



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION III  
1650 Arch Street  
Philadelphia, Pennsylvania 19103-2029

**Decision Rationale**  
**Total Maximum Daily Loads**  
**Blacks Creek Watershed**  
**For Acid Mine Drainage Affected Segments**  
**Butler County**

*Signed*

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**Water Protection Division**

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## I. Introduction

The Clean Water Act (CWA) requires a total maximum daily load (TMDL) be developed for those waterbodies identified as impaired by the state where technology-based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a margin of safety (MOS), that may be discharged to a water quality-limited waterbody without violating water quality standards.

The Pennsylvania Department of the Environmental Protection (PADEP), Bureau of Watershed Conservation, submitted the *Blacks Creek Watershed TMDL*, dated October 20, 2004 (TMDL Report), electronically to the Environmental Protection Agency (EPA) for final Agency review on October 21, 2004, followed by a printed copy which was received November 3, 2004. This report included TMDLs for three metals (aluminum, iron, and manganese) and pH, and addresses one segment on Pennsylvania's 1996 Section 303(d) list of impaired waters.

EPA's rationale is based on the TMDL Report and information contained in the attachments to the report. EPA's review determined that the TMDL meets the following eight regulatory requirements pursuant to 40 CFR Part 130.

1. The TMDLs are designed to implement the applicable water quality standards.
2. The TMDLs include a total allowable load as well as individual Wasteload Allocations (WLAs) and Load Allocations (LAs).
3. The TMDLs consider the impacts of background pollutant contributions.
4. The TMDLs consider critical environmental conditions.
5. The TMDLs consider seasonal environmental variations.
6. The TMDLs include a MOS.
7. There is reasonable assurance that the proposed TMDLs can be met.
8. The TMDLs have been subject to public participation.

## II. Summary

Table 1 presents the 1996, 1998, and 2002 Section 303(d) listing information for the water quality limited segments listed in 1996. The segment was re-numbered in 2002.

The TMDLs were developed using a statistical procedure to ensure that water quality criteria are met 99 percent of the time as required by Pennsylvania's water quality standards at Pennsylvania Code Title 25, Chapter 96.3(c). Table 2 shows the TMDLs for Blacks Creek

Watershed at the

Year	Miles	Segment ID	DEP Stream Code	Stream Name	Designated Use	Data Source	Source	EPA 305(b) Cause Code
1996	4.6	4570	34731	Blacks Creek	CWF	305(b) Report	RE	Metals
1998	No additional assessment data collected for the 1998 303(d) list.			Blacks Creek	CWF			
2000	4.54	4570	34731	Blacks Creek	CWF	SWMP	AMD	Metals
2002	4.6	4570	34731	Blacks Creek	CWF	SWMP	AMD	Metals
1996	Not Listed on 1996 Section 303(d) List			Unt. Blacks Creek				
1998	Not Listed on 1998 Section 303(d) List			Unt. Blacks Creek				
2000	0.07	4570	34744	Unt. Blacks Creek	CWF	SWMP	AMD	Metals

Resource Extraction = RE  
Cold Water Fishes=CWF  
Surface Water Monitoring Program = SWMP  
Abandoned Mine Drainage = AMD

downs  
stream-  
most  
point  
in the  
watershed.

TMDLs are defined as the summation of the point source WLAs plus the summation of the nonpoint source LAs plus a MOS and are often shown as:

$$\text{TMDL} = \sum \text{WLAS} + \sum \text{LAS} + \text{MOS}$$

The Blacks Creek Watershed TMDLs are shown in Table 2.

**Table 2. TMDL Summary**

<b>Blacks Creek TMDLs</b>	<b>Parameter</b>	<b>TMDL (lbs/day)</b>	<b>WLA (lbs/day)</b>	<b>LA (lbs/day)</b>	<b>MOS (lbs/day)</b>
Blacks Creek PA-20C-34731- 4570	Fe	10.2	0	10.2	implicit
	Mn	8.0	0	8.0	implicit
	Al	0	0	0	implicit
	Acidity	0	0	0	implicit

The TMDL is a written plan and analysis established to ensure that a waterbody will attain and maintain water quality standards. The TMDL is a scientifically-based strategy which considers current and foreseeable conditions, the best available data, and accounts for uncertainty with the inclusion of a MOS value. Conditions, available data, and the understanding of the natural processes can change more than anticipated by the MOS. The option is always available to refine the TMDL for resubmittal to EPA for approval.

