Anderson Creek TMDL
West Branch Susquehanna River
Clearfield County, Pennsylvania

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DEPARTMENT OF ENVIRONMENTAL PROTECTION

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ATTACHMENTS

INTRODUCTION

This Total Maximum Daily Load (TMDL) calculation has been prepared for segments in the Anderson Creek Watershed (Attachment A). It was done to address the impairments noted on the 1996, 1998 and draft 2000 303(d) lists, required under the Clean Water Act, and covers 20 segments on this list (Table 1). High levels of metals and, in some areas, depressed pH caused these impairments. In addition, stream surveys conducted in 1999 added nutrients and sediment to the causes of impairment for selected segments. This TMDL addresses the three primary metals associated with abandoned mine drainage (iron, manganese and aluminum), pH, phosphorus, and sediment.

Table 1. 303(d) List: State Water Plan (SWP) Subbasin 08-B: Upper West Branch Susquehanna River Basin

2012 Pennsylvania Integrated Water Quality Monitoring and Assessment Report - Streams, Category 5 Waterbodies, Pollutants Requiring a TMDL

Stream Name / ***Use Designation (Assessment ID)*** / ***Source***	***Cause***	***Date Listed***	***TMDL Date***
Hydrologic Unit Code: 02050201-Upper West Branch Susquehanna			
Anderson Creek			
HUC: 02050201			
Aquatic Life (9938) - 5.98 miles			
Abandoned Mine Drainage	Metals	1996	2009
	pH	2002	2015
Aquatic Life (13680) - 1.53 miles			
Abandoned Mine Drainage	Metals	2008	2021
	pH	2008	2021
Anderson Creek Unnamed To (ID:61830533)			
HUC: 02050201			
Aquatic Life (9940) - 0.85 miles			
Abandoned Mine Drainage	Metals	2004	2017
	pH	2004	2017
Anderson Creek Unnamed To (ID:61830563)			
HUC: 02050201			
Aquatic Life (9940) - 0.86 miles			
Abandoned Mine Drainage	Metals	2004	2017
	pH	2004	2017
Anderson Creek Unnamed To (ID:61830673)			
HUC: 02050201			
Aquatic Life (9940) - 1.29 miles			
Abandoned Mine Drainage	Metals	2004	2017
	pH	2004	2017
Anderson Creek Unnamed To (ID:61831175)			
HUC: 02050201			
Aquatic Life (9940) - 2.14 miles			
Abandoned Mine Drainage	Metals	2004	2017
	pH	2004	2017
Bilger Run			
HUC: 02050201			
Aquatic Life (5661) - 4.07 miles			
Abandoned Mine Drainage	pH	2004	2017
Aquatic Life (10356) - 1.09 miles			
Abandoned Mine Drainage	Metals	2002	2015
	pH	2002	2015
On site Wastewater	Nutrients	2002	2015
Fenton Run			
HUC: 02050201			
Aquatic Life (5661) - 1.54 miles			
Abandoned Mine Drainage	pH	2004	2017
Fenton Run Unnamed To (ID:61831349)			
HUC: 02050201			
Aquatic Life (5661) - 0.31 miles			
Abandoned Mine Drainage	pH	2004	2017

Stream Name / *Use Designation (Assessment ID)* / *Source*	*Cause*	*Date Listed*	*TMDL Date*
Fenton Run Unnamed To (ID:61831371)			
HUC: 02050201			
Aquatic Life (5661) - 0.62 miles			
Abandoned Mine Drainage	pH	2004	2017
Hughey Run			
HUC: 02050201			
Aquatic Life (5661) - 1.85 miles			
Abandoned Mine Drainage	pH	2004	2017
Kratzer Run			
HUC: 02050201			
Aquatic Life (10355) - 0.76 miles			
Abandoned Mine Drainage	Metals	1996	2009
	pH	2002	2015
On site Wastewater	Nutrients	2002	2015
Aquatic Life (10357) - 1.32 miles			
Abandoned Mine Drainage	Metals	2004	2017
	pH	2004	2017
On site Wastewater	Nutrients	2004	2017
Kratzer Run Unnamed Of (ID:61831733)			
HUC: 02050201			
Aquatic Life (5661) - 0.46 miles			
Abandoned Mine Drainage	pH	2004	2017
Kratzer Run Unnamed Of (ID:61831769)			
HUC: 02050201			
Aquatic Life (5661) - 0.41 miles			
Abandoned Mine Drainage	pH	2004	2017
Kratzer Run Unnamed To (ID:61831539)			
HUC: 02050201			
Aquatic Life (5661) - 0.45 miles			
Abandoned Mine Drainage	pH	2004	2017
Kratzer Run Unnamed To (ID:61831649)			
HUC: 02050201			
Aquatic Life (5661) - 0.64 miles			
Abandoned Mine Drainage	pH	2004	2017
Kratzer Run Unnamed To (ID:61831767)			
HUC: 02050201			
Aquatic Life (10357) - 1.14 miles			
Abandoned Mine Drainage	Metals	2004	2017
	pH	2004	2017
On site Wastewater	Nutrients	2004	2017
Kratzer Run Unnamed To (ID:61831907)			
HUC: 02050201			
Aquatic Life (10357) - 1.02 miles			
Abandoned Mine Drainage	Metals	2004	2017
	pH	2004	2017
On site Wastewater	Nutrients	2004	2017

Stream Name *Use Designation (Assessment ID)* *Source*	*Cause*	*Date Listed*	*TMDL Date*
Kratzer Run Unnamed To (ID:61831923)			
HUC: 02050201			
Aquatic Life (10356) - 1.24 miles			
Abandoned Mine Drainage	Metals	2002	2015
	pH	2002	2015
On site Wastewater	Nutrients	2002	2015
Kratzer Run Unnamed To (ID:61832085)			
HUC: 02050201			
Aquatic Life (10357) - 0.61 miles			
Abandoned Mine Drainage	Metals	2004	2017
	pH	2004	2017
On site Wastewater	Nutrients	2004	2017
Little Anderson Creek			
HUC: 02050201			
Aquatic Life (10332) - 4.93 miles			
Abandoned Mine Drainage	Metals	1996	2009
	pH	2002	2015
Grazing Related Agric	Siltation	2002	2015
Aquatic Life (10333) - 0.7 miles			
Abandoned Mine Drainage	Metals	2002	2015
	pH	2002	2015
Grazing Related Agric	Siltation	2002	2015
Aquatic Life (13681) - 0.92 miles			
Abandoned Mine Drainage	Metals	2008	2021
	pH	2008	2021
Little Anderson Creek Unnamed To (ID:61830475)			
HUC: 02050201			
Aquatic Life (10334) - 0.59 miles			
Abandoned Mine Drainage	Metals	2004	2017
	pH	2004	2017
Grazing Related Agric	Siltation	2004	2017
Little Anderson Creek Unnamed To (ID:61830481)			
HUC: 02050201			
Aquatic Life (10334) - 0.37 miles			
Abandoned Mine Drainage	Metals	2004	2017
	pH	2004	2017
Grazing Related Agric	Siltation	2004	2017
Little Anderson Creek Unnamed To (ID:61830645)			
HUC: 02050201			
Aquatic Life (10334) - 0.75 miles			
Abandoned Mine Drainage	Metals	2004	2017
	pH	2004	2017
Grazing Related Agric	Siltation	2004	2017

Stream Name *Use Designation (Assessment ID)* *Source*	*Cause*	*Date Listed*	*TMDL Date*
Little Anderson Creek Unnamed To (ID:61830669)			
HUC: 02050201			
Aquatic Life (10334) - 0.67 miles			
Abandoned Mine Drainage	Metals	2004	2017
	pH	2004	2017
Grazing Related Agric	Siltation	2004	2017
Little Anderson Creek Unnamed To (ID:61830955)			
HUC: 02050201			
Aquatic Life (10334) - 1.21 miles			
Abandoned Mine Drainage	Metals	2004	2017
	pH	2004	2017
Grazing Related Agric	Siltation	2004	2017
Little Anderson Creek Unnamed To (ID:61830997)			
HUC: 02050201			
Aquatic Life (10334) - 1.18 miles			
Abandoned Mine Drainage	Metals	2004	2017
	pH	2004	2017
Grazing Related Agric	Siltation	2004	2017
Rock Run			
HUC: 02050201			
Aquatic Life (10333) - 3.7 miles			
Abandoned Mine Drainage	Metals	2002	2015
	pH	2002	2015
Grazing Related Agric	Siltation	2002	2015
Rock Run Unnamed To (ID:61830355)			
HUC: 02050201			
Aquatic Life (10334) - 0.57 miles			
Abandoned Mine Drainage	Metals	2004	2017
	pH	2004	2017
Grazing Related Agric	Siltation	2004	2017

* Attachment B includes a justification of differences between the 1996, 1998, and draft 2000 303(d) lists.
** This segment is a candidate for delisting.

HQ = High Quality Water
CWF = Cold Water Fishes
SWMP = Surface Water Monitoring Program

DIRECTIONS TO THE ANDERSON CREEK WATERSHED

The Anderson Creek Watershed, approximately 78 square miles in area, is located in Clearfield County, Pennsylvania. It is located approximately five miles east of DuBois, Pennsylvania, and seven miles west of Clearfield, Pennsylvania. The boroughs of Curwensville and Grampian and the town of Hepburnia are in the southern part of the watershed. The towns of Chestnut Grove and Rockton are in the west-central section of the watershed. The Anderson Creek Watershed is easily accessible from Interstate 80, U.S. Routes 219 and 322, and Pa. State Highway 879.

SEGMENTS ADDRESSED IN THIS TMDL

The Anderson Creek Watershed is affected by pollution from acid mine drainage (AMD), on-site wastewater, and grazing-related agriculture. The AMD has caused high levels of metals and low pH in the mainstem of Anderson Creek below Little Anderson Creek. Strip mining in the western portion of the watershed accounts for most of the AMD inputs. Little Anderson Creek and its tributary Rock Run have major impacts on Anderson Creek. Little Anderson Creek's flow is substantial and is a major contributor to the mainstem's reduced quality. Eleven of the thirteen major AMD problem areas listed in the Operation Scarlift report (Gwin 1974) are identified as draining into Little Anderson Creek. There also is a problem of excess sediment from grazing-related agriculture in the Little Anderson Creek Subwatershed. The mainstem of Anderson Creek also is affected by mine discharges after its confluence with Little Anderson Creek. Kratzer Run also has been shown to adversely affect the main stem of Anderson Creek. Two major AMD problem areas from the Operation Scarlift report (Gwin 1974) drain into Kratzer Run. Strip mining also is prevalent along Hughey Run, Fenton Run, and Bilger Run, tributaries to Kratzer Run. The Kratzer Run was impacted by excess nutrients from on-site wastewater, as of the original 2003 version of this report. However, the Kratzer Run Sewer Authority has been operating the Grampian Borough Kratzer Run Authority Sewer Treatment Plant under NPDES Permit Number: PA0208647, (last permitted to operate since 2009). The watershed is still influenced by other non-point nutrient influences and associated disturbed land attributed to agricultural operations.

There are active mining operations in the watershed (Attachment C); however, none of the operations produce a discharge. Some are also remining operations (Subchapter F) that are not contributing to point source pollution because they have not created any new discharges and have not caused pre-existing discharges to worsen (Attachment D). All of the discharges in the watershed are from abandoned mines and will be treated as nonpoint sources. The distinction between point and nonpoint 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 nonpoint source. Each segment on the 303(d) list will be addressed as a separate TMDL. These TMDLs will be expressed as long-term, average loadings. Due to the nature and complexity of mining effects on the watershed, expressing the TMDL as a long-term average gives better representation of the data used for calculations.

The use designation for the stream segments in this TMDL can be found in PA Title 25 Chapter 96.

CLEAN WATER ACT REQUIREMENTS

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

Additionally, the federal Clean Water Act and the U.S. Environmental Protection Agency's (USEPA) implementing regulations (40 CFR 130) require:

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

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

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

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

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

Despite these requirements, states, territories, authorized tribes, and USEPA have not developed many TMDLs since 1972. Beginning in 1986, organizations in many states filed lawsuits against the USEPA for failing to meet the TMDL requirements contained in the federal Clean Water Act and its implementing regulations. While USEPA has entered into consent agreements with the plaintiffs in several states, many lawsuits still are pending across the country.

In the cases that have been settled to date, the consent agreements require USEPA to backstop TMDL development, track TMDL development, review state monitoring programs, and fund studies on issues of concern (e.g., AMD, implementation of nonpoint source Best Management Practices (BMPs), etc.). These TMDLs were developed in partial fulfillment of the 1996 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA.*

303(D) LISTING PROCESS

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

The primary method adopted by Pennsylvania Department of Environmental Protection (Pa. DEP) for evaluating waters changed between the publication of the 1996 and 1998 303(d) lists. Prior to 1998, data used to list streams were in a variety of formats, collected under differing protocols. Information also was gathered through the 305(b)[1] reporting process. Pa. DEP is now using the Unassessed Waters Protocol (UWP), a modification of the USEPA Rapid Bioassessment Protocol II (RPB-II), as the primary mechanism to assess Pennsylvania's waters. The UWP provides a more consistent approach to assessing Pennsylvania's streams.

The assessment method requires selecting representative stream segments based on factors such as surrounding land uses, stream characteristics, surface geology, and point-source discharge locations. The biologist selects as many sites as necessary to establish an accurate assessment for a stream segment, and 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 303(d) list with the documented source and cause. A TMDL must be developed for the stream segment. A TMDL is for only one pollutant. If a stream segment is impaired by two pollutants, two TMDLs must be developed for that stream segment. In order for the process to be more effective, adjoining stream segments with the same source and cause listing are addressed collectively, and on a watershed basis.

BASIC STEPS FOR DETERMINING A TMDL

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

1. Collection and summarization of pre-existing data (watershed characterization, inventory contaminant sources, determination of pollutant loads, etc.);
2. Calculate TMDL for the waterbody using USEPA-approved methods and computer models;
3. Allocate pollutant loads to various sources;
4. Determine critical and seasonal conditions;
5. Submit draft report for public review and comments; and
6. USEPA approval of the TMDL.

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

This document will present the information used to develop the Anderson Creek Watershed TMDL.

WATERSHED BACKGROUND

The Anderson Creek Watershed lies in the Appalachian Plateau Province. It is characterized by rolling hills and narrow V-shaped valleys. The maximum elevation of approximately 2,380 feet is found in the headwaters of Bear Run and the minimum elevation of approximately 1,140 feet at the mouth of Anderson Creek. This watershed receives approximately 41.49 inches of precipitation per year. The average annual evapotranspiration is 19.68 inches.

Anderson Creek flows from its headwaters in Pine Township in a southward arc to its confluence with the West Branch of the Susquehanna River in Curwensville. Major tributaries of Anderson Creek include Kratzer Run and Little Anderson Creek. Smaller tributaries include Whitney Run, Burns Run, Bear Run, Irvin Branch, Panther Run, Montgomery Run, Coupler Run, Dressler Run, Blanchard Run, Stony Run, Tanners Run, Bilger Run, Hughey Run, Fenton Run, and Rock Run.

The watershed is primarily forested (83.9 percent) with minimal developed lands (1.3 percent). Agriculture, mainly croplands and hay fields, accounts for 11.7 percent of the land use. Surface coal and clay mines have impacted approximately 2.6 percent of the watershed. Water bodies and wetlands account for the rest of the area.

The surficial geology of the Anderson Creek Watershed is 100 percent sedimentary. The strata include sandstones of the Pottsville Group, Huntley Mountain Formation, and Burgoon Sandstone and interbedded sedimentary strata of the Allegheny Group and Glenshaw Formation. The soils in the watershed are moderately deep to very deep. They range from poorly drained to well drained; the permeability of the soils likewise varies from slow to rapid. Most of the areas in the Anderson Creek Watershed are moderately permeable and well drained. All of the soils in the watershed are formed from acidic bedrock. The soils are therefore strongly acidic without much buffering capacity. The erodibility (K) factor is a measure of inherent soil erosion potential based on the soils texture and composition. The k factor for these soils range from 0.18 to 0.34. Soil erosion is a concern in some areas of the watershed.

Anderson Creek and its tributaries from their source to the DuBois Reservoir are classified as HQ-CWF. This section of the Anderson Creek Watershed is also classified as a conservation area (Department of Environmental Resources 1979a). Below the DuBois Reservoir, Anderson Creek and its tributaries are designated as CWF, with the exception of Bear Run. Bear Run is classified as a HQ-CWF from its source to the Pike Township Municipal Authority dam. Below the dam Bear Run is classified as a CWF.

Bituminous coal has historically been the most economically important geologic resource in Clearfield County. The mineable coal seams are the Upper and Lower Freeport; Upper, Middle, and Lower Kittanning; Clarion; Brookville; and Mercer. The coal seams also are typically associated with clay seams that are commercially valuable for refractory purposes, particularly the Mercer Clay.

The extraction of the coal and clay seams in Clearfield County has been primarily from surface mining. Several of the older mining permits were for the deep mining of the Mercer Clay seam. Strip and drift mining of coal seams that are horizontal in orientation characterize the bituminous coal region; this often resulted in fairly level underground tunnels running for miles as coal was mined along a particular seam. After the mine workings had been abandoned, the tunnels often collapsed, filled up with water, and some discharged to the surface. Many of these discharges are very large and are responsible for much of the water quality impairment in the watershed. Fourteen of the 60-plus discharges have historically accounted for over 80 percent of the AMD loadings (Gwin 1974).

Multiple mining companies have mined large areas of the watershed from the late 1800's to the present (Attachment C). There are four active mining permits in the watershed (Gerald S. Dimmick Cream Hill, MP# 17920801; Johnson Brothers Coal Company, MP# 17990122; Hepburnia Coal Company MP# 17000110; and Hepburnia Coal Company MP# 17823101). There also are two remining permits for Johnson Brothers Coal Company (MP# 17980125) and R. J. Coal Company (MP# 17980121). Pennsylvania's remining program is discussed in Attachment D. None of these permits have been associated with problem discharges.

The Hawk Run District Mining Office foresees new coal mining permits in the Kratzer Run Subwatershed within the next few years. These permits will be limited to the upper coal seams, which are alkaline in nature. There also is a possibility of several new noncoal mining permits in the Little Anderson Creek Subwatershed (Rieg 2002). If any of these new permitted mines produce a problem discharge, the TMDL for Anderson Creek will have to be reevaluated.

There have been numerous grant applications and studies on the Anderson Creek Watershed in the past 15 years.

- In 1989, the Pa. DEP Bureau of Abandoned Mine Reclamation (BAMR) completed a reclamation project removing a dangerous highwall and spoil area on three acres in Bloom Township.

- In 1990, the U.S. Army Corps of Engineers completed a hydrological study on Tanners Run. A control channel was constructed to reduce the flooding impacts in Curwensville from this tributary to Anderson Creek.

- In 1990, Pa. DEP BAMR completed a reclamation project removing a dangerous highwall, a portal, a spoil area, and a vertical opening on 6.2 acres in Bloom Township.

- The Pike Township Municipal Authority manages a public water supply reservoir on Bear Run. In 1991, the Pa. Department of Environmental Resources (Pa. DER) completed a special protection evaluation report and water quality standards review on Bear Run and the Irvin Branch. They recommended that Bear Run's designation be changed to a HQ-CWF to further protect its use as a public water supply. The designation change on Bear Run, from its source to the Pike Township Municipal Authority Dam, occurred shortly thereafter. Bear Run remains classified as a CWF below the dam. Irvin Branch was recommended to remain a CWF because of elevated levels of metals and a lowered pH. Conflicting reports concerning Irvin Branch debate whether or not it is impaired by AMD. In the spring of 2002 an aquatic biology survey using the Pa. DEP Unassessed Waters Program (UWP) will be completed; therefore, Irvin Branch will not be addressed in this document. If any impairment is found, it will be addressed at a later date.

- In 1996, Pa. DEP BAMR completed a reclamation project removing a dangerous highwall and spoil area on 7.7 acres in Union Township.

- In 1997, a sewage treatment plant for the town of Grampian came online. It is run by the Kratzer Run Sewage Authority.

- In 1998 and 1999, Pa. DEP's UWP surveyed the macroinvertebrate communities in most of the watershed to determine if the streams were meeting their designated uses.

- In 1999, Pike Township received 319 funding for an assessment and remediation plan to correct AMD problems in the watershed.

- The Clearfield County Conservation District received a 104(b)3 grant for an assessment of the Upper West Branch Susquehanna River, which includes the Anderson Creek Watershed. The project report was completed in 1999.

- The Cambria County Conservation and Recreation Authority also received funding in 1999 from a Department of Conservation and Natural Resources (DCNR) Rivers Conservation Grant to conduct a study of the Upper West Branch of the Susquehanna River. Their final report was published in 2001 (WRAS 2000).

- In 2000, the Clearfield County Commissioners contacted the USDA-NRCS to begin the process for a PL-566 study of Anderson Creek on behalf of the Anderson Creek Watershed Association. A preliminary assessment was completed through the Headwaters Resource Conservation and Development Council and the Clearfield County Conservation District.
- In February 2000, the Anderson Creek Watershed Association submitted a Growing Greener Grant application to construct a passive treatment system to the Smouse Discharge on the headwaters of Little Anderson Creek. The project was not funded and has not been resubmitted.
- In 2000, the City of DuBois Watershed Commission received a Water Resource Education Network Grant from the League of Women Voters to place a sign at the DuBois Reservoir with a spill response number and customer information.
- In April 2000, the City of DuBois was awarded a Growing Greener Grant to identify the sources of metals, low pH, and other pollutants in order to develop a remediation plan for their drinking water supply. Most of the streams that flow into their reservoir have at least one water quality parameter that does not meet Pa. DEP drinking water standards. The parameters most often violated are pH, iron, manganese, sodium, and aluminum. The final report, entitled the DuBois Reservoir Watershed Water Quality Assessment Project, was completed in 2001. The water quality violations are due to natural conditions and therefore, will not be addressed in this document because they are not caused by AMD. Anderson Creek and its tributaries above the DuBois Reservoir are meeting their designated uses for aquatic life according to the Pa. DEP Unassessed Waters Surveys despite these chemical violations.

There are several active watershed and conservation agencies in the Anderson Creek Watershed: the Anderson Creek Watershed Association, the City of DuBois Watershed Commission, and the Clearfield County Conservation District. Their most recent projects are listed below.

- In 2000, the Anderson Creek Watershed Association began a limestone sand dosing project on Bilger Run to increase the alkalinity in the stream. The second addition of limestone sand took place in July 2001.
- The Clearfield County Conservation District and the Anderson Creek Watershed Association have been monitoring the AMD discharges in the Anderson Creek Watershed on a monthly basis since 2000.
- In January 2000, the City of DuBois submitted a Growing Greener Grant application to construct containment ponds that would stop chemical contamination of the DuBois Reservoir in the event of an accidental pollutant spill on the I-80 bridge that spans Anderson Creek just above the reservoir. This proposal was approved in July 2001.
- In 2001, the City of DuBois Watershed Commission received a Watershed Resource Education Network Grant to produce an educational video on the watershed of the DuBois Reservoir. The video will be completed in June 2002.
- In 2001, Anderson Creek was stocked with brook trout from the DuBois Reservoir for two miles downstream to the unnamed tributary below the Route 322 bridge. No other streams in the watershed were stocked because of either size restrictions or poor water quality (Hollender 2001).

- In December 2001, the DCNR placed the Upper West Branch Susquehanna River Watershed, which includes the Anderson Creek Watershed, on its Rivers Registry.
- Pa. DEP BAMR is in the process of designing a project to reclaim two acres of spoil area and a dangerous highwall in Brady Township. The anticipated bid opening is June 2002.

ACID MINE DRAINAGE TMDLS

TMDL Endpoints

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

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

Table 2. Applicable Water Quality Criteria

Parameter	Criterion Value (mg/l)	Total Recoverable/Dissolved
Iron (Fe)	1.50 0.3	Total Recoverable Dissolved
Manganese (Mn)	1.00	Total Recoverable
Aluminum (Al)	0.75	Total Recoverable
pH *	6.0-9.0	N/A

* The pH values shown will be used when applicable. In the case of freestone streams with little or no buffering capacity, the TMDL endpoint for pH will be the natural background water quality. These values are typically as low as 5.4 (Pennsylvania Fish and Boat Commission).

TMDL Elements (WLA, LA, MOS)

A TMDL equation consists of a wasteload allocation, load allocation and a margin of safety. The wasteload allocation is the portion of the load assigned to point sources. The load allocation is the portion of the load assigned to nonpoint sources. The margin of safety is applied to account for uncertainties in the computational process. The margin of safety may be expressed implicitly (documenting conservative processes in the computations) or explicitly (setting aside a portion of the allowable load).

Hydrology

Flow measurements used for each loading point were taken during several different studies. These data were combined together if the sampling points from different studies were located close together. This allowed for more flow data points to be included in the data set, adding more natural variation.

Data for points KR1, KR2, and A2 did not include measurements of flow where they were taken. Although an average flow was available at points BR2, LA3, RR3, LA2, and A1, the values were not used because the flow data that were available underestimated that actual mean flow at these points. Flow determinations were made at these points using the ArcView Version Generalized Watershed Loading Function (AVGWLF) model. ArcView v3.2 was used to delineate the watersheds and determine watershed areas upstream of the points.

Table 3. Flow Determination for Loading Points in Anderson Creek Watershed

Point Identification	Average Flow (mgd*)	Determination Method	Number of Samples	Date Range
A1	26.11	AVGWLF**		
LA1	0.15	Average	155	1972-2000
UNT LA1	0.15	Average	46	1972-2000
LA2	1.55	AVGWLF**		
UNT LA2	0.09	Average	45	1993-2000
RR1	0.83	Average	26	1989-1995
RR2	1.31	Average	91	1982-1998
UNT RR	0.12	Average	65	1982-2000
RR3	3.02	AVGWLF**		
LA3	10.42	AVGWLF**		
HR1	0.66	Average	79	1972-1999
BR1	1.84	Average	62	1983-1999
BR2	4.14	AVGWLF**		
FR1	0.31	Average	29	1983-1992
KR1	1.41	AVGWLF		
KR2	4.68	AVGWLF		
A2	74.19	AVGWLF		
OSL 211-214	0.30	Average	12	1973-1974
OSL 220	1.53	Average	11	1973-1974
OSL 301	0.20	Average	11	1973-1974
OSL 303	0.38	Average	11	1973-1974
OSL 305	0.13	Average	12	1973-1974
OSL 329	0.12	Average	12	1973-1974
OSL 330	0.01	Average	9	1973
OSL 350	0.05	Average	12	1973-1999
OSL 351	0.02	Average	12	1973-1999
OSL 352	0.04	Average	10	1973-1974

*mgd = million gallons per day
**AVGWLF flow used instead of average flow

TMDL Allocations Summary

Analyses of data for metals for the points shown indicated that there was no single critical flow condition for pollutant sources, and further, that there was no significant correlation between source flows and pollutant concentrations (Table 4). The other points in this TMDL did not have enough paired flow/parameter data to calculate correlations (fewer than 15 paired observations).

Table 4. Correlation Between Metals and Flow for Selected Points

Point Identification	Flow vs.			Number of Samples
	Iron	Manganese	Aluminum	
HR1	0.06	0.01	-	80, 78
BR1	0.13	0.19	-	57
FR1	0.02	0.06	-	26, 23
LA1	0.01	0.01	0.06	129, 126, 18
UNT LA1	0	0.01	-	38, 36
RR1	0.16	0.20	0.06	23
RR2	0.05	0.01	0.10	83, 83, 26
UNT RR	0.01	0.10	-	55,57

Methodology for dealing with metal and pH impairments is discussed in Attachment E. An example calculation from the Swatara Creek TMDL, including detailed tabular summaries of the Monte Carlo results, is presented for the Lorberry Creek TMDL in Attachment F. Information for the TMDL analysis using the methodology described above is contained in the AMD TMDLs by segment section in Attachment G.

This TMDL will focus remediation efforts on the identified numerical reduction targets for each watershed. As changes occur in the watershed, the TMDL may be reevaluated to reflect current conditions. The estimated reductions identified for all points in the watershed are presented in Table 5. Attachment G gives detailed TMDLs by segment analysis for each allocation point.

Table 5. Anderson Creek Watershed AMD Summary Table

Station	Parameter	Measured Sample Data		Allowable		Reduction Identified
		Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)	Percent
LA1						
	Fe	3.73	4.67	0.15	0.19	96
	Mn	5.09	6.37	0.15	0.19	97
	Al	0.25	0.31	0.21	0.26	16
	Acidity	24.91	31.16	1.49	1.86	94
	Alkalinity	10.87	13.60			
UNT LA1						
	Fe	2.02	2.53	0.36	0.45	82
	Mn	3.54	4.43	0.18	0.23	95
	Al	0.11	0.14	0.11	0.14	0
	Acidity	0.43	0.54	0.44	0.55	0
	Alkalinity	27.52	34.43			
LA2						
	Fe	0.52	6.72	0.34	4.40	0*
	Mn	3.56	46.02	0.25	3.23	91*
	Al	0.32	4.14	0.21	2.71	34*
	Acidity	2.66	34.39	1.38	17.84	0*
	Alkalinity	12.61	163.01			

Station	Parameter	Measured Sample Data		Allowable		Reduction Identified
		Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)	Percent
UNT LA2						
	Fe	0.63	0.47	0.25	0.19	60
	Mn	2.27	1.70	0.16	0.12	93
	Al	1.48	1.11	0.07	0.05	95
	Acidity	10.44	7.84	1.35	1.01	87
	Alkalinity	11.93	8.95			
OSL 352						
	Fe	78.80	26.29	0.63	0.21	99.2
	Mn	No data available				
	Al	No data available				
	Acidity	860.00	286.90	0	0	100
	Alkalinity	0	0			
OSL 329						
	Fe	143.02	143.13	0.57	0.57	99.6
	Mn	No data available				
	Al	No data available				
	Acidity	760.00	760.61	0	0	100
	Alkalinity	0	0			
OSL 330						
	Fe	1.82	0.15	0.42	0.04	77
	Mn	No data available				
	Al	No data available				
	Acidity	201.40	16.80	0	0	100
	Alkalinity	0	0			
OSL 301						
	Fe	153.13	255.42	0.61	1.02	99.6
	Mn	19.79	33.01	-	-	-
	Al	46.67	77.85	-	-	-
	Acidity	929.33	1,550.12	0	0	100
	Alkalinity	0.47	0.78			
OSL 303						
	Fe	20.66	65.48	0.41	1.30	98
	Mn	8.00	25.35	-	-	-
	Al	7.48	23.71	-	-	-
	Acidity	232.62	737.22	0	0	100
	Alkalinity	0	0			
OSL 305						
	Fe	49.11	53.25	0.44	0.48	99.1
	Mn	No data available				
	Al	No data available				
	Acidity	479.17	519.52	0	0	100
	Alkalinity	0	0			
RR1						
	Fe	2.17	15.02	0.54	3.74	75
	Mn	18.86	130.55	0.38	2.63	98
	Al	2.70	18.69	0.32	2.22	88
	Acidity	82.54	571.36	0.25	1.73	99.7
	Alkalinity	0.69	4.78			

Station	Parameter	Measured Sample Data		Allowable		Reduction Identified
		Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)	Percent
RR2						
	Fe	1.62	17.70	0.31	3.39	47*
	Mn	17.49	191.09	0.17	1.86	97*
	Al	2.76	30.15	0.28	3.06	78*
	Acidity	62.88	686.99	3.77	41.19	65*
	Alkalinity	14.35	156.78			
UNT RR						
	Fe	0.62	0.62	0.30	0.30	52
	Mn	22.03	22.05	0.20	0.20	99.1
	Al	0.80	0.80	-	-	-
	Acidity	59.38	59.43	1.19	1.19	98
	Alkalinity	5.99	5.99			
RR3						
	Fe	2.61	65.74	0.31	7.81	80*
	Mn	20.20	508.77	0.20	5.04	97*
	Al	0.92	23.17	0.19	4.79	0*
	Acidity	76.85	1,935.61	4.61	116.11	82*
	Alkalinity	17.88	450.34			
LA3						
	Fe	5.06	439.73	0.56	48.67	0*
	Mn	4.74	411.92	0.52	45.19	0*
	Al	5.47	475.36	0.38	33.02	92*
	Acidity	78.00	6,778.42	0	0	0*
	Alkalinity	0	0			
OSL 350						
	Fe	111.02	46.30	0.44	0.18	99.6
	Mn	0.91	0.38	-	-	-
	Al	13.00	5.42	-	-	-
	Acidity	872.92	364.01	0	0	100
	Alkalinity	0	0			
OSL 351						
	Fe	45.93	7.66	0.41	0.07	99.1
	Mn	0.10	0.02	-	-	-
	Al	0.20	0.03	-	-	-
	Acidity	604.15	100.77	0	0	100
	Alkalinity	4.00	0.67			
HR1						
	Fe	0.62	3.41	0.25	1.38	59
	Mn	0.19	1.05	0.19	1.05	0
	Al	0.21	1.16	0.21	1.16	0
	Acidity	8.31	45.74	1.16	6.39	86
	Alkalinity	9.58	52.73			
OSL 211-214						
	Fe	7.40	18.51	0.07	0.18	99
	Mn	No data available				
	Al	No data available				
	Acidity	271.54	679.39	0	0	100
	Alkalinity	0	0			

Station	Parameter	Measured Sample Data		Allowable		Reduction Identified
		Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)	Percent
BR1						
	Fe	1.66	25.47	0.20	3.07	57*
	Mn	6.01	92.23	0.24	3.68	96*
	Al	2.44	37.44	0.15	2.30	94*
	Acidity	43.05	660.63	0.86	13.20	0*
	Alkalinity	4.76	73.05			
BR2						
	Fe	0.87	30.04	0.40	13.81	0*
	Mn	6.51	224.77	0.31	10.70	92*
	Al	1.73	59.73	0.12	4.14	83*
	Acidity	45.59	1,574.11	0.91	31.42	85*
	Alkalinity	4.54	156.76			
FR1						
	Fe	0.51	1.32	0.19	0.49	63
	Mn	1.92	4.96	0.13	0.34	93
	Al	1.56	4.03	-	-	-
	Acidity	5.50	14.22	3.24	8.38	41
	Alkalinity	22.72	58.74			
KR1						
	Fe	0.58	6.82	0.58	6.82	0
	Mn	0.13	1.53	0.13	1.53	0
	Al	0.25	2.94	0.25	2.94	0
	Acidity	0.50	5.88	0.51	6.00	0
	Alkalinity	53.00	623.25			
KR2						
	Fe	0.83	32.40	-	-	-
	Mn	0.87	33.96	-	-	-
	Al	0.38	14.83	-	-	-
	Acidity	1.53	59.72	-	-	-
	Alkalinity	22.13	863.76	-	-	
OSL 220						
	Fe	10.17	129.77	0.51	6.51	95
	Mn	No data available				
	Al	No data available				
	Acidity	86.83	1,107.97	0	0	100
	Alkalinity	0	0			
A2						
	Fe	0.28	173.25	0.28	173.25	0*
	Mn	0.92	569.25	-	-	0*
	Al	0.79	488.81	-	-	0*
	Acidity	12.58	7,783.81	8.55	5,290.27	0*
	Alkalinity	1.63 (17.85)ϑ	1,008.55 (11,044.59)ϑ			

* The Percent Reductions for LA2, RR2, RR3, LA3, BR1, BR2, and A2 are found in Attachment G Tables G5, G16, G20, G23, G30, G33, and G40 respectively.
ϑ Alkalinity Value used as water quality standard

Recommendations

There have been several reports published since 1974 with recommendations for treating AMD in the Anderson Creek Watershed. The earliest of these reports is the Operation Scarlift Report (Gwin 1974). This report credited approximately 72 percent of the acid load to six major discharges: 211-214-Stronach Discharge, 220-Widemire Discharge, 301-Draucker Discharge, 303-Wingert Discharge, 305-Little Anderson Seeps, and 329-Korb Discharge. Reclamation of any one or a combination of these discharges would have a major impact on the water quality in Anderson Creek.

The Scarlift Report prioritized reclamation based on the relative acid load, cost of reclamation, and relative benefit to the receiving stream. The first priority listed was the Draucker Discharges, OSL 301, 301a, and 302, because they are a major polluter of Little Anderson Creek (Gwin 1974). Gwin Engineering, Inc. (1974) recommended that the entries to the mine workings should be sealed to inundate the workings and the strip mine areas backfilled and planted. They further state that if a breakout should occur, it would be at higher elevations and should have improved water quality. The Anderson Creek Watershed Association also lists the Draucker Discharge as a priority site (Smeal 2001). There is a large amount of land area available for a passive treatment system if the landowner(s) would agree to a project.

The second priority site listed in the Scarlift report was the Wingert Discharge, OSL 303. Gwin Engineering, Inc. (1974) recommended that the strip mine area be backfilled and planted to cover the exposed coal seams and a diversion ditch installed to prevent the headwaters of Little Anderson Creek from flowing over the highwall. They also recommended a clay barrier around the highwall to contain any AMD from the deep mine workings. The Anderson Creek Watershed Association also lists the Wingert Discharge as a priority. Reclamation at this site would substantially clean several miles of the headwaters of Little Anderson Creek. There is enough land to place a passive treatment system and the landowner is very interested in reclamation work (Smeal 2001).

The Widemire Discharges, OSL 220 and 221, are the next priority in the Scarlift report because they contribute approximately 50 percent of the acidity in Kratzer Run. Gwin Engineering, Inc. (1974) recommended that all the deep mine entries be sealed to inundate the mine workings and eliminate the acid discharge. The probability for breakouts is low as long as the seals are placed sufficiently inside the entries because the terrain rises over the mine workings. The Widemire Discharges also made the Anderson Creek Watershed Association's list of priority sites (Smeal 2001).

The Korb Discharges (OSL 329, 330, and 352) are fourth on the priority list of the Scarlift Report. Reclamation of these discharges would significantly improve the water quality of Little Anderson Creek. Gwin Engineering, Inc. (1974) recommended sealing all six openings of the deep mine to inundate the mine workings and backfilling and planting of the strip mine areas. If a breakout would occur at higher elevations it should have improved water quality. The Anderson Creek Watershed Association also lists the Korb Discharges on their priority list (Smeal 2001).

The Stronach Discharges, OSL 211-214, were listed as seventh on the priority list by Gwin Engineering, Inc. (1974). The Stronach Discharges are diffuse and will be difficult to reclaim but the improvement would be highly beneficial to Bilger Run. The Anderson Creek Watershed Association has been adding limestone sand to Bilger Run since 2000. These additions have raised the alkalinity in the stream and the practice should continue until other treatment methods become available.

