.30	0.94
4/26/2006	SRNP	40-43-08	076-06-56	25,340	6.5	23.00	14.2	0.00	2.02	0.84
6/7/2006	SRNP	40-43-08	076-06-56	6,609	6.2	0.00	17.6	0.00	1.82	0.97
AVERAGE				10779.25	6.48	21.00	16.85	0.00	1.85	1.05
ST DEV				10042.13	0.21	14.66	1.89	0.00	0.42	0.27
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (MG/L)**	**Fe (mg/l)**	**Mn (mg/l))**
4/22/1975	S7	40.72958	-76.12467	2,064	4.5	45.00	0.0		20.00	
11/7/1991	S7	40.72958	-76.12467	233	6.0	237.00	54.0		27.00	3.50
4/16/1997	S7	40.72958	-76.12467	2,280	5.8	22.00	42.0	0.97	17.00	2.88
6/12/1997	S7	40.72958	-76.12467	1,682	5.8	56.00	46.0	1.51	23.00	3.33
7/8/1997	S7	40.72958	-76.12467	925	5.9	38.00	42.0	1.34	20.50	3.21
8/9/1995	S7	40.72958	-76.12467	738	5.6	66.00	28.0	1.94	31.30	4.30
11/7/2002	S7	40.72958	-76.12467	1,094	6.1	70.60	58.0	1.24	26.20	3.61
12/30/2002	S7	40.72958	-76.12467	1,667	6.1	42.40	58.0	1.56	23.20	3.38
3/19/2003	S7	40.72958	-76.12467	2,671	6.0	39.40	54.6	2.22	24.10	3.44
4/24/2003	S7	40.72958	-76.12467	2,125	5.8	40.60	40.0	1.85	20.10	3.31
5/21/2003	S7	40.72958	-76.12467	1,108	5.7	62.20	31.2	1.62	21.10	3.32
6/30/2003	S7	40.72958	-76.12467	3,102	6.1	19.20	57.2	2.35	18.10	3.09
10/16/2003	S7	40.72958	-76.12467	1,175	6.1	42.80	43.0	1.52	21.10	3.19
4/15/2004	S7	40.72958	-76.12467	1,913	5.8	34.80	50.2	1.46	19.70	2.86
AVERAGE				1626.93	5.81	58.29	43.16	1.63	22.31	3.34
STDEV				794.28	0.41	53.58	15.67	0.40	3.84	0.36
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (MG/L)**	**Fe (mg/l)**	**Mn (mg/l))**
11/7/2002	S6	40.72800	-76.11097	198	5.0	53.60	8.4	3.55	4.62	2.89
12/30/2002	S6	40.72800	-76.11097	253	4.9	55.20	8.2	3.86	4.01	2.63
3/19/2003	S6	40.72800	-76.11097	1,109	5.2	29.20	8.2	2.06	1.38	1.18
4/24/2003	S6	40.72800	-76.11097	200	4.8	41.80	7.6	3.49	3.54	2.41
5/21/2003	S6	40.72800	-76.11097	130	4.8	61.60	6.8	3.05	3.76	2.70
6/30/2003	S6	40.72800	-76.11097	314	4.7	47.80	9.4	4.74	2.81	2.56
10/16/2003	S6	40.72800	-76.11097	289	5.0	38.20	8.2	2.26	2.83	2.02
4/15/2004	S6	40.72800	-76.11097	639	4.8	23.00	7.2	1.51	1.80	1.17