Pennsylvania’s Unassessed Waters Protocol, PADEP’s method of conducting biological assessments of Pennsylvania’s waters, was developed in 1996 and implementation began in 1997. PADEP’s goal is a statewide assessment of surface waters in Pennsylvania. After completion of the initial assessments, the long-range goal is to reassess all waters on a five-year cycle. Therefore, while the TMDL should not be modified at the expense of achieving water quality standards expeditiously, the TMDL may be modified when warranted by additional data or other information.

### **III. Background**

The Blacks Creek, Stream Code 34731 in Basin 20-C of the State Waterplan has a drainage area of 7 sq. miles. Segment ID# 4570 is 5.5 miles long and flows through the northwestern-most area of the main bituminous coal region in Butler County, PA. It enters Slippery Rock Creek one mile west of the village of Boyers. The impairment, elevated metals, is the result of acid drainage from abandoned coal mines and, possibly, the natural conditions of ground water.

There are no active mining operations in the northern section of the watershed. The permitted limestone mine, Porok Mine, Quality Aggregates Inc. SMP # 10960301, in the southern section near the mouth, is no longer operating. Limestone removal in the Blacks Creek watershed is completed. The area has been regraded except for a haul road that connects SMP# 10990302 (to the west) with SMP 10960301 (to the east the Gray Mine which discharges to an unnamed tributary to Slippery Rock Creek). No WLA is required.

The McIntire site, Adobe Mining SMO #3078BC12, is a bond-forfeiture site. The permitted forfeited the performance bond required under Surface Mining Control and Reclamation Act of 1977 (SMCRA, Public Law 95-87). No WLA is required.

In addition, there are five known abandoned oil wells in the Blacks Creek Watershed. Four of these have been sampled, BC15, BC16, BC19 and BC19B, the fifth, unsampled well is below point BC1. The wells discharge elevated concentrations of iron, manganese, and sulfates, further degrading the stream. The impact of these five, unpermitted discharges, apart from the acid mine drainage (AMD) already in the stream, has not been evaluated. All of the discharges in the watershed are from abandoned mines or abandoned oil wells will be treated as nonpoint sources.

For purposes of these TMDLs only, point sources are identified as permitted discharge points and nonpoint sources are identified as other discharges from abandoned mine lands which can include tunnel discharges, seeps, and surface runoff. Abandoned and reclaimed mine lands were treated in the allocations as nonpoint sources because there are no National Pollutant Discharge Elimination System (NPDES) permits associated with these areas. As such, the discharges associated with these landuses were assigned LAs (as opposed to WLAs). The decision to assign LAs to abandoned and reclaimed mine lands does not reflect any determination by EPA as to whether there are unpermitted point source discharges within these landuses. In addition, by approving these TMDLs with mine drainage discharges treated as LAs, EPA is not determining that these discharges are exempt from NPDES permitting requirements.

PADEP treats each segment as defined by the sampling points as a separate TMDL. The TMDLs are expressed as long-term averages. See the *Blacks Creek Watershed TMDL Report*, Attachment D, for TMDL calculations.

The 1977 SMCRA and its subsequent revisions were enacted to established a nationwide program to, among other things, protect the beneficial uses of land or water resources, and public health and safety from the adverse effects of current surface coal mining operations, as well as promote the reclamation of mined areas left without adequate reclamation prior to August 3, 1977. SMCRA requires a permit for the development of new, previously mined, or abandoned sites for the purpose of surface mining. Permittees are required to post a performance bond that will be sufficient to ensure the completion of reclamation requirements by the regulatory authority in the event that the applicant forfeits. Mines that ceased operating by the effective date of SMCRA (often called “pre-law” mines) are not subject to the requirements of SMCRA.

These TMDLs were completed by PADEP to meet the eighth year (2005) TMDL milestone commitment under the requirements of the 1997 TMDL lawsuit settlement agreement. Eighth year milestones include the development of TMDLs for 40 percent of the waters listed on Pennsylvania’s 1996 Section 303(d) list of impaired waters by the effects of AMD or 40 waters since 2003, and 80 percent of waters listed impaired by non-AMD related impacts or 34 waters since 2003. Delisted waters may count for 20 percent of the requirement.