The Little Anderson Seeps Area, OSL 305, was low on the Scarlift Report's priority list. At the time of the report there was still a liability question about the current coal operation's impact on the discharges. That claim has since been settled and the discharges remain. The Scarlift Report also listed the Spencer Discharges, OSL 330 and 352, as top priorities for reclamation. These discharges can produce heavy acid loads after periods of rainfall. Gwin Engineering, Inc. (1974) suggested placing an impervious barrier along the deep mine entries so that the water level would rise and prevent atmospheric contact with pyretic materials, thereby improving the water quality of the discharge.

The Headwaters Resource Conservation and Development Council with the Clearfield County Conservation District completed the Anderson Creek Preliminary Assessment for PL-566 Planning Assistance from the USDA Natural Resources Conservation in October 1999. This preliminary report also lists the discharges mentioned above as priorities for reclamation (Lincoln 1999). The assessment adds OSL Discharge 204 to the list for reclamation. Water collects in the strip cut and percolates through the exposed spoil material to be discharged at the toe of the spoil bank into Fenton Run. Gwin Engineering, Inc. (1974) recommended a clay barrier around the highwalls to prevent seepage and that the area be backfilled and planted.

In February 2000, the Anderson Creek Watershed Association submitted a Growing Greener application for a passive treatment system for the Smouse Discharge, OSL 341-343. This project would recover almost a mile of headwater stream in Little Anderson Creek Watershed (Anderson Creek Watershed Association 2000). The Smouse Discharge was listed by Gwin Engineering, Inc. (1974) as the eighth priority on the Scarlift Report for Anderson Creek Watershed. The area has since been regraded and backfilled, but the problem discharge remains. The Growing Greener application by the Anderson Creek Watershed Association was not funded and has not been resubmitted (Smeal 2001).

This TMDL concurs with the sites for reclamation set above. However, additional data collection has shown a difference in the priority list based on acid loadings. The first 10 priority discharges are listed below:

1. The Drauker Discharges, OSL 301, into Little Anderson Creek.
2. The Widemire Discharge, OSL 220, into Kratzer Run.
3. The Korb Discharge, OSL 329, into Little Anderson Creek.
4. The Wingert Discharge, OSL 303, into Little Anderson Creek.
5. The Stronach Discharges, OSL 211-214, into Bilger Run
6. The Little Anderson Seeps, OSL 305, into Little Anderson Creek.
7. The Korb Discharge, OSL 350, into an Unnamed Tributary to Anderson Creek.
8. The Spencer Discharge, OSL 352, into Little Anderson Creek.

9. The Korb Discharge, OSL 351, into an Unnamed Tributary to Anderson Creek.
10. The Spencer Discharge, OSL 330, into Little Anderson Creek.

The Smouse Discharge, OSL 341-343, could not be included in the TMDL analysis because there were no flow data. However, the water quality data for the discharge and its location in the headwaters of the Unnamed Tributary to Little Anderson Creek support its placement on the TMDL priority list as well.

The Anderson Creek Watershed Association has been active in the watershed since 1998. They hold public meetings the first Thursday of every month excluding June, July, and August. The Watershed Association, along with an AmeriCorps member of the Clearfield County Conservation District, have been taking water quality samples from the major discharges in the watershed. The collections should continue so that current, seasonal data will be available for treatment system designs.

The Anderson Creek Technical Committee was formed in 1999 to prepare a draft watershed restoration plan for Anderson Creek. The committee proposed a Geographic Information System (GIS) Watershed Modeling System to help identify, evaluate, and recommend treatment facilities or BMPs for point and nonpoint pollution in the watershed. The Clearfield County Conservation District and the Anderson Creek Watershed Association are submitting a Growing Greener Grant application in February 2002 to finish the watershed restoration plan (Smeal 2002).

There are several active watershed and conservation agencies in the Anderson Creek Watershed including the Anderson Creek Watershed Association, City of DuBois Watershed Commission, and the Clearfield County Conservation District. There also is a large amount of interest shown by the various municipalities and concerned citizens to start reclaiming the AMD discharges. These groups should be given as much support as possible in their reclamation efforts.

SEDIMENT AND NUTRIENT TMDLS

Pollutants & Sources

Nutrients and siltation have been identified as the pollutants causing designated use impairments in the Anderson Creek Watershed. Subbasin 1 represents the portion of the watershed affected by siltation. The watersheds in Subbasin 1 are comprised of Little Anderson Creek and Rock Run (Attachment A). Subbasin 2 represents the portion of the watershed affected by nutrient impairment. Kratzer and Bilger Run are the two streams in Subbasin 2 (Attachment A). There is one NPDES permitted wastewater discharge present within the Kratzer Run subbasin. Based on the assessment data and visual observations, abandoned mine and agricultural lands are the sources of the siltation in Subbasin 1. Some areas are sparsely vegetated where acid conditions exist, contributing to significant sediment runoff. There also are portions of the watershed where livestock have unlimited access to the stream, and no riparian buffer exits.

For Subbasin 2, the assessment data stated that Kratzer Run was impacted by excess nutrients from on-site wastewater, as of the original 2003 version of this report. However, the Kratzer Run Sewer Authority has been operating the Grampian Borough Kratzer Run Authority Sewer Treatment Plant under NPDES Permit Number: PA0208647, (last permitted to operate since 2009). The watershed is still influenced by other non-point nutrient influences and associated disturbed land attributed to agricultural operations.

TMDL Endpoints

In an effort to address the sediment nutrient impairments found in the Anderson Creek Watershed, TMDLs were developed for sediment and phosphorus. The sediment and phosphorus TMDLs are intended to address the impairments from agriculture, mining and developed land uses that were first identified in Pennsylvania's 2000 305(b) report (Table 1). The decision to use phosphorus load reductions to address nutrient enrichment is based on an understanding of the relationship between nitrogen, phosphorus, and organic enrichment in stream systems. Elevated nutrient loads (nitrogen and phosphorus in particular) can lead to increased productivity of plants and other organisms (Novotny and Olem, 1994). In aquatic ecosystems the quantities of trace elements are typically plentiful; however, nitrogen and phosphorus may be in short supply. The nutrient that is in the shortest supply is called the limiting nutrient because its relative quantity affects the rate of production (growth) of aquatic biomass. If the limiting nutrient load to a water body can be reduced, the available pool of nutrients that can be utilized by plants and other organisms will be reduced and, in general, the total biomass can subsequently be decreased as well (Novotny and Olem, 1994). In most efforts to control the eutrophication processes in water bodies, emphasis is placed on the limiting nutrient. This is not always the case, however. For example, if nitrogen is the limiting nutrient, it still may be more efficient to control phosphorus loads if the nitrogen originates from difficult to control sources such as nitrates in ground water.

In most freshwater systems, phosphorus is the limiting nutrient for aquatic growth. In some cases, however, the determination of which nutrient is the most limiting is difficult. For this reason, the ratio of the amount of nitrogen to the amount of phosphorus is often used to make this determination (Thomann and Mueller, 1987). If the nitrogen/phosphorus (N/P) ratio is less than 10, nitrogen is limiting. If the N/P ratio is greater than 10, phosphorus is the limiting nutrient. For Anderson Creek, the average N/P ratio is approximately 18 for Subbasin 2, which points to phosphorus as the limiting nutrient. Controlling the phosphorus loading in Subbasin 2 will limit plant growth, thereby helping to eliminate use impairments currently being caused by excess nutrients.

Reference Watershed Approach

The TMDL developed for Anderson Creek Subbasins 1 and 2 addresses sediment and phosphorus respectively. Because neither Pennsylvania nor USEPA has numeric water quality criteria for these pollutants, a method was developed to determine water quality objectives that would result in the impaired stream segments attaining their designated uses. The method employed for these TMDLs is termed the "Reference Watershed Approach."

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

Selection of the Reference Watershed

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

Curry Creek, stream code 26760, was selected as the reference watershed for developing the Anderson Creek Subbasin TMDLs. The Curry Creek Watershed is located just west of Anderson Creek in Clearfield County, Pennsylvania. The watershed is located in State Water Plan Subbasin 8B, and protected uses include aquatic life and recreation. As part of the greater Susquehanna River Basin, Curry Creek is also considered a Migratory Fishery. The entire basin is currently designated as CWF under §93.9z in Title 25 of the Pa. Code (Commonwealth of Pennsylvania, 2001). Based on the Pa. DEP's 305(b) report database, Curry Creek is currently attaining its designated uses. The attainment of designated uses is based on sampling done by the Pa. DEP in 1999.

Drainage area, location, and other physical characteristics of the Anderson Creek Subbasins were compared to the reference watershed (Table 6). Land cover/use distributions in both watersheds are similar. Forested land is the dominant land use category in both the Curry Creek Watershed (90 percent) and the Anderson Creek Watershed Subbasins 1 (74 percent) and 2 (73 percent). Surface geology in both watersheds is comprised almost entirely of sedimentary rocks. Bedrock geology primarily affects surface runoff and background nutrient loads through its influences on soils, landscape, fracture density, and directional permeability. The Anderson Creek Subbasins and Curry Creek are nearly identical in terms of precipitation, soil types, and soil K factor.

Table 6. Comparison Between Anderson Creek and Curry Creek Watersheds

Attribute	Watershed		
	Subbasin 1	**Subbasin 2**	**Curry Creek**
Physiographic Province	Appalachian Plateau (100%)	Appalachian Plateau (100%)	Appalachian Plateau (100%)
Area (mi^2)	21	15	14
Land Use	Forested (74%) Agriculture (17%) Disturbed (9%)	Forested (73%) Agriculture (21%) Disturbed (4%) Development (2%)	Forested (90%) Agriculture (6%) Disturbed (4%)
Geology	Sandstone – Interbedded Sedimentary (100%)	Sandstone – Interbedded Sedimentary (100%)	Sandstone – Interbedded Sedimentary (100%)
Soils	Udorthents-Ernest-Gilpin Hazleton-DeKalb-Buchanan Gilpin-Ernest-Cavode Hazleton-Cookport-Ernest	Udorthents-Ernest-Gilpin Hazleton-DeKalb-Buchanan Gilpin-Ernest-Cavode	Udorthents-Ernest-Gilpin Hazleton-DeKalb-Buchanan Gilpin-Ernest-Cavode
Dominant HSG	C	C	C
K Factor	0.25 – 0.30	0.25 – 0.30	0.25 – 0.30
20-Yr. Ave. Rainfall (in)	43.4	43.4	42.1
20-Yr. Ave. Runoff (in)	3.2	3.0	2.5

Watershed Assessment and Modeling

TMDLs for the Anderson Creek Watershed were developed using AVGWLF as described in Attachment I. The AVGWLF model was used to establish existing loading conditions for the Anderson Creek Watershed and the Curry Creek reference watershed. All modeling outputs have been attached to this TMDL as Attachment J. The Susquehanna River Basin Commission staff visited the Anderson Creek and Curry Creek Watersheds in the fall of 2000, and again in the summer and fall of 2001. The field visits were conducted to get a better understanding of existing conditions that might influence the AVGWLF model. General observations of the individual watershed characteristics include:

Anderson Creek Watershed

- Local geology dominated by sedimentary rocks.
- Significant presence of abandoned mine lands.
- Significant lack of vegetation in some areas due to acid soil conditions.
- Presence of grazing cattle, with general lack of riparian buffers.
- General lack of strip cropping and contour plowing.

Curry Creek Watershed

- Local geology dominated by sedimentary rocks.
- Forest buffers along streams.

Minor adjustments were made to specific parameters used in the AVGWLF model based on observations made while touring the watersheds. These adjustments are summarized at the end of Attachment I.

The AVGWLF model produced information on watershed size, land use, sediment loading, and phosphorus loading (Attachments J and K). The phosphorus and sediment loads represent an annual average over a 20-year period (1976 to 1996). This information was then used to calculate existing unit area loading rates for the Anderson Creek and Curry Creek Watersheds.

Unit area loading rates were estimated by dividing the mean annual loading (lbs/yr) of each pollutant by the total area (acres) of the watershed. Unit area loading rates for sediment and total phosphorus in Subbasins 1 and 2 of the Anderson Creek Watershed were estimated to be 239.69 lbs/acre/yr and 0.21 lbs/acre/yr, respectively (Table 7). Estimated unit area loading rate for total phosphorus in the Curry Creek Watershed was 0.16 lbs/acre/yr.

Table 7. Unit Area Loading Rates for the Anderson and Curry Watersheds

Watershed	Area (ac)	Mean Annual Loading (lbs/yr)	Unit Area Loading Rate (lbs/ac/yr)
Subbasin 1-Sediment	6,626.31	1,588,248.60	239.69
Subbasin 2-Phosphorus	9,943.20	2,052.30	0.21
Curry	8,920.50	Sediment— 924,442.80 Phosphorus — 1,430.43	Sediment — 103.63 Phosphorus — 0.16

TMDLs

Targeted TMDL values for the Anderson Creek Watershed were established based on current loading rates for sediment and phosphorus in the Curry Creek reference watershed. Biological assessments have determined that Curry Creek is currently attaining its designated uses. Reducing the loading rate of sediment and phosphorus in the Anderson Creek Watershed to levels equivalent to those in the Curry Creek Watershed will provide conditions favorable for the reversal of current use impairments.

Targeted TMDLs

Targeted TMDL values for sediment and phosphorus were determined by multiplying the total area of Subbasins 1 and 2 of the Anderson Creek Watershed (6,626.31 and 9,943.2 acres respectively) by the appropriate unit-area loading rate for the Curry Creek Watershed (Table 8). The existing mean annual loading of sediment to Subbasin 1 (1,588,248.60 lbs/yr) will need to be reduced by 57 percent to meet the targeted TMDL of 686,684.51 lbs/yr. Meeting the targeted phosphorus TMDL of 1,590.90 lbs/yr for Subbasin 2 will require a 22 percent reduction in the current mean annual loading (2,052.3 lbs/yr).

Table 8. Targeted TMDLs for the Anderson Creek Watershed

Pollutant	Area (ac.)	Unit Area Loading Rate Curry Watershed (lbs/ac/yr)	Targeted TMDL (lbs/yr)
Sediment – Subbasin 1	6,626.31	103.63	686,684.51
Phosphorus – Subbasin 2	9,943.2	0.16	1,590.90

Targeted TMDL values were than used as the basis for load allocations and reductions in the Anderson Creek Watershed, using the following two equations:

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

where:

TMDL = Total Maximum Daily Load
WLA = Waste Load Allocation (point sources)
LA = Load Allocation (nonpoint sources)
ALA = Adjusted Load Allocation
LNR = Loads Not Reduced

Wasteload Allocation

The waste load allocation (WLA) portion of the TMDL equation is the total loading of a pollutant that is assigned to point sources. A search of the Pennsylvania Department of Environmental Protection's (Department) efacts permit database identified no known NPDES permits in Subbasin 1, Anderson Creek Watershed (watersheds in Subbasin 1 are comprised of Little Anderson Creek and Rock Run (Attachment A)). No WLA was adjusted based on permit information; however, an allocation of 1% of the Sediment TMDL – Subbasin 1 (686,684.51 lbs./yr.) was incorporated as a bulk reserve (6,866.85 lbs./yr.) for the dynamic nature of future permit activity.

WLA= 686,684.51 lbs./yr. (TMDL) x 0.01 (1% Bulk Reserve)

WLA (Sediment – Subbasin 1) = 6,866.85 lbs./yr.

A search of the Pennsylvania Department of Environmental Protection's (Department) efacts permit database identified one known NPDES permitted wastewater discharge present within Kratzer Run, Subbasin 2. The Grampian Borough, Kratzer Run Authority Sewer Treatment Plant operates under the NPDES Permit Number: PA0208647. Information from this permit and its discharge to Kratzer Run was used in the WLA adjustment. An additional allocation of 1% of the Phosphorus TMDL – Subbasin 2 (1,590.9 lbs./yr.) was incorporated as a bulk reserve (15.9 lbs./yr.) for the dynamic nature of future permit activity.

The WLA portion of the TMDL equation is the total loading of a pollutant that is assigned to point source and the bulk reserve (see below).

WLA= 0.08 MGD Flow * 2.0 mg/L monthly average concentration* 8.34* 365= 487.35 lbs./yr. or 1.34 lbs./day

WLA= 487.35 lbs./yr. (WLA for the NPDES permit) or 1.34 lbs./day

WLA= 487.35 lbs./yr. (WLA for NPDES permits) + 15.9 lbs./yr. (1% Bulk Reserve)

WLA (Phosphorus – Subbasin 2) = 503.3 lbs./yr.

Margin of Safety

The margin of safety (MOS) is that portion of the pollutant loading that is reserved to account for any uncertainty in the data and computational methodology used for the analysis. For this analysis, the MOS is explicit. Ten percent of the targeted TMDLs for sediment and phosphorus were reserved as the MOS. Using 10 percent of the TMDL load is based on professional judgment and will provide an additional level of protection to the designated uses of Anderson Creek. The MOS used for the TMDLs ((Sediment – Subbasin 1) and (Phosphorus – Subbasin 2)) was 68,668.45 lbs/yr and 159.1 lbs/yr, respectively.

MOS (Sediment – Subbasin 1) = 686,684.51 lbs/yr (TMDL) x 0.1 = 68,668.4 lbs/yr
MOS (Phosphorus – Subbasin 2) = 1,590.9 lbs/yr (TMDL) x 0.1 = 159.1 lbs/yr

Load Allocation

The load allocation (LA) is that portion of the TMDL that is assigned to nonpoint sources. LAs for sediment and phosphorus were computed by subtracting the MOS value and the WLA from the TMDL value. LAs for sediment and phosphorus were 611,149.21 lbs/yr and 928.6 lbs/yr, respectively.

LA (Sediment – Subbasin 1) =
686,684.51 lbs/yr (TMDL) – 68,668.45 lbs/yr (MOS) – 6,866.85 lbs./yr. (WLA) = 611,149.21 lbs/yr

LA (Phosphorus – Subbasin 2) =
1,590.9 lbs/yr (TMDL) – 159.1 lbs/yr (MOS) – 503.3 lbs./yr (WLA) = 928.6 lbs/yr

Adjusted Load Allocation

The adjusted load allocation (ALA) is the actual portion of the LA distributed among those nonpoint sources receiving reductions. It is computed by subtracting those nonpoint source loads that are not being considered for reductions (loads not reduced or LNR) from the LA. Since the Anderson Creek Subbasin TMDLs were developed to address impairments resulting from agricultural, development, and mining activities, only these sources were considered for reductions. Phosphorus reductions were made to agricultural (cropland and pastureland) and associated transitional/disturbed land uses for Subbasin 1 and 2. Those land uses/sources for which existing loads were not reduced (FOREST, LO_INT_DEV) were carried through at their existing loading values (Table 9). The ALA for the TMDLs (Sediment – Subbasin 1) and (Phosphorus – Subbasin 2)) were 584,549.21 lbs/yr and 346.0 lbs/yr, respectively.

Table 9. Load Allocations, Loads Not Reduced, and Adjusted Load Allocations for the Anderson Creek Subbasin TMDLs

	Subbasin 1 Sediment (lbs/yr)	*Subbasin 2 Total P (lbs/yr)*
Load Allocation	611,149.2	928.6
Loads Not Reduced	26,600.0	582.6
FOREST	26,600.0	560.0
LO_INT_DEV	0.0	22.6
Adjusted Load Allocation	584,549.2	346.0

Summary

Both the sediment and phosphorus TMDLs established for the Anderson Creek Subbasins consists of a LA and a MOS. No TMDL was established for nitrogen because the stream is phosphorus limited. The individual components of the TMDLs are summarized in Table 10.

Table 10. TMDL, WLA, MOS, LA, LNR, and ALA for the Anderson Creek Subbasins

Component	***Subbasin 1 Sediment (lbs/yr)***	***Subbasin 2 Total Phosphorus (lbs/yr)***
TMDL (Total Maximum Daily Load)	686,684.5	1,590.9
WLA (Wasteload Allocation)	6,866.9	503.3
MOS (Margin of Safety)	68,668.5	159.1
LA (Load Allocation)	611,149.2	928.6
LNR (Loads Not Reduced)	26,600.0	582.6
ALA (Adjusted Load Allocation)	584,549.2	346.0

Calculation of Sediment and Nutrient Load Reductions

ALAs established in the previous section represent the annual sediment and total phosphorus loads that are available for allocation between contributing sources in the Anderson Creek Subbasins. The ALA for sediment and phosphorus was allocated between agricultural, developed, and disturbed/abandoned-mine land uses. LA and reduction procedures were applied to the Anderson Creek Subbasins using the Equal Marginal Percent Reduction (EMPR) allocation method (Attachment L). The LA and EMPR procedures were performed using MS Excel and results are presented in Attachment M.

In order to meet the sediment TMDL (686,684.51 lbs/yr), the sediment load currently emanating from sources (1,588,248.60 lbs/yr) must be reduced to 591,416 lbs/yr (Table 11). This can be achieved through a 23 percent reduction in current sediment loading from agriculture and developed lands, along with a 67 percent reduction for disturbed/abandoned mine lands. Meeting the total phosphorous TMDL (1,590.9 lbs/yr) will require a reduction of current phosphorous loading (2,052.3 lbs/yr) to 346.0 lbs/yr (Table 11). This is achievable through individual target load reductions of: 72 percent from cropland, 55 percent from hay/pasture, and 55 percent of associated transitional/disturbed land.

Table 11. Sediment and Phosphorus Load Allocations & Reductions for the Anderson Creek Subbasins

Sediment – Subbasin 1						
Pollutant Source	***Acres***	***Unit Area Loading Rate (lbs/ac/yr)***		***Pollutant Loading (lbs/yr)***		***% Reduction***
		Current	***Allowable***	***Current***	***Allowable (LA)***	
Hay/Pasture	398.8	43.1	33.3	17,200.0	13,265.7	23
Cropland	672.1	234.5	180.9	157,600.0	121,550.9	23
Developed	41.4	14.5	11.2	600.0	462.8	23
Disturbed/ Abandoned-mine land	661.4	2096.0	689.7	1,386,249.6	456,136.7	67
Total				**1,561,649.6**	**591,416.1**	**62**
Total Phosphorus – Subbasin 2						
Hay/Pasture	560.9	0.4	0.1	103.50	46.7	55
Cropland	1,522.2	0.2	0.1	558.10	157.6	72
Disturbed/Transitional	341.86	0.9	0.4	320.80	144.8	55
Point Sources				487.3		
Total				**1,469.7**	**349.1**	**65**

Consideration of Critical Conditions

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

Consideration of Seasonal Variations

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

Recommendations for Implementation

TMDLs represent an attempt to quantify the pollutant load that may be present in a waterbody and still ensure attainment and maintenance of water quality standards. The Anderson Creek Subbasin 1, Sediment TMDL and the Subbasin 2, Phosphorus TMDL identify the necessary overall load reductions for sediment and total phosphorus currently causing use impairments and distributes those reduction goals to the appropriate nonpoint sources. Reaching the reduction goals established by this TMDL will only occur through Best Management Practices (BMPs). BMPs that would be helpful in lowering the amounts of sediment and nutrients reaching Anderson Creek include the following: streambank stabilization and fencing; riparian buffer strips; strip cropping; conservation tillage; stormwater retention wetlands; and heavy use area protection, Some of the work needed is actively being pursued through efforts targeting the abandoned mine lands.

The Natural Resources Conservation Service maintains a National Handbook of Conservation Practices (NHCP), which provides information on a variety of BMPs. The NHCP is available online at http://www.ncg.nrcs.usda.gov/nhcp_2.html. Many of the practices described in the handbook could be used in the Anderson Creek Watershed to help limit sediment impairments. Determining the most appropriate BMPs, where they should be installed, and actually putting them into practice, will require the development and implementation of restoration plans. Development of any restoration plan will involve the gathering of site-specific information regarding current land uses and existing conservation practices. This type of assessment has been ongoing in the Anderson Creek Watershed, and it is strongly encouraged to continue.

The nitrogen, phosphorus and sediment reductions for the Bay TMDL are independent of those needed to implement any TMDLs developed to address nitrogen, phosphorus and sediment-related impairments in Pennsylvania's non-tidal waterbodies (including Anderson Creek watershed), although their reduction goals and strategies do overlap. For example, the implementation planning framework, developed by the Bay watershed jurisdictions in partnership with EPA, provides a staged approach to achieving Bay TMDL reduction goals that are also applicable to implementation of nitrogen, phosphorus and sediment TMDLs in local non-tidal watersheds. In short, reductions required to meet the Chesapeake Bay TMDL will also support the restoration and protection of local water quality.

The sediment reductions for the Bay TMDL are independent of those needed to implement any TMDLs developed to address sediment-related impairments in Pennsylvania's non-tidal waterbodies, although their reduction goals and strategies do overlap. For example, the implementation planning framework, developed by the Bay watershed jurisdictions in partnership with EPA, provides a staged approach to achieving Bay TMDL sediment reduction goals that is also applicable to implementation of sediment TMDLs in local non-tidal watersheds. In short, sediment reductions required to meet the Chesapeake Bay TMDL will also support the restoration and protection of local water quality and vice versa. Links to Chesapeake Bay TMDL related documents are provided below.

The Federal Nonpoint Source Management Program (§ 319 of the Clean Water Act) is one funding source for nonpoint source pollution reduction BMPs, such as those described above. This grant program provides funding to assist in implementing Pennsylvania's Nonpoint Source Management Program. This includes funding for abandoned mine drainage, agricultural and urban run-off, and natural channel design/streambank stabilization projects. Information on Pennsylvania's Nonpoint Source Management Program can be found at: http://www.portal.state.pa.us/portal/server.pt/community/nonpoint_source_management/10615

A second funding source is Pennsylvania's Growing Greener Watershed Grants, which provides nearly $547 million in funding to clean up non-point sources of pollution throughout Pennsylvania. Examples of projects include acid mine drainage abatement, mine cleanup efforts, abandoned oil and gas well plugging and local watershed-based conservation projects. The grants were established by the Environmental Stewardship and Watershed Protection Act. Information on Pennsylvania's Growing Greener Watershed Grants can be found at: http://www.depweb.state.pa.us/portal/server.pt/community/growing_greener/13958

Information on these and other programs and additional funding sources can be found at: http://www.depreportingservices.state.pa.us/ReportServer/Pages/ReportViewer.aspx?/Grants/GrantLoans

By developing a sediment and total phosphorus TMDLs for the Anderson Creek Watershed, PADEP continues to support design and implementation of restoration plans to correct current use impairments. PADEP welcomes local efforts to support watershed restoration plans. For more information about this TMDL, interested parties should contact the appropriate watershed manager in PADEP's North Central Regional Office (570-327-3636).

PUBLIC PARTICIPATION

Public notice of the TMDL was published in the *Pennsylvania Bulletin* on December 14, 2002, and *The Progress* on January 6, 2003, to foster public comment on the allowable loads calculated. A public meeting was held on January 9, 2003, at the Anderson Creek Watershed Organization's meeting in the Pike Township Municipal Building, to discuss the proposed TMDL. Upon the revision in December 2014 to incorporate an NPDES permit, this TMDL was published in the Pennsylvania Bulletin on December 20, 2014. No comments were received during the 30 days of the public notice.

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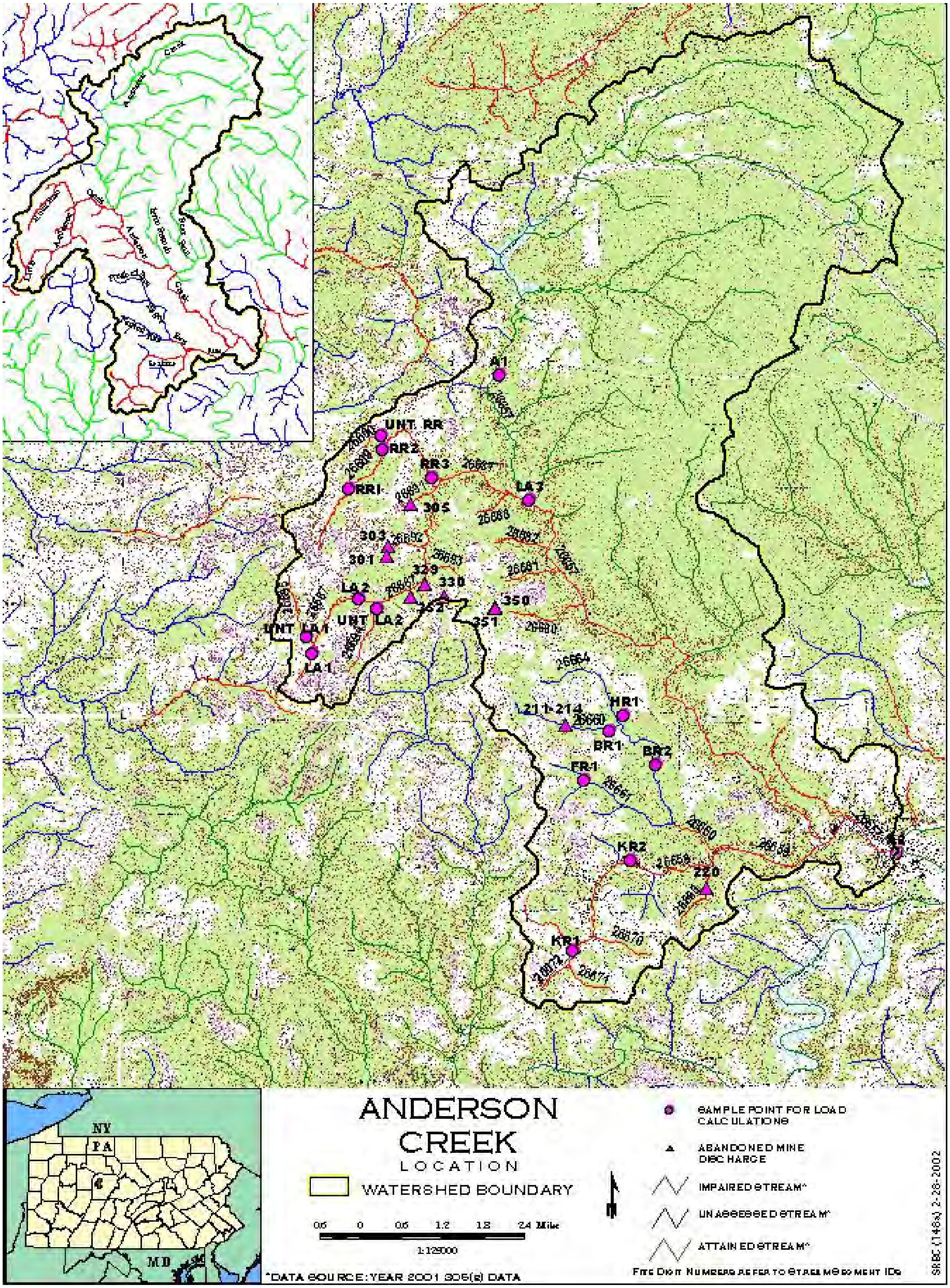
Attachment A

Anderson Creek Watershed Map


ANDERSON
CREEK
LOCATION
WATERSHED BOUNDARY
SAMPLE POINT FOR LOAD CALCULATIONS
ABANDONED MINE DISCHARGE
IMPAIRED STREAM^
UNASSESSED STREAM^
ATTAINED STREAM^
1:125000
^DATA SOURCE: YEAR 2001 305(b) DATA
NY
PA
MD
A1
UNT RR
RR2
RR3
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305
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301
329
330
350
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352
LA2
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LA1
HR1
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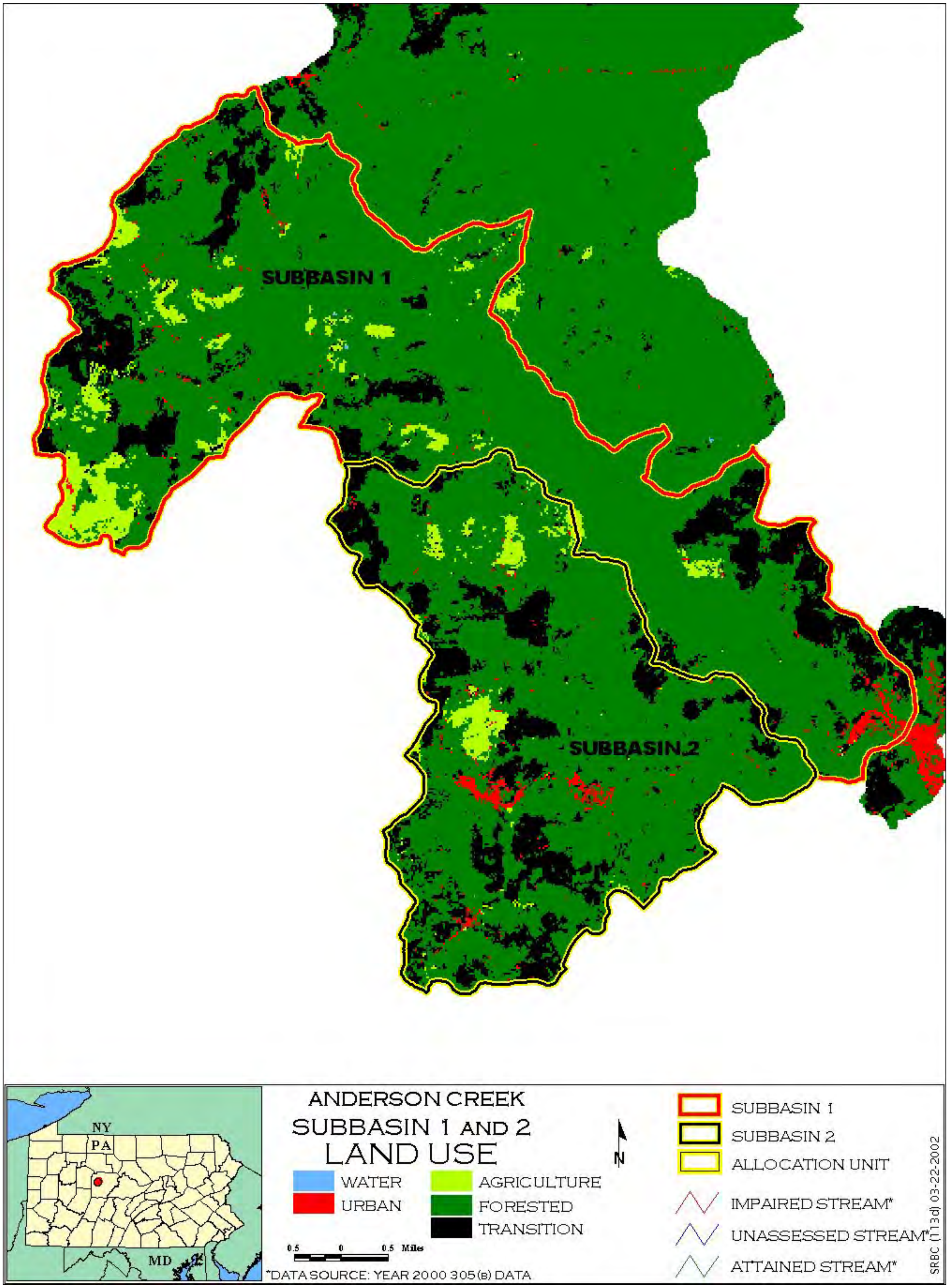
BR2
FR1
KR2
220
KR1
211-214


SUBBASIN 1
SUBBASIN 2
NY
PA
MD
ANDERSON CREEK
SUBBASIN 1 AND 2
LAND USE
WATER
URBAN
AGRICULTURE
FORESTED
TRANSITION
0.5 0 0.5 Miles
N
*DATA SOURCE: YEAR 2000 305(B) DATA
SUBBASIN 1
SUBBASIN 2
ALLOCATION UNIT
IMPAIRED STREAM*
UNASSESSED STREAM*
ATTAINED STREAM*
SRBC (113d) 03-22-2002

Attachment B

Excerpt Justifying Changes Between the 1996, 1998, Draft 2000, and Draft 2002 Section 303(d) Lists

The following are excerpts from the Pennsylvania Department of Environmental Protection (DEP) Section 303(d) narratives that justify changes in listings between the 1996, 1998,Draft 2000, and Draft 2002 list. The Section 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).

The most notable difference between the 1998 and Draft 2000 303(d) lists are the listing of unnamed tributaries in 2000. In 1998, the GIS stream layer was coded to the named stream level so there was no way to identify the unnamed tributary records. As a result, the unnamed tributaries were listed as part of the first downstream named stream. The GIS stream coverage used to generate the 2000 list had the unnamed tributaries coded with the Pa. DEP's five-digit stream code. As a result, the unnamed tributary records are now split out as separate records on the 2000 303(d) list. This is the reason for the change in the appearance of the list and the noticeable increase in the number of pages. After due consideration of comments from EPA and PADEP on the Draft 2000 Section 303(d) list, the Draft 2002 Pa Section 303(d) list was written in a manner similar to the 1998 Section 303(d) list.

Attachment C

Mining Permits in the
Anderson Creek Watershed

Permit Number	Company Name	Status
4574SM35	North American Refractories Firebrick 1 Quarry	Stage 1 Bond Release
4570BSM6	Harbison Walker Hartzfield	Completed by 3rd Party
4571BSM17	North American Refractories G H Wise Tract	Completed
4573SM2	North American Refractories NAR Quarry	Completed
17960118	Johnson Bros Gearhart Mine	Stage 1 Bond Release
17794035	Pentz Bloom Mine	Completed
17920109	Thomas Coal Kress 2 Mine	Stage 3 Bond Release Pending
17793078	Thomas Coal Weber Mine	Completed
17783076	Thomas Coal McKenrick Mine	Completed
17803000	Swistock Purport 6 Mine	Completed
17820125	Thomas Coal Echo Glen	Completed
17960103	BBC Coal Hudson White	Stage 2 Bond Release
17870119	Thomas Coal Hudson Mine	Complete
45A77SM17	Thomas Coal Mahlon Mine	Complete
17803083	Thomas Coal Mahlon II Mine	Complete
17920801	Gerald S. Dimmick Cream Hill	Active; Non-Coal
17980121	R. J. Coal Company Bloom 2	Active; Subchapter F
17990122	Laurel Energy, L. P. Hatten	Active
17930144	Waroquier Coal Spencer	Stage 1 Bond Release
17930130	Sky Haven Coal Hartzfield	Stage 1 Bond Release
17960123	Johnson Bros Coal Thomas	Stage 2 Bond Release
17980125	Johnson Bros Coal Wingert	Not Started; Subchapter F
17783017	Sky Haven Coal Wingert	Stage 2 Bond Release
17860133	Johnson Bros McMurray	Stage 2 Bond Release
17880101	Hepburnia Coal Hartzfield	Partial Stage 2 Release
17880108	Larry D Baumgardner Dush	Stage 2 Bond Release
17793088	Sky Haven Moore # 1	Completed
17823101	Hepburnia Coal Smith 1 Mine	No Active Mining
17000110	Hepburnia Coal Penn 2	Active
17860803	DEP Bureau of Forestry	Idle

Attachment D

TMDLs and Remining Activities in Pennsylvania

This attachment provides an overview and history of the remining requirements as related to NPDES permitting and TMDLs. Described in the following text is an overview of the regulations and incentives that pertain to the water quality aspect of the current remining programs in Pennsylvania.