AVERAGE				391.50	4.90	43.80	8.00	3.07	3.09	2.20
STDEV				328.25	0.16	13.31	0.80	1.06	1.11	0.68
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (mG/L)**	**Fe (mg/l)**	**Mn (mg/l))**
5/10/2005	SRM	40-43-06	076-05-14	6,930	6.9	0.20	19.4	0.00	0.81	0.94
6/30/2005	SRM	40-43-06	076-05-14	4,969	6.7	31.80	15.2	0.00	0.94	1.60
9/9/2005	SRM	40-43-06	076-05-14	1,498	6.4	18.00	16.2	0.00	0.00	0.64
4/26/2006	SRM	40-43-06	076-05-14	16,397	6.6	36.40	15.4	0.00	1.12	0.75
6/7/2006	SRM	40-43-06	076-05-14	4,638	6.3	0.00	19.6	0.00	0.33	0.79
AVERAGE				6886.40	6.58	17.28	17.16	0.00	0.64	0.94
ST DEV				5661.71	0.24	17.08	2.17	0.00	0.46	0.38
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (MG/L)**	**Fe (mg/l)**	**Mn (mg/l))**
11/7/2002	S5	40.75067	-76.06255	3,067	4.8	30.40	7.0	0.63	0.00	0.24
12/30/2002	S5	40.75067	-76.06255	6,964	4.5	27.00	5.8	0.83	0.00	0.41
3/19/2003	S5	40.75067	-76.06255	19,204	4.6	28.80	6.4	0.77	0.34	0.21
4/24/2003	S5	40.75067	-76.06255	3,445	4.6	24.40	5.4	0.67	0.00	0.30
5/21/2003	S5	40.75067	-76.06255	1,670	4.6	30.00	4.8	0.00	0.00	0.25
6/30/2003	S5	40.75067	-76.06255	7,482	4.4	32.20	6.8	0.89	0.00	0.34
10/16/2003	S5	40.75067	-76.06255	2,232	4.6	26.00	6.0	0.54	0.00	0.28
4/15/2004	S5	40.75067	-76.06255	8,086	4.4	21.60	5.2	0.00	0.00	0.15
AVERAGE				6518.75	4.56	27.55	5.93	0.54	0.04	0.27
ST DEV				5703.97	0.13	3.49	0.78	0.35	0.12	0.08
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (MG/L)**	**Fe (mg/l)**	**Mn (Mg/l))**
11/7/2002	S4	40.75429	-76.05679	987	6.4	48.40	22.0	0.55	6.82	1.71
12/30/2002	S4	40.75429	-76.05679	3,102	6.1	35.60	15.6	0.52	2.60	1.12
3/19/2003	S4	40.75429	-76.05679	2,482	6.7	28.40	16.6	1.92	8.12	1.03
4/24/2003	S4	40.75429	-76.05679	2,274	6.3	28.60	14.8	0.62	2.49	1.05
5/21/2003	S4	40.75429	-76.05679	1,317	6.0	57.40	14.4	0.76	3.37	1.26
6/30/2003	S4	40.75429	-76.05679	2,671	6.3	28.40	20.0	0.00	2.49	0.90
10/16/2003	S4	40.75429	-76.05679	1,298	6.3	34.80	17.6	0.00	3.32	1.23
4/15/2004	S4	40.75429	-76.05679	1,715	6.0	20.20	16.0	0.00	2.35	0.82
AVERAGE				1980.75	6.26	35.23	17.13	0.55	3.95	1.14
ST DEV				759.30	0.23	12.12	2.64	0.64	2.24	0.27
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (MG/L)**	**Fe (mg/l)**	**Mn (mg/l))**
4/18/1975	S3	40.75464	-76.05600	449	6.2	26.00	5.0		4.00	
11/1/1991	S3	40.75464	-76.05600	40	6.5	1.00	9.0		0.07	0.02
7/29/1997	S3	40.75464	-76.05600	1,100	6.2	0.00	54.0	0.57	7.22	1.45
8/12/1997	S3	40.75464	-76.05600	1,800	6.2	34.00	64.0	0.39	7.14	1.59
11/7/2002	S3	40.75464	-76.05600	643	6.9	0.00	46.0	0.00	4.58	1.64
12/30/2002	S3	40.75464	-76.05600	1,224	6.9	0.00	48.4	0.00	4.43	1.45
3/19/2003	S3	40.75464	-76.05600	2,297	6.6	21.60	28.0	1.12	7.72	1.29
4/24/2003	S3	40.75464	-76.05600	1,108	6.7	0.00	41.8	0.00	3.94	1.35
5/21/2003	S3	40.75464	-76.05600	747	6.9	0.00	39.0	0.00	3.64	1.39
6/30/2003	S3	40.75464	-76.05600	1,202	6.8	0.00	45.2	0.55	3.67	1.33
10/16/2003	S3	40.75464	-76.05600	1,108	6.6	0.00	37.8	0.62	4.48	1.59
4/15/2004	S3	40.75464	-76.05600	1,317	6.3	11.40	29.4	0.00	3.04	1.10