## *Computational Procedure*

The TMDLs were developed using a statistical procedure to ensure that water quality criteria are met 99 percent of the time as required by Pennsylvania's water quality standards. The Blacks Creek TMDL allocates loadings to five instream sampling points along Blacks Creek. Between August 1996 and November 2001, four to six samples were collected in the Blacks Creek Watershed at each of the sampling points. One to four samples were taken at several other locations in the watershed, see map in Attachment A to this decision rationale. Five to nine samples were taken at four of the five known abandoned oil wells.

A critical flow could not be identified, and the reductions specified in this TMDL apply at all flow conditions. Regression and correlation analyses between flow and concentration almost always produce little or no correlation and disclose no critical condition. For these TMDLs, the lack of flow data required use of the unit-area method, see Section IV.4.

TMDLs for each parameter were determined using a Monte Carlo simulation, @RISK,<sup>1</sup> with the measured, or existing, pollutant concentration data. For each source and pollutant, it was assumed that the observed data are lognormally distributed. Each pollutant was evaluated separately using @RISK.

Using the collected sample concentration parameters, mean and standard deviation, the simulation performs 5000 iterations and predicts an existing long-term average concentration and this analysis shows whether or not the existing data is from a population where water quality standards are exceeded more than one percent of the time. A second simulation of 5000 iterations is performed to calculate the percent reduction necessary to meet the criteria 99 percent of the time. Finally, using the calculated percent reductions, a final simulation is run to confirm that the target value for a long-term average concentration will result in meeting water quality criteria 99 percent of the time.

The existing and allowable long-term average loads were computed using the mean concentration from @RISK multiplied by the average flow. 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.

## **IV. Discussions of Regulatory Requirements**

EPA has determined that these TMDLs are consistent with statutory and regulatory requirements and EPA policy and guidance.

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

1. *The TMDLs are designed to implement the applicable water quality standards.*

Water quality standards are state regulations that define the water quality goals of a waterbody. Standards are comprised of three components, including: (1) designated uses, (2) criteria necessary to protect those uses, and (3) antidegradation provisions that prevent the degradation of water quality. All of the stream segments evaluated in the Blacks Creek Watershed have been designated by Pennsylvania as Cold Water Fishes with criteria to protect the aquatic life uses. The designations for these stream segments can be found at Pennsylvania Title 25 § 93.9. To protect the designated uses, as well as the existing uses, the water quality criteria shown in Table 3 apply to all evaluated segments. The table includes the instream numeric criterion for each parameter and any associated specifications.

**Table 3. Applicable Water Quality Criteria**

Parameter	Criterion Value (mg/l)	Duration	Total Recoverable/ Dissolved
Aluminum (Al)	0.75	Maximum	Total Recoverable
Iron (Fe)	1.5 0.3	30-day Average Maximum	Total Recoverable Dissolved
Manganese (Mn)	1.0	Maximum	Total Recoverable
pH	6.0 - 9.0	Inclusive	N/A

Pennsylvania Title 25 § 96.3(c) requires that water quality criteria be achieved at least 99 percent of the time, and TMDLs expressed as long-term average concentrations, are expected to meet these requirements. That is, the statistical Monte Carlo simulation used to develop TMDLs and LAs for each parameter results in a determination that any required percent pollutant reduction assures that the water quality criteria will be met instream at least 99 percent of the time. The Monte Carlo simulation used 5000 iterations where each iteration was independent of all other iterations, and the observed data were assumed to be lognormally distributed for each source and pollutant.

EPA finds that these TMDLs will attain and maintain the applicable narrative and numerical water quality standards. For iron, the TMDL endpoint was expressed as total recoverable iron because all monitoring data was expressed as total recoverable iron.

The pH values shown in Table 3 were used as the TMDL endpoints for these TMDLs. In the case of freestone streams with little or no buffering capacity, the allowable TMDL endpoint for pH may be the natural background water quality; these values can get as low as 5.4 (Pennsylvania Fish and Boat Commission). However, PADEP chose to set the pH standard between 6.0 to 9.0, inclusive, which is presumed to be met when the net alkalinity is maintained

above zero. This presumption is based on the relationship between net alkalinity and pH, on which PADEP based its methodology to addressing pH in the watershed. See the *Blacks Creek Watershed TMDL* report, Attachment B. A summary of the methodology is presented as follows.