Acid drainage from abandoned underground and surface coal mines and coal refuse piles is a large problem in the Appalachian Coal Region of the Eastern United States. Prior to the passage of the federal Surface Mining Control and Reclamation Act (SMCRA) in 1977, reclamation of mining sites was not a federal requirement and therefore, was not often done. One of SMCRA's goals was to promote the reclamation of mined areas left without adequate reclamation prior to the enactment of SMCRA and which continue, in their unreclaimed condition, to substantially degrade the quality of the environment; damage the beneficial use of land or water resources; or endanger the health or safety of the public.

In 1982, EPA promulgated final effluent limit guidelines under the Clean Water Act to limit the discharges from the coal mining industry point source category. The rule amended previously promulgated effluent limit guidelines based on "best practicable control technology" (BPT) and "new source performance standards" (NSPS), and established new guidelines based on "best available technology economically achievable" (BAT). The issue of remining was raised during the comment period following the 1982 proposal of the final rule. Comments addressed the fact that technology-based standards would likely serve as a deterrent to remining activities, since the operator would have to assume responsibility for treating effluent from previous operations that already may be significantly contaminated. This was not addressed in the final rule, and EPA stated that generally, the effluent limitations guidelines are applicable to all point source discharges even if those discharges pre-dated the remining operation.

In 1987, the "Rahall Amendment" to the Clean Water Act was passed, and provided incentives for remining abandoned mine lands that were mined prior to the 1977 passage of SMCRA. The amendment established that BAT effluent limitations for iron, manganese and pH are not required for discharges that existed prior to remining activities. Instead, site-specific BAT limits, determined by Best Professional Judgment (BPJ) are applicable to these pre-existing discharges, and the permit effluent limits for iron, manganese, and pH (acidity) may not exceed pre-existing baseline levels. Prior to the federal law changes in 1987, the Pennsylvania (PA) legislature amended PA SMCRA in 1984 to include remining incentives. Under the PA law and related regulations [25 PA Code 87, Subchapter F (bituminous coal) and Chapter 88 (anthracite coal)], a baseline pollution load is established; a pollution abatement plan is submitted incorporating best technology; and the effluent limits for the pre-existing discharges are determined by the BPJ process.

Pennsylvania has issued over 260 remining permits dating back to 1985 and continues to do so. For the purpose of TMDL development in watersheds where remining operations are occurring, the pre-existing discharges associated with the remining activity will not be given wasteload allocations. These loads will be accounted for in the TMDL as part of the overall load allocation. This is consistent with the Clean Water Act and PA regulations, since the current operator is not responsible for cleanup and remediation of these pre-existing discharges

Attachment E

AMD Methodology, the pH Method, and Surface Mining Control and Reclamation Act

AMD Methodology

Two approaches are used for the TMDL analysis of AMD-affected stream segments. Both of these approaches use the same statistical method for determining the instream allowable loading rate at the point of interest. The difference between the two is based on whether the pollution sources are defined as discharges that are permitted or have a responsible party, which are considered point sources. Nonpoint sources are then any pollution sources that are not point sources.

For situations where all of the impact is due to nonpoint sources, the equations shown below are applied using data for a point in the stream. The load allocation made at that point will be for all of the watershed area that is above that point. For situations where there are only point-source impacts or a combination of point and nonpoint sources, the evaluation will use the point-source data and perform a mass balance with the receiving water to determine the impact of the point source.

TMDLs and load allocations for each pollutant were determined using Monte Carlo simulation. 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[2] by performing 5,000 iterations to determine any required percent reduction so that the water quality criteria 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 99^{th} percentile value of the probability distribution generated by the 5,000 iterations, so that the allowable long-term average (LTA) concentration is:

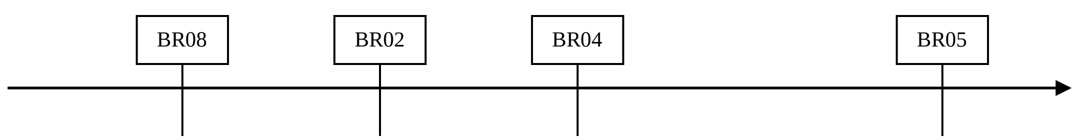
[2] @Risk – Risk Analysis and Simulation Add-in for Microsoft Excel, Palisade Corporation, Newfield, NY, 1990-1997.

LTA = Mean * (1 – PR99)   where   (2)
LTA = allowable LTA source concentration in mg/l
Once the required percent reduction for each pollutant source was determined, a second series of Monte Carlo simulations were performed to determine if the cumulative loads from multiple sources allow instream water quality criteria to be met at all points at least 99 percent of the time. The second series of simulations combined the flows and loads from individual sources in a step-wise fashion, so that the level of attainment could be determined immediately downstream of each source. Where available data allowed, pollutant-source flows used were the average flows. Where data were insufficient to determine a source flow frequency distribution, the average flow derived from the ArcView Version Generalized Watershed Loading Function (AVGWLF) model was used.

In general, these cumulative impact evaluations indicate that, if the percent reductions determined during the first step of the analysis are achieved, water quality criteria will be achieved at all upstream points, and no further reduction in source loadings is required.

Accounting for Upstream Reductions in AMD TMDLs

In AMD TMDLs, sample points are evaluated in headwaters (most upstream) to stream mouth (most downstream) order. As the TMDL evaluation moves downstream the impact of the previous, upstream, evaluations must be considered. The following examples are from the Beaver Run AMD TMDL (2003):



In the first example BR08 is the most upstream sample point and BR02 is the next downstream sample point. The sample data, for both sample points, are evaluated using @Risk (explained above) to calculate the existing loads, allowable loads, and a percentage reduction for aluminum, iron, manganese, and acidity (when flow and parameter data are available).

Any calculated load reductions for the upstream sample point, BR08, must be accounted for in the calculated reductions at sample point BR02. To do this (see table A) the allowable load is subtracted from the existing load, for each parameter, to determine the total load reduction.

Table A	Alum.	Iron	Mang.	Acidity
BR08	(#/day)	(#/day)	(#/day)	(#/day)
existing load=	3.8	2.9	3.5	0.0
allowable load=	3.8	2.9	3.5	0.0
TOTAL LOAD REDUCTION=	**0.0**	**0.0**	**0.0**	**0.0**

In table B the Total Load Reduction BR08 is subtracted from the Existing loads at BR02 to determine the Remaining Load. The Remaining Load at BR02 has the previously calculated Allowable Loads at BR02 subtracted to determine any load reductions at sample point BR02. This results in load reductions for aluminum, iron and manganese at sample point BR02.

Table B. Necessary Reductions at Beaver Run BR02

	Al (#/day)	Fe (#/day)	Mn (#/day)	Acidity (#/day)
Existing Loads at BR02	13.25	38.44	21.98	6.48
Total Load Reduction BR08	0.00	0.00	0.00	0.00
Remaining Load (Existing Load at BR02 - BR08)	13.25	38.44	21.98	6.48
Allowable Loads at BR02	2.91	9.23	7.03	6.48
Percent Reduction	78.0%	76.0%	68.0%	NA
Additional Removal Required at BR02	10.33	29.21	14.95	0.00

At sample point BR05 this same procedure is also used to account for calculated reductions at sample points BR08 and BR02. As can be seen in Tables C and D this procedure results in additional load reductions for iron, manganese and acidity at sample point BR04.

At sample point BR05 (the most downstream) no additional load reductions are required, see Tables E and F.

Table C	Alum.	Iron	Mang.	Acidity
BR08 & BR02	(#/day)	(#/day)	(#/day)	(#/day)
Total Load Reduction=	**10.33**	**29.21**	**14.95**	**0.0**

Table E	Alum.	Iron	Mang.	Acidity
BR08 BR02 &BR04	(#/day)	(#/day)	(#/day)	(#/day)
Total Load Reduction=	10.3	29.2	14.9	0.0

Table D. Necessary Reductions at Beaver Run BR04

	Al (#/day)	Fe (#/day)	Mn (#/day)	Acidity (#/day)
Existing Loads at BR04	12.48	138.80	54.47	38.76
Total Load Reduction BR08 & BR02	10.33	29.21	14.95	0.00
Remaining Load (Existing Load at BBR04 - TLR Sum	2.15	109.59	39.53	38.76
Allowable Loads at BR04	8.99	19.43	19.06	38.46
Percent Reduction	NA	82.3%	51.8%	0.8%
Additional Removal Required at BR04	0.00	90.16	20.46	0.29

Table F. Necessary Reductions at Beaver Run BR05

	Al (#/day)	Fe (#/day)	Mn (#/day)	Acidity (#/day)
Existing Loads at BR05	0.0	31.9	22.9	4.1
Total Load Reduction BR08, BR02 & BR04	10.3	119.4	35.4	0.3
Remaining Load (Existing Load at BBR05 - TLR Sum	NA	NA	NA	3.8
Allowable Loads at BR05	0.0	20.4	15.1	4.1
Percent Reduction	NA	NA	NA	NA
Additional Removal Required at BR05	0.0	0.0	0.0	0.0

Although the evaluation at sample point BR05 results in no additional removal this does not mean there are no AMD problems in the stream segment BR05 to BR04. The existing and allowable loads for BR05 show that iron and manganese exceed criteria and, any abandoned mine discharges in this stream segment will be addressed.

Method for Addressing Section 303(d) Listings for pH

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

The pH, a measurement of hydrogen ion acidity presented as a negative logarithm, is not conducive to standard statistics. Additionally, pH does not measure latent acidity. For this reason, and based on the above information, Pennsylvania is using the following approach to address the stream impairments noted on the 303(d) list due to pH. The concentration of acidity in a stream is at least partially chemically dependent upon metals. For this reason, it is extremely difficult to predict the exact pH values, which would result from treatment of abandoned mine drainage. 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 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. 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 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 meet a minimum net alkalinity of zero.

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.*

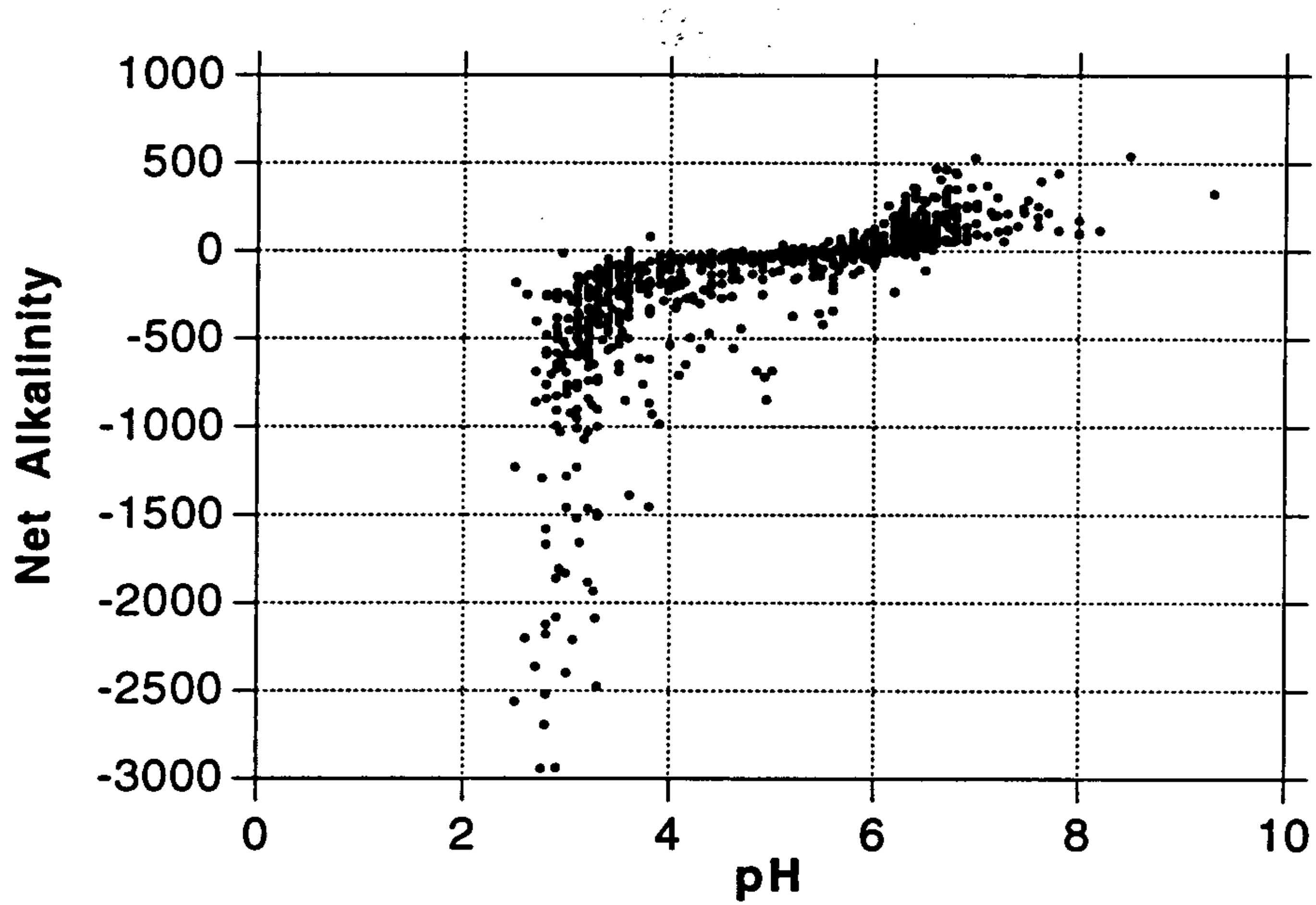


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania.

Surface Mining Control and Reclamation Act

The Surface Mining Control and Reclamation Act of 1977 (SMCRA, Public Law 95-87) 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 pubic 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.

Title IV of the Act is designed to provide assistance for reclamation and restoration of abandoned mines, while Title V states that any surface coal mining operations shall be required to meet all applicable performance standards. Some general performance standards include:

- Restoring the affected land to a condition capable of supporting the uses which it was capable of supporting prior to any mining,
- Backfilling and compacting (to insure stability or to prevent leaching of toxic materials) in order to restore the approximate original contour of the land with all highwalls being eliminated, and topsoil replaced to allow revegetation, and
- Minimizing the disturbances to the hydrologic balance and to the quality and quantity of water in surface and ground water systems both during and after surface coal mining operations and during reclamation by avoiding acid or other toxic mine drainage.

For purposes of these TMDLs, point sources are identified as NPDES-permitted discharge points, and non-point sources include discharges from abandoned mine lands, including but not limited to, tunnel discharges, seeps, and surface runoff. Abandoned and reclaimed mine lands were treated in the allocations as non-point sources because there are no NPDES permits associated with these areas. In the absence of an NPDES permit, the discharges associated with these land uses were assigned load allocations.

The decision to assign load allocations to abandoned and reclaimed mine lands does not reflect any determination by EPA as to whether there are, in fact, unpermitted point source discharges within these land uses. In addition, by establishing these TMDLs with mine drainage discharges treated as load allocations, EPA is not determining that these discharges are exempt from NPDES permitting requirements.

Related Definitions

Pre-Act (Pre-Law) - Mines that ceased operating by the effective date of SMCRA and are not subject to the requirements of SMCRA.

Bond – A instrument by which a permittee assures faithful performance of the requirements of the acts, this chapter, Chapters 87-90 and the requirements of the permit and reclamation plan.

Postmining pollution discharge – A discharge of mine drainage emanating from or hydrologically connected to the permit area, which may remain after coal mining activities have been completed, and which does not comply with the applicable effluent requirements described in Chapters 87.102, 88.92, 88.187, 88.292, 89.52 or 90.102. The term includes minimal-impact postmining discharges, as defined in Section of the Surface Mining Conservation and Reclamation Act.

Forfeited Bond – Bond money collected by the regulatory authority to complete the reclamation of a mine site when a permittee defaults on his reclamation requirements.

Attachment F

Example Calculation: Lorberry Creek

Lorberry Creek was evaluated for impairment due to high metals contents in the following manner: the analysis was completed in a stepwise manner, starting at the headwaters of the stream and moving to the mouth. The Rowe Tunnel (Swat-04) was treated as the headwaters of Lorberry Creek for the purpose of this analysis.

1. A simulation of the concentration data at point Swat-04 was completed. This estimated the necessary reduction needed for each metal to meet water quality criteria 99 percent of the time as a long-term average daily concentration. Appropriate concentration reductions were made for each metal.

2. A simulation of the concentration data at point Swat-11 was completed. It was determined that no reductions in metals concentrations are needed for Stumps Run at this time. Therefore, no TMDL for metals in Stumps Run is required at this time.

3. A mass balance of loading from Swat-04 and Swat-11 was completed to determine if there was any need for additional reductions as a result of combining the loads. No additional reductions were necessary.

4. The mass balance was expanded to include the Shadle Discharge (L-1). It was estimated that best available technology (BAT) requirements for the Shadle Discharge were adequate for iron and manganese. There is no BAT requirement for aluminum. A wasteload allocation was necessary for aluminum at point L-1.

There are no other known sources below the Shadle Discharge. However, there is additional flow from overland runoff and one unnamed tributary not impacted by mining. It is reasonable to assume that the additional flow provides assimilation capacity below point L-1, and no further analysis is needed downstream.

The calculations are detailed in the following section (Tables 1-8). Table 9 shows the allocations made on Lorberry Creek.

1. A series of four equations was used to determine if a reduction was needed at point Swat-04, and, if so the magnitude of the reduction.

Table 1. Equations Used for Rowe Tunnel Analysis (SWAT 04)

	Field Description	Equation	Explanation
1	Swat-04 Initial Concentration Value (Equation 1A)	= Risklognorm (Mean, St Dev)	This simulates the existing concentration of the sampled data.
2	Swat-04 % Reduction (from the 99th percentile of percent reduction)	= (Input a percentage based on reduction target)	This is the percent reduction for the discharge.
3	Swat-04 Final Concentration Value	= Sampled Value x (1-percent reduction)	This applies the given percent reduction to the initial concentration.
4	Swat-04 Reduction Target (PR)	= Maximum (0, 1- Cd/Cc)	This computes the necessary reduction, if needed, each time a value is sampled. The final reduction target is the 99th percentile value of this computed field.

2. The reduction target (PR) was computed taking the 99th percentile value of 5,000 iterations of the equation in row four of Table 1. The targeted percent reduction is shown, in boldface type, in the following table.

Table 2. Swat-04 Estimated Target Reductions			
Name	**Swat-04 Aluminum**	**Swat-04 Iron**	**Swat-04 Manganese**
Minimum =	0	0.4836	0
Maximum =	0.8675	0.9334	0.8762
Mean =	0.2184	0.8101	0.4750
Std. Deviation =	0.2204	0.0544	0.1719
Variance =	0.0486	0.0030	0.0296
Skewness =	0.5845	-0.8768	-0.7027
Kurtosis =	2.0895	4.3513	3.1715
Errors Calculated =	0	0	0
Targeted Reduction % =	**72.2**	**90.5**	**77.0**
Target #1 (Perc%)=	99	99	99

3. This PR value was used as the percent reduction in the equation in row three of Table 1. Testing was done to see that the water quality criterion for each metal was achieved at least 99 percent of the time. This verified the estimated percent reduction necessary for each metal. Table 3 shows, in boldface type, the percent of the time criteria for each metal was achieved during 5,000 iterations of the equation in row three of Table 1.

Table 3. Swat-04 Verification of Target Reductions			
Name	**Swat-04 Aluminum**	**Swat-04 Iron**	**Swat-04 Manganese**
Minimum =	0.0444	0.2614	0.1394
Maximum =	1.5282	2.0277	1.8575
Mean =	0.2729	0.7693	0.4871
Std Deviation =	0.1358	0.2204	0.1670
Variance =	0.0185	0.0486	0.0279
Skewness =	1.6229	0.8742	1.0996
Kurtosis =	8.0010	4.3255	5.4404
Errors Calculated =	0	0	0
Target #1 (value) (WQ Criteria)=	0.75	1.5	1
Target #1 (Perc%)=	**99.15**	**99.41**	**99.02**

4. These same four equations were applied to point Swat-11. The result was that no reduction was needed for any of the metals. Tables 4 and 5 show the reduction targets computed for, and the verification of, reduction targets for Swat-11.

Table 4. Swat-11 Estimated Target Reductions			
Name	**Swat-11 Aluminum**	**Swat-11 Iron**	**Swat-11 Manganese**
Minimum =	0.0000	0.0000	0.0000
Maximum =	0.6114	0.6426	0.0000
Mean =	0.0009	0.0009	0.0000
Std Deviation =	0.0183	0.0186	0.0000
Variance =	0.0003	0.0003	0.0000
Skewness =	24.0191	23.9120	0.0000
Kurtosis =	643.4102	641.0572	0.0000
Errors Calculated =	0	0	0
Targeted Reduction % =	**0**	**0**	**0**
Target #1 (Perc%) =	99	99	99

Table 5. Swat-11 Verification of Target Reductions			
Name	**Swat-11 Aluminum**	**Swat-11 Iron**	**Swat-11 Manganese**
Minimum =	0.0013	0.0031	0.0246
Maximum =	1.9302	4.1971	0.3234
Mean =	0.0842	0.1802	0.0941
Std Deviation =	0.1104	0.2268	0.0330
Variance =	0.0122	0.0514	0.0011
Skewness =	5.0496	4.9424	1.0893
Kurtosis =	48.9148	48.8124	5.1358
Errors Calculated =	0	0	0
WQ Criteria =	**0.75**	**1.5**	**1**
% of Time Criteria Achieved =	**99.63**	**99.60**	**100**

5. Table 6 shows variables used to express mass balance computations.

Table 6. Variable Descriptions for Lorberry Creek Calculations	
Description	**Variable Shown**
Flow from Swat-04	Q_{swat04}
Swat-04 Final Concentration	C_{swat04}
Flow from Swat-11	Q_{swat11}
Swat-11 Final Concentration	C_{swat11}
Concentration below Stumps Run	C_{stumps}
Flow from L-1 (Shadle Discharge)	Q_{L1}
Final Concentration From L-1	C_{L1}
Concentration below L-1	C_{allow}

6. Swat-04 and Swat-11 were mass balanced in the following manner:

   The majority of the sampling done at point Swat-11 was done in conjunction with point Swat-04 (20 matching sampling days). This allowed for the establishment of a significant correlation between the two flows (the R-squared value was 0.85). Swat-04 was used as the base flow, and a regression analysis on point Swat-11 provided an equation for use as the flow from Swat-11.

The flow from Swat-04 (Q_{swat04}) was set into an @RISK function so it could be used to simulate loading into the stream. The cumulative probability function was used for this random flow selection. The flow at Swat-04 is as follows (Equation 1):

$$Q_{swat04} = \text{RiskCumul (min,max,bin range, cumulative percent of occurrence)} \quad (1)$$

The RiskCumul function takes four arguments: minimum value, maximum value, the bin range from the histogram, and cumulative percent of occurrence.

The flow at Swat-11 was randomized using the equation developed through the regression analysis with point Swat-04 (Equation 2).

$$Q_{swat11} = Q_{swat04} \times 0.142 + 0.088 \quad (2)$$

The mass balance equation is as follows (Equation 3):

$$C_{stumps} = ((Q_{swat04} * C_{swat04}) + (Q_{swat11} * C_{swat11}))/(Q_{swat04}+Q_{swat11}) \quad (3)$$

This equation was simulated through 5,000 iterations, and the 99th percentile value of the data set was compared to the water quality criteria to determine if standards had been met. The results show there is no further reduction needed for any of the metals at either point. The simulation results are shown in Table 7.

Table 7. Verification of Meeting Water Quality Standards Below Stumps Run			
Name	**Below Stumps Run Aluminum**	**Below Stumps Run Iron**	**Below Stumps Run Manganese**
Minimum =	0.0457	0.2181	0.1362
Maximum =	1.2918	1.7553	1.2751
Mean =	0.2505	0.6995	0.4404
Std Deviation =	0.1206	0.1970	0.1470
Variance =	0.0145	0.0388	0.0216
Skewness =	1.6043	0.8681	1.0371
Kurtosis =	7.7226	4.2879	4.8121
Errors Calculated =	0	0	0
WQ Criteria =	**0.75**	**1.5**	**1**
% of Time Criteria Achieved =	**99.52**	**99.80**	**99.64**

7. The mass balance was expanded to determine if any reductions would be necessary at point L-1.

   The Shadle Discharge originated in 1997, and very few data are available for it. The discharge will have to be treated or eliminated. It is the current site of a USGS test remediation project. The data that were available for the discharge were collected at a point prior to a settling pond. Currently, no data for effluent from the settling pond are available. Modeling for iron and manganese started with the BAT-required concentration value. The current effluent variability based on limited sampling was kept at its present level. There was no BAT value for aluminum, so the starting concentration for the modeling was arbitrary. The BAT values for iron and manganese are 6 mg/l and 4 mg/l, respectively. Table 8 shows the BAT-adjusted values used for point L-1.

Table 8. L-1 Adjusted BAT Concentrations				
Parameter	**Measured Value**		**BAT adjusted Value**	
	Average Conc.	*Standard Deviation*	*Average Conc.*	*StandardDeviation*
Iron	538.00	19.08	6.00	0.21
Manganese	33.93	2.14	4.00	0.25

The average flow (0.048 cfs) from the discharge will be used for modeling purposes. There were not any means to establish a correlation with point Swat-04.

The same set of four equations used for point Swat-04 was used for point L-1. The equation used for evaluation of point L-1 is as follows (Equation 4):

$$C_{allow} = ((Q_{swat04}*C_{swat04})+(Q_{swat11}*C_{swat11})+(Q_{L1}*C_{L1}))/(Q_{swat04}+Q_{swat11}+Q_{L1}) \quad (4)$$

This equation was simulated through 5,000 iterations, and the 99th percentile value of the data set was compared to the water quality criteria to determine if standards had been met. It was estimated that an 81 percent reduction in aluminum concentration was needed for point L-1.

8. Table 9 shows the simulation results of the equation above.

Table 9. Verification of Meeting Water Quality Standards Below Point L-1			
Name	**Below L-1 Aluminum**	**Below L-1 Iron**	**Below L-1 Manganese**
Minimum =	0.0815	0.2711	0.1520
Maximum =	1.3189	2.2305	1.3689
Mean =	0.3369	0.7715	0.4888
Std Deviation =	0.1320	0.1978	0.1474
Variance =	0.0174	0.0391	0.0217
Skewness =	1.2259	0.8430	0.9635
Kurtosis =	5.8475	4.6019	4.7039
Errors Calculated =	0	0	0
WQ Criteria=	**0.75**	**1.5**	**1**
Percent of time achieved=	**99.02**	**99.68**	**99.48**

9. Table 10 presents the estimated reductions needed to meet water quality standards at all points in Lorberry Creek.

Table 10. Lorberry Creek Summary Table						
		Measured Sample Data		**Allowable**		**Reduction Identified**
Station	Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)	%
Swat 04						
	Al	1.01	21.45	0.27	5.79	73%
	Fe	8.55	181.45	0.77	16.33	91%
	Mn	2.12	44.95	0.49	10.34	77%
Swat 11						
	Al	0.08	0.24	0.08	0.24	0%
	Fe	0.18	0.51	0.18	0.51	00%
	Mn	0.09	0.27	0.09	0.27	00%
L-1						
	Al	34.90	9.03	6.63	1.71	81%
	Fe	6.00	1.55	6.00	1.55	0%
	Mn	4.00	1.03	4.00	1.03	0%

All values shown in this table are long-term average daily values

The TMDL for Lorberry Creek requires that a load allocation be made to the Rowe Tunnel Discharge (Swat-04) for the three metals listed, and that a wasteload allocation is made to the Shadle Discharge (L-1) for aluminum. There is no TMDL for metals required for Stumps Run (Swat-11) at this time.

Margin of safety

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

- None of the data sets were filtered by taking out extreme measurements. Because the 99 percent level of protection is designed to protect for the extreme event, it was pertinent not to filter the data set.

- Effluent variability plays a major role in determining the average value that will meet water quality criteria over the long term. This analysis maintained that the variability at each point would remain the same. The general assumption can be made that a treated discharge would be less variable than an untreated discharge. This implicitly builds in another margin of safety.

Attachment G

AMD TMDLs By Segment

ANDERSON CREEK

The TMDL for Anderson Creek consists of load allocations of six tributaries, ten AMD discharges, and one sampling point along the stream. Following is an explanation of the TMDL for each allocation point.

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

Anderson Creek above A1

The reach of Anderson Creek above point A1 is the area of Anderson Creek located above and just below the DuBois Reservoir. Anderson Creek above point A1 is not listed on the 303(d) list as being impaired by AMD; therefore, a TMDL will not be done for this point. The DuBois Reservoir is used by the City of DuBois as a public water supply. Up to 3.00 mgd is allocated to DuBois from the reservoir (Runkle 2000). A conservation release of 1.52 mgd must be maintained at all times over the reservoir to sustain downstream uses (Runkle 2000). This release becomes especially important in times of low flow, as a back-up public water supply intake for the Pike Township Municipal Authority is located a few miles downstream on Anderson Creek.

Although the area above point A1 is not impacted by AMD, other potential problems exist in this area of the watershed. U.S. Interstate 80 transects the watershed in its upper reaches less than one mile upstream of the DuBois Reservoir. The City of DuBois applied for and received a Growing Greener Grant through the Commonwealth of Pennsylvania to investigate sources of pollution to the upper reaches of the watershed. The City of DuBois Watershed Commission is concerned that a spill on Interstate 80, the spraying of overpasses during the winter months by the Pennsylvania Department of Transportation (PENNDOT), and the possibility of malfunctioning gas wells present risks to the water supply. The study was completed by the EADS Group of Clarion, Pa., in July 2001. It concluded that the pollution is from natural sources, such as acid rain leaching metals from the bedrock (DuBois Reservoir Watershed Water Quality Assessment Project 2001).

Little Anderson Creek above LA1

The point LA1 represents Little Anderson Creek before the confluence of the first unnamed tributary. Little Anderson Creek is impacted by AMD from numerous seeps beginning in its headwaters.

The TMDL for Little Anderson Creek consists of a load allocation to all of the watershed area above point LA1. Addressing the mining impacts above this point addresses the impairment for the segment. An instream flow measurement was available for LA1 (0.15 mgd).

An allowable long-term average instream concentration was determined at point LA1 for iron, manganese, aluminum, and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point LA1 for this stream segment are presented in Table G1.

Table G1. Reductions for Little Anderson Creek Above LA1

Station	Parameter	Measured Sample Data		Allowable		Reduction Identified
		Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)	Percent
LA1	Fe	3.73	4.67	0.15	0.19	96
	Mn	5.09	6.37	0.15	0.19	97
	Al	0.25	0.31	0.21	0.26	16
	Acidity	24.91	31.16	1.49	1.86	94
	Alkalinity	10.87	13.60			

All values shown in this table are long-term average daily values.

The TMDL for Little Anderson Creek at point LA1 requires that a load allocation be made for all areas above LA1 for total iron, total manganese, total aluminum and acidity.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Unnamed Tributary 1 to Little Anderson Creek

The point UNT LA1 represents the first Unnamed Tributary to Little Anderson Creek. The Unnamed Tributary to Little Anderson Creek is impacted by AMD from numerous seeps beginning in its headwaters.

Sample data for the first Unnamed Tributary to Little Anderson Creek show pH to range between 4.0 and 7.6, with an average pH of 6.48. The 99th percentile acidity concentration determined by

Monte Carlo analysis shows UNT LA1 to be net alkaline (27.52mg/l alkalinity compared to 4.80 mg/L acidity). Therefore, reductions in acidity were not taken for point UNT LA1. The method and rationale for addressing pH is contained in Attachment E.

The TMDL for the Unnamed Tributary to Little Anderson Creek consists of a load allocation to all of the watershed area above point UNT LA1. Addressing the mining impacts above this point addresses the impairment for the segment. An instream flow measurement was available for LA1 (0.15 mgd).

An allowable long-term average instream concentration was determined at point UNT LA1 for iron, manganese, aluminum, and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point UNT LA1 for this stream segment are presented in Table G2.

Table G2. Reductions for Little Anderson Creek Above UNT LA1

Station	Parameter	Measured Sample Data		Allowable		Reduction Identified
		Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)	Percent
UNT LA1	Fe	2.02	2.53	0.36	0.45	82
	Mn	3.54	4.43	0.18	0.23	95
	Al	0.11	0.14	0.11	0.14	0
	Acidity	0.43	0.54	0.44	0.55	0
	Alkalinity	27.52	34.43			

All values shown in this table are long-term average daily values.

The TMDL for the Unnamed Tributary Little Anderson Creek at point UNT LA1 requires that a load allocation be made for all areas above UNT LA1 for total iron and total manganese. The TMDL at UNT LA1 does not require a load allocation to be made for total aluminum and acidity.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Little Anderson Creek at LA2

Little Anderson Creek at LA2 represents Little Anderson Creek after the confluence of the first unnamed tributary.

Sample data for Little Anderson Creek at LA2 show pH to range between 3.8 and 7.4 with an average pH of 6.03. The 99th percentile acidity concentration determined by Monte Carlo analysis shows LA2 to be net acidic (23.75 mg/L acidity compared to 12.61 mg/L alkalinity). Therefore, reductions in acidity were taken for LA2. The method and rationale for addressing pH is contained in Attachment E.

The TMDL for Little Anderson Creek consists of a load allocation to Little Anderson Creek between point LA1 and point LA2. Addressing the mining impacts above this point addresses the impairment for the segment. An instream flow measurement was not available for LA2; therefore, the flow was determined using the AVGWLF model (1.55 mgd).

An allowable long-term average instream concentration was determined at point LA2 for iron, manganese, aluminum, and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point LA2 for this stream segment are presented in Table G3.

Table G3. Long Term Average (LTA) Concentrations for Little Anderson Creek Above LA2

Station	Parameter	Measured Sample Data		Allowable	
		Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
LA2	Fe	0.52	6.72	0.34	4.40
	Mn	3.56	46.02	0.25	3.23
	Al	0.32	4.14	0.21	2.71
	Acidity	2.66	34.39	1.38	17.84
	Alkalinity	12.61	163.01		

All values shown in this table are long-term average daily values.

The loading reductions for LA1 and UNT LA1 were used to show the total load that was removed from upstream sources. For each parameter, the total load that was removed upstream was subtracted from the existing load at point LA2. This value was compared to the allowable load at point LA2. Reductions at point LA2 are necessary for any parameter that exceeds the allowable load at this point. A summary of all loads that affect point LA2 are shown in Table G4. Necessary reductions at point LA2 are shown in Table G5.

Table G4. Summary of Loads Affecting Point LA2

	Iron (lbs/day)	Manganese (lbs/day)	Aluminum (lbs/day)	Acidity (lbs/day)
LA1				
Existing Load	4.67	6.37	0.31	31.16
Allowable Load	0.19	0.19	0.26	1.86
Load Reduction	4.48	6.18	0.05	29.30
UNT LA1				
Existing Load	2.53	4.43	0.14	0.54
Allowable Load	0.45	0.23	0.14	0.55
Load Reduction	2.08	4.20	0	0

Table G5. Reductions Necessary at Point LA2

	Iron (lbs/day)	Manganese (lbs/day)	Aluminum (lbs/day)	Acidity (lbs/day)
Existing Loads at LA2	6.72	46.02	4.14	34.39
Total Load Reduction (LA1 and UNT LA1)	6.56	10.38	0.05	29.30
Remaining Load	0.16	35.64	4.09	5.09
Allowable Loads at LA2	4.40	3.23	2.71	17.84
Percent Reduction	0	91	34	0

The TMDL for Little Anderson Creek at point LA2 requires that a load allocation be made for total manganese and total aluminum. The TMDL for Little Anderson Creek at point LA2 does not require a load allocation to be made for total iron and acidity. All necessary reductions have been made upstream from this point.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Unnamed Tributary 2 to Little Anderson Creek

The second unnamed tributary to Little Anderson Creek is affected by AMD from seeps and abandoned mine spoils at its headwaters. The Smouse Discharge (OSL 341-343) also enters the tributary shortly before its confluence with Little Anderson Creek. The Smouse Discharge originates from an old strip mining operation for clay and coal. During the period of the Operation Scarlift Report, this area had open strip cuts but has since been remined, backfilled, and replanted. However, there is still a problem discharge associated with the site (Lincoln 1999).

The TMDL for the second Unnamed Tributary to Little Anderson Creek consists of a load allocation to all of the watershed area above point UNT LA2. Addressing the mining impacts at this point addresses the pH and metal impairment for the segment. This allocation does not include the Smouse Discharge since there was no flow data available. The loads for point LA3 at the mouth of Little Anderson Creek will be allocated to all areas of the Little Anderson Creek Subwatershed and will include the Smouse Discharge. An instream flow measurement was available for UNT LA2 (0.09 mgd).

An allowable long-term average instream concentration was determined at point UNT LA2 for iron, manganese, aluminum, and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point UNT LA2 for this stream segment are presented in Table G6.

Table G6. Reductions for Unnamed Tributary for Little Anderson Creek above UNT LA2						
Station	**Parameter**	**Measured Sample Data**		**Allowable**		**Reduction Identified**
		Conc. (mg/l)	**Load (lbs/day)**	**LTA Conc. (mg/l)**	**Load (lbs/day)**	**Percent**
UNT LA2	Fe	0.63	0.47	0.25	0.19	60
	Mn	2.27	1.70	0.16	0.12	93
	Al	1.48	1.11	0.07	0.05	95
	Acidity	10.44	7.84	1.35	1.01	87
	Alkalinity	11.93	8.95			

All values shown in this table are long-term average daily values.

The TMDL for the Unnamed Tributary to Little Anderson Creek at point UNT LA2 requires that a load allocation be made for all areas above UNT LA2 for total iron, total manganese, total aluminum, and acidity.

Johnson Brothers Coal Company has an active coal mining permit in the Unnamed Tributary to Little Anderson Creek Watershed (MP# 17990122, NPDES PA0242772). To this date there has been no active discharge from the existing sedimentation pond, and the second sedimentation pond permitted has not been built since mining has not commenced at its location (Rieg 2001). This permit is not expected to produce a discharge. For these reasons it was decided that a waste load allocation is not necessary.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Spencer Discharge (OSL 352)

The Spencer 352 Discharge originates from an area known as Spencer Mine. Although operations have ceased, the area has been extensively impacted by both surface and deep mining operations. Areas not reclaimed contribute to AMD, specifically, where impounded water comes into contact with mine refuse. There are three openings to the deep mine workings; one which currently discharges AMD (Gwin 1974). These seeps/discharges combine and flow into Little Anderson Creek.