AVERAGE				1086.25	6.57	7.83	37.30	0.33	4.49	1.29
ST DEV				593.48	0.28	12.41	17.24	0.39	2.10	0.45
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (MG/L)**	**Fe (mg/l)**	**Mn (mg/l))**
4/3/2002	S2A	40.75333	-76.05028	2,827						
7/2/2002	S2A	40.75333	-76.05028	803	4.5		0.0	1.00	0.04	1.20
9/10/2002	S2A	40.75333	-76.05028	503	3.8		0.0	0.70	3.65	1.68
9/24/2002	S2A	40.75333	-76.05028	336	4.5		0.0	0.99	2.70	1.40
10/23/2004	S2A	40.75333	-76.05028	1,351	5.5		2.8	0.80	2.20	1.00
12/17/2002	S2A	40.75333	-76.05028	3,967	5.3		3.0	0.91	1.65	0.76
3/5/2003	S2A	40.75333	-76.05028	1,800	5.2		3.0	1.15	1.25	1.05
4/28/2003	S2A	40.75333	-76.05028	2,127	4.4		3.0	1.40	1.09	1.25
6/30/2003	S2A	40.75333	-76.05028	3,729	4.5		0.0	1.25	1.00	1.24
8/27/2003	S2A	40.75333	-76.05028	637	4.5		0.0	1.25	1.50	1.49
10/6/2003	S2A	40.75333	-76.05028	2,235	5.1		2.6	1.30	2.85	1.38
11/5/2003	S2A	40.75333	-76.05028	3,519	5.1		3.3			
12/16/2003	S2A	40.75333	-76.05028	1,836	5.2		2.6			
AVERAGE				1974.61	4.80	#DIV/0!	1.69	1.07	1.79	1.24
ST DEV				1248.37	0.50	#DIV/0!	1.50	0.23	1.06	0.26
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (MG/L)**	**Fe (mg/l)**	**Mn (mg/l))**
4/21/1975	S2	40.75322	-76.04909	943	3.6	66.00	0.0		2.00	
11/1/1991	S2	40.75322	-76.04909	229	5.0	156.00	3.0		12.00	1.50
8/12/1997	S2	40.75322	-76.04909	277	3.9	30.00	0.0	1.19	2.89	1.41
10/16/1997	S2	40.75322	-76.04909	319	3.9	26.00	0.0	1.30	4.50	1.60
7/2/2002	S2	40.75322	-76.04909	423	4.0		0.0	0.70	2.30	1.12
9/10/2002	S2	40.75322	-76.04909	254	3.9		0.0	0.62	5.95	1.32
10/23/2002	S2	40.75322	-76.04909	395	4.0		0.0	0.90	7.45	1.67
11/7/2002	S2	40.75322	-76.04909	401	4.1	70.20	3.6	0.90	9.52	1.80
12/17/2002	S2	40.75322	-76.04909	1,194	4.2			0.86	4.20	0.91
3/5/2003	S2	40.75322	-76.04909	507	3.7		0.0	0.99	3.55	1.61
4/28/2003	S2	40.75322	-76.04909	812	4.4		0.0	1.30	2.05	1.48
6/30/2003	S2	40.75322	-76.04909	1,889	4.0		0.0	1.50	2.80	1.62
8/27/2003	S2	40.75322	-76.04909	274	3.9		0.0	1.25	2.65	1.68
10/6/2003	S2	40.75322	-76.04909	920	4.1		0.0	1.20	3.30	1.64
12/16/2003	S2	40.75322	-76.04909	1,791	4.3					
4/15/2004	S2	40.75322	-76.04909	1,036	3.9	35.40	3.8	0.99	3.10	1.44
AVERAGE				729.00	4.06	63.93	0.74	1.05	4.55	1.49
ST DEV				534.80	0.32	48.84	1.49	0.26	2.96	0.24
Date	**MP Id**	**Latitude**	**Longitude**	**Flow (gpm)**	**pH L**	**Hot A (mg/l)**	**Alk (mg/l)**	**Al (MG/L)**	**Fe (mg/l)**	**Mn (mg/l))**
11/7/2002	S1	40.75394	-76.04954	1,683	6.2	59.60	11.4	0.98	0.53	0.99
12/30/2002	S1	40.75394	-76.04954	1,565	5.5	38.20	8.2	1.34	0.73	1.14
3/19/2003	S1	40.75394	-76.04954	5,609	6.5	47.80	9.2	1.04	0.78	0.64
4/24/2003	S1	40.75394	-76.04954	971	5.6	38.00	8.6	1.53	0.60	1.28
5/21/2003	S1	40.75394	-76.04954	450	5.7	69.80	7.0	1.24	0.75	1.46
6/30/2003	S1	40.75394	-76.04954	2,000	5.8	42.40	10.2	1.18	0.55	1.01
10/16/2003	S1	40.75394	-76.04954	1,310	6.3	43.80	11.6	0.77	0.49	0.94