The parameter of pH, a measurement of hydrogen ion acidity presented as a negative logarithm of effective hydrogen ion concentration, is not conducive to standard statistics. Additionally, pH does not measure latent acidity that can be produced from the hydrolysis of metals. PADEP is using the following approach to address the stream impairments noted on the Section 303(d) list due to pH. Because the concentration of acidity in a stream is partially dependent upon metals, it is extremely difficult to predict the exact pH values which would result from treatment of AMD. 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 able to measure the reduction of acidity. When acidity in a stream is neutralized or is restored to natural levels, pH will be acceptable ( $\geq 6.0$ ). 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 used to calculate the required 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. EPA finds this approach to pH to be reasonable.

2. *The TMDLs include a total allowable load as well as individual WLAs and LAs.*

There are no permitted dischargers in the watershed and no WLAs are required. For purposes of these TMDLs only, point sources are identified as permitted discharge points and nonpoint sources are identified as other discharges from abandoned mine lands which can include, but are not limited to, tunnel discharges, seeps, and surface runoff. Abandoned and reclaimed mine lands were treated in the allocations as nonpoint sources because there are no NPDES permits associated with these areas. As such, the discharges associated with these landuses were assigned LAs (as opposed to WLAs). The decision to assign LAs to abandoned and reclaimed mine lands does not reflect any determination by EPA as to whether there are unpermitted point source discharges within these landuses. In addition, by approving these TMDLs with mine drainage discharges treated as LAs, EPA is not determining that these discharges are exempt from NPDES permitting requirements.

The LA for each sampling point was computed using water-quality data collected from that point. The instream TMDLs for sampling point BC6 consists of LAs made to the area above the point. The instream TMDLs for sampling points BC2, BC2B, BC1, and BC8 consist of LAs to the area between them and the next upstream sample point. Although the downstream-most sampling point, BC8, is located more than 1.5 miles from Black Creek's mouth and the entire stream length is on the Section 303(d) list, none of the four samples taken at sample point QAS4 exceeded criteria for metals. In addition, see below. The sampling points are shown on the map in Attachment A.



Once PADEP determined the allowable concentration and load for each pollutant, a mass-balance accounting was performed starting at the top of the watershed and working down in sequence, see the flow diagram in Attachment A. 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 a guide for expected changes in the allowable loads.

PADEP used are two basic rules for the load tracking between two ends of a stream segment; (1) if the measured upstream loads are less than the downstream loads, it is indicative that there is an increase in load between the points being evaluated and no instream processes are assumed. (2) 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 points, and the ratio of the decrease shall be applied to the allowable load being tracked from the upstream point.

Tracking loads through the watershed provides picture of how the pollutants are affecting the watershed, based on the available information. The analysis is done to insure that water quality standards will be met at all points in the stream. EPA finds this approach reasonable.

Table 4 presents a summary of the allowable loads for the Blacks Creek Watershed. In this table the “NA” under “Reduction Identified” indicates that the the pH criterion is met at that sampling point and no TMDL is required. The “NA” for metals for sampling points BC2B, BC1, and BC8 indicates that once upstream reductions are made, no further reductions are required at that point. See Appendix D, *Blacks Creek Watershed TMDL*.

**Table 4. Summary Table for Blacks Creek Watershed**

Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Reduction Identified %
BC6 Upstream Point	Fe	2.8	0.2	0	0.2	92
	Mn	0.6	0.6	0	0.6	0
	Al	3.5	0.7	0	0.7	79
	Acidity	14.6	6.0	0	6.0	59
	Alkalinity	48.3				
BC2	Fe	4.0	1.0	0	1.0	29
	Mn	60.2	1.2	0	1.2	98
	Al	26.6	1.1	0	1.1	96
	Acidity	0	0	0	0	NA
	Alkalinity	376.1				
BC2B	Fe	5.2	2.2	0	2.2	NA
	Mn	33.6	4.7	0	4.7	NA
	Al	25.8	2.6	0	2.6	NA
	Acidity	0	0	0	0	NA
	Alkalinity	47.6				

Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Reduction Identified %
BC1	Fe	6.2	6.2	0	6.2	NA
	Mn	20.1	5.6	0	5.6	NA
	Al	35.9	7.2	0	7.2	31
	Acidity	0	0	0	0	NA
	Alkalinity	1,079.2				
BC8	Fe	0	0	0	0	NA
	Mn	10.2	10.2	0	10.2	NA
	Al	25.1	8.0	0	8.0	NA
	Acidity	0	0	0	0	NA
	Alkalinity	1,062.3				

LTA = Long Term Average

WLA = point source loads

LA = total nonpoint loads entering segment, including any upstream loads

PADEP allocated only to nonpoint sources as there are no current mining operations within the watershed. Where there are active mining operations or post-mining discharge treatment in the watershed, Federal regulations require that subsequent to TMDL development and approval, point sources permitted effluent limitations be water quality-based.<sup>2</sup> In addition, PA Title 25, Chapter 96, Section 96.4(d) requires that WLAs shall serve as the basis for determination

of permit limits for point source discharges regulated under Chapter 92 (relating to NPDES permitting, monitoring and compliance). Therefore, no new mining may be permitted within the watershed without reallocation of the TMDL.