The TMDL for Spencer Mine consists of a load allocation to OSL 352. Addressing the mining impacts for this discharge addresses the impairment for the discharge. An instream flow measurement was available for OSL 352 (0.04 mgd).

There were fewer manganese and aluminum data than necessary for this discharge to conduct Monte Carlo analysis; therefore, they were not evaluated for this TMDL. However, the observations for manganese and aluminum in the downstream segments of Little Anderson Creek indicate that they also may be violating water quality standards. It is assumed that BMPs used to reduce iron loads in this reach also would reduce the amount of manganese and aluminum.

An allowable long-term average instream concentration was determined at point OSL 352 for iron and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point OSL 352 for this discharge are presented in Table G7.

Table G7. Reductions for Spencer Discharge (OSL 352)

Station	Parameter	Measured Sample Data		Allowable		Reduction Identified
		Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)	Percent
OSL 352	Fe	78.80	26.29	0.63	0.21	99.2
	Acidity	860.00	286.90	0	0	100
	Alkalinity	0	0			

All values shown in this table are long-term average daily values.

The TMDL for the Spencer Discharge requires that a load allocation be made for OSL 352 for total iron and acidity.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Korb Discharge (OSL 329)

This discharge originates from the Korb Mine, which was extensively deep mined for coal and Mercer Clay. There also was limited strip mining at three of the openings. OSL 329 flows from the west end of the Korb workings where the mine connects to the Spencer Mine and drains into Little Anderson Creek (Lincoln 1999).

The TMDL for the northern discharge of the Korb Mine consists of a load allocation to OSL 329. Addressing the mining impacts for this drainage addresses the impairment for the discharge. An instream flow measurement was available for OSL 329 (0.12 mgd).

There were fewer manganese and aluminum data than necessary for this discharge to conduct Monte Carlo analysis; therefore, they were not evaluated for this TMDL. However, the observations for manganese and aluminum in the downstream segments of Little Anderson Creek indicate that they also may be violating water quality standards. It is assumed that BMPs used to reduce iron loads in this reach also would reduce the amount of manganese and aluminum.

An allowable long-term average instream concentration was determined at point OSL 329 for iron and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point OSL 329 for this discharge are presented in Table G8.

Table G8. Reductions for the Korb Discharge (OSL 329)						
Station	**Parameter**	**Measured Sample Data**		**Allowable**		**Reduction Identified**
		Conc. (mg/l)	**Load (lbs/day)**	**LTA Conc. (mg/l)**	**Load (lbs/day)**	**Percent**
OSL 329	Fe	143.02	143.13	0.57	0.57	99.6
	Acidity	760.00	760.61	0	0	100
	Alkalinity	0	0			

All values shown in this table are long-term average daily values.

The TMDL for the Korb Discharge requires that a load allocation be made for OSL 329 for total iron and acidity.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Spencer Discharge (OSL 330)

The Spencer 330 Discharge originates from an area known as Spencer Mine. Although operations have ceased, the area has been extensively impacted by both surface and deep mining operations. Areas not reclaimed contribute to AMD, specifically where impounded water comes into contact with mine refuse. There are three openings to the deep mine workings; one currently discharges AMD (Gwin 1974). These seeps/discharges combine and flow into Little Anderson Creek.

The TMDL for Spencer Mine consists of a load allocation to OSL 330. Addressing the mining impacts for this drainage addresses the pH and metal impairment for the discharge. An instream flow measurement was available for OSL 330 (0.01 mgd).

There were fewer manganese and aluminum data than necessary for this discharge to conduct Monte Carlo analysis; therefore, they were not evaluated for this TMDL. However, the observations for manganese and aluminum in the downstream segments of Little Anderson Creek indicate that they also may be violating water quality standards. It is assumed that BMPs used to reduce iron loads in this reach also would reduce the amount of manganese and aluminum.

An allowable long-term average instream concentration was determined at point OSL 330 for iron and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point OSL 330 for this discharge are presented in Table G9.

Table G9. Reductions for the Spencer Discharge (OSL 330)

Station	**Parameter**	**Measured Sample Data**		**Allowable**		**Reduction Identified**
		Conc. (mg/l)	**Load (lbs/day)**	**LTA Conc. (mg/l)**	**Load (lbs/day)**	**Percent**
OSL330	Fe	1.82	0.15	0.42	0.04	77
	Acidity	201.40	16.80	0	0	100
	Alkalinity	0	0			

All values shown in this table are long-term average daily values.

The TMDL for the Spencer Discharge requires that a load allocation be made for OSL 330 for total iron and acidity.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Draucker Discharge (OSL 301)

The Draucker Discharge is a combination of discharges that originate from the Draucker #1 and #2 Mines, which were deep mined and later strip mined for Mercer Clay. The workings of Draucker #1 Mine are intercepted by the workings of the Pearce Mine. AMD is discharging from two openings of the deep mines that combine in an unnamed tributary to Little Anderson Creek. The Operation Scarlift report designated these discharges as the highest priority for reclamation (Lincoln 1999). The Anderson Creek Watershed Association also lists these discharges as a reclamation priority (Smeal 2001).

The TMDL for the Draucker Mine consists of a load allocation to OSL 301. Addressing the mining impacts for this drainage addresses impairment for the discharge. An instream flow measurement was available for OSL 301 (0.20 mgd).

There were fewer manganese and aluminum data than necessary for this discharge to conduct Monte Carlo analysis; therefore, they were not evaluated for this TMDL. However, the observations for manganese and aluminum in the downstream segments of Little Anderson Creek indicate that they also may be violating water quality standards. It is assumed that BMPs used to reduce iron loads in this reach also would reduce the amount of manganese and aluminum.

An allowable long-term average instream concentration was determined at point OSL 301 for iron and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point OSL 301 for this discharge are presented in Table G10.

Table G10. Reductions for the Draucker Discharge (OSL 301)

Station	***Parameter***	***Measured Sample Data***		***Allowable***		***Reduction Identified***
		Conc. (mg/l)	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***	***Percent***

OSL 301	Fe	153.13	255.42	0.61	1.02	99.6
	Mn	19.79	33.01	-	-	-
	Al	46.67	77.85	-	-	-
	Acidity	929.33	1,550.12	0	0	100
	Alkalinity	0.47	0.78			

All values shown in this table are long-term average daily values.

The TMDL for the Draucker Discharge requires that a load allocation be made for OSL 301 for total iron and acidity.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Wingert Discharge (OSL 303)

The Wingert Discharge originates from two ponds formed in the strip cuts left behind after extensive strip mining of the area. The headwaters of an unnamed tributary to Little Anderson Creek add a continual recharge to the system by flowing over the highwall and into the ponds. A small deep mine, known as Wingert Mine, also is present, though dry (Lincoln 1999). The Anderson Creek Watershed Association considers this site a reclamation priority (Smeal 2001).
The TMDL for Wingert Discharge consists of a load allocation to OSL 303. Addressing the mining impacts for this drainage addresses the impairment for the discharge. An instream flow measurement was available for OSL 303 (0.38 mgd).

There were fewer manganese and aluminum data than necessary for this discharge to conduct Monte Carlo analysis; therefore, they were not evaluated for this TMDL. However, the observations for manganese and aluminum in the downstream segments of Little Anderson Creek indicate that they also may be violating water quality standards. It is assumed that BMPs used to reduce iron loads in this reach also would reduce the amount of manganese and aluminum.

An allowable long-term average instream concentration was determined at point OSL 303 for iron and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point OSL 303 for this discharge are presented in Table G11.

Table G11. Reductions for the Wingert Discharge (OSL 303)

Station	Parameter	Measured Sample Data		Allowable		Reduction Identified
		Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)	Percent
OSL 303	Fe	20.66	65.48	0.41	1.30	98
	Mn	8.00	25.35	-	-	-
	Al	7.48	23.71	-	-	-
	Acidity	232.62	737.22	0	0	100
	Alkalinity	0	0			

All values shown in this table are long-term average daily values.

The TMDL for Wingert Discharge requires that a load allocation be made for OSL 303 for total iron and acidity.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Little Anderson Seeps Discharge (OSL 305)

The Little Anderson Seeps Discharge originates from several places in an old strip mined area. The combined discharges flow into an unnamed tributary to Little Anderson Creek before the confluence of Rock Run (Gwin 1974).

The TMDL for Little Anderson Seeps 305 Discharge consists of a load allocation to OSL 305. Addressing the mining impacts for this drainage addresses the impairment for the discharge. An instream flow measurement was available for OSL 305 (0.13 mgd).

There were fewer manganese and aluminum data than necessary for this discharge to conduct Monte Carlo analysis; therefore, they were not evaluated for this TMDL. However, the observations for manganese and aluminum in the downstream segments of Little Anderson Creek indicate that they also may be violating water quality standards. It is assumed that BMPs used to reduce iron loads in this reach also would reduce the amount of manganese and aluminum.

An allowable long-term average instream concentration was determined at point OSL 305 for iron and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point OSL 305 for this discharge are presented in Table G12.

Table G12. Reductions for the Little Anderson Seeps Discharge (OSL 305)

Station	Parameter	Measured Sample Data		Allowable		Reduction Identified
		Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)	Percent
OSL 305	Fe	49.11	53.25	0.44	0.48	99.1
	Acidity	479.17	519.52	0	0	100
	Alkalinity	0	0			

All values shown in this table are long-term average daily values.

The TMDL for Little Anderson Seeps Discharge requires that a load allocation be made for OSL 305 for total iron and acidity.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Rock Run at its Headwaters

Rock Run is impacted by AMD from discharges and seeps from old spoil beginning at its headwaters. The Operation Scarlift report (Gwin 1974) identifies several seeps that affect Rock Run. The loads from these discharges will be allocated at RR1 because the flows from the discharges are minimal.

The TMDL for Rock Run consists of a load allocation to all of the watershed area above point RR1. Addressing the mining impacts above this point addresses the pH and metal impairment for the discharge. An instream flow measurement was available for RR1 (0.83 mgd).

An allowable long-term average instream concentration was determined at point RR1 for iron, manganese, aluminum, and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point RR1 for this stream segment are presented in Table G13.

Table G13. Reductions for Rock Run above RR1				
Station	***Parameter***	***Measured Sample Data***	***Allowable***	***Reduction Identified***

		Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)	Percent
RR1	Fe	2.17	15.02	0.54	3.74	75
	Mn	18.86	130.55	0.38	2.63	98
	Al	2.70	18.69	0.32	2.22	88
	Acidity	82.54	571.36	0.25	1.73	99.7
	Alkalinity	0.69	4.78			

All values shown in this table are long-term average daily values.

The TMDL for Rock Run at point RR1 requires that a load allocation be made for all areas above RR1 for total iron, total manganese, total aluminum and acidity.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Rock Run at RR2

Rock Run at RR2 is impacted by AMD from discharges and seeps from old spoil and an unnamed tributary. The Operation Scarlift report (Gwin 1974) identifies several seeps that affect Rock Run. The loads from these discharges will be allocated at RR2 because the flows from the discharges are minimal.

The TMDL for Rock Run consists of a load allocation to all of the watershed area between points RR1 and RR2. Addressing the mining impacts above this point addresses the pH and metal impairment for the discharge. An instream flow measurement was available for RR2 (1.31 mgd).

An allowable long-term average instream concentration was determined at point RR2 for iron, manganese, aluminum, and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point RR2 for this stream segment are presented in Table G14.

Table G14. Long Term Average (LTA) Concentrations for Rock Run Above RR2					
Station	Parameter	Measured Sample Data		Allowable	
		Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
RR2	Fe	1.62	17.70	0.31	3.39
	Mn	17.49	191.09	0.17	1.86
	Al	2.76	30.15	0.28	3.06
	Acidity	62.88	686.99	3.77	41.19
	Alkalinity	14.35	156.78		

All values shown in this table are long-term average daily values.

The loading reductions for RR1 were used to show the total load that was removed from upstream sources. For each parameter, the total load that was removed upstream was subtracted from the existing load at point RR2. This value was compared to the allowable load at point RR2. Reductions at point RR2 are necessary for any parameter that exceeds the allowable load at this point. A summary of all loads that affect point RR2 are shown in Table G15. Necessary reductions at point RR2 are shown in Table G16.

Table G15. Summary of Loads Affecting Point RR2				
	Iron (lbs/day)	Manganese (lbs/day)	Aluminum (lbs/day)	Acidity (lbs/day)
RR1				
Existing Load	15.02	130.55	18.69	571.36
Allowable Load	3.74	2.63	2.22	1.73
Load Reduction	11.28	127.92	16.47	569.63

Table G16. Reductions Necessary at Point RR2				
	Iron (lbs/day)	Manganese (lbs/day)	Aluminum (lbs/day)	Acidity (lbs/day)
Existing Loads at RR2	17.70	191.09	30.15	686.99
Total Load Reduction (RR1)	11.28	127.92	16.47	569.63
Remaining Load	6.42	63.17	13.68	117.36
Allowable Loads at RR2	3.39	1.86	3.06	41.19
Percent Reduction	47	97	78	65

The TMDL for Rock Run at point RR2 requires that a load allocation be made for total iron, total manganese, total aluminum, and acidity.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Unnamed Tributary to Rock Run

The Unnamed Tributary to Rock Run is impacted by AMD from discharges and seeps from old spoil beginning at its headwaters. There are two discharges identified by the Operation Scarlift report (Gwin 1974) that affect the Unnamed Tributary to Rock Run. The loads from these discharges will be allocated at UNT RR because the flows from the discharges are minimal.

The TMDL for the Unnamed Tributary to Rock Run consists of a load allocation to all of the watershed area above point UNT RR. Addressing the mining impacts above this point addresses the pH and metal impairment for the discharge. An instream flow measurement was available for RR1 (0.12 mgd).

There were fewer aluminum data than necessary for this discharge to conduct Monte Carlo analysis; therefore, it was not evaluated for this TMDL. However, the observations for aluminum in the downstream segments of Rock Run indicate that it also may be violating water quality standards. It is assumed that BMPs used to reduce iron loads in this reach also would reduce the amount of aluminum.

An allowable long-term average instream concentration was determined at point UNT RR for iron, manganese, and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point UNT RR for this stream segment are presented in Table G17.

Table G17. Reductions for the Unnamed Tributary to Rock Run above UNT RR

Station	Parameter	Measured Sample Data		Allowable		Reduction Identified
		Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)	Percent
UNT RR	Fe	0.62	0.62	0.30	0.30	52
	Mn	22.03	22.05	0.20	0.20	99.1
	Al	0.80	0.80	-	-	-
	Acidity	59.38	59.43	1.19	1.19	98
	Alkalinity	5.99	5.99			

All values shown in this table are long-term average daily values.

The TMDL for the Unnamed Tributary to Rock Run at point UNT RR requires that a load allocation be made for all areas above UNT RR for total iron, total manganese, and acidity.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Future Mining Waste Load Allocation (WLA)

It is anticipated that there will be mining in the Rock Run Creek Watershed in the near future based on available coal reserves, mining operator interests, re-mining reclamation potential, and other factors. A WLA that is representative of one future surface mining operation has been included to accommodate this eventuality.

The WLAs for iron, manganese, and aluminum were calculated using the methodology explained in the *Method to Quantify Treatment Pond Pollutant Load* section in Attachment C. The following table shows the wasteload allocations for the discharge.

Table E21. Wasteload Allocations for Future Mining Site

Paramet er	***Monthly Avg. Allowable Conc. (mg/l)***	***Average Flow (MGD)***	***Allowable Load (lbs/day)***
Fe	3.0	0.0446	1.1
Mn	2.0	0.0446	0.7
Al	2.0	0.0446	0.7

Rock Run at RR3

Rock Run at RR3 represents Rock Run after the confluence with the Unnamed Tributary to Rock Run.

The TMDL for Rock Run consists of a load allocation to all of the watershed area between point RR2 and point RR3. Addressing the mining impacts above this point addresses the impairment for the segment. An instream flow measurement was not available for RR3; therefore, the flow was determined using the AVGWLF model (3.02 mgd).

An allowable long-term average instream concentration was determined at point RR3 for iron, manganese, aluminum, and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point RR3 for this stream segment are presented in Table G18.

Table G18. Long Term Average (LTA) Concentrations for Rock Run Above RR3					
Station	Parameter	Measured Sample Data		Allowable	
		Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
RR3	Fe	2.61	65.74	0.31	7.81
	Mn	20.20	508.77	0.20	5.04
	Al	0.92	23.17	0.19	4.79
	Acidity	76.85	1,935.61	4.61	116.11
	Alkalinity	17.88	450.34		

All values shown in this table are long-term average daily values.

The loading reductions for RR1, RR2 and UNT RR were used to show the total load that was removed from upstream sources. For each parameter, the total load that was removed upstream was subtracted from the existing load at point RR3. This value was compared to the allowable load at point RR3. Reductions at point RR3 are necessary for any parameter that exceeds the allowable load at this point. A summary of all loads that affect point RR3 are shown in Table G19. Necessary reductions at point RR3 are shown in Table G20.

Table G19. Summary of Loads Affecting Point RR3				
	Iron (lbs/day)	Manganese (lbs/day)	Aluminum (lbs/day)	Acidity (lbs/day)
RR1				
Existing Load	15.02	130.55	18.69	571.36
Allowable Load	3.74	2.63	2.22	1.73
Load Reduction	11.28	127.92	16.47	569.63
RR2				
Existing Load	17.70	191.09	30.15	686.99
Allowable Load	3.39	1.86	3.06	41.19
Load Reduction	14.31	189.23	27.09	645.80
UNT RR				
Existing Load	0.62	22.05	0.80	59.43
Allowable Load	0.30	0.20	-	1.19
Load Reduction	0.32	21.85	-	58.24

Table G20. Reductions Necessary at Point RR3				
	Iron (lbs/day)	Manganese (lbs/day)	Aluminum (lbs/day)	Acidity (lbs/day)
Existing Loads at RR3	65.74	508.77	23.17	1,935.61
Total Load Reduction (RR1, RR2, and UNT RR)	25.91	339.00	43.56	1,273.67
Remaining Load	39.83	169.77	0	661.94
Allowable Loads at RR3	7.81	5.04	4.79	116.11
Percent Reduction	80	97	0	82

The TMDL for Rock Run at point RR3 requires that a load allocation be made for total iron, total manganese, and acidity. The TMDL for Rock Run at point RR3 does not require a load allocation to be made for total aluminum. All necessary reductions have been made upstream from this point.

Future Mining Waste Load Allocation (WLA)

It is anticipated that there will be mining in the Rock Run Creek Watershed in the near future based on available coal reserves, mining operator interests, re-mining reclamation potential, and other factors. A WLA that is representative of one future surface mining operation has been included to accommodate this eventuality.

The WLAs for iron, manganese, and aluminum were calculated using the methodology explained in the *Method to Quantify Treatment Pond Pollutant Load* section in Attachment C. The following table shows the wasteload allocations for the discharge.

Table E21. Wasteload Allocations for Future Mining Site

Parameter	***Monthly Avg. Allowable Conc. (mg/l)***	***Average Flow (MGD)***	***Allowable Load (lbs/day)***
Fe	3.0	0.0446	1.1
Mn	2.0	0.0446	0.7
Al	2.0	0.0446	0.7

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Little Anderson at LA3

Little Anderson Creek at point LA3 represents Little Anderson Creek after the addition of the OSL Discharges 352, 329, 330, 301, 303, and 305, the confluence of one unnamed tributary to Little Anderson Creek, and the confluence of Rock Run.

The TMDL for this section of Little Anderson Creek consists of a load allocation to all of the watershed area between point LA2 and point LA3. Addressing the mining impacts above this point addresses the pH and metal impairment for the segment. An instream flow measurement was not available for LA3; therefore, the flow was determined using the AVGWLF model (10.42 mgd).

An allowable long-term average instream concentration was determined at point LA3 for iron, manganese, aluminum, and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point LA3 for this stream segment are presented in Table G21.

Table G21. Long Term Average (LTA) Concentrations for Little Anderson Creek at LA3

Station	**Parameter**	**Measured Sample Data**		**Allowable**	
		Conc. (mg/l)	**Load (lbs/day)**	**LTA Conc. (mg/l)**	**Load (lbs/day)**
LA3	Fe	5.06	439.73	0.56	48.67
	Mn	4.74	411.92	0.52	45.19
	Al	5.47	475.36	0.38	33.02
	Acidity	78.00	6,778.42	0	0
	Alkalinity	0	0		

All values shown in this table are long-term average daily values.

The loading reductions for the upstream discharges, LA1, UNT LA1, LA2, UNT LA2, RR1, RR2, UNT RR, and RR3 were used to show the total load that was removed from upstream sources. For each parameter, the total load that was removed upstream was subtracted from the existing load at point LA3. This value was compared to the allowable load at point LA3. Reductions at point LA3 are necessary for any parameter that exceeds the allowable load at this point. A summary of all loads that affect point LA3 are shown in Table G22. Necessary reductions at point LA3 are shown in Table G23.

Table 22. Summary of Loads Affecting Point LA3				
	Iron (lbs/day)	*Manganese (lbs/day)*	*Aluminum (lbs/day)*	*Acidity (lbs/day)*
LA1				
Existing Load	4.67	6.37	0.31	31.16
Allowable Load	0.19	0.19	0.26	1.86
Load Reduction	4.48	6.18	0.05	29.30
UNT LA1				
Existing Load	2.53	4.43	0.14	0.54
Allowable Load	0.45	0.23	0.14	0.55
Load Reduction	2.08	4.20	0	0
LA2				
Existing Load	6.72	46.02	4.14	34.39
Allowable Load	4.40	3.23	2.71	17.84
Load Reduction	2.32	42.79	1.43	16.55
UNT LA2				
Existing Load	0.47	1.70	1.11	7.84
Allowable Load	0.19	0.12	0.05	1.01
Load Reduction	0.28	1.58	1.06	6.83
OSL 352				
Existing Load	26.29	-	-	286.90
Allowable Load	0.21	-	-	0
Load Reduction	26.08	-	-	286.90
OSL 329				
Existing Load	143.13	-	-	760.61
Allowable Load	0.57	-	-	0
Load Reduction	142.56	-	-	760.61
OSL 330				
Existing Load	0.15	-	-	16.80
Allowable Load	0.04	-	-	0
Load Reduction	0.11			16.80
OSL 301				
Existing Load	255.42	33.01	77.85	1,550.12
Allowable Load	1.02	-	-	0
Load Reduction	254.40	-	-	1,550.12
OSL 303				
Existing Load	65.48	25.35	23.71	737.22
Allowable Load	1.30	-	-	0
Load Reduction	64.18	-	-	737.22
OSL 305				
Existing Load	53.25	-	-	519.52
Allowable Load	0.48	-	-	0
Load Reduction	52.77			519.52
RR1				
Existing Load	15.02	130.55	18.69	571.36
Allowable Load	3.74	2.63	2.22	1.73
Load Reduction	11.28	127.92	16.47	569.63
RR2				
Existing Load	17.70	191.09	30.15	686.99
Allowable Load	3.39	1.86	3.06	41.19
Load Reduction	14.31	189.23	27.09	645.80
UNT RR				
Existing Load	0.62	22.05	0.80	59.43
Allowable Load	0.30	0.20	-	1.19
Load Reduction	0.32	21.85	-	58.24
RR3				
Existing Load	65.74	508.77	23.17	1,935.61
Allowable Load	7.81	5.04	4.79	116.11
Load Reduction	57.93	503.73	18.38	1,819.50

Table G23. Reductions Necessary at Point LA3				
	Iron (lbs/day)	Manganese (lbs/day)	Aluminum (lbs/day)	Acidity (lbs/day)
Existing Loads at LA3	439.73	411.92	475.36	6,778.42
Total Load Reduction (Sum of OSL Discharges, La1, UNT LA1, LA2, UNT LA2, RR1, RR2, UNT RR, and RR3)	633.1	897.48	64.48	7,017.02
Remaining Load	0	0	410.88	0
Allowable Loads at LA3	48.67	45.19	33.02	0
Percent Reduction	0	0	92	0

The TMDL for point LA3 requires that a load allocation be made for all areas above LA3 for total aluminum. The TMDL for Little Anderson Creek at point LA3 does not require a load allocation to be made for total iron, total manganese, and acidity. All necessary reductions have been made upstream from this point.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The unit area flow was used to derive loading values for the TMDL.

Korb Discharge (OSL 350)

Harbison Walker Refractories deep mined the area known as the Korb Complex and then the mine openings were stripped for Mercer Clay. During the mining the Korb Complex combined with the Spencer Mine Complex. When the mining ceased four discharges were produced (OSL 329, 350, 351, 352). OSL 329 and 352 drain into Little Anderson Creek while OSL 350 and 351 drains into an unnamed tributary of Anderson Creek. The Anderson Creek Watershed Association considers OSL 350 a priority site for reclamation (Smeal 2001).

The TMDL for Korb Discharge consists of a load allocation to OSL 350. Addressing the mining impacts for this drainage addresses the impairment for the discharge. An instream flow measurement was available for OSL 350 (0.05 mgd).

There were fewer manganese and aluminum data than necessary for this discharge to conduct Monte Carlo analysis; therefore, they were not evaluated for this TMDL. However, the observations for manganese and aluminum in the downstream segments of Little Anderson Creek indicate that they also may be violating water quality standards. It is assumed that BMPs used to reduce iron loads in this reach also would reduce the amount of manganese and aluminum.

An allowable long-term average instream concentration was determined at point OSL 350 for iron and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point OSL 350 for this discharge are presented in Table G24.

Table G24. Reductions for the Korb Discharge (OSL 350)

Station	**Parameter**	**Measured Sample Data**		**Allowable**		**Reduction Identified**
		Conc. (mg/l)	**Load (lbs/day)**	**LTA Conc. (mg/l)**	**Load (lbs/day)**	**Percent**
OSL 350	Fe	111.02	46.30	0.44	0.18	99.6
	Mn	0.91	0.38	-	-	-
	Al	13.00	5.42	-	-	-
	Acidity	872.92	364.01	0	0	100
	Alkalinity	0	0			

All values shown in this table are long-term average daily values.

The TMDL for Korb Discharge requires that a load allocation be made for OSL 350 for total iron and acidity.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Korb Discharge (OSL 351)

Harbison Walker Refractories deep mined the area known as the Korb Complex and then the mine openings were stripped for Mercer Clay. During the mining the Korb Complex combined with the Spencer Mine Complex. When the mining ceased four discharges were produced (OSL 329, 350, 351, 352). OSL 329 and 352 drain into Little Anderson Creek while OSL 350 and 351 drains into an unnamed tributary of Anderson Creek. The Anderson Creek Watershed Association considers OSL 351 a priority site for reclamation (Smeal 2001).

The TMDL for Korb Discharge consists of a load allocation to OSL 351. Addressing the mining impacts for this drainage addresses the impairment for the discharge. An instream flow measurement was available for OSL 351 (0.02mgd).

There were fewer manganese and aluminum data than necessary for this discharge to conduct Monte Carlo analysis; therefore, they were not evaluated for this TMDL. However, the observations for manganese and aluminum in the downstream segments of Little Anderson Creek indicate that they also may be violating water quality standards. It is assumed that BMPs used to reduce iron loads in this reach also would reduce the amount of manganese and aluminum.

An allowable long-term average instream concentration was determined at point OSL 351 for iron and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point OSL 351 for this discharge are presented in Table G25.

Table G25. Reductions for the Korb Discharge (OSL 351)						
Station	***Parameter***	***Measured Sample Data***		***Allowable***		***Reduction Identified***
		Conc. (mg/l)	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***	***Percent***
OSL 351	Fe	45.93	7.66	0.41	0.07	99.1
	Mn	0.10	0.02	-	-	-
	Al	0.20	0.03	-	-	-
	Acidity	604.15	100.77	0	0	100
	Alkalinity	4.00	0.67			

All values shown in this table are long-term average daily values.

The TMDL for Korb Discharge requires that a load allocation be made for OSL 352 for total iron and acidity.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Hughey Run

Hughey Run is a tributary to Bilger Run. Although no major discharges impact Hughey Run, levels of acidity and iron are high. This may be due to small seeps or may be the natural background condition of the stream; more study is necessary to determine the origin of the pollutants.

The TMDL for Hughey Run consists of a load allocation to all of the watershed area above point HR1. Addressing the mining impacts above this point addresses the impairment for the segment. An instream flow measurement was available for HR1 (0.66 mgd).

An allowable long-term average instream concentration was determined at point HR1 for iron, manganese, aluminum, and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point HR1 for this stream segment are presented in Table G26.

Table G26. Reductions for Hughey Run Above HR1

Station	**Parameter**	***Measured Sample Data***		***Allowable***		***Reduction Identified***
		Conc. (mg/l)	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***	***Percent***
HR1	Fe	0.62	3.41	0.25	1.38	59
	Mn	0.19	1.05	0.19	1.05	0
	Al	0.21	1.16	0.21	1.16	0
	Acid	8.31	45.74	1.16	6.39	86
	Alkalinity	9.58	52.73			

All values shown in this table are long-term average daily values.

The TMDL for Hughey Run at point HR1 requires that a load allocation be made for all areas above HR1 for total iron and acidity. The TMDL for Hughey Run at point HR1 does not require a load allocation to be made for total manganese and total aluminum.

Gerald S. Dimmick has an active non-coal mining permit in the Hughey Run Watershed (MP# 17920801). This operation does not have a NPDES permit; therefore, a wasteload allocation is not necessary.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Stronach Discharges (OSL 211-214)

The Stronach Discharges are a collection of four discharges that flow through spoil materials and into Bilger Run. They will be considered together for the purposes of these TMDL analyses.

The TMDL for the Stronach Discharges consists of a load allocation to OSL 211-214. Addressing the mining impacts for this drainage addresses the impairment for the discharge. An instream flow measurement was available for OSL 211-214 (0.30 mgd).

There were fewer manganese and aluminum data than necessary for these discharges to conduct Monte Carlo analysis; therefore, they were not evaluated for this TMDL. However, the observations for manganese and aluminum in the downstream segments of Bilger Run indicate that they also may be violating water quality standards. It is assumed that BMPs used to reduce iron loads in this reach also would reduce the amount of manganese and aluminum.

An allowable long-term average instream concentration was determined at point OSL 211-214 for iron and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point OSL 211-214 for this discharge are presented in Table G27.

Table G27. Reductions for the Stronach Discharges (OSL 211-214)

Station	***Parameter***	***Measured Sample Data***		***Allowable***		***Reduction Identified***
		Conc. (mg/l)	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***	***Percent***
OSL 211-214	Fe	7.40	18.51	0.07	0.18	99
	Acidity	271.54	679.39	0	0	100
	Alkalinity	0	0			

All values shown in this table are long-term average daily values.

The TMDL for the Stronach Discharges requires that a load allocation be made at OSL 211-214 for total iron and acidity.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Bilger Run above BR1

Bilger Run at BR1 represents Bilger Run before the confluence with Hughey Run. Bilger Run in this reach receives drainage from the Stronach Discharges (OSL 211-214).

The TMDL for Bilger Run consists of a load allocation to all of the watershed area above point BR1. Addressing the mining impacts above this point addresses the impairment for the segment. An instream flow measurement was available for BR1 (1.84 mgd).

An allowable long-term average instream concentration was determined at point BR1 for iron, manganese, aluminum, and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point BR1 for this stream segment are presented in Table G28.

Table G28. Long Term Average (LTA) Concentrations for Bilger Run Above BR1					
Station	Parameter	Measured Sample Data		Allowable	
		Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
BR1	Fe	1.66	25.47	0.20	3.07
	Mn	6.01	92.23	0.24	3.68
	Al	2.44	37.44	0.15	2.30
	Acidity	43.05	660.63	0.86	13.20
	Alkalinity	4.76	73.05		

All values shown in this table are long-term average daily values.

The loading reductions for the Stronach Discharges (OSL 211-214) were used to show the total load that was removed from upstream sources. For each parameter, the total load that was removed upstream was subtracted from the existing load at point BR1. This value was compared to the allowable load at point BR1. Reductions at point BR1 are necessary for any parameter that exceeds the allowable load at this point. A summary of all loads that affect point BR1 are shown in Table G29. Necessary reductions at point BR1 are shown in Table G30.

Table G29. Summary of Loads Affecting Point BR1				
	Iron (lbs/day)	Manganese (lbs/day)	Aluminum (lbs/day)	Acidity (lbs/day)
OSL 211-214				
Existing Load	18.51	-	-	679.39
Allowable Load	0.18	-	-	0
Load Reduction	18.33	-	-	679.39

Table G30. Reductions Necessary at Point BR1				
	Iron (lbs/day)	Manganese (lbs/day)	Aluminum (lbs/day)	Acidity (lbs/day)
Existing Loads at BR1	25.47	92.23	37.44	660.63
Total Load Reduction (OSL 211-214)	18.33	-	-	679.39
Remaining Load	7.14	92.23	37.44	0
Allowable Loads at BR1	3.07	3.68	2.30	13.20
Percent Reduction	57	96	94	0

The TMDL for Bilger Run at point BR1 requires that a load allocation be made for total iron, total manganese, and total aluminum. The TMDL for Bilger Run at point BR1 does not require a load allocation to be made for acidity. All necessary reductions have been made upstream from this point.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Bilger Run between BR1 and BR2

Bilger Run between BR1 and BR2 receives drainage from Hughey Run. It represents Bilger Run upstream of the confluence with Fenton Run.

The TMDL for Bilger Run at point BR2 consists of a load allocation to all of the watershed area between BR1 and BR2. Addressing the mining impacts above this point addresses the impairment for the segment. An instream flow measurement was not available for BR2; therefore, the flow was determined using the AVGWLF model (4.14 mgd).

An allowable long-term average instream concentration was determined at point BR2 for iron, manganese, aluminum, and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point BR2 for this stream segment are presented in Table G31.

Table G31. Long Term Average (LTA) Concentrations for Bilger Run Between BR1 and BR2

Station	***Parameter***	***Measured Sample Data***		***Allowable***	
		Conc. (mg/l)	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
BR2	Fe	0.87	30.04	0.04	13.81
	Mn	6.51	224.77	0.31	10.70
	Al	1.73	59.73	0.12	4.14
	Acidity	45.59	1,574.11	0.91	31.42
	Alkalinity	4.54	156.76		

All values shown in this table are long-term average daily values.

The loading reductions for HR1, OSL 211-214, and BR1 were used to show the total load that was removed from upstream sources. For each parameter, the total load that was removed upstream was subtracted from the existing load at point BR2. This value was compared to the allowable load at point BR2. Reductions at point BR2 are necessary for any parameter that exceeds the allowable load at this point. A summary of all loads that affect point BR2 are shown in Table G32. Necessary reductions at point BR2 are shown in Table G33.

Table G32. Summary of Loads Affecting Point BR2

	Iron (lbs/day)	***Manganese (lbs/day)***	***Aluminum (lbs/day)***	***Acidity (lbs/day)***
HR1				
Existing Load	3.41	1.05	1.16	45.74
Allowable Load	1.38	1.05	1.16	6.39
Load Reduction	2.03	0	0	39.35
OSL 211-214				
Existing Load	18.51	-	-	679.39
Allowable Load	0.18	-	-	0
Load Reduction	18.33	-	-	679.39
BR1				
Existing Load	25.47	92.23	37.44	660.63
Allowable Load	3.07	3.68	2.30	13.20
Load Reduction	22.40	88.55	35.14	647.43

Table G33. Reductions Necessary at Point BR2

	Iron (lbs/day)	***Manganese (lbs/day)***	***Aluminum (lbs/day)***	***Acidity (lbs/day)***
Existing Loads at BR2	30.04	224.77	59.73	1,574.11
Total Load Reduction (OSL 211-214, BR1, and HR1)	42.76	88.55	35.14	1,366.17
Remaining Load	0	136.22	24.59	207.94
Allowable Loads at BR2	13.81	10.70	4.14	31.42
Percent Reduction	0	92	83	85

The TMDL for Bilger Run at point BR2 requires that a load allocation be made for total manganese, total aluminum, and acidity. The TMDL for Bilger Run at point BR2 does not require a load allocation to be made for total iron. All necessary reductions have been made upstream from this point.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The unit area flow was used to derive loading values for the TMDL.

Fenton Run

Fenton Run is a tributary of Bilger Run. While no major discharges drain into Fenton Run, it is still impacted by AMD, most likely the result of diffuse pollution.

Sample data for Fenton Run show pH to range between 4.15 and 7.65, with an average pH of 6.34. The 99th percentile acidity concentration determined by Monte Carlo analysis shows FR1 to be net acidic (37.89 mg/L acidity compared to 22.72 mg/L alkalinity). Therefore, reductions in acidity were taken at FR1. The method and rationale for addressing pH is contained in Attachment E.

The TMDL for Fenton Run consists of a load allocation to all of the watershed area above point FR1. Addressing the mining impacts above this point addresses the pH and metal impairment for the segment. An instream flow measurement was available for FR1 (0.31 mgd).

There were fewer aluminum data than necessary for FR1 to conduct Monte Carlo analysis; therefore, it was not evaluated for this TMDL. However, the observations for other metals indicate that it also may be violating water quality standards. It is assumed that BMPs used to reduce iron loads in this reach also would reduce the amount of aluminum.

An allowable long-term average instream concentration was determined at point FR1 for iron, manganese, and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point FR1 for this stream segment are presented in Table G34.

Table G34. Reductions for Fenton Run Above FR1						
Station	Parameter	Measured Sample Data		Allowable		Reduction Identified
		Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)	Percent
FR1	Fe	0.51	1.32	0.19	0.49	63
	Mn	1.92	4.96	0.13	0.34	93
	Al	1.56	4.03	-	-	-
	Acid	5.50	14.22	3.24	8.38	41
	Alkalinity	22.72	58.74			

All values shown in this table are long-term average daily values.

The TMDL for Fenton Run at point FR1 requires that a load allocation be made for all areas above FR1 for total iron, total manganese, and acidity.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Kratzer Run above KR1

Kratzer Run above KR1 represents the headwaters of Kratzer Run upstream of the town of Hepburnia.

Sample data for point KR1 show pH ranging between 6.7 and 6.9 with an average pH of 6.8. Therefore, reductions in acidity were not taken for point KR1 because it is meeting the pH criteria of between 6.0 and 9.0. The method and rationale for addressing pH is contained in Attachment E.

The TMDL for Kratzer Run consists of a load allocation to all of the watershed area above point KR1. Addressing the mining impacts above this point addresses the pH and metal impairment for the segment. An instream flow measurement was not available for KR1; therefore, the flow for this point was determined using the AVGWLF model (1.41 mgd).