4/15/2004	S1	40.75394	-76.04954	3,268	5.9	41.80	11.8	0.76	0.77	0.64
Average				2107.00	5.94	47.68	9.75	1.10	0.65	1.01
St Dev				1637.43	0.36	11.29	1.78	0.27	0.12	0.28

Non detections are calculated and shown as zeros in data sets.

Attachment G
Comment and Response

Commenter – Citizen's for Pennsylvania's Future

Comment: Inadequate Public Comment Period and Misleading Public Notice

The TMDL is labeled "Draft" throughout, and does not suggest that it is a revision of an earlier draft TMDL that had been released for public comment. Given that PADEP invited the public to present comments on the draft TMDL at a public hearing and to submit comments in writing, 37 Pa. Bull. 579, it clearly considers the document to be a draft that may be changed based on this public input. The governing regulation is clear that "[d]raft TMDL notices shall be subject to a minimum 30-day comment period." 25 Pa. Code § 96.7(b). The 20-day public comment period being offered for the draft TMDL obviously falls short of satisfying this requirement and is clearly unlawful.

The problem of providing an unlawfully short public comment period is exacerbated by PADEP's misleading public notice. The public notice for this draft TMDL does not mention the word "Upper", and repeatedly refers to the "TMDL for the Schuylkill River Watershed", id. At 578 or the "Schuylkill River Watershed TMDL". Id. At 579. It also states that "the proposed TMDL for the Schuylkill River Watershed can be accessed through the Department's website," and provides instructions for navigating to the TMDL page on PADEP's website. Id. The alphabetized list of TMDLS on PADEP's website has no entry under "Schuylkill River", however, because the draft TMDL actually is entitled "Upper Schuylkill River Watershed TMDL", and is alphabetized under "u" for Upper Schuylkill River TMDL" on PADEP's list. (Oddly, however, under the "Upper Schuylkill River TMDL" alphabetized listing, the link that takes one to eh "Upper Schuylkill River Watershed TMDL" appears as "TMDL: Schuylkill River".

PennFuture just discovered today [February 23, 2007] that the TMDL identified in the PADEP's public notice as the "Schuylkill River Watershed TMDL" is actually entitled "Upper Schuylkill River Watershed TMDL" and is available under "U" in the alphabetized list on PADEP's website. PennFuture therefore is forced to limits its comments to objecting to the misleading public notice and the unlawfully short public comment period for the draft TMDL.

Response: The Department will extend the public notice period for an additional 10 days to allow for the full 30-day comment period according to regulation. Notice of the extension of the comment period will be published in the Pennsylvania Bulletin. Discrepancies between the wording of Schuylkill River versus Upper Schuylkill River have been addressed.

Commenter: U.S. Environmental Protection Agency, Region III

Comment: The text says there are six permitted mine discharges but Table 5 seems to indicate more than six. In addition, there are eight different NPDES numbers. Please clarify.

Response: There are ten permitted mines with NPDES discharges addressed in this TMDL document. The text and tables have been corrected to reflect this number.

Comment: Attachment E, sample S15. The averages and standard deviations are in the wrong column. The spreadsheet also has them in the wrong column but the calculations are correct. Attachment E should be corrected.

Response: The correction has been made to Attachment E.