3. *The TMDLs consider the impacts of background pollutant contributions.*

Blacks Creek is located in an area that was extensively mined. The TMDLs were developed using instream data which account for existing background conditions.

4. *The TMDLs consider critical environmental 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. Flow measurements are missing from the data set. PADEP considered the available flow measurements at BC6 to be the best data available and used the unit area method to estimate average flows at the other locations where allowable loads were determined.

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<sup>2</sup>It should be noted that technology-based permit limits may be converted to water quality-based limits according to EPA's *Technical Support Document For Water Quality-based Toxics Control*, March 1991, recommendations.

5. *The TMDLs consider seasonal environmental variations.*

All sample sets included data points from various seasons indicate that PADEP considered seasonal variations to the extent that data was available.

6. *The TMDLs include a MOS.*

The CWA and Federal regulations require TMDLs to include a MOS to take into account any lack of knowledge concerning the relationship between effluent limitations and water quality. EPA guidance suggests two approaches to satisfy the MOS requirement. First, it can be met implicitly by using conservative model assumptions to develop the allocations. Alternately, it can be met explicitly by allocating a portion of the allowable load to the MOS.

PADEP used an implicit MOS in these TMDLs by assuming the treated instream concentration variability to be the same as the untreated stream's concentration variability. This is a more conservative assumption than the general assumption that a treated discharge has less variability than an untreated discharge. By retaining variability in the treated discharge, a lower average concentration is required to meet water quality criteria 99 percent of the time than if the variability of the treated discharge is reduced.

With respect to iron, PADEP identified an additional implicit MOS in the analysis and TMDL development by treating the iron water quality criterion as if the 1.50 mg/l were a maximum value instead of a thirty-day average value.

7. *There is reasonable assurance that the proposed TMDLs can be met.*

Grant applications have been submitted in the past and are expected in the future. Growing Greener grants for round 4 were approved for BC19 and BC19B and BC16. Applications were submitted in earlier rounds for the McIntire site, but were not approved. There is a proposal to do some geophysics at the McIntire site, Adobe Mining SMP #3078BC12, regarding discharges MC1, MC3 and possibly BC16. Bonds were forfeited at this site, so money is available. Abandoned oil well discharges are a significant source of impairment. These discharges exhibit characteristics of acid mine drainage, so there needs to be coordination between agencies regarding mine reclamation, passive treatment, and well plugging.

In addition, the *Recommendations* section highlights what can be done in the watershed to eliminate or treat pollutant sources. Aside from PADEP's primary efforts to improve water quality in the Blacks Creek Watershed through reclamation of abandoned mine lands and through the NPDES permit program, additional opportunities for reasonable assurance exist. PADEP expects activities, such as research conducted by its Bureau of Abandoned Mine Reclamation, funding from EPA's 319 grant program, and Pennsylvania's Growing Greener program will also help remedy abandoned mine drainage impacts. PADEP also has in place an initiative that aims to maximize reclamation of Pennsylvania's abandoned mineral extraction lands. Through Reclaim PA, Pennsylvania's goal is to accomplish complete reclamation of abandoned mine lands

and plugging of orphaned wells. Pennsylvania strives to achieve this objective through legislative and policy land management efforts, and activities described in the TMDL report.

8. *The TMDLs have been subject to public participation.*

PADEP public noticed the draft TMDLs in the *Pennsylvania Bulletin* in June 2003, and in a local newspaper. A public meeting was held on December 12, 2002 to discuss the proposed TMDLs.

Notice of the final TMDL approval will be posted on the PADEP website and, although not specifically stated in the TMDL Report, PADEP routinely posts the approved TMDL report their web site: [www.dep.state.pa.us/watermanagement\\_apps/tmdl/](http://www.dep.state.pa.us/watermanagement_apps/tmdl/).

# **Attachment A**

Blacks Creek Sampling Locations