An allowable long-term average instream concentration was determined at point KR1 for iron, manganese, aluminum, and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point KR1 for this stream segment are presented in Table G35.

Table G35. Reductions for Kratzer Run Above KR1

Station	Parameter	Measured Sample Data		Allowable		Reduction Identified
		Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)	Percent
KR1	Fe	0.58	6.82	0.58	6.82	0
	Mn	0.13	1.53	0.13	1.53	0
	Al	0.25	2.94	0.25	2.94	0
	Acid	0.50	5.88	0.51	6.00	0
	Alkalinity	53.00	623.25			

All values shown in this table are long-term average daily values.

The TMDL for Kratzer Run at point KR1 does not require a load allocation to be made for total iron, total manganese, total aluminum, and acidity.

A coal mining permit has just been issued in the Kratzer Run Watershed to Hepburnia Coal Company (MP# 17000110, NPDES PA0243019). The operation has not yet commenced. After consultation with a mining inspector, it was decided that a waste load allocation for the permit is not necessary. If a discharge were to occur, it would likely be alkaline and low in metals due to the nature of the Upper and Lower Freeport coal seams (Salada 2002). However, the operation is not expected to produce a discharge.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Kratzer Run at KR2

Kratzer Run between KR1 and KR2 receives drainage from several unnamed tributaries. The point KR2 lies between Grampian and Stronach; it represents Kratzer Run before it receives drainage from the Widemire Discharge (OSL 220) and Bilger Run.

Monte Carlo analysis was not conducted for point KR2 because there were fewer data points than necessary (4). An instream flow measurement was not available for KR2; therefore, the flow for this point was determined using the AVGWLF model (4.68 mgd). The data points indicate that Kratzer Run is meeting water quality standards at KR2. The water quality data is found in Table G36.

Table G36. Long Term Average (LTA) Concentrations for Kratzer Run Between KR1 and KR2

Station	***Parameter***	***Measured Sample Data***	
		Conc. (mg/l)	***Load (lbs/day)***
KR2	Fe	0.83	32.40
	Mn	0.87	33.96
	Al	0.38	14.83
	Acidity	1.53	59.72
	Alkalinity	22.13	863.76

All values shown in this table are long-term average daily values.

Widemire Discharge (OSL 220)

The Widemire Discharge is from the Widemire Mine that was deep mined for Mercer Clay by Harbison Walker Refractories. A second, much smaller discharge (OSL 221) with similar chemical characteristics, occurs in the same area but its effects are minimal compared to OSL 220. The Anderson Creek Watershed Association considers this discharge as a reclamation priority (Smeal 2001).

The TMDL for Widemire Discharge consists of a load allocation to OSL 220. Addressing the mining impacts for this drainage addresses the pH and metal impairment for the discharge. An instream flow measurement was available for OSL 220 (1.53 mgd).

There were fewer manganese and aluminum data than necessary for this discharge to conduct Monte Carlo analysis; therefore, they were not evaluated for this TMDL. However, the observations for manganese and aluminum in the downstream segments of an unnamed tributary to Kratzer Run indicate that they also may be violating water quality standards. It is assumed that BMPs used to reduce iron loads in this reach also would reduce the amount of manganese and aluminum.

An allowable long-term average instream concentration was determined at point OSL 220 for iron and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point OSL 220 for this discharge are presented in Table G37.

Table G37. Reductions for the Widemire Discharge (OSL 220)

Station	***Parameter***	***Measured Sample Data***		***Allowable***		***Reduction Identified***
		Conc. (mg/l)	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***	***Percent***
OSL 220	Fe	10.17	129.77	0.51	6.51	95
	Acidity	86.83	1,107.97	0	0	100
	Alkalinity	0	0			

All values shown in this table are long-term average daily values.

The TMDL for Widemire Discharge requires that a load allocation be made for OSL 220 for total iron and acidity.

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The average flow was used to derive loading values for the TMDL.

Anderson Creek between A1 and A2

Anderson Creek between A1 and A2 represents Anderson Creek and its unnamed tributaries from above the confluence with Little Anderson Creek to the mouth of Anderson Creek. This includes the entire main-stem segment and its unnamed tributaries from below the DuBois reservoir at point A1 to the mouth of Anderson Creek at the West Branch of the Susquehanna River in Curwensville.

The TMDL for Anderson Creek at point A2 consists of a load allocation to all of the watershed area between A1 and A2. Addressing the mining impacts above this point addresses the pH and metal impairment for the segment. An instream flow measurement was not available for A2; therefore, the flow was determined using the AVGWLF model (74.19 mgd).

The water quality standard for acidity (17.85 mg/l) at point A2 was determined by adding the net alkalinity at A1 (A1 alkalinity – A1 acidity) to the acidity at A2 (9.97 –4.70 = 5.27; 5.27 + 12.58 = 17.85). Load reductions for acidity were calculated using this value as the water quality standard for acidity at point A2.

There were fewer manganese and aluminum data than necessary for this discharge to conduct Monte Carlo analysis; therefore, they were not evaluated for this TMDL. However, the observations for manganese and aluminum in these segments of Anderson Creek indicate that they also may be violating water quality standards. It is assumed that BMPs used to reduce iron loads in this reach also would reduce the amount of manganese and aluminum.

An allowable long-term average instream concentration was determined at point A2 for iron and acidity. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 that percent reduction times that sampled value was run to insure that criteria were met 99 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards. The load allocations made at point A2 for this stream segment are presented in Table G38.

Table G38. Long Term Average (LTA) Concentrations for Anderson Creek Between A1 and A2					
Station	**Parameter**	**Measured Sample Data**		**Allowable**	
		Conc. (mg/l)	**Load (lbs/day)**	**LTA Conc. (mg/l)**	**Load (lbs/day)**
A2	Fe	0.28	173.25	0.28	173.25
	Mn	0.92	569.25	-	-
	Al	0.79	488.81	-	-
	Acidity	12.58	7,783.81	8.55	5,290.27
	Alkalinity	1.63 (17.85)*	1,008.55 (11,044.59)*		

All values shown in this table are long-term average daily values.
*Alkalinity value used as water quality standard

The loading reductions for LA1, UNT LA1, LA2, UNT LA2; OSL 352, 329, 330, 301, 303, 305; RR1, RR2, UNT RR, RR3, LA3, OSL 350, OSL 351, HR1, OSL 211-214, BR1, BR2, FR1, KR1, and OSL 220 were used to show the total load that was removed from upstream sources. For each parameter, the total load that was removed upstream was subtracted from the existing load at point A2. This value was compared to the allowable load at point A2. Reductions at point A2 are necessary for any parameter that exceeds the allowable load at this point. A summary of all loads that affect point A2 are shown in Table G39. Necessary reductions at point A2 are shown in Table G40.

Table G39. Summary of Loads Affecting Point A2				
	Iron (lbs/day)	**Manganese (lbs/day)**	**Aluminum (lbs/day)**	**Acidity (lbs/day)**
LA1				
Existing Load	4.67	6.37	0.31	31.16
Allowable Load	0.19	0.19	0.26	1.86
Load Reduction	4.48	6.18	0.05	29.30
UNT LA1				
Existing Load	2.53	4.43	0.14	0.54
Allowable Load	0.45	0.23	0.14	0.55
Load Reduction	2.08	4.20	0	0
LA2				
Existing Load	6.72	46.02	4.14	34.39
Allowable Load	4.40	3.23	2.71	17.84
Load Reduction	2.32	42.79	1.43	16.55
UNT LA2				
Existing Load	0.47	1.70	1.11	7.84
Allowable Load	0.19	0.12	0.05	1.01
Load Reduction	0.28	1.58	1.06	6.83
OSL 352				
Existing Load	26.29	-	-	286.90
Allowable Load	0.21	-	-	0
Load Reduction	26.08	-	-	286.90
OSL 329				
Existing Load	143.13	-	-	760.61
Allowable Load	0.57	-	-	0
Load Reduction	142.56	-	-	760.61
OSL 330				
Existing Load	0.15	-	-	16.80

Table G39. Summary of Loads Affecting Point A2				
	Iron (lbs/day)	*Manganese (lbs/day)*	*Aluminum (lbs/day)*	*Acidity (lbs/day)*
Allowable Load	0.04	-	-	0
Load Reduction	0.11			16.80
OSL 301				
Existing Load	255.42	33.01	77.85	1,550.12
Allowable Load	1.02	-	-	0
Load Reduction	254.40	-	-	1,550.12
OSL 303				
Existing Load	65.48	25.35	23.71	737.22
Allowable Load	1.30	-	-	0
Load Reduction	64.18	-	-	737.22
OSL 305				
Existing Load	53.25	-	-	519.52
Allowable Load	0.48	-	-	0
Load Reduction	52.77			519.52
RR1				
Existing Load	15.02	130.55	18.69	571.36
Allowable Load	3.74	2.63	2.22	1.73
Load Reduction	11.28	127.92	16.47	569.63
RR2				
Existing Load	17.70	191.09	30.15	686.99
Allowable Load	3.39	1.86	3.06	41.19
Load Reduction	14.31	189.23	27.09	645.80
UNT RR				
Existing Load	0.62	22.05	0.80	59.43
Allowable Load	0.30	0.20	-	1.19
Load Reduction	0.32	21.85	-	58.24
RR3				
Existing Load	65.74	508.77	23.17	1,935.61
Allowable Load	7.81	5.04	4.79	116.11
Load Reduction	57.93	503.73	18.38	1,819.50
LA3				
Existing Load	439.73	411.92	475.36	6,778.42
Allowable Load	48.67	45.19	33.02	0
Load Reduction	391.06	366.73	442.34	6,778.42
OSL 350				
Existing Load	46.30	0.38	5.42	364.01
Allowable Load	0.18	-	-	0
Load Reduction	46.12	-	-	364.01
OSL 351				
Existing Load	7.66	0.02	0.03	100.77
Allowable Load	0.07	-	-	0
Load Reduction	7.59	-	-	100.77
HR1				
Existing Load	3.41	1.05	1.16	45.74
Allowable Load	1.38	1.05	1.16	6.39
Load Reduction	2.03	0	0	39.35
OSL 211-214				
Existing Load	18.51	-	-	679.39
Allowable Load	0.18	-	-	0
Load Reduction	18.33	-	-	679.39
BR1				
Existing Load	25.47	92.23	37.44	660.63
Allowable Load	3.07	3.68	2.30	13.20

Table G39. Summary of Loads Affecting Point A2				
	Iron (lbs/day)	***Manganese (lbs/day)***	***Aluminum (lbs/day)***	***Acidity (lbs/day)***
Load Reduction	22.40	88.55	35.14	647.43
BR2				
Existing Load	30.04	224.77	59.73	1,574.11
Allowable Load	13.81	10.70	4.14	31.42
Load Reduction	16.23	214.07	55.59	1,542.69
FR1				
Existing Load	1.32	4.96	4.03	14.22
Allowable Load	0.49	0.34	-	8.38
Load Reduction	0.83	4.62	-	5.84
KR1				
Existing Load	6.82	1.53	2.94	5.88
Allowable Load	6.82	1.53	2.94	6.00
Load Reduction	0	0	0	0
OSL 220				
Existing Load	129.77	-	-	1,107.97
Allowable Load	6.51	-	-	0
Load Reduction	123.26	-	-	1,107.97

Table G40. Reductions Necessary at Point A2				
	Iron (lbs/day)	***Manganese (lbs/day)***	***Aluminum (lbs/day)***	***Acidity (lbs/day)***
Existing Loads at A2	173.25	569.25	488.81	7,783.81
Total Load Reduction (LA1, UNT LA1, LA2, UNT LA2; OSL 352, 329, 330, 301, 303, 305; RR1, RR2, UNTRR, RR3, LA3, OSL 350, OSL 351, HR1, OSL 211-214, BR1, BR2, FR1, KR1, OSL 220)	1,260.95	1,571.45	597.55	18,282.89
Remaining Load	0	0	0	0
Allowable Loads at A2	173.25	-	-	5,290.27
Percent Reduction	0	0	0	0

The TMDL for Anderson Creek at point A2 does not require a load allocation to be made for total iron, total manganese, total aluminum, and acidity. All necessary reductions have been made upstream from this point.

Hepburnia Coal Company has an active permit in an Unnamed Tributary to Anderson Creek watershed (MP# 17823101, NPDES PA0609412). A wasteload allocation is not necessary for this permit because there has been no active mining on the site for twenty years. The Hawk Run District Mining office does not foresee any future mining on the site (Rieg 2002).

Margin of Safety

For each TMDL calculated in this study the margin of safety is applied implicitly. The allowable concentrations and loadings were simulated using Monte Carlo techniques and by employing the @Risk software.

Seasonal Variation

Seasonal variation is implicitly accounted for in each TMDL because the data used represent all seasons.

Critical Conditions

The reductions specified in each TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis. The unit area flow was used to derive loading values for the TMDL.

Attachment H

AMD Water Quality Data Used In TMDL Calculations

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
HR1	Thomas Coal	17803083	A hughey run up	7/14/1986	*	*	4.80	0.48	0.16	<0.5	16.00	9.00	<40
	Thomas Coal	17810144	hughey run Y	3/5/1996	150.00	4.25	4.10	0.20	0.14	*	4.50	0.50	14.60
	Thomas Coal	17810144	hughey run Y	4/23/1996	125.00	5.20	5.25	0.12	0.09	*	9.50	3.00	15.10
	Thomas Coal	17810144	hughey run Y	7/22/1996	1350.00	5.50	5.60	0.35	0.13	*	8.50	6.50	23.60
	Thomas Coal	17810144	hughey run Y	10/21/1996	1500.00	5.65	5.70	0.25	0.11	*	9.50	8.00	12.30
	Thomas Coal	17810144	hughey run Y	1/16/1997	600.00	5.35	5.30	0.27	0.10	*	15.00	5.00	15.80
	Thomas Coal	17810144	hughey run Y	4/18/1997	270.00	5.10	5.15	0.24	0.11	*	6.50	9.00	13.70
	Thomas Coal	17810144	hughey run Y	7/28/1997	15.00	5.60	5.80	0.98	0.09	*	7.50	7.00	11.30
	Thomas Coal	17810144	hughey run Y	10/21/1993	404.00	5.75	5.85	0.34	0.39	*	4.50	8.00	19.10
	Thomas Coal	17810144	hughey run Y	3/17/1994	1436.00	5.55	5.55	0.10	0.11	*	5.50	6.50	12.40
	Thomas Coal	17810144	hughey run Y	5/9/1994	1077.00	5.20	5.25	0.01	0.31	*	4.50	7.00	13.70
	Thomas Coal	17810144	hughey run Y	8/8/1994	15.00	5.65	5.70	1.23	0.17	*	7.00	8.00	6.10
	Thomas Coal	17810144	hughey run Y	11/11/1994	90.00	6.15	6.30	0.34	0.23	*	1.00	4.00	15.20
	Thomas Coal	17810144	hughey run Y	1/11/1995	75.00	5.85	6.00	0.12	0.11	*	4.00	7.00	16.00
	Thomas Coal	17810144	hughey run Y	5/17/1995	400.00	5.05	5.20	0.30	0.18	*	4.50	4.00	14.70
	Thomas Coal	17810144	hughey run Y	8/4/1995	30.00	5.55	5.65	1.04	0.12	*	7.50	5.50	10.00
	Thomas Coal	17810144	hughey run Y	11/3/1995	675.00	4.70	4.70	0.28	0.21	*	10.50	6.00	13.30
	Thomas Coal	17810144	hughey run Y	12/13/1990	673.00	5.20	5.75	0.41	0.22	*	4.50	9.00	15.30
	Thomas Coal	17810144	hughey run Y	2/20/1991	1346.00	5.15	5.25	0.34	0.19	*	4.50	8.50	15.40
	Thomas Coal	17810144	hughey run Y	4/30/1991	718.00	5.15	5.20	0.28	0.12	*	7.00	8.00	15.20
	Thomas Coal	17810144	hughey run Y	7/10/1991	30.00	5.65	6.00	1.37	0.32	*	5.50	10.50	10.80
	Thomas Coal	17810144	hughey run Y	10/14/1991	15.00	5.70	5.90	2.20	0.19	*	0.00	115.00	3.80
	Thomas Coal	17810144	hughey run Y	1/30/1992	431.00	5.10	5.20	0.14	0.19	*	7.00	11.00	16.50
	Thomas Coal	17810144	hughey run Y	5/8/1992	224.00	5.15	5.15	0.23	0.23	*	6.00	7.00	14.10
	Thomas Coal	17810144	hughey run Y	8/13/1992	323.00	5.20	5.30	0.40	0.09	*	5.00	6.50	13.00
	Thomas Coal	17810144	hughey run Y	11/25/1992	1346.00	4.55	4.30	0.17	0.19	*	6.00	1.00	16.50
	Thomas Coal	17810144	hughey run Y	2/4/1993	650.00	5.90	5.70	0.26	0.09	*	9.00	8.00	17.10
	Thomas Coal	17810144	hughey run Y	5/5/1993	650.00	6.10	6.00	0.18	0.16	*	2.00	8.00	15.60
	Thomas Coal	17810144	hughey run Y	8/5/1993	15.00	5.35	5.45	0.69	0.23	*	1.50	4.50	7.30
	BBC	17960103	mp 32 (Hughey Run downstream)	7/15/1998	25.00	6.50	6.30	0.90	0.17	0.20	0.00	14.00	9.00
	BBC	17960103	mp 32 (Hughey Run downstream)	12/7/1998	12.00	6.40	6.60	1.52	0.28	0.08	0.00	12.00	9.00
	BBC	17960103	mp 32 (Hughey Run downstream)	2/24/1999	25.00	5.10	5.10	0.07	0.08	0.12	6.00	6.00	18.00
	BBC	17960103	mp 32 (Hughey Run downstream)	6/16/1999	42.00	5.60	5.60	0.59	0.19	0.23	8.00	6.00	13.00
	BBC	17960103	mp 32 (Hughey Run downstream)	7/30/1999	20.00	7.00	6.30	2.27	0.30	0.46	4.00	12.00	8.00
	BBC	17960103	mp 32 (Hughey Run downstream)	11/24/1999	51.00	5.80	5.30	0.54	0.17	0.19	6.00	6.00	15.00
	Thomas Coal	17870119	S3 Hughey Run	8/14/1986	300.00	4.85	4.85	0.64	0.18	*	10.50	7.50	15.20
	Thomas Coal	17870119	S3 Hughey Run	11/3/1986	375.00	4.50	4.70	0.50	0.27	*	7.00	4.00	15.30
	Thomas Coal	17870119	S3 Hughey Run	2/27/1987	200.00	4.90	5.10	0.42	0.23	*	4.50	8.50	17.30
	Thomas Coal	17870119	S3 Hughey Run	6/8/1987	30.00	5.10	5.10	0.57	0.15	*	5.50	6.50	12.40
	Thomas Coal	17870119	S3 Hughey Run	9/2/1987	50.00	5.55	5.55	1.43	0.23	*	6.50	8.50	8.90
	Thomas Coal	17870119	S3 Hughey Run	11/16/1987	30.00	5.10	5.10	0.41	0.36	*	6.00	7.00	13.20

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Thomas Coal	17870119	S3 Hughey Run	2/17/1988	200.00	5.05	5.05	0.18	0.18	*	17.00	8.00	19.30
	Thomas Coal	17870119	S3 Hughey Run	5/4/1988	150.00	5.00	5.00	0.23	0.20	*	8.00	7.50	18.40
	Thomas Coal	17870119	S3 Hughey Run	10/24/1988	100.00	5.00	5.00	0.61	0.63	*	8.50	7.50	30.90
	Thomas Coal	17870119	S3 Hughey Run	2/18/1989	505.00	4.95	4.45	0.23	0.17	*	7.50	2.50	14.70
	Thomas Coal	17870119	S3 Hughey Run	4/27/1989	60.00	4.40	4.10	0.42	0.25	*	11.00	1.00	15.90
	Thomas Coal	17870119	S3 Hughey Run	8/7/1989	15.00	4.00	5.60	1.83	0.40	*	9.00	8.00	7.30
	Thomas Coal	17870119	S3 Hughey Run	10/31/1989	10.00	5.45	5.60	1.37	0.37	*	7.50	7.50	13.30
	Thomas Coal	17870119	S3 Hughey Run	1/18/1990	2693.00	4.65	4.75	0.73	0.38	*	10.50	6.50	17.50
	Thomas Coal	17870119	S3 Hughey Run	6/13/1990	898.00	4.90	4.95	0.28	0.08	*	6.00	9.00	14.20
	Thomas Coal	17870119	S3 Hughey Run	9/28/1990	505.00	5.25	5.35	0.37	0.08	*	6.50	6.50	12.00
	Thomas Coal	17870119	S3 Hughey Run	12/13/1990	673.00	5.20	5.75	0.41	0.22	*	4.50	9.00	15.30
	Thomas Coal	17870119	S3 Hughey Run	2/20/1991	1346.00	5.15	5.25	0.34	0.19	*	4.50	8.50	15.40
	Thomas Coal	17870119	S3 Hughey Run	4/30/1991	718.00	5.15	5.20	0.28	0.12	*	7.00	8.00	15.20
	Thomas Coal	17870119	S3 Hughey Run	7/10/1991	30.00	5.65	6.00	1.37	0.32	*	5.50	10.50	10.80
	Thomas Coal	17870119	S3 Hughey Run	10/14/1991	15.00	5.70	5.90	2.20	0.19	*	0.00	115.00	3.80
	Thomas Coal	17870119	S3 Hughey Run	1/30/1992	431.00	5.10	5.20	0.14	0.19	*	7.00	11.00	16.50
	Thomas Coal	17870119	S3 Hughey Run	5/8/1992	224.00	5.15	5.15	0.23	0.23	*	6.00	7.00	14.10
	Thomas Coal	17870119	S3 Hughey Run	8/13/1992	323.00	5.20	5.30	0.40	0.09	*	5.00	6.50	13.00
	Thomas Coal	17870119	S3 Hughey Run	11/25/1992	1346.00	4.55	4.30	0.17	0.19	*	6.00	1.00	16.50
	Thomas Coal	17870119	S3 Hughey Run	2/4/1993	650.00	5.90	5.70	0.26	0.09	*	9.00	8.00	17.10
	Thomas Coal	17870119	S3 Hughey Run	5/5/1993	650.00	6.10	6.00	0.18	0.16	*	2.00	8.00	15.60
	Thomas Coal	17870119	S3 Hughey Run	8/5/1993	15.00	5.35	5.45	0.69	0.23	*	1.50	4.50	7.30
	Thomas Coal	17870119	S3 Hughey Run	10/21/1993	404.00	5.75	5.85	0.34	0.39	*	4.50	8.00	19.10
	Thomas Coal	17870119	S3 Hughey Run	3/17/1994	1436.00	5.55	5.56	0.10	0.11	*	5.50	6.50	12.40
	Thomas Coal	17870119	S3 Hughey Run	5/9/1994	1077.00	5.20	5.25	0.09	0.31	*	4.50	7.00	13.70
	Thomas Coal	17870119	S3 Hughey Run	8/9/1994	15.00	5.65	5.70	1.23	0.17	*	7.00	8.00	6.10
	Thomas Coal	17870119	S3 Hughey Run	11/11/1994	90.00	6.15	6.35	0.34	0.23	*	1.00	4.00	15.20
	Thomas Coal	17870119	S3 Hughey Run	1/11/1995	75.00	5.85	6.00	0.12	0.11	*	4.00	7.00	16.00
	Thomas Coal	17870119	S3 Hughey Run	5/17/1995	400.00	5.05	5.20	0.30	0.18	*	4.50	6.00	14.70
	Thomas Coal	17870119	S3 Hughey Run	8/4/1995	30.00	5.55	5.65	1.04	0.12	*	7.50	5.50	10.00
	Thomas Coal	17870119	S3 Hughey Run	11/3/1995	675.00	4.70	4.70	0.28	0.21	*	10.50	6.00	13.30
	Thomas Coal	17870119	S3 Hughey Run	3/5/1996	150.00	4.25	4.25	0.20	0.14	*	4.50	0.50	14.60
	Thomas Coal	17870119	S3 Hughey Run	4/23/1996	125.00	5.20	5.25	0.12	0.09	*	9.50	3.00	15.10
	Thomas Coal	17870119	S3 Hughey Run	7/22/1996	1350.00	5.50	5.60	0.35	0.13	*	8.50	6.50	23.60
	Thomas Coal	17870119	S3 Hughey Run	10/21/1996	1500.00	5.65	5.70	0.25	0.11	*	9.50	8.00	12.30
	Thomas Coal	17870119	S3 Hughey Run	1/16/1997	600.00	5.35	5.30	0.27	0.10	*	15.00	5.00	15.80
	Thomas Coal	17870119	S3 Hughey Run	4/18/1997	270.00	5.10	5.15	0.24	0.11	*	6.50	9.00	13.70
	Thomas Coal	17870119	S3 Hughey Run	7/28/1997	15.00	5.60	5.80	0.98	0.09	*	7.50	7.00	11.30
	ScarLift Report	3A-7	Hughey Run- Mouth	10//1972	421.00	*	3.80	5.00	*	*	130.00	*	300.00
	ScarLift Report	3A-7	Hughey Run- Mouth	10//1972	898.00	*	5.70	2.76	*	*	36.00	*	156.00
				Avg	**461.01**	**5.33**	**5.36**	**0.62**	**0.19**	**0.21**	**8.31**	**9.58**	**19.36**
				St Dev	**522.69**	**0.52**	**0.55**	**0.75**	**0.10**	**0.13**	**14.48**	**17.29**	**35.76**

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
BR1	Thomas Coal	17870119	S4 Bilger Run	8/14/1986	1900.00	3.75	3.80	1.16	4.88	*	35.00	0.00	194.90
	Thomas Coal	17870119	S4 Bilger Run	11/3/1986	2400.00	3.75	3.80	0.97	6.55	*	45.00	0.00	256.00
	Thomas Coal	17870119	S4 Bilger Run	3/5/1987	*	4.20	4.25	0.48	3.82	*	20.50	4.50	147.10
	Thomas Coal	17870119	S4 Bilger Run	6/9/1987	300.00	3.60	3.60	1.15	12.86	*	60.50	0.00	473.00
	Thomas Coal	17870119	S4 Bilger Run	9/2/1987	400.00	3.75	3.70	1.02	13.14	*	56.50	0.00	433.60
	Thomas Coal	17870119	S4 Bilger Run	11/16/1987	500.00	4.05	4.05	0.98	7.29	*	38.00	2.50	292.60
	Thomas Coal	17870119	S4 Bilger Run	2/17/1988	*	4.15	4.15	0.82	6.43	*	56.00	4.00	281.80
	Thomas Coal	17870119	S4 Bilger Run	5/9/1988	1200.00	4.00	3.95	0.41	6.31	*	54.50	1.50	284.20
	Thomas Coal	17870119	S4 Bilger Run	8/22/1988	3.00	3.75	3.75	0.91	12.66	*	61.00	0.00	449.40
	Thomas Coal	17870119	S4 Bilger Run	10/24/1988	1200.00	3.85	3.85	0.79	10.16	*	47.00	0.00	571.70
	Thomas Coal	17870119	S4 Bilger Run	2/2/1989	3500.00	4.05	4.10	0.35	3.78	*	28.00	2.50	168.10
	Thomas Coal	17870119	S4 Bilger Run	4/27/1989	1500.00	3.30	3.45	0.60	7.84	*	77.00	0.00	320.50
	Thomas Coal	17870119	S4 Bilger Run	8/7/1989	1000.00	3.45	3.45	2.00	12.82	*	59.50	0.00	457.90
	Thomas Coal	17870119	S4 Bilger Run	10/31/1989	350.00	3.80	3.85	0.84	11.16	*	40.50	0.00	348.30
	Thomas Coal	17870119	S4 Bilger Run	1/18/1990	>5000	4.05	4.10	0.24	4.92	*	22.50	3.50	148.50
	Thomas Coal	17870119	S4 Bilger Run	6/13/1990	3029.00	4.10	4.10	0.44	3.82	*	29.50	4.50	209.20
	Thomas Coal	17870119	S4 Bilger Run	9/28/1990	2394.00	3.85	3.95	0.57	3.79	*	25.50	2.00	181.40
	Thomas Coal	17870119	S4 Bilger Run	12/13/1990	2525.00	4.15	4.15	0.39	4.96	*	36.00	4.00	237.90
	Thomas Coal	17870119	S4 Bilger Run	2/20/1991	>5000	4.10	4.15	0.79	6.03	*	31.00	5.00	218.10
	Thomas Coal	17870119	S4 Bilger Run	4/30/1991	1795.00	4.00	4.05	0.44	5.15	*	44.50	3.00	245.00
	Thomas Coal	17870119	S4 Bilger Run	7/10/1991	449.00	3.55	3.70	0.95	7.02	*	38.00	0.00	290.00
	Thomas Coal	17870119	S4 Bilger Run	10/14/1991	10.00	4.95	5.00	4.34	7.01	*	25.00	9.50	309.80
	Thomas Coal	17870119	S4 Bilger Run	1/30/1992	*	4.35	4.40	0.74	2.73	*	21.50	7.00	149.10
	Thomas Coal	17870119	S4 Bilger Run	5/8/1992	1616.00	4.00	4.00	0.42	6.90	*	52.00	2.00	294.30
	Thomas Coal	17870119	S4 Bilger Run	8/13/1992	1616.00	3.85	3.95	1.17	5.36	*	46.00	2.00	260.40
	Thomas Coal	17870119	S4 Bilger Run	11/25/1992	3590.00	3.90	3.75	0.41	2.72	*	20.00	0.00	113.10
	Thomas Coal	17870119	S4 Bilger Run	2/4/1993	3000.00	4.15	4.15	0.52	5.26	*	49.00	5.00	268.20
	Thomas Coal	17870119	S4 Bilger Run	5/5/1993	2200.00	4.00	3.95	0.33	5.14	*	36.00	1.00	262.00
	Thomas Coal	17870119	S4 Bilger Run	8/5/1993	105.00	3.30	3.30	1.93	11.60	*	50.00	0.00	370.20
	Thomas Coal	17870119	S4 Bilger Run	10/21/1993	2693.00	3.95	4.00	0.77	3.76	*	25.50	1.00	171.10
	Thomas Coal	17870119	S4 Bilger Run	3/17/1994	>5000	4.05	4.10	0.21	2.49	*	23.00	2.00	109.90
	Thomas Coal	17870119	S4 Bilger Run	5/9/1994	2199.00	4.05	4.05	0.37	2.99	*	25.00	3.00	107.40
	Thomas Coal	17870119	S4 Bilger Run	8/9/1994	200.00	4.45	4.50	5.19	7.00	*	25.00	6.00	340.30
	Thomas Coal	17870119	S4 Bilger Run	11/11/1994	450.00	4.05	4.00	1.33	3.33	*	29.50	1.00	138.60
	Thomas Coal	17870119	S4 Bilger Run	1/11/1995	450.00	3.95	4.05	1.31	5.63	*	42.00	2.00	193.30
	Thomas Coal	17870119	S4 Bilger Run	5/17/1995	2000.00	4.05	4.05	0.73	3.32	*	24.00	1.00	135.60
	Thomas Coal	17870119	S4 Bilger Run	8/4/1995	90.00	3.60	3.60	7.77	4.31	*	102.00	0.00	233.40
	Thomas Coal	17870119	S4 Bilger Run	11/3/1995	2400.00	4.05	4.05	1.37	4.01	*	24.00	2.00	154.50
	Thomas Coal	17870119	S4 Bilger Run	3/5/1996	2200.00	3.70	3.70	0.59	3.91	*	40.00	0.00	184.10
	Thomas Coal	17870119	S4 Bilger Run	4/23/1996	2000.00	3.60	3.60	0.61	3.35	*	60.00	15.00	154.50
	Thomas Coal	17870119	S4 Bilger Run	7/22/1996	2250.00	4.10	4.05	0.91	2.30	*	35.50	15.00	83.40

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Thomas Coal	17870119	S4 Bilger Run	10/21/1996	5000.00	4.40	4.35	0.55	1.78	*	15.00	9.00	82.80
	Thomas Coal	17870119	S4 Bilger Run	1/16/1997	3000.00	3.95	3.90	1.33	3.99	*	36.00	1.00	154.20
	Thomas Coal	17870119	S4 Bilger Run	4/18/1997	2000.00	4.15	4.20	1.00	4.26	*	36.50	3.00	151.60
	Thomas Coal	17870119	S4 Bilger Run	7/28/1997	175.00	5.55	5.70	12.48	3.11	*	69.50	25.00	73.70
	Thomas Coal	17803083	B bilger run above	10/18/1985	*	*	3.80	1.66	13.82	5.30	124.00	0.00	459.00
	Thomas Coal	17803083	B bilger run	12/19/1986	*	*	4.20	0.34	4.64	3.26	54.00	4.00	212.00
	Thomas Coal	17803083	B bilger run up	7/14/1986	*	*	4.20	0.64	2.71	1.62	38.00	5.00	110.00
	Thomas Coal	17803083	B bilger run	6/5/1986	*	*	4.20	<0.3	1.34	<0.5	26.00	5.00	167.00
	Thomas Coal	17803083	B bilger run above	2/4/1986	*	*	4.10	0.41	7.07	9.22	56.00	3.00	273.00
	Swistock Coal	17803000	p5 Bilger Run	9/29/1992	*	*	3.90	0.74	4.33	2.61	36.00	0.00	174.00
	Swistock Coal	17803000	p5 Bilger Run Below	6/16/1983	725.00	3.55	3.56	0.86	13.00	*	97.00	<1	595.00
	Swistock Coal	17803000	p5 Bilger Run Below	7/5/1983	2700.00	3.75	*	*	*	*	*	*	*
	Swistock Coal	17803000	p5 Bilger Run Below	8/2/1983	120.00	3.50	3.47	1.11	18.50	*	91.00	<1	655.00
	Swistock Coal	17803000	p5 Bilger Run Below	9/20/1983	3.00	3.70	*	*	*	*	*	*	*
	Swistock Coal	17803000	p5 Bilger Run Below	10/17/1983	16.00	3.80	3.84	0.74	11.90	*	49.00	<1	430.00
	Swistock Coal	17803000	p5 Bilger Run Below	11/9/1983	1140.00	4.15	*	*	*	*	*	*	*
	Swistock Coal	17803000	p5 Bilger Run Below	6/2/1984	3300.00	4.25	3.94	0.43	6.29	*	39.00	<1	258.00
	Swistock Coal	17803000	p5 Bilger Run Below	8/30/1984	2800.00	3.50	3.64	1.15	6.93	*	67.00	<1	319.00
	Swistock Coal	17803000	p5 Bilger Run Below	11/8/1984	400.00	3.90	4.12	0.85	5.28	*	29.00	<1	189.00
	Swistock Coal	17803000	p5 Bilger Run Below	5/23/1985	40.00	3.85	3.82	0.70	11.90	*	129.00	<1	449.00
	Swistock Coal	17803000	p5 Bilger Run Below	12/6/1985	70.00	3.55	4.01	0.24	5.76	*	53.00	<1	208.00
	Swistock Coal	17803000	p5 Bilger Run Below	2/4/1986	150.00	3.55	3.98	0.22	5.52	*	56.00	<1	229.00
	Swistock Coal	17803000	p5 Bilger Run Below	6/3/1986	250.00	2.85	3.70	0.89	11.90	*	138.00	<1	458.00
	Swistock Coal	17803000	p5 Bilger Run Below	8/22/1986	275.00	4.10	3.76	0.95	7.04	*	47.00	<1	276.00
	BBC	17960103	mp27 (Bigler's Run dnst)	4/15/1995	175.00	4.60	4.40	0.34	2.02	1.62	18.00	6.00	81.00
	BBC	17960103	mp27 (Bigler's Run dnst)	5/17/1995	150.00	4.00	4.10	0.58	3.46	2.63	28.00	2.00	140.00
	BBC	17960103	mp27 (Bigler's Run dnst)	6/23/1995	175.00	4.00	3.90	1.63	4.32	3.57	56.00	0.00	237.00
	BBC	17960103	mp27 (Bigler's Run dnst)	7/11/1995	220.00	4.10	4.10	2.13	3.36	2.62	36.00	0.00	149.00
	BBC	17960103	mp27 (Bigler's Run dnst)	8/21/1995	110.00	5.10	4.90	11.54	4.76	1.80	16.00	0.00	218.00
	BBC	17960103	mp27 (Bigler's Run dnst)	9/26/1995	70.00	5.10	5.20	4.32	4.76	1.31	8.00	10.00	225.00
	BBC	17960103	mp27 (Bigler's Run dnst)	7/15/1998	*	6.60	6.40	7.92	3.60	0.44	0.00	26.00	122.00
	BBC	17960103	mp27 (Bigler's Run dnst)	12/7/1998	8.00	6.50	6.70	7.05	3.19	0.04	0.00	24.00	162.00
	BBC	17960103	mp27 (Bigler's Run dnst)	6/16/1999	*	4.50	3.90	2.33	6.27	2.30	36.00	0.00	276.00
	BBC	17960103	mp27 (Bigler's Run dnst)	7/30/1999	*	4.10	6.80	7.92	2.71	0.22	0.00	56.00	105.00
	BBC	17960103	mp27 (Bigler's Run dnst)	11/24/1999	*	5.00	5.70	0.64	2.38	0.20	4.00	10.00	96.00
	Thomas Coal	45A77SM17	bilger run up #23	6/18/1987	*	*	3.80	0.99	6.68	2.87	40.00	0.00	227.00
	Thomas Coal	45A77SM17	bilger run up #23	3/30/1987	*	*	4.20	0.59	4.03	2.36	40.00	4.00	162.00
				Avg	**1276.43**	**4.07**	**4.14**	**1.66**	**6.01**	**2.44**	**43.05**	**4.76**	**244.88**
				St Dev	**1234.07**	**0.61**	**0.66**	**2.47**	**3.52**	**2.16**	**26.98**	**8.74**	**127.64**
BR2	Thomas Coal	17803083	C bilger run	6/5/1986	*	*	3.70	1.08	13.90	8.73	76.00	0.00	378.00
	Thomas Coal	17803083	C bilger run down	7/14/1986	*	*	4.40	0.45	1.66	1.05	26.00	7.00	61.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Thomas Coal	17803083	C bilger run	12/19/1986	*	*	4.10	1.31	11.40	3.29	66.00	4.00	251.00
	Thomas Coal	17803083	C bilger run below	2/4/1986	*	*	4.40	<.3	2.80	2.81	32.00	7.00	120.00
	Thomas Coal	17803083	C bilger run below	10/18/1985	*	*	4.40	0.60	4.25	1.31	78.00	6.00	164.00
	Thomas Coal	17803083	C bilger run	4/19/1982	1500.00	3.85	3.85	0.28	3.30	*	40.00	0.00	99.50
	Thomas Coal	17803083	C bilger run	7/6/1982	900.00	3.85	3.85	0.58	3.85	*	48.00	0.00	128.80
	Thomas Coal	17803083	C bilger run	10/6/1982	50.00	3.45	3.45	1.21	10.54	*	64.00	0.00	305.30
	Thomas Coal	17803083	C bilger run	1/6/1983	175.00	4.45	4.45	0.40	3.12	*	38.00	6.00	104.10
	Thomas Coal	17803083	C bilger run	4/14/1983	1000.00	4.20	4.25	0.25	2.72	*	34.00	4.00	109.50
	Thomas Coal	17803083	C bilger run	7/11/1983	250.00	3.90	3.90	0.82	6.14	*	62.00	0.00	235.40
	Thomas Coal	17803083	C bilger run	10/27/1983	175.00	3.80	3.95	0.79	5.10	*	67.00	0.00	197.90
	Thomas Coal	17803083	C bilger run	2/7/1984	800.00	4.40	4.45	0.30	3.03	*	47.00	2.00	119.10
	Thomas Coal	17803083	C bilger run	4/11/1984	800.00	4.20	4.20	0.17	3.76	*	36.50	3.50	164.90
	Thomas Coal	17803083	C bilger run	7/17/1984	750.00	4.00	4.10	0.22	4.11	*	39.00	2.00	181.70
	Thomas Coal	17803083	C bilger run	10/5/1984	225.00	3.90	3.90	1.22	8.78	*	42.00	1.00	252.60
	Thomas Coal	17803083	C bilger run	1/7/1985	800.00	4.25	4.25	0.38	3.12	*	27.00	3.50	112.70
	Thomas Coal	17803083	C bilger run	4/15/1985	800.00	4.85	4.85	0.31	3.22	*	43.00	25.00	147.10
	Thomas Coal	17803083	C bilger run	9/4/1985	175.00	3.95	4.00	0.97	4.79	*	32.00	0.50	155.60
	Thomas Coal	17803083	C bilger run	11/18/1985	1750.00	4.40	4.45	0.36	1.45	*	22.50	6.00	56.00
	Thomas Coal	17803083	C bilger run	1/24/1986	1500.00	4.50	4.55	0.30	1.77	*	24.00	6.00	77.70
	Thomas Coal	17803083	C bilger run	5/1/1986	900.00	4.10	4.20	0.30	2.83	*	23.00	5.00	103.70
	Thomas Coal	17803083	C bilger run	8/12/1986	2520.00	4.30	4.30	0.59	2.13	*	15.00	6.50	86.40
	Thomas Coal	45A77SM17	bilger run below #25	11/3/1986	2400.00	3.75	3.80	0.97	6.55	*	45.00	0.00	256.00
	Thomas Coal	45A77SM17	bilger run below #25	3/5/1987	*	4.20	4.25	0.48	3.82	*	20.50	4.50	147.10
	Thomas Coal	45A77SM17	bilger run below #25	6/8/1987	112.00	3.60	3.60	1.15	12.86	*	60.50	0.00	473.00
	Thomas Coal	45A77SM17	bilger run below #25	9/2/1987	400.00	3.75	3.70	1.02	13.14	*	56.50	0.00	433.60
	Thomas Coal	45A77SM17	bilger run below #25	6/18/1987	*	*	3.90	2.04	6.91	2.48	38.00	0.00	216.00
	Thomas Coal	45A77SM17	bilger run below #25	3/30/1987	*	*	4.60	0.49	1.60	1.21	14.00	6.00	70.00
	Thomas Coal	45A77SM17	bilger run 2210 #24	3/30/1987	*	*	5.00	1.24	4.77	0.73	24.00	8.00	117.00
	Thomas Coal	45A77SM17	bilger run 2210 #24	4/20/1982	700.00	4.45	4.50	0.15	0.22	*	12.00	3.00	18.20
	Thomas Coal	45A77SM17	bilger run 2210 #24	7/7/1982	600.00	3.55	3.55	0.86	10.50	*	99.00	0.00	273.60
	Thomas Coal	45A77SM17	bilger run 2210 #24	10/6/1982	15.00	3.40	3.45	2.81	18.48	*	109.00	0.00	488.60
	Thomas Coal	45A77SM17	bilger run 2210 #24	1/6/1983	*	4.25	4.25	0.45	3.89	*	54.00	5.00	160.90
	Thomas Coal	45A77SM17	bilger run 2210 #24	4/13/1983	400.00	4.18	4.20	0.25	4.30	*	43.00	5.00	181.90
	Thomas Coal	45A77SM17	bilger run 2210 #24	7/11/1983	200.00	3.72	3.70	1.56	12.50	*	109.00	0.00	479.00
	Thomas Coal	45A77SM17	bilger run 2210 #24	10/13/1983	60.00	4.05	3.90	1.10	14.62	*	104.00	0.00	401.20
	Thomas Coal	45A77SM17	bilger run 2210 #24	2/8/1984	*	4.15	4.15	0.63	6.35	*	41.00	3.00	236.20
	Thomas Coal	45A77SM17	bilger run 2210 #24	4/23/1984	600.00	3.90	3.95	0.75	9.58	*	64.50	0.50	263.40
	Thomas Coal	45A77SM17	bilger run 2210 #24	7/19/1984	600.00	4.10	4.10	1.46	7.37	*	69.00	3.00	230.40
	Thomas Coal	45A77SM17	bilger run 2210 #24	10/15/1984	150.00	3.30	3.30	1.52	22.68	*	121.00	0.00	177.90
	Thomas Coal	45A77SM17	bilger run 2210 #24	1/10/1985	620.00	4.00	4.05	0.79	7.37	*	75.00	3.00	351.60
	Thomas Coal	45A77SM17	bilger run 2210 #24	4/16/1985	625.00	3.35	3.40	1.15	8.09	*	74.00	0.00	265.10
	Thomas Coal	45A77SM17	bilger run 2210 #24	9/4/1985	125.00	3.75	3.80	1.72	53.00	*	156.50	0.00	682.20

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Thomas Coal	45A77SM17	bilger run 2210 #24	11/18/1985	1250.00	4.00	4.05	0.31	2.78	*	32.50	2.50	108.30
	Thomas Coal	45A77SM17	bilger run 2210 #24	1/28/1986	140.00	4.05	4.10	0.42	5.29	*	59.50	3.00	259.90
	Thomas Coal	45A77SM17	bilger run 2210 #24	4/3/1986	1200.00	4.10	4.20	0.97	8.00	*	54.00	5.50	341.10
	Thomas Coal	45A77SM17	bilger run 2210 #24	8/14/1986	1900.00	3.75	3.80	1.16	4.88	*	35.00	0.00	194.90
	Clearfield Cons. Dist.	CC8	Bilgers at Bilgers Rocks	5/18/1999	*	*	4.50	0.36	5.07	1.85	17.40	7.00	147.00
	Clearfield Cons. Dist.	CC8	Bilgers at Bilgers Rocks	8/15/2000	*	*	7.30	0.46	2.30	0.36	0.00	28.00	85.40
	Clearfield Cons. Dist.	CC8	Bilgers at Bilgers Rocks	5/25/2000	*	*	4.60	0.36	2.18	1.03	13.00	7.60	92.00
	Clearfield Cons. Dist.	CC8	Bilgers at Bilgers Rocks	8/18/1994	*	*	4.10	1.65	3.89	2.54	40.00	3.00	142.00
	Clearfield Cons. Dist.	CC9	Bilger at 879	7/10/2000	*	*	6.00	2.04	1.22	0.35	3.60	11.00	129.00
	Clearfield Cons. Dist.	CC9	Bilger at 879	8/15/2000	*	*	6.50	1.64	0.81	0.20	0.00	22.00	128.00
	Clearfield Cons. Dist.	CC9	Bilger at 879	5/25/2000	*	*	5.30	0.98	1.59	1.01	10.40	9.20	94.00
	Clearfield Cons. Dist.	CC9	Bilger at 879	8/18/1994	*	*	4.60	1.66	2.92	2.11	26.00	6.60	126.00
	Clearfield Cons. Dist.	CC9	Bilger at 879	5/18/1999	*	*	6.10	2.68	1.87	0.59	4.60	11.40	172.00
	Clearfield Cons. Dist.	CC11	Bilgers below Bilgers Rocks	6/7/2000	*	*	4.70	0.17	2.67	0.85	11.80	8.00	102.00
	Clearfield Cons. Dist.	CC11	Bilgers below Bilgers Rocks	7/10/2000	*	*	4.80	0.24	2.53	0.46	10.80	7.20	79.00
				Avg	**734.24**	**3.99**	**4.30**	**0.87**	**6.51**	**1.73**	**45.59**	**4.54**	**198.91**
				St Dev	**646.94**	**0.34**	**0.73**	**0.62**	**7.66**	**1.93**	**32.16**	**5.74**	**129.30**
FR1	Thomas Coal	17783076	s1 Fenton Run above Trib	12/7/1990	539.00	5.55	5.60	0.50	1.83	*	4.50	7.50	169.90
	Thomas Coal	17783076	s1 Fenton Run above Trib	2/14/1991	808.00	5.30	5.45	0.25	2.72	*	10.50	9.00	276.10
	Thomas Coal	17783076	s1 Fenton Run above Trib	4/29/1991	359.00	5.25	5.35	0.32	2.46	*	11.00	8.00	268.20
	Thomas Coal	17783076	s1 Fenton Run above Trib	7/20/1991	67.00	4.05	4.15	1.95	7.59	*	19.00	5.00	627.30
	Thomas Coal	17783076	s1 Fenton Run above Trib	10/28/1991	15.00	5.30	5.45	3.70	7.02	*	17.50	12.50	419.70
	Thomas Coal	17783076	s1 Fenton Run above Trib	1/30/1992	337.00	5.50	5.65	0.20	1.45	*	6.00	9.50	164.20
	Thomas Coal	17783076	s1 Fenton Run above Trib	6/1/1992	269.00	4.95	5.00	0.29	2.82	*	9.50	7.00	380.40
	Thomas Coal	17783076	s1 Fenton Run above Trib	8/6/1992	269.00	5.70	5.70	0.45	2.68	*	5.00	9.00	284.20
	Thomas Coal	17783076	s1 Fenton Run above Trib	12/7/1990	673.00	6.95	7.15	0.38	0.53	*	0.00	37.00	153.30
	Thomas Coal	17783076	s1 Fenton Run above Trib	2/14/1991	450.00	7.15	7.45	0.33	0.46	*	0.00	66.00	243.50
	Thomas Coal	17783076	s1 Fenton Run above Trib	4/29/1991	289.00	6.65	7.15	0.52	0.27	*	0.00	57.00	209.20
	Thomas Coal	17783076	s1 Fenton Run above Trib	7/20/1991	45.00	7.45	7.65	0.44	0.17	*	0.00	83.00	467.90
	Thomas Coal	17783076	s1 Fenton Run above Trib	10/28/1991	15.00	6.55	6.90	0.07	0.14	*	0.00	76.00	480.70
	Thomas Coal	17783076	s1 Fenton Run above Trib	1/30/1992	325.00	6.85	7.05	0.05	0.27	*	0.00	30.50	152.80
	Thomas Coal	17783076	s1 Fenton Run above Trib	6/1/1992	269.00	6.65	6.95	0.28	0.27	*	0.00	37.00	183.40
	Thomas Coal	17783076	s1 Fenton Run above Trib	8/6/1992	202.00	7.30	7.35	0.21	0.33	*	0.00	68.50	248.40
	Thomas Coal	17820125	teg A Fenton	4/1/1987	*	*	6.00	3.07	0.22	1.56	0.00	16.00	<40
	Thomas Coal	17820125	teg A Fenton	6/18/1987	*	*	5.80	<0.3	0.17	<0.5	8.00	10.00	<40
	Thomas Coal	17820125	teg A Fenton	12/19/1986	*	*	5.60	<0.3	<0.05	<0.5	40.00	11.00	<40
	Swistock Coal	17803000	p6 Fenton Run	6/16/1983	6.00	6.70	6.99	0.11	<0.1	*	3.00	6.00	112.00
	Swistock Coal	17803000	p6 Fenton Run	7/5/1983	100.00	7.05	*	*	*	*	*	*	*
	Swistock Coal	17803000	p6 Fenton Run	8/2/1983	14.00	7.30	7.09	0.06	0.20	*	1.00	8.00	97.00
	Swistock Coal	17803000	p6 Fenton Run	9/20/1983	<1	6.15	*	*	*	*	*	*	*
	Swistock Coal	17803000	p6 Fenton Run	10/17/1983	2.00	5.85	7.13	0.13	0.16	*	5.00	11.00	43.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Swistock Coal	17803000	p6 Fenton Run	11/9/1983	330.00	5.00	*	*	*	*	*	*	*
	Swistock Coal	17803000	p6 Fenton Run	6/2/1984	250.00	6.25	7.04	0.05	<0.1	*	2.00	5.00	72.00
	Swistock Coal	17803000	p6 Fenton Run	8/30/1984	40.00	5.75	7.42	0.13	<0.1	*	3.00	13.00	99.00
	Swistock Coal	17803000	p6 Fenton Run	11/8/1984	45.00	5.75	6.47	0.10	0.14	*	3.00	6.00	50.00
	Swistock Coal	17803000	p6 Fenton Run	5/23/1985	<1	7.45	7.61	0.09	0.35	*	3.00	49.00	518.00
	Swistock Coal	17803000	p6 Fenton Run	12/6/1985	120.00	5.45	5.60	0.08	1.06	*	4.00	4.00	97.00
	Swistock Coal	17803000	p6 Fenton Run	2/4/1986	75.00	5.45	5.50	0.17	1.21	*	4.00	5.00	125.00
	Swistock Coal	17803000	p6 Fenton Run	6/3/1986	1.00	5.35	6.10	0.10	9.91	*	2.00	7.00	577.00
	Swistock Coal	17803000	p6 Fenton Run	8/22/1986	15.00	6.10	5.80	0.23	5.51	*	4.00	8.00	329.00
				Avg	**211.75**	**6.09**	**6.34**	**0.51**	**1.92**	**1.56**	**5.50**	**22.72**	**253.64**
				St Dev	**214.76**	**0.88**	**0.92**	**0.89**	**2.66**	*****	**8.19**	**24.38**	**167.93**
KR1	Clearfield Cons. Dist.	CC26	Kratzer in Grampian	7/6/2000	*	*	6.80	0.62	0.13	0.20	2.00	58.00	124.00
	Clearfield Cons. Dist.	CC26	Kratzer in Grampian	5/18/1999	*	*	6.80	0.52	0.16	0.31	0.00	52.00	181.00
	Clearfield Cons. Dist.	CC26	Kratzer in Grampian	8/15/2000	*	*	6.90	0.53	0.12	0.20	0.00	62.00	177.96
	Clearfield Cons. Dist.	CC26	Kratzer in Grampian	5/25/2000	*	*	6.70	0.66	0.13	0.28	0.00	40.00	68.00
				Avg	*	*	**6.80**	**0.58**	**0.13**	**0.25**	**0.50**	**53.00**	**137.74**
				St Dev	*	*	**0.08**	**0.07**	**0.02**	**0.06**	**1.00**	**9.59**	**53.36**
KR 2	Clearfield Cons. Dist.	CC28	Kratzer at Rustic Rd	7/6/2000	*	*	6.30	0.81	0.86	0.20	0.00	18.00	107.00
	Clearfield Cons. Dist.	CC28	Kratzer at Rustic Rd	8/15/2000	*	*	6.70	0.87	0.49	0.20	0.00	36.00	111.60
	Clearfield Cons. Dist.	CC28	Kratzer at Rustic Rd	5/25/2000	*	*	6.20	0.82	1.26	0.73	4.60	12.40	85.00
				Avg	*	*	**6.40**	**0.83**	**0.87**	**0.38**	**1.53**	**22.13**	**101.20**
				St Dev	*	*	**0.26**	**0.03**	**0.38**	**0.30**	**2.66**	**12.33**	**14.22**
A1	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	6/10/1983	*	5.90	6.15	0.04	0.01	*	5.00	9.00	8.69
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	8/29/1983	*	5.30	5.85	0.06	0.01	*	6.00	16.00	27.28
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	12/8/1983	*	6.10	6.40	0.02	0.10	*	5.00	9.00	98.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	3/29/1984	*	6.10	6.20	0.05	0.14	*	7.00	5.00	15.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	6/29/1984	*	6.40	6.20	0.08	0.08	*	6.00	8.00	20.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	9/5/1984	*	6.00	5.80	0.14	0.31	*	9.00	0.00	20.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	12/15/1984	999.00	6.10	6.20	0.16	0.40	*	9.00	1.00	18.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	3/6/1985	999.00	6.30	6.10	0.12	0.30	*	7.00	1.00	20.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	6/10/1985	*	5.70	6.30	0.07	0.03	*	8.00	8.00	26.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	8/1/1985	999.00	6.50	6.60	0.01	0.01	*	10.00	10.00	47.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	11/19/1985	999.00	5.40	5.60	0.30	0.43	*	8.00	8.00	35.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	2/18/1986	2000.00	7.20	5.70	0.01	0.16	*	8.00	10.00	38.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	6/4/1986	350.00	6.50	6.60	0.01	0.04	*	8.00	10.00	27.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	8/11/1986	750.00	6.10	6.40	0.42	0.14	*	6.00	12.00	43.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	11/20/1986	3000.00	6.10	6.50	0.18	0.33	*	6.00	12.00	42.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	1/28/1987	2500.00	6.60	6.40	0.13	0.16	*	4.00	8.00	44.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	6/2/1987	1500.00	6.40	6.50	0.03	0.06	*	4.00	8.00	58.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	7/23/1987	*	7.20	7.20	0.15	0.01	*	0.00	16.00	41.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	12/14/1987	*	5.90	6.10	0.04	0.15	*	4.00	10.00	33.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	3/3/1988	*	6.30	6.30	0.11	0.27	*	12.00	8.00	38.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	6/29/1988	350.00	6.70	6.90	0.01	0.09	*	6.00	14.00	41.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	9/13/1988	175.00	6.90	7.10	0.08	0.01	*	2.00	20.00	65.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	11/4/1988	1000.00	6.40	6.20	0.03	0.21	*	4.00	14.00	68.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	2/6/1989	*	5.50	5.80	0.03	0.23	*	8.00	8.00	29.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	4/21/1989	*	5.90	6.30	0.21	0.05	*	3.00	8.00	35.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	7/27/1994	*	6.80	6.60	0.47	0.05	*	0.00	12.00	35.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	9/25/1996	*	7.60	5.90	0.17	0.13	*	0.00	10.00	30.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	11/18/1996	*	5.60	5.90	0.15	0.09	*	0.00	8.00	23.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	3/31/1997	*	7.00	6.20	0.13	0.08	*	0.00	10.00	32.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	6/18/1997	*	6.70	6.50	0.30	0.17	*	0.00	14.00	13.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	8/21/1997	*	6.70	7.00	0.33	0.32	*	0.00	18.00	53.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	12/10/1997	*	6.00	6.40	0.09	0.06	*	0.00	12.00	20.00
	Hepburnia Coal	17823101	mp5 Anderson Creek dnst.	2/18/1998	*	6.40	6.50	0.22	0.21	*	0.00	12.00	24.00
				Avg	**1201.62**	**6.31**	**6.32**	**0.13**	**0.15**	*****	**4.70**	**9.97**	**35.36**
				St dev	**844.58**	**0.54**	**0.39**	**0.12**	**0.12**	*****	**3.55**	**4.43**	**18.15**
A2	Clearfield Cons. Dist.	CC3	Anderson above Susq.	4/13/1976	*	*	4.50	0.45	*	*	16.00	0.00	47.00
	Clearfield Cons. Dist.	CC3	Anderson above Susq.	4/27/1976	*	*	4.60	0.27	*	*	10.00	0.00	42.00
	Clearfield Cons. Dist.	CC3	Anderson above Susq.	6/22/2000	*	*	5.80	0.76	0.68	0.74	4.60	10.00	50.00
	Clearfield Cons. Dist.	CC3	Anderson above Susq.	5/11/1976	*	*	4.80	0.16	*	*	15.00	0.00	65.00
	Clearfield Cons. Dist.	CC3	Anderson above Susq.	5/25/1976	*	*	4.40	0.18	*	*	10.00	0.00	29.00
	Clearfield Cons. Dist.	CC3	Anderson above Susq.	6/8/1976	*	*	4.60	0.12	*	*	12.00	0.00	28.00
	Clearfield Cons. Dist.	CC3	Anderson above Susq.	6/29/1976	*	*	4.80	0.33	*	*	12.00	1.00	45.00
	Clearfield Cons. Dist.	CC3	Anderson above Susq.	7/20/1976	*	*	4.80	0.21	*	*	13.00	1.00	48.00
	Clearfield Cons. Dist.	CC3	Anderson above Susq.	8/17/1976	*	*	4.50	0.35	*	*	14.00	0.00	37.00
	Clearfield Cons. Dist.	CC3	Anderson above Susq.	8/31/1976	*	*	4.30	0.18	*	*	20.00	0.00	67.00
	Clearfield Cons. Dist.	CC3	Anderson above Susq.	9/21/1976	*	*	4.52	0.23	*	*	17.50	0.00	67.00
	Clearfield Cons. Dist.	CC3	Anderson above Susq.	7/19/2000	*	*	4.90	0.11	1.16	0.84	6.80	7.60	84.00
				Avg	*	*	**4.71**	**0.28**	**0.92**	**0.79**	**12.58**	**1.63**	**50.75**
				St Dev	*	*	**0.39**	**0.18**	**0.34**	**0.07**	**4.37**	**3.41**	**16.92**
211-214	ScarLift Report	214	Bilger Run Discharge Area	2/5/1973	21.70	*	4.00	<0.1	*	*	94.00	0.00	190.00
	ScarLift Report	214	Bilger Run Discharge Area	3/5/1973	123.00	*	4.10	0.20	*	*	96.00	0.00	190.00
	ScarLift Report	214	Bilger Run Discharge Area	4/2/1973	41.80	*	4.20	<0.2	*	*	110.00	0.00	220.00
	ScarLift Report	211	Bilger Run Discharge Area	4/2/1973	956.00	*	3.70	0.20	*	*	250.00	0.00	530.00
	ScarLift Report	211	Bilger Run Discharge Area	5/7/1973	236.00	*	3.50	1.10	*	*	250.00	0.00	1000.00
	ScarLift Report	211	Bilger Run Discharge Area	6/4/1973	207.00	*	3.60	13.00	*	*	310.00	0.00	990.00
	ScarLift Report	211	Bilger Run Discharge Area	7/9/1973	19.10	*	3.60	3.96	*	*	310.00	0.00	1300.00
	ScarLift Report	211	Bilger Run Discharge Area	8/6/1973	67.80	*	3.40	4.00	*	*	360.00	0.00	1200.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	ScarLift Report	211	Bilger Run Discharge Area	9/10/1973	51.90	*	3.30	52.00	*	*	400.00	0.00	1500.00
	ScarLift Report	211	Bilger Run Discharge Area	10/8/1973	131.00	*	3.30	3.04	*	*	360.00	0.00	150.00
	ScarLift Report	211	Bilger Run Discharge Area	11/5/1973	183.00	*	3.50	1.52	*	*	340.00	0.00	1100.00
	ScarLift Report	211	Bilger Run Discharge Area	12/3/1973	396.00	*	3.40	1.49	*	*	412.00	0.00	1050.00
	ScarLift Report	211	Bilger Run Discharge Area	1/8/1974	289.00	*	3.70	0.89	*	*	238.00	0.00	1060.00
				Avg	**209.48**	*****	**3.64**	**7.40**	*****	*****	**271.54**	**0.00**	**806.15**
				St Dev	**251.33**	*****	**0.30**	**15.23**	*****	*****	**111.81**	**0.00**	**480.60**
221	ScarLift Report	221	Trib of Kratzer Discharge #1	2/5/1973	15.60	*	4.40	3.20	*	*	17.00	0.00	38.00
	ScarLift Report	221	Trib of Kratzer Discharge #1	3/5/1973	3.40	*	3.80	5.20	*	*	34.00	0.00	80.00
	ScarLift Report	221	Trib of Kratzer Discharge #1	4/2/1973	8.90	*	4.00	3.00	*	*	34.00	0.00	67.00
	ScarLift Report	221	Trib of Kratzer Discharge #1	5/7/1973	4.90	*	5.40	5.40	*	*	56.00	0.00	120.00
	ScarLift Report	221	Trib of Kratzer Discharge #1	6/4/1973	4.90	*	3.70	5.10	*	*	59.00	0.00	96.00
	ScarLift Report	221	Trib of Kratzer Discharge #1	7/9/1973	2.20	*	3.60	11.00	*	*	86.00	0.00	210.00
	ScarLift Report	221	Trib of Kratzer Discharge #1	8/6/1973	2.20	*	3.40	11.00	*	*	96.00	0.00	170.00
	ScarLift Report	221	Trib of Kratzer Discharge #1	9/10/1973	2.20	*	3.40	11.00	*	*	90.00	0.00	180.00
	ScarLift Report	221	Trib of Kratzer Discharge #1	10/8/1973	3.00	*	3.30	7.37	*	*	102.00	0.00	195.00
	ScarLift Report	221	Trib of Kratzer Discharge #1	11/5/1973	3.80	*	3.40	0.32	*	*	20.00	0.00	175.00
	ScarLift Report	221	Trib of Kratzer Discharge #1	12/3/1973	6.10	*	3.70	3.67	*	*	52.00	0.00	175.00
	ScarLift Report	221	Trib of Kratzer Discharge #1	1/8/1974	3.80	*	3.60	225.18	*	*	60.00	0.00	175.00
				Avg	**5.08**	*****	**3.81**	**24.29**	*****	*****	**58.83**	**0.00**	**140.08**
				St Dev	**3.83**	*****	**0.59**	**63.36**	*****	*****	**29.39**	**0.00**	**57.02**
220	ScarLift Report	220	Trib of Kratzer Discharge #2	2/5/1973	1817.00	*	3.50	8.40	*	*	68.00	0.00	170.00
	ScarLift Report	220	Trib of Kratzer Discharge #2	3/5/1973	835.00	*	3.40	9.30	*	*	99.00	0.00	190.00
	ScarLift Report	220	Trib of Kratzer Discharge #2	4/2/1973	907.00	*	3.50	8.30	*	*	110.00	0.00	160.00
	ScarLift Report	220	Trib of Kratzer Discharge #2	5/7/1973	980.50	*	3.70	7.10	*	*	100.00	0.00	190.00
	ScarLift Report	220	Trib of Kratzer Discharge #2	6/4/1973	931.00	*	3.50	6.30	*	*	95.00	0.00	180.00
	ScarLift Report	220	Trib of Kratzer Discharge #2	7/9/1973	835.00	*	3.60	12.00	*	*	88.00	0.00	200.00
	ScarLift Report	220	Trib of Kratzer Discharge #2	8/6/1973	835.00	*	3.40	11.00	*	*	92.00	0.00	180.00
	ScarLift Report	220	Trib of Kratzer Discharge #2	9/10/1973	835.00	*	3.60	15.00	*	*	86.00	0.00	180.00
	ScarLift Report	220	Trib of Kratzer Discharge #2	10/8/1973	931.00	*	3.40	2.12	*	*	82.00	0.00	205.00
	ScarLift Report	220	Trib of Kratzer Discharge #2	11/5/1973	1134.00	*	3.50	11.84	*	*	40.00	0.00	150.00
	ScarLift Report	220	Trib of Kratzer Discharge #2	12/3/1973	1351.00	*	3.40	12.81	*	*	110.00	0.00	200.00
	ScarLift Report	220	Trib of Kratzer Discharge #2	1/8/1974	1351.00	*	3.60	17.86	*	*	72.00	0.00	175.00
				Avg	**1061.88**	*****	**3.51**	**10.17**	*****	*****	**86.83**	**0.00**	**181.67**
				St Dev	**303.52**	*****	**0.10**	**4.19**	*****	*****	**19.73**	**0.00**	**16.56**
350	Clearfield Cons. Dist.	350	Korb Mine #50	5/26/1999	*	*	3.20	2.02	0.91	13.00	138.00	0.00	140.00
	ScarLift Report	350	Korb Mine #50	2/5/1973	24.60	*	2.40	95.00	*	*	680.00	0.00	730.00
	ScarLift Report	350	Korb Mine #50	3/5/1973	127.00	*	2.40	98.00	*	*	760.00	0.00	740.00
	ScarLift Report	350	Korb Mine #50	4/2/1973	41.80	*	2.50	99.00	*	*	780.00	0.00	780.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	ScarLift Report	350	Korb Mine #50	5/7/1973	30.90	*	2.50	120.00	*	*	840.00	0.00	840.00
	ScarLift Report	350	Korb Mine #50	6/4/1973	41.80	*	2.60	75.00	*	*	760.00	0.00	810.00
	ScarLift Report	350	Korb Mine #50	7/9/1973	14.60	*	2.80	140.00	*	*	900.00	0.00	950.00
	ScarLift Report	350	Korb Mine #50	8/6/1973	*	*	2.30	140.00	*	*	980.00	0.00	960.00
	ScarLift Report	350	Korb Mine #50	9/10/1973	1.70	*	2.50	53.00	*	*	630.00	0.00	650.00
	ScarLift Report	350	Korb Mine #50	10/8/1973	12.40	*	2.70	142.66	*	*	1100.00	0.00	1075.00
	ScarLift Report	350	Korb Mine #50	11/5/1973	16.70	*	2.60	200.08	*	*	1200.00	0.00	1000.00
	ScarLift Report	350	Korb Mine #50	12/3/1973	50.30	*	2.90	118.55	*	*	1200.00	0.00	700.00
	ScarLift Report	350	Korb Mine #50	1/8/1974	21.70	*	2.60	159.97	*	*	1380.00	0.00	700.00
				Avg	**34.86**	*****	**2.62**	**111.02**	**0.91**	**13.00**	**872.92**	**0.00**	**775.00**
				St Dev	**33.86**	*****	**0.24**	**50.22**	*****	*****	**317.07**	**0.00**	**231.71**
351	Clearfield Cons. Dist.	351	Korb Mine #51	5/26/1999	*	*	6.80	0.52	0.10	0.20	0.00	52.00	132.00
	ScarLift Report	351	Korb Mine #51	2/5/1973	41.80	*	2.70	39.00	*	*	500.00	0.00	490.00
	ScarLift Report	351	Korb Mine #51	3/5/1973	27.50	*	2.70	63.00	*	*	350.00	0.00	340.00
	ScarLift Report	351	Korb Mine #51	4/2/1973	18.00	*	2.70	29.00	*	*	400.00	0.00	390.00
	ScarLift Report	351	Korb Mine #51	5/7/1973	10.70	*	2.60	46.00	*	*	520.00	0.00	530.00
	ScarLift Report	351	Korb Mine #51	6/4/1973	12.40	*	2.70	24.50	*	*	440.00	0.00	550.00
	ScarLift Report	351	Korb Mine #51	7/9/1973	4.90	*	3.00	35.00	*	*	540.00	0.00	740.00
	ScarLift Report	351	Korb Mine #51	8/6/1973	*	*	2.40	42.00	*	*	640.00	0.00	670.00
	ScarLift Report	351	Korb Mine #51	9/10/1973	1.70	*	2.50	53.00	*	*	630.00	0.00	650.00
	ScarLift Report	351	Korb Mine #51	10/8/1973	4.90	*	2.70	27.24	*	*	54.00	0.00	425.00
	ScarLift Report	351	Korb Mine #51	11/5/1973	3.80	*	2.70	38.84	*	*	700.00	0.00	625.00
	ScarLift Report	351	Korb Mine #51	12/3/1973	19.20	*	2.90	93.14	*	*	1340.00	0.00	600.00
	ScarLift Report	351	Korb Mine #51	1/8/1974	6.10	*	2.70	105.91	*	*	1740.00	0.00	900.00
				Avg	**13.73**	*****	**3.01**	**45.93**	**0.10**	**0.20**	**604.15**	**4.00**	**541.69**
				St Dev	**12.22**	*****	**1.15**	**28.22**	*****	*****	**471.32**	**14.42**	**194.57**
LA1	Sky Haven Coal	17930130	1 Little Anderson Upst	2/14/1989	284.00	4.50	4.80	0.35	0.93	*	41.00	8.00	46.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	5/5/1989	24.00	4.40	4.10	0.20	3.48	*	22.00	4.00	215.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	7/8/1989	25.00	3.30	3.30	22.92	16.96	*	106.00	0.00	484.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	7/28/1989	15.00	3.00	3.20	4.97	14.90	*	120.00	0.00	448.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	11/2/1989	8.00	4.70	4.20	0.18	6.50	*	30.00	4.00	236.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	1/11/1990	12.00	4.90	4.50	0.16	3.41	*	2.00	4.00	92.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	1/18/1990	60.00	4.50	4.50	0.35	3.37	*	9.00	6.00	99.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	4/19/1990	25.00	3.50	3.50	5.46	6.59	*	42.00	0.00	235.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	5/15/1990	16.00	4.00	3.90	0.45	3.57	*	20.00	0.00	116.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	8/10/1990	15.00	3.10	3.10	18.24	16.80	*	104.00	0.00	401.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	8/20/1990	12.00	3.40	3.50	2.02	7.97	*	62.00	0.00	281.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	10/31/1990	11.00	3.70	3.70	2.27	7.00	*	34.00	0.00	206.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	2/12/1991	<1	3.40	3.40	2.70	14.29	0.60	118.00	0.00	438.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	4/11/1991	2.00	4.90	5.80	1.60	0.70	*	10.00	5.00	54.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Sky Haven Coal	17930130	1 Little Anderson Upst	8/20/1991	<1	5.30	4.70	1.15	1.33	0.22	12.00	1.00	35.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	4/4/1994	9.00	*	5.40	0.04	<0.02	0.14	0.00	6.00	38.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	5/14/1999	14.00	6.00	5.95	0.07	0.32	*	3.00	11.00	63.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	10/8/1999	<1	4.40	3.76	7.56	7.20	*	35.00	<1	172.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	2/3/2000	*	5.20	3.64	15.10	8.72	*	39.00	<1	240.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	4/10/2000	12.00	4.10	4.03	0.80	4.59	*	17.00	3.00	141.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	7/12/2000	1.00	3.60	3.30	8.24	6.95	*	56.00	<1	183.00
	Sky Haven Coal	17930130	1 Little Anderson Upst	10/2/2000	3.00	4.20	3.70	5.88	5.11	*	31.00	<1	115.00
	Johnson Bros	17860133	4 Little Anderson Creek	3/20/1986	23.00	3.50	3.60	10.86	9.62	*	65.00	0.00	231.90
	Johnson Bros	17860133	4 Little Anderson Creek	4/30/1986	1.50	3.08	3.20	18.06	18.46	*	130.00	0.00	496.50
	Johnson Bros	17860133	4 Little Anderson Creek	5/21/1986	1.00	3.25	3.30	3.31	12.30	*	81.00	0.00	302.90
	Johnson Bros	17860133	4 Little Anderson Creek	6/23/1986	0.00	3.10	3.20	11.10	13.22	*	82.50	0.00	340.80
	Johnson Bros	17860133	4 Little Anderson Creek	7/8/1986	5.00	3.57	3.60	1.97	9.90	*	28.00	0.00	170.20
	Johnson Bros	17860133	4 Little Anderson Creek	8/14/1986	5.00	2.83	3.00	19.06	20.08	*	170.00	0.00	539.60
	Johnson Bros	17860133	4 Little Anderson Creek	9/30/1987	4.00	3.60	3.60	12.13	10.31	*	76.00	0.00	363.30
	Johnson Bros	17860133	4 Little Anderson Creek	12/28/1987	60.00	4.55	4.60	0.59	2.13	*	13.50	9.00	71.60
	Johnson Bros	17860133	4 Little Anderson Creek	3/2/1988	25.00	4.65	4.70	4.94	2.28	*	8.50	11.50	82.40
	Johnson Bros	17860133	4 Little Anderson Creek	5/16/1988	20.00	4.50	4.60	4.80	2.25	*	11.00	10.00	75.30
	Johnson Bros	17860133	4 Little Anderson Creek	9/14/1988	5.00	3.80	3.80	0.52	11.74	*	58.50	0.00	254.00
	Johnson Bros	17860133	4 Little Anderson Creek	12/7/1988	1.00	3.95	3.95	0.79	8.43	*	25.50	1.00	183.10
	Johnson Bros	17860133	4 Little Anderson Creek	4/29/1989	5.00	3.15	3.15	1.17	8.58	*	42.00	0.00	252.20
	Johnson Bros	17860133	4 Little Anderson Creek	7/8/1989	25.00	3.30	3.30	22.92	16.96	*	106.00	0.00	483.90
	Johnson Bros	17860133	4 Little Anderson Creek	1/18/1990	60.00	4.45	4.50	0.35	3.37	*	8.50	6.00	98.80
	Johnson Bros	17860133	4 Little Anderson Creek	4/19/1990	25.00	3.50	3.50	5.46	6.59	*	42.00	0.00	234.80
	Johnson Bros	17860133	4 Little Anderson Creek	8/10/1990	15.00	3.05	3.10	18.24	16.80	*	104.00	0.00	401.00
	Johnson Bros	17860133	4 Little Anderson Creek	10/31/1990	11.00	3.70	3.70	2.27	7.00	*	34.00	0.00	205.90
	Johnson Bros	17860133	4 Little Anderson Creek	1/23/1991	34.00	3.55	3.55	21.04	12.80	*	79.00	0.00	372.80
	Johnson Bros	17860133	4 Little Anderson Creek	4/24/1991	22.00	5.90	6.10	0.19	0.59	*	3.50	11.50	88.30
	Johnson Bros	17860133	4 Little Anderson Creek	7/8/1991	7.50	3.45	3.60	1.60	5.39	*	37.50	0.00	228.10
	Johnson Bros	17860133	4 Little Anderson Creek	8/18/1992	0.50	3.20	3.30	13.96	17.30	*	118.00	0.00	390.40
	Johnson Bros	17860133	4 Little Anderson Creek	11/20/1992	7.50	5.10	5.30	0.88	1.25	*	5.00	5.00	88.30
	Johnson Bros	17860133	4 Little Anderson Creek	2/3/1993	4.00	2.95	3.20	4.60	11.18	*	57.00	0.00	309.80
	Johnson Bros	17860133	4 Little Anderson Creek	4/20/1993	30.00	3.25	3.30	12.42	7.02	*	50.00	0.00	233.60
	Johnson Bros	17860133	4 Little Anderson Creek	5/18/1994	15.00	3.55	3.55	15.32	12.04	*	68.00	0.00	361.30
	Johnson Bros	17860133	4 Little Anderson Creek	12/8/1994	15.00	5.40	5.55	0.36	0.62	*	4.00	4.00	79.40
	Johnson Bros	17860133	4 Little Anderson Creek	3/3/1995	1.00	3.55	3.55	1.02	5.28	*	24.00	24.00	164.20
	Johnson Bros	17860133	4 Little Anderson Creek	6/15/1995	15.00	3.20	3.20	5.90	5.56	*	38.50	38.50	171.10
	Johnson Bros	17860133	4 Little Anderson Creek	11/8/1995	0.50	4.85	4.85	0.03	2.52	*	10.00	10.00	112.40
	Johnson Bros	17860133	4 Little Anderson Creek	3/6/1996	30.00	4.20	4.20	0.19	0.89	*	13.00	13.00	72.60
	Johnson Bros	17860133	4 Little Anderson Creek	5/24/1996	7.50	5.00	5.00	17.18	0.81	*	19.50	19.50	73.60
	Johnson Bros	17860133	4 Little Anderson Creek	7/26/1996	15.00	4.55	4.55	2.75	1.80	*	11.50	11.50	73.60
	Johnson Bros	17860133	4 Little Anderson Creek	11/15/1996	30.00	5.55	5.55	0.50	0.95	*	4.00	4.00	72.20

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Johnson Bros	17860133	4 Little Anderson Creek	8/18/1997	30.00	5.10	5.10	2.64	1.27	*	1.50	1.50	60.40
	Johnson Bros	17860133	4 Little Anderson Creek	5/9/1997	15.00	3.45	3.45	0.82	1.29	*	65.00	65.00	58.20
	Johnson Bros	17860133	4 Little Anderson Creek	3/20/1997	30.00	5.70	5.70	0.16	0.53	*	9.50	9.50	61.50
	Johnson Bros	17860133	4 Little Anderson Creek	3/3/1998	8.00	6.30	6.70	0.16	0.20	*	0.00	20.00	21.00
	Johnson Bros	17860133	4 Little Anderson Creek	6/2/1998	4.00	6.10	7.00	2.28	3.75	*	0.00	32.00	15.00
	Johnson Bros	17860133	4 Little Anderson Creek	8/10/1998	2.00	6.20	6.40	0.57	0.83	*	0.00	14.00	42.00
	Johnson Bros	17860133	4 Little Anderson Creek	11/16/1998	<1	7.20	6.70	1.31	4.01	*	0.00	20.00	256.00
	Johnson Bros	17860133	4 Little Anderson Creek	3/15/1999	21.00	6.20	6.00	0.22	1.49	*	4.00	10.00	206.00
	Johnson Bros	17860133	4 Little Anderson Creek	6/14/1999	2.00	6.00	6.20	2.35	1.67	*	0.00	18.00	39.00
	Johnson Bros	17860133	4 Little Anderson Creek	7/22/1999	<1	6.80	6.50	0.89	2.98	*	0.00	22.00	282.00
	Johnson Bros	17860133	4 Little Anderson Creek	11/3/1999	8.00	6.70	5.80	0.91	0.34	*	4.00	8.00	54.00
	Johnson Bros	17860133	4 Little Anderson Creek	1/11/2000	25.00	5.40	6.10	0.44	0.34	*	2.00	10.00	68.00
	Johnson Bros	17860133	4 Little Anderson Creek	4/17/2000	*	5.90	6.80	3.61	3.63	*	0.00	24.00	78.00
	Johnson Bros	17860133	4 Little Anderson Creek	7/18/2000	<1		7.00	2.11	2.00	*	0.00	30.00	324.00
	Johnson Bros	17860133	4 Little Anderson Creek	10/9/2000	2.00	6.40	6.50	0.80	1.80	*	0.00	14.00	154.00
	Hepburnia	17880101	17 Little Anderson Upst	5/21/1981	*	*	4.30	0.11	9.29	*	30.00	5.00	230.00
	Hepburnia	17880101	17 Little Anderson Upst	10/30/1981	5.00	3.50	3.47	0.43	7.14	*	37.00	0.00	124.00
	Hepburnia	17880101	17 Little Anderson Upst	6/21/1981	*	*	5.10	0.22	1.53	0.45	22.00	7.00	40.00
	Hepburnia	17880101	17 Little Anderson Upst	3/11/1983	*	*	4.30	0.20	5.26	*	36.00	5.00	130.00
	Hepburnia	17880101	17 Little Anderson Upst	3/23/1983	*	*	4.80	0.60	2.35	*	12.00	7.00	80.00
	Hepburnia	17880101	17 Little Anderson Upst	1/24/1984	*	*	6.30	0.41	8.10	*	0.00	36.00	290.00
	Hepburnia	17880101	17 Little Anderson Upst	4/17/1985	*	*	3.50	16.00	8.30	*	94.00	0.00	530.00
	Hepburnia	17880101	17 Little Anderson Upst	3/20/1985	23.00	3.50	3.60	10.86	9.32	*	65.00	0.00	232.00
	Hepburnia	17880101	17 Little Anderson Upst	4/30/1986	1.50	3.08	3.20	18.06	18.46	*	130.00	0.00	497.00
	Hepburnia	17880101	17 Little Anderson Upst	5/21/1986	1.00	3.25	3.30	3.31	12.30	*	81.00	0.00	303.00
	Hepburnia	17880101	17 Little Anderson Upst	6/23/1986	0.00	3.10	3.20	11.10	13.22	*	83.00	0.00	341.00
	Hepburnia	17880101	17 Little Anderson Upst	7/8/1986	5.00	3.57	3.60	1.97	9.90	*	28.00	0.00	170.00
	Hepburnia	17880101	17 Little Anderson Upst	8/14/1986	5.00	2.83	3.00	19.06	20.08	*	170.00	0.00	540.00
	Hepburnia	17880101	17 Little Anderson Upst	5/1/1987	*	3.00	3.50	1.35	10.50	*	44.00	0.00	401.00
	Hepburnia	17880101	17 Little Anderson Upst	5/8/1987	1.00	3.70	3.70	1.39	5.60	*	2.00	0.00	258.00
	Hepburnia	17880101	17 Little Anderson Upst	8/17/1987	1.00	3.80	3.80	1.67	7.90	*	42.00	0.00	288.00
	Hepburnia	17880101	17 Little Anderson Upst	9/11/1987	1.00	4.10	4.60	0.41	6.80	*	36.00	6.00	376.00
	Hepburnia	17880101	17 Little Anderson Upst	10/13/1987	4.00	4.10	4.40	0.12	4.70	*	16.00	4.00	123.00
	Hepburnia	17880101	17 Little Anderson Upst	11/1/1987	2.00	5.30	4.70	0.45	4.73	*	16.00	6.00	225.00
	Hepburnia	17880101	17 Little Anderson Upst	4/2/1991	28.00	4.50	3.70	2.04	7.67	*	42.00	0.00	336.00
	Hepburnia	17880101	17 Little Anderson Upst	7/24/1991	6.00	3.80	4.10	0.20	8.45	*	34.00	3.00	359.00
	Hepburnia	17880101	17 Little Anderson Upst	11/13/1991	1.00	6.20	4.50	0.71	7.26	*	18.00	6.00	352.00
	Hepburnia	17880101	17 Little Anderson Upst	4/9/1992	65.00	5.80	4.50	0.01	1.27	*	4.00	6.00	86.00
	Hepburnia	17880101	17 Little Anderson Upst	7/30/1992	11.00	3.90	4.00	0.85	2.99	*	26.00	0.00	231.00
	Hepburnia	17880101	17 Little Anderson Upst	11/16/1992	52.00	6.30	4.30	0.49	2.65	*	8.00	4.00	91.00
	Hepburnia	17880101	17 Little Anderson Upst	1/12/1993	45.00	4.40	4.10	0.78	3.71	*	18.00	2.00	116.00
	Hepburnia	17880101	17 Little Anderson Upst	4/5/1993	65.00	4.50	4.30	0.32	2.18	*	8.00	4.00	76.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Hepburnia	17880101	17 Little Anderson Upst	7/30/1993	2.00	6.50	6.30	1.51	2.14	*	0.00	20.00	35.00
	Hepburnia	17880101	17 Little Anderson Upst	11/9/1993	5.00	5.40	5.60	0.28	1.74	*	32.00	6.00	96.00
	Hepburnia	17880101	17 Little Anderson Upst	6/30/1994	<1	6.00	6.60	2.28	10.60	*	0.00	18.00	410.00
	Hepburnia	17880101	17 Little Anderson Upst	8/23/1994	68.00	5.40	6.30	1.77	1.71	*	0.00	22.00	31.00
	Hepburnia	17880101	17 Little Anderson Upst	12/20/1994	20.00	4.10	6.30	0.24	0.43	*	0.00	14.00	46.00
	Hepburnia	17880101	17 Little Anderson Upst	3/7/1995	45.00	5.90	6.10	0.10	0.20	*	0.00	12.00	14.00
	Hepburnia	17880101	17 Little Anderson Upst	5/15/1995	12.00	6.50	6.50	1.16	1.63	*	0.00	26.00	24.00
	Hepburnia	17880101	17 Little Anderson Upst	3/5/1996	32.00	5.60	6.00	0.09	0.12	*	0.00	16.00	29.00
	Hepburnia	17880101	17 Little Anderson Upst	5/20/1996	10.00	7.30	6.50	0.10	0.17	*	0.00	18.00	36.00
	Hepburnia	17880101	17 Little Anderson Upst	8/7/1996	<1	5.80	6.60	5.90	4.79	*	0.00	40.00	33.00
	Hepburnia	17880101	17 Little Anderson Upst	11/18/1996	18.00	6.30	6.60	36.00	0.23	*	0.00	18.00	55.00
	Hepburnia	17880101	17 Little Anderson Upst	3/26/1997	40.00	6.60	6.00	0.19	0.03	*	0.00	10.00	30.00
	Hepburnia	17880101	17 Little Anderson Upst	6/4/1997	19.00	6.00	6.80	1.55	1.64	*	0.00	26.00	23.00
	Hepburnia	17880101	17 Little Anderson Upst	7/9/1997	1.00	7.20	7.00	3.20	5.70	*	0.00	40.00	29.00
	Hepburnia	17880101	17 Little Anderson Upst	11/24/1997	*	*	6.30	0.49	0.33	*	0.00	14.00	24.00
	Hepburnia	17880101	17 Little Anderson Upst	2/4/1998	22.00	5.50	6.60	0.99	0.89	*	0.00	18.00	27.00
	Hepburnia	17880101	17 Little Anderson Upst	6/2/1998	4.00	6.10	7.00	2.28	3.75	*	0.00	32.00	15.00
	Hepburnia	17880101	17 Little Anderson Upst	8/10/1998	2.00	6.20	6.40	0.57	0.83	*	0.00	14.00	42.00
	Hepburnia	17880101	17 Little Anderson Upst	11/16/1998	<1	7.20	6.70	1.31	4.01	*	0.00	20.00	256.00
	Hepburnia	17880101	17 Little Anderson Upst	3/15/1999	21.00	6.20	6.00	0.22	1.49	*	4.00	10.00	206.00
	Hepburnia	17880101	17 Little Anderson Upst	6/14/1999	2.00	6.00	6.20	2.35	1.67	*	0.00	18.00	39.00
	Hepburnia	17880101	17 Little Anderson Upst	11/3/1999	8.00	6.70	5.80	0.91	0.34	*	4.00	8.00	54.00
	Johnson Bros	17860133	25 Little Anderson	1/7/1998	25.00	4.70	4.00	0.26	3.01	*	18.00	0.00	112.00
	Johnson Bros	17860133	25 Little Anderson	2/28/1998	58.00	4.70	4.90	5.23	4.28	*	6.00	14.00	139.00
	Johnson Bros	17860133	25 Little Anderson	6/16/1998	14.00	6.00	6.00	0.36	3.43	*	0.00	14.00	172.00
	Johnson Bros	17860133	25 Little Anderson	8/10/1998	3.00	6.00	6.80	3.72	11.85	*	0.00	34.00	319.00
	Johnson Bros	17860133	25 Little Anderson	3/15/1999	*	6.20	6.00	0.23	1.40	*	2.00	10.00	202.00
	Johnson Bros	17860133	25 Little Anderson	6/14/1999	<1	6.60	6.40	8.27	2.51	*	0.00	18.00	344.00
	Johnson Bros	17860133	25 Little Anderson	7/22/1999	<1	7.00	6.50	13.60	3.80	*	0.00	22.00	290.00
	Johnson Bros	17860133	25 Little Anderson	11/3/1999	12.00	6.00	6.10	0.35	1.00	*	2.00	10.00	138.00
	Johnson Bros	17860133	25 Little Anderson	1/11/2000	12.00	5.50	6.00	2.47	0.92	*	2.00	10.00	166.00
	Johnson Bros	17860133	25 Little Anderson	4/17/2000	*	4.60	6.10	1.47	1.13	*	2.00	10.00	139.00
	Johnson Bros	17860133	25 Little Anderson	7/18/2000	28.00		6.90	7.07	2.46	*	0.00	30.00	319.00
	Johnson Bros	17860133	25 Little Anderson	10/9/2000	8.00	6.00	6.60	0.67	1.77	*	0.00	14.00	154.00
	ScarLift Report	12-G	Little Anderson upst. of 12-H	10//1972	698.00	*	4.80	5.00	*	*	6.00	*	193.00
	ScarLift Report	12-G	Little Anderson upst. of 12-H	10//1972	1496.00	*	4.80	1.30	*	*	7.00	*	110.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	3/19/1996	184.00	5.60	6.00	0.06	2.85	0.04	0.00	14.00	284.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	4/30/1996	2953.00	5.10	5.60	0.07	1.32	0.04	0.00	8.00	213.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	5/30/1996	324.00	5.00	5.00	0.24	3.83	0.53	0.00	8.00	225.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	6/19/1996	3660.00	4.30	5.20	0.26	3.05	0.18	0.00	8.00	111.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	7/23/1996	281.00	6.10	6.60	2.38	4.49	0.14	0.00	30.00	109.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	8/23/1995	371.00	6.20	7.10	1.00	2.32	0.04	0.00	36.00	200.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Johnson Bros	17960123	JT-5 Little Anderson Above	6/4/1997	100.00	5.10	5.40	0.25	2.14	0.28	14.00	6.00	183.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	7/9/1997	25.00	6.90	6.20	1.05	3.59	0.26	0.00	18.00	332.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	11/27/1997	>250	6.70	6.90	0.14	1.15	0.28	4.00	12.00	123.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	1/22/1998	170.00	5.40	6.20	0.13	2.04	0.48	0.00	14.00	196.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	6/2/1998	48.00	5.10	5.70	0.36	4.02	0.21	14.00	10.00	323.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	8/10/1998	38.00	6.30	6.30	3.61	11.74	0.28	0.00	30.00	323.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	12/22/1998	190.00	5.30	5.50	0.43	1.37	0.44	0.00	8.00	114.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	2/8/1999	200.00	5.10	5.80	0.21	1.43	0.09	0.00	10.00	127.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	4/27/1999	188.00	6.20	5.60	0.17	1.23	0.19	4.00	8.00	171.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	7/22/1999	20.00	7.10	7.50	0.79	2.37	*	0.00	76.00	293.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	11/3/1999	150.00	5.80	6.10	0.23	1.01	0.15	2.00	8.00	139.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	1/11/2000	*	5.60	6.00	0.16	0.75	0.19	2.00	10.00	152.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	4/17/2000	*	4.80	5.60	0.12	0.82	0.14	6.00	6.00	154.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	8/22/2000	25.00	7.10	6.80	3.09	4.48	0.07	0.00	50.00	265.00
	Johnson Bros	17960123	JT-5 Little Anderson Above	10/23/2000	70.00	6.60	6.40	0.73	1.61	0.58	0.00	14.00	159.00
				Avg	**102.52**	**4.92**	**5.01**	**3.73**	**5.09**	**0.25**	**24.91**	**10.87**	**187.80**
				St Dev	**434.47**	**1.26**	**1.29**	**6.04**	**4.88**	**0.17**	**36.17**	**12.64**	**132.04**
UNTLA 1	Johnson Bros	17980125	JW7 UT Little Anderson	4/2/1997	>100	6.90	7.10	0.61	0.27	*	0.00	36.00	36.00
	Johnson Bros	17980125	JW7 UT Little Anderson	5/23/1997	5.00	6.20	7.40	2.61	0.44	*	0.00	54.00	47.00
	Johnson Bros	17980125	JW7 UT Little Anderson	6/19/1997	18.00	7.20	7.50	3.93	0.96	*	0.00	116.00	26.00
	Johnson Bros	17980125	JW7 UT Little Anderson	7/24/1997	2.00	5.60	7.30	4.31	0.57	*	0.00	82.00	18.00
	Johnson Bros	17980125	JW7 UT Little Anderson	8/26/1997	1.00	7.10	7.60	1.60	0.43	0.04	0.00	72.00	43.00
	Johnson Bros	17980125	JW7 UT Little Anderson	9/26/1997	18.00	6.70	7.40	1.67	0.41	0.04	0.00	66.00	31.00
	Johnson Bros	17980125	JW-8 UT Little Anderson	4/2/1997	27.00	6.70	6.70	0.04	0.10	*	0.00	14.00	24.00
	Johnson Bros	17980125	JW-8 UT Little Anderson	5/23/1997	2.00	6.40	7.20	0.22	0.04	*	0.00	28.00	23.00
	Johnson Bros	17980125	JW-19 UT Little Anderson	4/3/1997	15.00	5.40	6.00	0.08	0.04	0.17	0.00	8.00	29.00
	Johnson Bros	17980125	JW-19 UT Little Anderson	5/23/1997	8.00	5.30	6.10	0.13	0.16	0.23	0.00	10.00	14.00
	Johnson Bros	17980125	JW-19 UT Little Anderson	6/19/1997	8.00	5.70	6.40	0.34	0.10	0.10	0.00	14.00	12.00
	Johnson Bros	17980125	JW-19 UT Little Anderson	8/26/1997	11.00	6.00	6.00	0.11	0.05	0.18	0.00	12.00	18.00
	Johnson Bros	17980125	JW-19 UT Little Anderson	9/26/1997	15.00	5.80	6.50	0.13	0.17	0.04	0.00	12.00	17.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	10/30/1990	2.00	6.80	7.60	1.81	4.75	*	0.00	106.00	236.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	12/16/1991	18.00	6.20	6.30	0.44	0.77	*	0.00	16.00	59.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	11/27/1993	52.00	7.10	6.80	0.87	2.86	*	0.00	18.00	21.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	12/16/1993	62.00	5.90	6.40	0.55	2.95	*	0.00	12.00	275.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	1/27/1994	84.00	6.00	6.60	0.46	2.26	*	0.00	11.00	275.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	2/28/1994	78.00	6.60	6.40	0.58	1.88	*	0.00	14.00	110.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	6/24/1994	50.00	5.80	6.80	2.47	5.59	*	0.00	42.00	264.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	9/21/1994	32.00	5.80	6.50	1.56	5.93	*	0.00	32.00	226.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	12/21/1994	68.00	5.80	6.20	0.66	3.52	*	0.00	16.00	133.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	3/29/1995	75.00	6.00	6.40	0.90	4.17	*	0.00	14.00	142.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	6/27/1995	48.00	6.40	6.70	3.20	8.05	*	0.00	22.00	205.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Waroquier	17930114	WS-30 UNT-A Little Anderson	9/30/1995	5.00	6.70	7.40	1.76	7.27	*	0.00	40.00	278.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	12/15/1995	100.00	5.90	6.10	2.01	5.24	*	0.00	14.00	194.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	3/21/1996	*	6.20	6.20	0.59	0.94	*	0.00	14.00	44.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	5/20/1996	70.00	5.80	6.50	1.16	4.64	*	0.00	14.00	200.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	9/4/1996	10.00	6.00	6.90	4.52	12.91	*	0.00	28.00	273.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	11/18/1996	78.00	6.00	6.60	4.20	4.76	*	0.00	16.00	153.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	3/26/1997	75.00	5.80	6.10	1.89	2.18	*	0.00	12.00	100.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	6/8/1997	16.00	5.90	6.80	3.64	5.50	*	0.00	28.00	156.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	8/21/1997	57.00	5.40	5.60	1.47	4.18	*	0.00	10.00	116.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	12/31/1997	48.00	5.60	6.30	2.32	2.33	*	0.00	18.00	100.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	3/31/1998	>100	5.40	6.10	4.61	5.20	*	0.00	14.00	187.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	6/2/1998	25.00	6.20	6.30	6.22	8.00	*	0.00	22.00	240.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	8/18/1998	<1	6.00	6.40	3.53	8.44	*	0.00	22.00	236.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	11/16/1998	<1	5.10	6.80	3.78	7.27	*	0.00	24.00	219.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	3/29/1999	200.00	5.70	5.70	1.56	2.07	*	4.00	6.00	107.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	6/17/1999	*	5.70	5.50	5.24	10.14	*	2.00	8.00	288.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	9/23/1999	15.00	5.30	7.00	2.56	6.60	*	0.00	40.00	181.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	11/18/1999	5.00	6.40	6.60	2.93	4.11	*	0.00	22.00	163.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	3/30/2000	*	6.20	5.60	2.62	3.85	*	2.00	8.00	162.00
	Waroquier	17930114	WS-30 UNT-A Little Anderson	6/27/2000	*	5.90	6.80	3.67	3.63	*	0.00	24.00	78.00
	ScarLift Report	12-H	UNT Little Anderson upst of 12-F	10//1972	1036.00	*	4.00	1.94	*	*	6.00	*	125.00
	ScarLift Report	12-H	UNT Little Anderson upst of 12-F	10//1972	1616.00	*	5.10	1.20	*	*	6.00	*	21.00
				Avg	**106.71**	**6.06**	**6.48**	**2.02**	**3.54**	**0.11**	**0.43**	**27.52**	**128.37**
				St Dev	**301.51**	**0.52**	**0.69**	**1.59**	**3.13**	**0.08**	**1.39**	**25.23**	**92.70**
LA 2	Hepburnia	17880101	3 Little Anderson Downstream	1/19/1982	*	4.96	5.03	0.08	0.30	*	6.00	0.00	144.00
	Hepburnia	17880101	3 Little Anderson Downstream	5/4/1982	7.00	5.90	5.60	0.09	2.43	*	2.00	0.00	208.00
	Hepburnia	17880101	3 Little Anderson Downstream	10/7/1982	1.00	4.45	5.07	0.06	0.68	*	10.00	0.00	117.00
	Hepburnia	17880101	3 Little Anderson Downstream	1/18/1982	5.00	5.15	5.41	0.05	0.18	*	11.00	1.00	133.00
	Hepburnia	17880101	3 Little Anderson Downstream	5/1/1987	*	*	4.60	0.23	8.60	*	8.00	6.00	458.00
	Hepburnia	17880101	3 Little Anderson Downstream	6/8/1987	40.00	4.10	4.20	0.19	13.90	*	36.00	2.00	513.00
	Hepburnia	17880101	3 Little Anderson Downstream	8/17/1987	25.00	5.80	3.80	0.23	8.90	*	3.00	12.00	429.00
	Hepburnia	17880101	3 Little Anderson Downstream	9/11/1987	36.00	5.90	6.30	0.26	7.40	0.04	22.00	12.00	478.00
	Hepburnia	17880101	3 Little Anderson Downstream	10/13/1987	60.00	5.80	6.50	0.34	3.44	0.20	4.00	12.00	145.00
	Hepburnia	17880101	3 Little Anderson Downstream	11/1/1987	50.00	6.90	6.80	0.41	4.08	0.12	10.00	10.00	321.00
	Hepburnia	17880101	3 Little Anderson Downstream	4/2/1991	46.00	5.50	4.80	0.20	6.62	0.86	9.00	7.00	344.00
	Hepburnia	17880101	3 Little Anderson Downstream	7/24/1991	4.00	5.90	6.30	0.61	8.41	0.30	8.00	12.00	429.00
	Hepburnia	17880101	3 Little Anderson Downstream	11/13/1991	18.00	7.90	6.00	0.45	7.46	0.13	0.00	10.00	401.00
	Hepburnia	17880101	3 Little Anderson Downstream	2/13/1992	*	6.10	6.40	2.46	4.28	0.80	0.00	10.00	281.00
	Hepburnia	17880101	3 Little Anderson Downstream	4/9/1992	256.00	6.00	5.40	0.11	1.57	0.54	0.00	8.00	92.00
	Hepburnia	17880101	3 Little Anderson Downstream	7/30/1992	210.00	5.70	6.30	0.60	2.86	0.15	0.00	12.00	193.00
	Hepburnia	17880101	3 Little Anderson Downstream	11/16/1992	185.00	6.10	6.60	0.30	2.13	0.19	0.00	12.00	105.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Hepburnia	17880101	3 Little Anderson Downstream	1/12/1993	225.00	5.10	5.40	0.66	4.67	0.57	0.00	10.00	300.00
	Hepburnia	17880101	3 Little Anderson Downstream	4/5/1993	428.00	5.70	5.50	0.83	3.83	0.35	6.00	8.00	258.00
	Hepburnia	17880101	3 Little Anderson Downstream	7/30/1993	65.00	5.60	5.80	0.37	9.23	0.21	0.00	10.00	448.00
	Hepburnia	17880101	3 Little Anderson Downstream	11/9/1993	65.00	6.40	6.60	0.34	1.88	0.25	0.00	12.00	110.00
	Hepburnia	17880101	3 Little Anderson Downstream	3/1/1994	275.00	5.70	5.90	0.22	1.78	0.26	0.00	8.00	110.00
	Hepburnia	17880101	3 Little Anderson Downstream	6/30/1994	72.00	6.10	6.70	0.77	6.71	0.27	0.00	20.00	300.00
	Hepburnia	17880101	3 Little Anderson Downstream	8/23/1994	225.00	6.00	6.60	0.47	3.39	0.17	0.00	16.00	85.00
	Hepburnia	17880101	3 Little Anderson Downstream	12/20/1994	225.00	4.40	5.50	0.19	2.45	0.31	0.00	8.00	125.00
	Hepburnia	17880101	3 Little Anderson Downstream	3/7/1995	450.00	6.30	6.10	0.07	2.15	0.15	0.00	10.00	74.00
	Hepburnia	17880101	3 Little Anderson Downstream	5/15/1995	312.00	5.70	5.80	0.30	2.86	0.29	0.00	8.00	138.00
	Hepburnia	17880101	3 Little Anderson Downstream	9/11/1995	21.00	7.20	7.40	0.57	8.30	0.03	0.00	62.00	288.00
	Hepburnia	17880101	3 Little Anderson Downstream	10/10/1995	26.00	5.90	6.50	0.46	7.95	0.21	0.00	22.00	283.00
	Hepburnia	17880101	3 Little Anderson Downstream	3/5/1996	301.00	6.70	5.60	0.70	4.38	0.61	0.00	10.00	152.00
	Hepburnia	17880101	3 Little Anderson Downstream	5/20/1996	180.00	6.20	5.50	0.28	4.11	0.35	2.00	8.00	186.00
	Hepburnia	17880101	3 Little Anderson Downstream	8/7/1996	44.00	6.60	6.80	0.39	7.74	0.10	0.00	20.00	287.00
	Hepburnia	17880101	3 Little Anderson Downstream	11/18/1996	139.00	5.80	5.90	0.59	2.64	0.39	0.00	8.00	140.00
	Hepburnia	17880101	3 Little Anderson Downstream	3/26/1997	428.00	6.00	5.90	0.53	1.73	0.50	0.00	10.00	105.00
	Hepburnia	17880101	3 Little Anderson Downstream	6/4/1997	216.00	6.20	6.50	0.49	2.13	0.26	0.00	10.00	123.00
	Hepburnia	17880101	3 Little Anderson Downstream	7/9/1997	15.00	6.50	6.30	1.01	3.28	0.16	0.00	16.00	277.00
	Hepburnia	17880101	3 Little Anderson Downstream	1/22/1998	225.00	5.60	5.40	1.00	3.02	0.62	8.00	8.00	197.00
	Hepburnia	17880101	3 Little Anderson Downstream	6/2/1998	*	6.40	6.20	0.09	5.70	0.16	0.00	12.00	256.00
	Hepburnia	17880101	3 Little Anderson Downstream	8/7/1998	62.00	6.10	6.30	0.91	3.51	0.67	6.00	12.00	224.00
	Hepburnia	17880101	3 Little Anderson Downstream	11/16/1998	28.00	7.00	6.60	0.08	1.89	0.04	0.00	14.00	209.00
	Hepburnia	17880101	3 Little Anderson Downstream	3/15/1999	217.00	6.40	6.20	1.13	2.43	0.29	8.00	10.00	157.00
	Hepburnia	17880101	3 Little Anderson Downstream	6/14/1999	65.00	6.50	6.30	0.70	3.25	0.28	0.00	12.00	348.00
	Hepburnia	17880101	3 Little Anderson Downstream	8/19/1999	18.00	6.60	6.80	0.31	1.83	0.07	0.00	34.00	226.00
	Hepburnia	17880101	3 Little Anderson Downstream	11/3/1999	190.00	6.30	5.80	0.33	1.00	0.26	4.00	8.00	108.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	3/29/1996	1400.00	5.20	5.50	0.21	4.12	0.48	0.00	10.00	171.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	4/30/1996	*	5.30	5.60	0.59	1.77	0.54	0.00	8.00	97.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	5/30/1996	611.00	5.00	5.00	0.27	6.05	0.88	10.00	8.00	192.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	6/19/1996	911.00	5.10	5.60	0.42	2.47	0.31	0.00	10.00	86.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	7/23/1996	619.00	5.90	6.10	0.56	3.59	0.14	0.00	10.00	122.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	8/23/1995	526.00	6.40	6.90	0.46	3.87	0.04	0.00	30.00	159.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	6/4/1997	180.00	5.50	5.50	0.28	2.11	0.18	4.00	6.00	136.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	7/9/1997	40.00	6.40	6.40	0.78	3.24	0.04	0.00	14.00	298.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	11/11/1997	*	5.00	5.40	0.21	0.90	0.10	6.00	8.00	70.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	1/22/1998	225.00	5.60	5.40	1.00	3.02	0.62	8.00	8.00	197.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	6/2/1998	160.00	6.10	5.20	0.19	6.23	0.38	40.00	10.00	336.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	8/18/1998	10.00	6.20	6.80	1.07	7.39	0.22	0.00	32.00	250.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	12/22/1998	215.00	5.30	5.40	0.43	1.39	0.47	0.00	8.00	116.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	2/8/1999	280.00	5.60	5.80	0.17	1.24	0.14	2.00	8.00	100.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	4/27/1999	200.00	6.60	5.20	0.12	2.15	0.33	4.00	8.00	164.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Johnson Bros	17960123	JT-17 Little Anderson dnst	8/19/1999	10.00	6.80	7.00	0.39	1.84	0.12	0.00	36.00	234.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	11/3/1999	225.00	6.10	5.90	0.32	1.01	0.31	4.00	8.00	110.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	1/11/2000	>250	5.70	5.90	0.26	1.03	0.26	4.00	10.00	104.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	4/17/2000	*	5.70	6.00	0.43	1.63	0.20	2.00	8.00	127.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	8/22/2000	50.00	7.00	6.70	3.23	4.65	0.14	0.00	24.00	119.00
	Johnson Bros	17960123	JT-17 Little Anderson dnst	10/23/2000	228.00	6.70	6.40	1.92	1.77	0.64	0.00	14.00	77.00
	Waroquier	17930114	WS-15 Little Anderson	10/29/1990	175.00	5.90	6.10	0.72	5.07	*	4.00	5.00	222.00
	Waroquier	17930114	WS-15 Little Anderson	11/29/1990	270.00	5.30	5.90	0.56	4.56	*	4.00	3.00	181.00
	Waroquier	17930114	WS-15 Little Anderson	12/20/1990	900.00	4.80	5.80	0.47	1.97	*	5.00	3.00	83.00
	Waroquier	17930114	WS-15 Little Anderson	1/24/1991	*	5.70	5.20	0.77	5.78	*	6.00	3.00	243.00
	Waroquier	17930114	WS-15 Little Anderson	11/8/1991	25.00	6.10	6.40	0.84	4.53	0.47	0.00	20.00	288.00
	Waroquier	17930114	WS-15 Little Anderson	12/18/1991	60.00	7.10	6.00	0.33	2.48	*	0.00	8.00	116.00
	Waroquier	17930114	WS-15 Little Anderson	6/24/1994	110.00	5.90	6.80	0.68	6.53	*	0.00	20.00	307.00
	Waroquier	17930114	WS-15 Little Anderson	8/25/1994	225.00	6.00	6.60	0.47	3.39	*	0.00	16.00	85.00
	Waroquier	17930114	WS-15 Little Anderson	9/21/1994	225.00	6.00	6.60	0.47	3.39	*	0.00	16.00	85.00
	Waroquier	17930114	WS-15 Little Anderson	12/21/1994	225.00	4.40	5.50	0.19	2.45	*	0.00	8.00	125.00
	Waroquier	17930114	WS-15 Little Anderson	3/29/1995	450.00	6.30	6.10	0.07	2.15	*	0.00	10.00	74.00
	Waroquier	17930114	WS-15 Little Anderson	6/27/1995	312.00	5.70	5.80	0.30	2.86	*	0.00	8.00	138.00
	Waroquier	17930114	WS-15 Little Anderson	9/30/1995	21.00	7.20	7.40	0.57	8.30	*	0.00	62.00	288.00
	Waroquier	17930114	WS-15 Little Anderson	12/15/1995	26.00	5.90	6.50	0.46	7.95	*	0.00	22.00	283.00
	Waroquier	17930114	WS-15 Little Anderson	3/21/1996	>300	6.70	5.60	0.70	4.38	0.61	0.00	10.00	152.00
	Waroquier	17930114	WS-15 Little Anderson	5/20/1996	180.00	6.20	5.50	0.28	4.11	*	2.00	8.00	186.00
	Waroquier	17930114	WS-15 Little Anderson	8/7/1996	44.00	6.60	6.80	0.39	7.74	*	0.00	20.00	287.00
	Waroquier	17930114	WS-15 Little Anderson	11/18/1996	139.00	5.80	5.90	0.59	2.64	0.39	0.00	8.00	140.00
	Waroquier	17930114	WS-15 Little Anderson	3/26/1997	428.00	6.00	5.90	0.53	1.73	0.50	0.00	10.00	105.00
	Waroquier	17930114	WS-15 Little Anderson	6/4/1997	216.00	6.20	6.50	0.49	2.13	0.26	0.00	10.00	123.00
	Waroquier	17930114	WS-15 Little Anderson	7/9/1997	15.00	6.50	6.30	1.01	3.28	*	0.00	16.00	277.00
	Waroquier	17930114	WS-15 Little Anderson	1/22/1998	225.00	5.60	5.40	1.00	3.02	0.62	8.00	8.00	197.00
	Waroquier	17930114	WS-15 Little Anderson	6/2/1998	*	6.40	6.20	0.09	5.70	0.16	0.00	12.00	256.00
	Waroquier	17930114	WS-15 Little Anderson	8/7/1998	62.00	6.10	6.30	0.91	3.51	0.67	6.00	12.00	224.00
	Waroquier	17930114	WS-15 Little Anderson	11/16/1998	28.00	7.00	6.60	0.08	1.89	0.04	0.00	14.00	209.00
	Waroquier	17930114	WS-15 Little Anderson	3/15/1999	217.00	6.40	6.20	1.13	2.43	*	8.00	10.00	157.00
	Waroquier	17930114	WS-15 Little Anderson	6/14/1999	65.00	6.50	6.30	0.70	3.25	0.28	0.00	12.00	348.00
	Waroquier	17930114	WS-15 Little Anderson	8/19/1999	18.00	6.60	6.80	0.31	1.83	0.07	0.00	34.00	226.00
	Waroquier	17930114	WS-15 Little Anderson	11/18/1999	190.00	6.30	5.80	0.33	1.00	0.26	4.00	8.00	108.00
	Waroquier	17930114	WS-15 Little Anderson	1/11/2000	>250	5.60	6.20	0.37	1.11	*	2.00	10.00	105.00
	Waroquier	17930114	WS-15 Little Anderson	6/27/2000	*	5.80	6.50	1.40	3.28	*	0.00	14.00	108.00
	Waroquier	17930114	WS-20 Little Anderson	10/29/1990	*	6.60	6.10	0.43	4.39	0.12	5.00	5.00	194.00
	Waroquier	17930114	WS-20 Little Anderson	11/29/1990	550.00	5.70	6.10	0.48	3.47	<0.1	4.00	3.00	181.00
	Waroquier	17930114	WS-20 Little Anderson	12/20/1990	100.00	4.00	5.80	0.40	1.70	1.04	4.00	3.00	73.00
	Waroquier	17930114	WS-20 Little Anderson	1/24/1991	*	5.80	5.20	0.48	5.91	<0.1	7.00	3.00	241.00
	Waroquier	17930114	WS-20 Little Anderson	12/21/1991	300.00	5.80	5.90	0.27	2.23	*	0.00	10.00	225.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Waroquier	17930114	WS-20 Little Anderson	1/27/1992	400.00	6.80	5.90	0.12	1.67	*	0.00	8.00	186.00
	Waroquier	17930114	WS-20 Little Anderson	6/24/1994	165.00	*	6.70	0.48	5.24	*	0.00	26.00	275.00
	Waroquier	17930114	WS-20 Little Anderson	9/21/1994	60.00	5.90	6.50	0.23	3.67	*	0.00	26.00	188.00
	Waroquier	17930114	WS-20 Little Anderson	12/21/1994	*	5.60	6.00	0.02	1.99	*	0.00	12.00	91.00
	Waroquier	17930114	WS-20 Little Anderson	3/29/1995	*	6.50	5.70	0.25	3.35	*	0.00	8.00	161.00
	Waroquier	17930114	WS-20 Little Anderson	6/27/1995	305.00	6.70	6.50	0.85	4.27	*	0.00	16.00	122.00
	Waroquier	17930114	WS-20 Little Anderson	9/30/1995	35.00	6.80	7.10	0.20	2.69	*	0.00	24.00	279.00
	Waroquier	17930114	WS-20 Little Anderson	12/15/1995	*	6.30	5.90	1.42	2.28	*	0.00	10.00	142.00
	Waroquier	17930114	WS-20 Little Anderson	3/21/1996	*	6.80	5.40	0.29	1.66	*	0.00	8.00	67.00
	Waroquier	17930114	WS-20 Little Anderson	5/20/1996	>450	6.30	5.70	0.23	3.84	*	0.00	8.00	175.00
	Waroquier	17930114	WS-20 Little Anderson	9/4/1996	200.00	6.80	7.40	0.87	5.00	*	0.00	44.00	231.00
	Waroquier	17930114	WS-20 Little Anderson	11/18/1996	*	6.10	5.70	0.55	2.94	*	0.00	6.00	140.00
	Waroquier	17930114	WS-20 Little Anderson	3/26/1997	*	5.70	5.90	0.52	1.54	*	0.00	10.00	110.00
	Waroquier	17930114	WS-20 Little Anderson	6/8/1997	*	6.80	6.40	1.02	2.07	*	0.00	14.00	137.00
	Waroquier	17930114	WS-20 Little Anderson	8/21/1997	*	5.70	6.00	0.62	1.93	*	0.00	10.00	97.00
	Waroquier	17930114	WS-20 Little Anderson	12/31/1997	*	6.00	6.20	0.38	1.21	*	0.00	14.00	92.00
	Waroquier	17930114	WS-20 Little Anderson	6/2/1998	125.00	5.80	5.80	0.13	5.88	*	8.00	10.00	279.00
	Waroquier	17930114	WS-20 Little Anderson	3/31/1998	*	6.20	5.70	0.10	3.25	*	0.00	12.00	185.00
	Waroquier	17930114	WS-20 Little Anderson	8/18/1998	70.00	6.60	6.70	0.73	5.96	*	0.00	20.00	236.00
	Waroquier	17930114	WS-20 Little Anderson	11/16/1998	25.00	7.40	6.60	0.04	1.05	*	0.00	14.00	205.00
	Waroquier	17930114	WS-20 Little Anderson	3/29/1999	*	6.10	5.60	0.24	1.21	*	6.00	6.00	85.00
	Waroquier	17930114	WS-20 Little Anderson	6/17/1999	*	5.30	6.00	0.47	3.68	*	2.00	8.00	292.00
	Waroquier	17930114	WS-20 Little Anderson	9/23/1999	*	6.80	7.00	0.29	0.26	*	0.00	24.00	187.00
	Waroquier	17930114	WS-20 Little Anderson	11/18/1999	*	7.10	6.40	0.15	0.46	*	2.00	10.00	160.00
	Waroquier	17930114	WS-20 Little Anderson	3/30/2000	*	7.70	5.70	0.29	1.54	*	4.00	6.00	119.00
	Waroquier	17930114	WS-20 Little Anderson	6/27/2000	*	7.50	6.50	2.01	3.26	*	0.00	14.00	97.00
				Avg	**195.12**	**6.07**	**6.03**	**0.52**	**3.56**	**0.32**	**2.66**	**12.61**	**193.29**
				St Dev	**219.85**	**0.69**	**0.61**	**0.46**	**2.34**	**0.23**	**5.69**	**9.68**	**97.27**
UNTLA 2	Johnson Bros	17990122	22 UNT #1 Little Anderson	3/3/1995	51.00	6.35	6.35	0.27	0.13	0.10	0.00	11.00	41.70
	Johnson Bros	17990122	22 UNT #1 Little Anderson	10/22/1999	9.50	6.30	6.20	0.44	0.31	0.07	0.00	10.00	27.00
	Johnson Bros	17990122	22 UNT #1 Little Anderson	12/28/1999	6.00	6.50	6.70	0.52	0.16	0.07	0.00	10.00	25.00
	Johnson Bros	17990122	22 UNT #1 Little Anderson	3/20/2000	18.00	6.40	6.70	0.17	0.13	0.07	0.00	12.00	21.00
	Johnson Bros	17990122	22 UNT #1 Little Anderson	11/15/2000	12.00	*	6.70	0.77	0.34	0.07	0.00	14.00	23.00
	Johnson Bros	17960118	jg39 UNT Little anderson creek	4/25/1995	10.00	3.60	4.60	0.73	0.04	0.34	10.00	6.00	21.00
	Johnson Bros	17960118	jg39 UNT Little anderson creek	5/25/1995	85.00	3.50	4.40	0.02	0.43	0.60	6.00	4.00	16.00
	Johnson Bros	17960118	jg39 UNT Little anderson creek	12/16/1995	32.00	4.60	4.70	0.01	0.40	0.83	4.00	8.00	23.00
	Johnson Bros	17960118	jg39 UNT Little anderson creek	1/29/1995	54.00	4.30	4.60	0.01	0.36	0.64	6.00	6.00	17.00
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	3/29/1996	*	*	5.50	0.21	4.12	0.48	0.00	10.00	171.00
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	4/30/1996	*	*	5.60	0.59	1.77	0.54	0.00	8.00	97.00
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	5/30/1996	*	*	5.00	0.27	6.05	0.88	10.00	8.00	192.00
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	6/19/1996	*	*	5.60	0.42	2.47	0.31	0.00	10.00	86.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	7/23/1996	*	*	6.10	0.56	3.59	0.14	0.00	10.00	122.00
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	8/23/1996	*	*	6.90	0.46	3.87	0.04	0.00	30.00	159.00
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	6/4/1997	*	*	5.50	0.28	2.11	0.18	4.00	6.00	136.00
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	7/9/1997	*	*	6.40	0.78	3.24	0.04	0.00	14.00	298.00
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	11/11/1997	*	*	5.40	0.21	0.90	0.10	6.00	8.00	10.00
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	1/22/1998	*	*	4.40	1.00	3.02	0.62	8.00	8.00	197.00
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	6/2/1998	*	*	5.20	0.19	6.23	0.38	40.00	10.00	336.00
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	8/18/1998	*	*	6.80	1.07	7.39	0.22	0.00	32.00	250.00
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	12/22/1998	*	*	5.40	0.43	1.39	0.47	0.00	8.00	116.00
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	2/8/1999	*	*	5.80	0.17	1.24	0.14	2.00	8.00	10.00
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	4/27/1999	*	*	5.20	0.12	*	0.33	4.00	8.00	164.00
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	8/19/1999	*	*	7.00	0.39	1.84	0.12	0.00	36.00	234.00
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	6/23/1999	*	*	4.90	*	3.20	0.57	6.00	8.80	280.10
	Clearfield Cons. Dist.	CC30	UNT LA above Smouse job	9/19/2000	*	*	6.60	2.15	2.99	0.20	0.00	26.00	124.00
	Johnson Bros	17960118	jg33 unt little anderson creek	4/20/1995	140.00	3.30	4.50	0.32	3.38	4.71	46.00	6.00	113.00
	Johnson Bros	17960118	jg33 unt little anderson creek	5/26/1995	168.00	3.00	4.00	0.32	2.64	4.48	46.00	0.00	73.00
	Johnson Bros	17960118	jg33 unt little anderson creek	10/26/1995	61.00	3.90	3.90	1.62	4.12	6.53	54.00	0.00	106.00
	Johnson Bros	17960118	jg33 unt little anderson creek	11/16/1995	189.00	4.10	4.10	0.82	3.76	6.40	74.00	2.00	144.00
	Johnson Bros	17960118	jg33 unt little anderson creek	12/16/1995	20.00	4.10	4.10	0.90	4.86	10.42	40.00	2.00	227.00
	Clearfield Cons. Dist.	CC47	jg33 unt little anderson creek	6/23/1999	*	*	3.80	1.54	13.10	8.89	84.00	0.00	300.00
	Clearfield Cons. Dist.	CC34	UNT Little Anderson by Farm	9/19/2000	*	*	6.50	1.80	4.24	0.20	0.00	36.00	231.00
	Clearfield Cons. Dist.	CC34	UNT Little Anderson by Farm	11/9/1993	*	*	4.80	0.31	2.12	*	20.00	6.00	91.00
	Clearfield Cons. Dist.	CC34	UNT Little Anderson by Farm	8/23/1994	*	*	5.50	0.21	0.16	*	0.00	14.00	36.00
	Clearfield Cons. Dist.	CC34	UNT Little Anderson by Farm	12/20/1994	*	*	6.40	4.55	0.62	*	0.00	21.00	45.00
	Clearfield Cons. Dist.	CC34	UNT Little Anderson by Farm	3/7/1995	*	*	5.90	0.55	0.11	*	0.00	10.00	10.00
	Clearfield Cons. Dist.	CC34	UNT Little Anderson by Farm	5/15/1995	*	*	6.30	0.81	0.51	*	0.00	16.00	14.00
	Clearfield Cons. Dist.	CC34	UNT Little Anderson by Farm	3/5/1996	*	*	5.80	0.06	0.07	*	0.00	16.00	27.00
	Clearfield Cons. Dist.	CC34	UNT Little Anderson by Farm	5/20/1996	*	*	6.00	0.26	0.10	*	0.00	18.00	39.00
	Clearfield Cons. Dist.	CC34	UNT Little Anderson by Farm	11/18/1997	*	*	5.30	0.30	2.31	*	0.00	8.00	173.00
	Clearfield Cons. Dist.	CC34	UNT Little Anderson by Farm	3/26/1997	*	*	6.10	0.47	0.05	*	0.00	18.00	41.00
	Clearfield Cons. Dist.	CC34	UNT Little Anderson by Farm	6/4/1997	*	*	6.50	0.39	0.14	*	0.00	20.00	44.00
	Clearfield Cons. Dist.	CC34	UNT Little Anderson by Farm	11/24/1997	*	*	6.50	0.16	0.05	*	0.00	14.00	37.00
				Avg	**61.11**	**4.61**	**5.56**	**0.63**	**2.27**	**1.48**	**10.44**	**11.93**	**109.95**
				St Dev	**61.92**	**1.30**	**0.93**	**0.77**	**2.56**	**2.72**	**20.69**	**8.79**	**94.06**
352	ScarLift Report	352	Spencer 352	2/5/1973	43.90	*	2.40	67.00	*	*	680.00	0.00	740.00
	ScarLift Report	352	Spencer 352	3/5/1973	76.00	*	2.30	94.00	*	*	740.00	0.00	820.00
	ScarLift Report	352	Spencer 352	4/2/1973	24.60	*	2.40	30.00	*	*	650.00	0.00	700.00
	ScarLift Report	352	Spencer 352	5/7/1973	30.90	*	2.50	72.00	*	*	670.00	0.00	760.00
	ScarLift Report	352	Spencer 352	6/4/1973	41.80	*	2.50	55.00	*	*	730.00	0.00	870.00
	ScarLift Report	352	Spencer 352	7/9/1973	14.60	*	2.80	93.00	*	*	830.00	0.00	900.00
	ScarLift Report	352	Spencer 352	8/6/1973	*	*	2.30	100.00	*	*	910.00	0.00	970.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	ScarLift Report	352	Spencer 352	9/10/1973	6.10	*	2.40	90.00	*	*	930.00	0.00	990.00
	ScarLift Report	352	Spencer 352	10/8/1973	12.40	*	2.60	86.92	*	*	1120.00	0.00	82.50
	ScarLift Report	352	Spencer 352	11/5/1973	21.70	*	2.50	125.18	*	*	1200.00	0.00	950.00
	ScarLift Report	352	Spencer 352	12/3/1973	24.60	*	2.90	86.16	*	*	1200.00	0.00	700.00
	ScarLift Report	352	Spencer 352	1/8/1974	24.60	*	2.60	46.38	*	*	660.00	0.00	600.00
				Avg	**29.20**	*****	**2.52**	**78.80**	*****	*****	**860.00**	**0.00**	**756.88**
				St Dev	**19.28**	*****	**0.19**	**26.05**	*****	*****	**211.27**	**0.00**	**245.04**
329	ScarLift Report	329	Korb 329	2/5/1973	139.00	*	2.40	120.00	*	*	890.00	0.00	740.00
	ScarLift Report	329	Korb 329	3/5/1973	156.00	*	2.50	260.00	*	*	750.00	0.00	700.00
	ScarLift Report	329	Korb 329	4/2/1973	160.50	*	2.60	99.00	*	*	620.00	0.00	640.00
	ScarLift Report	329	Korb 329	5/7/1973	78.90	*	2.60	110.00	*	*	700.00	0.00	710.00
	ScarLift Report	329	Korb 329	6/4/1973	123.00	*	2.60	85.00	*	*	600.00	0.00	750.00
	ScarLift Report	329	Korb 329	7/9/1973	59.70	*	2.90	140.00	*	*	880.00	0.00	790.00
	ScarLift Report	329	Korb 329	8/6/1973	41.80	*	2.40	140.00	*	*	820.00	0.00	820.00
	ScarLift Report	329	Korb 329	9/10/1973	24.60	*	2.50	150.00	*	*	880.00	0.00	920.00
	ScarLift Report	329	Korb 329	10/8/1973	21.70	*	2.60	137.94	*	*	840.00	0.00	950.00
	ScarLift Report	329	Korb 329	11/5/1973	27.50	*	2.60	173.72	*	*	200.00	0.00	850.00
	ScarLift Report	329	Korb 329	12/3/1973	123.00	*	2.90	175.35	*	*	1280.00	0.00	800.00
	ScarLift Report	329	Korb 329	1/8/1974	76.00	*	2.70	125.18	*	*	660.00	0.00	375.00
				Avg	**85.98**	*****	**2.61**	**143.02**	*****	*****	**760.00**	**0.00**	**753.75**
				St Dev	**52.33**	*****	**0.16**	**45.73**	*****	*****	**252.01**	**0.00**	**149.14**
330	ScarLift Report	330	Spencer 330	3/5/1973	25.30	*	3.40	0.90	*	*	740.00	0.00	85.00
	ScarLift Report	330	Spencer 330	4/2/1973	7.20	*	3.30	1.60	*	*	150.00	0.00	160.00
	ScarLift Report	330	Spencer 330	5/7/1973	5.10	*	3.20	1.70	*	*	200.00	0.00	250.00
	ScarLift Report	330	Spencer 330	6/4/1973	3.50	*	3.10	3.20	*	*	180.00	0.00	200.00
	ScarLift Report	330	Spencer 330	7/9/1973	0.20	*	3.50	3.50	*	*	130.00	0.00	160.00
	ScarLift Report	330	Spencer 330	8/6/1973	0.20	*	3.30	1.80	*	*	110.00	0.00	*
	ScarLift Report	330	Spencer 330	9/10/1973	0.04	*	3.50	0.10	*	*	86.00	0.00	96.00
	ScarLift Report	330	Spencer 330	10/8/1973	1.10	*	3.50	0.74	*	*	60.00	0.00	65.00
	ScarLift Report	330	Spencer 330	11/5/1973	3.90	*	3.40	1.20	*	*	54.00	0.00	55.00
	ScarLift Report	330	Spencer 330	12/3/1973	2.90	*	3.30	3.46	*	*	304.00	0.00	275.00
				Avg	**4.94**	*****	**3.35**	**1.82**	*****	*****	**201.40**	**0.00**	**149.56**
				St Dev	**7.53**	*****	**0.14**	**1.19**	*****	*****	**203.36**	**0.00**	**80.40**
301	Clearfield Cons. Dist.	301	Drauker 301	5/13/1999	*	*	2.80	93.80	26.50	52.00	716.00	0.00	766.00
	Clearfield Cons. Dist.	301	Drauker 301	12/29/1999	*	*	2.70	114.00	28.00	95.20	988.00	0.00	166.00
	Clearfield Cons. Dist.	301	Drauker 301	5/13/1999	*	*	4.40	*	4.86	1.81	26.00	7.00	*
	ScarLift Report	301	Drauker 301	2/5/1973	284.00	*	2.40	160.00	*	*	1000.00	0.00	1100.00
	ScarLift Report	301	Drauker 301	3/5/1973	193.00	*	2.40	170.00	*	*	1000.00	0.00	1300.00
	ScarLift Report	301	Drauker 301	4/2/1973	123.00	*	2.50	120.00	*	*	850.00	0.00	900.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	ScarLift Report	301	Drauker 301	5/7/1973	123.00	*	2.40	140.00	*	*	960.00	0.00	1000.00
	ScarLift Report	301	Drauker 301	6/4/1973	139.00	*	2.50	110.00	*	*	940.00	0.00	990.00
	ScarLift Report	301	Drauker 301	7/9/1973	94.20	*	2.90	180.00	*	*	980.00	0.00	1100.00
	ScarLift Report	301	Drauker 301	8/6/1973	81.70	*	2.30	180.00	*	*	1100.00	0.00	1100.00
	ScarLift Report	301	Drauker 301	9/10/1973	81.70	*	2.50	200.00	*	*	1200.00	0.00	1200.00
	ScarLift Report	301	Drauker 301	10/8/1973	94.20	*	2.70	244.06	*	*	1420.00	0.00	1200.00
	ScarLift Report	301	Drauker 301	11/5/1973	193.00	*	2.80	30.59	*	*	200.00	0.00	1175.00
	ScarLift Report	301	Drauker 301	12/3/1973	156.00	*	2.70	206.95	*	*	1540.00	0.00	975.00
	ScarLift Report	301	Drauker 301	1/8/1974	123.00	*	2.60	194.35	*	*	1020.00	0.00	77.50
				Avg	**140.48**	*****	**2.71**	**153.13**	**19.79**	**49.67**	**929.33**	**0.47**	**932.11**
				St Dev	**59.14**	*****	**0.50**	**55.49**	**12.95**	**46.74**	**391.07**	**1.81**	**369.84**
303	ScarLift Report	303	Wingert 303	2/5/1973	462.00	*	2.80	23.00	*	*	240.00	0.00	250.00
	ScarLift Report	303	Wingert 303	3/5/1973	880.00	*	3.10	12.00	*	*	160.00	0.00	290.00
	ScarLift Report	303	Wingert 303	4/2/1973	388.00	*	3.30	9.80	*	*	160.00	0.00	240.00
	ScarLift Report	303	Wingert 303	5/7/1973	200.50	*	3.10	18.00	*	*	240.00	0.00	360.00
	ScarLift Report	303	Wingert 303	6/4/1973	200.50	*	3.10	15.00	*	*	220.00	0.00	370.00
	ScarLift Report	303	Wingert 303	7/9/1973	99.90	*	3.30	20.00	*	*	320.00	0.00	480.00
	ScarLift Report	303	Wingert 303	8/6/1973	71.50	*	2.80	30.00	*	*	340.00	0.00	560.00
	ScarLift Report	303	Wingert 303	9/10/1973	99.90	*	2.90	48.00	*	*	480.00	0.00	710.00
	ScarLift Report	303	Wingert 303	10/8/1973	200.50	*	3.10	29.44	*	*	226.00	0.00	550.00
	ScarLift Report	303	Wingert 303	11/5/1973	105.50	*	3.10	16.00	*	*	120.00	0.00	325.00
	ScarLift Report	303	Wingert 303	12/3/1973	219.80	*	3.10	*	*	*	240.00	0.00	275.00
	ScarLift Report	303	Wingert 303	1/8/1974	200.50	*	3.10	18.89	*	*	180.00	0.00	350.00
	Clearfield Cons. Dist.	303	Wingert 303	12/29/1999	*	*	3.40	7.77	8.00	7.48	98.00	0.00	191.00
				Avg	**260.72**	*****	**3.09**	**20.66**	**8.00**	**7.48**	**232.62**	**0.00**	**380.85**
				St Dev	**227.24**	*****	**0.18**	**11.04**	*****	*****	**102.00**	**0.00**	**151.65**
305	ScarLift Report	305	LA Seeps 305	2/5/1973	106.20	*	3.00	34.00	*	*	370.00	0.00	560.00
	ScarLift Report	305	LA Seeps 305	3/5/1973	132.00	*	3.00	26.00	*	*	240.00	0.00	340.00
	ScarLift Report	305	LA Seeps 305	4/2/1973	191.50	*	3.20	34.00	*	*	360.00	0.00	510.00
	ScarLift Report	305	LA Seeps 305	5/7/1973	93.60	*	3.10	60.00	*	*	530.00	0.00	800.00
	ScarLift Report	305	LA Seeps 305	6/4/1973	72.30	*	2.90	45.50	*	*	580.00	0.00	870.00
	ScarLift Report	305	LA Seeps 305	7/9/1973	17.90	*	3.10	82.00	*	*	820.00	0.00	1100.00
	ScarLift Report	305	LA Seeps 305	8/6/1973	17.90	*	2.70	75.00	*	*	760.00	0.00	970.00
	ScarLift Report	305	LA Seeps 305	9/10/1973	13.40	*	2.80	100.00	*	*	750.00	0.00	1200.00
	ScarLift Report	305	LA Seeps 305	10/8/1973	51.00	*	2.70	40.20	*	*	420.00	0.00	450.00
	ScarLift Report	305	LA Seeps 305	11/5/1973	51.00	*	3.10	32.09	*	*	160.00	0.00	525.00
	ScarLift Report	305	LA Seeps 305	12/3/1973	219.80	*	3.20	26.28	*	*	288.00	0.00	225.00
	ScarLift Report	305	LA Seeps 305	1/8/1974	93.60	*	3.00	34.30	*	*	472.00	0.00	625.00
				Avg	**88.35**	*****	**2.98**	**49.11**	*****	*****	**479.17**	**0.00**	**681.25**
				St Dev	**66.60**	*****	**0.17**	**24.45**	*****	*****	**214.57**	**0.00**	**305.59**

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
RR1	Baumgardner	17880108	R-19 Rock Run	2/24/1989	*	3.80	4.00	0.98	8.23	1.83	40.00	0.00	429.00
	Baumgardner	17880108	R-19 Rock Run	5/26/1989	*	4.10	3.80	0.85	11.80	3.12	64.00	0.00	478.00
	Baumgardner	17880108	R-19 Rock Run	8/17/1989	225.00	3.40	3.50	2.28	27.80	3.41	104.00	0.00	960.00
	Baumgardner	17880108	R-19 Rock Run	11/7/1989	265.00	4.60	3.50	3.82	27.50	2.73	100.00	0.00	886.00
	Baumgardner	17880108	R-19 Rock Run	2/15/1990	*	4.40	3.90	1.40	14.70	3.77	72.00	0.00	582.00
	Baumgardner	17880108	R-19 Rock Run	5/11/1990	945.00	3.50	3.70	1.51	20.50	3.20	98.00	0.00	832.00
	Baumgardner	17880108	R-19 Rock Run	8/22/1990	585.00	3.50	3.60	2.54	21.20	4.77	112.00	0.00	646.00
	Baumgardner	17880108	R-19 Rock Run	11/19/1990	450.00	3.50	3.80	3.52	20.80	3.20	54.00	0.00	646.00
	Baumgardner	17880108	R-19 Rock Run	2/13/1991	750.00	3.90	3.90	3.01	19.50	3.58	80.00	0.00	681.00
	Baumgardner	17880108	R-19 Rock Run	5/3/1991	450.00	3.80	3.60	1.13	17.00	3.13	96.00	0.00	807.00
	Baumgardner	17880108	R-19 Rock Run	8/9/1991	90.00	3.10	3.40	4.18	23.90	2.09	98.00	0.00	832.00
	Baumgardner	17880108	R-19 Rock Run	11/8/1991	45.00	3.30	3.60	4.65	29.20	3.11	102.00	0.00	784.00
	Baumgardner	17880108	R-19 Rock Run	2/3/1992	145.00	5.00	4.00	1.48	13.50	2.56	46.00	0.00	582.00
	Baumgardner	17880108	R-19 Rock Run	5/14/1992	230.00	5.10	3.80	1.45	14.70	2.09	70.00	0.00	629.00
	Baumgardner	17880108	R-19 Rock Run	8/18/1992	135.00	5.40	3.70	1.70	21.70	3.29	80.00	0.00	919.00
	Baumgardner	17880108	R-19 Rock Run	11/5/1992	450.00	3.90	4.30	1.76	10.20	1.49	28.00	4.00	448.00
	Baumgardner	17880108	R-19 Rock Run	2/11/1993	740.00	3.80	3.60	3.05	25.10	3.57	118.00	0.00	832.00
	Baumgardner	17880108	R-19 Rock Run	5/24/1993	703.00	3.90	3.60	1.53	24.00	3.12	110.00	0.00	886.00
	Baumgardner	17880108	R-19 Rock Run	8/24/1993	156.00	4.30	3.50	2.52	25.20	3.23	154.00	0.00	919.00
	Baumgardner	17880108	R-19 Rock Run	11/12/1993	568.00	3.70	3.80	2.47	18.61	0.09	146.00	0.00	597.00
	Baumgardner	17880108	R-19 Rock Run	2/3/1994	506.00	3.70	3.90	3.15	18.49	2.72	82.00	0.00	919.00
	Baumgardner	17880108	R-19 Rock Run	5/27/1994	1069.00	3.60	3.90	1.46	16.82	1.95	64.00	0.00	586.00
	Baumgardner	17880108	R-19 Rock Run	8/25/1994	1620.00	3.60	5.90	1.03	8.27	1.50	32.00	12.00	352.00
	Baumgardner	17880108	R-19 Rock Run	11/11/1994	1890.00	3.40	4.10	1.31	14.94	1.57	58.00	2.00	405.00
	Baumgardner	17880108	R-19 Rock Run	2/2/1995	1010.00	3.30	3.90	2.57	20.15	2.86	90.00	0.00	570.00
	Baumgardner	17880108	R-19 Rock Run	5/23/1995	173.00	3.50	3.90	1.16	16.49	2.16	48.00	0.00	505.00
				Avg	**573.91**	**3.89**	**3.85**	**2.17**	**18.86**	**2.70**	**82.54**	**0.69**	**681.23**
				St Dev	**480.85**	**0.59**	**0.47**	**1.06**	**5.85**	**0.95**	**32.33**	**2.46**	**184.85**
RR 2	Baumgardner	17880108	R-13 Rock Run	2/24/1989	2520.00	3.90	4.20	0.55	7.31	2.24	34.00	4.00	410.00
	Baumgardner	17880108	R-13 Rock Run	5/26/1989	4500.00	4.10	4.00	0.59	13.70	4.25	76.00	0.00	567.00
	Baumgardner	17880108	R-13 Rock Run	8/17/1989	340.00	3.40	3.50	1.15	28.60	3.81	108.00	0.00	960.00
	Baumgardner	17880108	R-13 Rock Run	11/7/1989	380.00	4.50	3.70	1.40	26.40	3.04	84.00	0.00	832.00
	Baumgardner	17880108	R-13 Rock Run	2/15/1990	6600.00	4.50	4.20	0.81	16.90	4.14	76.00	4.00	629.00
	Baumgardner	17880108	R-13 Rock Run	5/11/1990	2250.00	3.60	3.90	0.73	15.00	3.08	74.00	0.00	567.00
	Baumgardner	17880108	R-13 Rock Run	8/22/1990	1135.00	3.40	3.70	1.89	28.00	5.48	88.00	0.00	807.00
	Baumgardner	17880108	R-13 Rock Run	11/19/1990	607.00	3.60	4.00	1.48	22.10	3.29	64.00	0.00	681.00
	Baumgardner	17880108	R-13 Rock Run	2/13/1991	1620.00	3.50	3.90	2.17	23.00	4.00	94.00	0.00	663.00
	Baumgardner	17880108	R-13 Rock Run	5/3/1991	648.00	3.70	3.60	1.84	29.70	4.21	158.00	0.00	1230.00
	Baumgardner	17880108	R-13 Rock Run	8/9/1991	270.00	5.30	7.00	1.12	15.20	0.94	0.00	40.00	858.00
	Baumgardner	17880108	R-13 Rock Run	11/8/1991	100.00	6.60	6.30	0.86	15.30	1.29	0.00	16.00	960.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Baumgardner	17880108	R-13 Rock Run	2/3/1992	180.00	6.00	4.10	1.00	15.50	2.84	54.00	2.00	629.00
	Baumgardner	17880108	R-13 Rock Run	5/14/1992	455.00	4.10	4.10	0.64	14.50	2.19	61.00	1.00	597.00
	Baumgardner	17880108	R-13 Rock Run	8/18/1992	283.00	4.00	3.80	0.96	22.20	2.61	76.00	0.00	1230.00
	Baumgardner	17880108	R-13 Rock Run	11/5/1992	900.00	4.20	4.00	1.14	17.70	2.33	48.00	0.00	582.00
	Baumgardner	17880108	R-13 Rock Run	2/11/1993	1294.00	4.00	3.60	2.47	30.20	4.24	202.00	0.00	832.00
	Baumgardner	17880108	R-13 Rock Run	5/24/1993	968.00	4.40	4.60	1.57	29.30	2.86	94.00	10.00	1400.00
	Baumgardner	17880108	R-13 Rock Run	8/24/1993	1145.00	6.10	7.30	1.39	16.60	0.68	0.00	82.00	663.00
	Baumgardner	17880108	R-13 Rock Run	11/12/1993	776.00	3.80	3.90	0.96	16.08	0.84	88.00	0.00	489.00
	Baumgardner	17880108	R-13 Rock Run	2/3/1994	619.00	3.50	3.90	1.30	15.59	2.80	60.00	0.00	553.00
	Baumgardner	17880108	R-13 Rock Run	5/27/1994	1559.00	3.70	4.00	0.69	15.38	2.24	58.00	0.00	597.00
	Baumgardner	17880108	R-13 Rock Run	8/25/1994	1890.00	3.60	4.10	0.69	10.81	1.74	38.00	2.00	376.00
	Baumgardner	17880108	R-13 Rock Run	11/11/1994	2025.00	3.30	4.30	0.60	14.71	1.83	28.00	4.00	341.00
	Baumgardner	17880108	R-13 Rock Run	2/2/1995	1320.00	3.40	3.90	1.73	17.22	2.69	86.00	0.00	460.00
	Baumgardner	17880108	R-13 Rock Run	5/23/1995	330.00	3.70	4.00	0.58	15.02	2.11	46.00	0.00	462.00
	Sky Haven Coal	17793088	6 Rock Run	4/15/1982	1200.00	3.90	3.90	0.55	7.36	*	43.00	<1	162.00
	Sky Haven Coal	17793088	6 Rock Run	7/2/1982	250.00	3.45	3.45	1.37	24.48	*	139.00	<1	481.00
	Sky Haven Coal	17793088	6 Rock Run	10/5/1982	150.00	3.20	3.20	1.27	21.66	*	104.00	<1	455.00
	Sky Haven Coal	17793088	6 Rock Run	1/5/1983	175.00	4.20	4.20	0.94	15.60	*	63.00	5.00	358.00
	Sky Haven Coal	17793088	6 Rock Run	4/4/1983	375.00	4.35	4.38	0.36	5.55	*	41.00	7.00	193.00
	Sky Haven Coal	17793088	6 Rock Run	7/8/1983	325.00	3.85	3.82	1.15	26.60	*	116.00	<1	739.00
	Sky Haven Coal	17793088	6 Rock Run	10/11/1983	100.00	3.60	3.65	1.69	28.16	*	137.00	<1	760.00
	Sky Haven Coal	17793088	6 Rock Run	1/23/1984	*	3.70	3.65	2.61	26.94	*	77.00	<1	626.00
	Sky Haven Coal	17793088	6 Rock Run	4/10/1984	350.00	4.05	4.05	0.77	13.44	*	51.00	2.00	419.00
	Sky Haven Coal	17793088	6 Rock Run	10/3/1984	210.00	3.35	3.35	3.81	32.50	*	82.00	<1	568.00
	Sky Haven Coal	17793088	6 Rock Run	1/4/1985	450.00	3.90	3.90	1.21	12.56	*	58.00	<1	355.00
	Sky Haven Coal	17793088	6 Rock Run	6/6/1985	275.00	3.75	3.75	1.94	23.84	*	75.00	<1	585.00
	Sky Haven Coal	17793088	6 Rock Run	9/20/1985	275.00	3.55	3.55	2.31	23.60	*	109.00	<1	650.00
	Sky Haven Coal	17793088	6 Rock Run	12/28/1985	500.00	3.55	3.55	3.08	23.26	*	104.00	<1	659.00
	Sky Haven Coal	17793088	6 Rock Run	2/26/1986	750.00	3.95	3.90	1.56	15.66	*	61.00	<1	405.00
	Sky Haven Coal	17793088	6 Rock Run	5/6/1986	425.00	3.55	3.60	1.74	21.80	*	60.00	<1	614.00
	Sky Haven Coal	17793088	6 Rock Run	8/25/1986	450.00	3.45	3.45	2.41	27.96	*	71.00	<1	678.00
	Sky Haven Coal	17793088	6 Rock Run	12/11/1986	575.00	3.20	3.99	0.87	9.06	*	39.00	<1	234.00
	Sky Haven Coal	17793088	6 Rock Run	2/16/1987	*	3.60	3.59	2.39	23.90	*	141.00	<1	594.00
	Sky Haven Coal	17793088	6 Rock Run	6/30/1987	*	7.20	7.56	10.90	8.54	*	14.00	383.00	1249.00
	Sky Haven Coal	17793088	6 Rock Run	9/30/1987	*	*	5.13	2.22	3.74	*	10.00	4.00	236.00
	Sky Haven Coal	17793088	6 Rock Run	12/30/1987	*	*	6.11	0.29	0.25	*	5.00	12.00	28.00
	Sky Haven Coal	17793088	6 Rock Run	2/10/1988	*	4.30	4.07	0.72	10.60	*	67.00	<1	338.00
	Sky Haven Coal	17793088	6 Rock Run	6/7/1988	86.00	3.30	3.69	1.09	17.10	*	57.00	<1	445.00
	Sky Haven Coal	17793088	6 Rock Run	8/16/1988	100.00	3.40	3.40	2.34	19.40	*	133.00	<1	557.00
	Sky Haven Coal	17793088	6 Rock Run	10/4/1988	225.00	3.70	3.31	2.20	20.00	*	69.00	<1	491.00
	Sky Haven Coal	17793088	6 Rock Run	1/9/1989	1750.00	4.30	4.09	0.83	9.21	*	39.00	<1	204.00
	Sky Haven Coal	17793088	6 Rock Run	4/4/1989	2794.00	4.60	4.14	0.89	6.76	*	36.00	<1	246.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Sky Haven Coal	17793088	6 Rock Run	7/10/1989	648.00	3.50	3.87	1.63	21.10	*	113.00	<1	453.00
	Sky Haven Coal	17793088	6 Rock Run	10/4/1989	254.00	3.90	3.61	2.07	23.20	*	183.00	<1	654.00
	Sky Haven Coal	17793088	6 Rock Run	1/4/1990	320.00	5.30	4.77	1.06	8.84	*	16.00	3.00	171.00
	Sky Haven Coal	17793088	6 Rock Run	5/3/1990	805.00	5.80	3.74	0.88	15.20	*	42.00	<1	521.00
	Sky Haven Coal	17793088	6 Rock Run	7/5/1990	1126.00	3.70	3.69	2.17	19.60	*	61.00	<1	655.00
	Sky Haven Coal	17793088	6 Rock Run	10/1/1990	1920.00	4.20	3.78	1.57	11.20	*	42.00	<1	662.00
	Sky Haven Coal	17793088	6 Rock Run	1/9/1991	1960.00	4.80	3.86	1.43	14.90	*	61.00	<1	477.00
	Sky Haven Coal	17793088	6 Rock Run	4/2/1991	1551.00	5.00	3.95	2.08	11.90	*	34.00	<1	378.00
	Sky Haven Coal	17793088	6 Rock Run	7/2/1991	159.00	4.00	3.41	2.67	23.80	*	105.00	<1	761.00
	Sky Haven Coal	17793088	6 Rock Run	10/8/1991	47.00	4.50	3.59	2.39	22.70	*	73.00	<1	632.00
	Sky Haven Coal	17793088	6 Rock Run	1/9/1992	290.00	4.80	4.12	1.05	9.52	*	30.00	<1	253.00
	Sky Haven Coal	17793088	6 Rock Run	7/9/1992	*	3.85	3.65	0.96	43.30	*	118.00	<1	1351.00
	Sky Haven Coal	17793088	6 Rock Run	10/8/1992	4443.00	4.30	3.85	0.76	34.70	*	76.00	<1	994.00
	Sky Haven Coal	17793088	6 Rock Run	1/7/1993	310.00	4.20	4.11	0.83	9.18	*	33.00	<1	309.00
	Sky Haven Coal	17793088	6 Rock Run	4/13/1993	7400.00	4.50	4.18	0.96	17.10	*	65.00	<1	676.00
	Sky Haven Coal	17793088	6 Rock Run	7/21/1993	184.00	4.40	4.23	0.46	24.00	*	23.00	<1	1564.00
	Sky Haven Coal	17793088	6 Rock Run	10/5/1993	550.00	4.40	3.86	1.12	12.30	*	34.00	<1	348.00
	Sky Haven Coal	17793088	6 Rock Run	3/17/1994	*	4.70	4.23	0.65	7.55	*	31.00	4.00	250.00
	Sky Haven Coal	17793088	6 Rock Run	5/4/1994	549.00	5.00	4.18	1.04	15.40	*	30.00	4.00	495.00
	Sky Haven Coal	17793088	6 Rock Run	7/5/1994	310.00	4.00	3.74	1.49	22.10	*	49.00	<1	703.00
	Sky Haven Coal	17793088	6 Rock Run	10/14/1994	341.00	4.50	4.18	1.12	16.10	*	29.00	6.00	527.00
	Sky Haven Coal	17793088	6 Rock Run	1/5/1995	680.00	4.50	3.87	1.32	14.70	*	35.00	<1	450.00
	Sky Haven Coal	17793088	6 Rock Run	4/21/1995	580.00	4.40	4.05	1.03	9.77	*	28.00	2.00	346.00
	Sky Haven Coal	17793088	6 Rock Run	8/1/1995	210.00	3.30	3.69	1.31	17.40	*	62.00	<1	553.00
	Sky Haven Coal	17793088	6 Rock Run	10/24/1995	261.00	3.70	3.87	1.20	11.50	*	29.00	<1	351.00
	Sky Haven Coal	17793088	6 Rock Run	1/29/1996	317.00	4.60	4.40	0.22	7.72	*	20.00	5.00	325.00
	Sky Haven Coal	17793088	6 Rock Run	4/16/1996	275.00	3.90	4.13	0.50	13.70	*	27.00	4.00	444.00
	Sky Haven Coal	17793088	6 Rock Run	7/8/1996	1250.00	4.10	3.83	3.16	16.50	*	61.00	<1	648.00
	Sky Haven Coal	17793088	6 Rock Run	10/8/1996	374.00	4.00	3.71	1.51	16.50	*	49.00	<1	565.00
	Sky Haven Coal	17793088	6 Rock Run	1/10/1997	430.00	4.30	3.96	1.09	12.90	*	29.00	1.00	484.00
	Sky Haven Coal	17793088	6 Rock Run	4/14/1997	494.00	4.10	4.03	0.89	13.20	*	31.00	2.00	476.00
	Sky Haven Coal	17793088	6 Rock Run	7/18/1997	22.00	3.80	3.47	5.19	22.20	*	65.00	<1	739.00
	Sky Haven Coal	17793088	6 Rock Run	10/17/1997	89.00	4.50	3.88	2.87	13.70	*	31.00	<1	514.00
	Sky Haven Coal	17793088	6 Rock Run	1/15/1998	494.00	4.20	4.18	0.80	9.69	*	33.00	4.00	387.00
	Sky Haven Coal	17793088	6 Rock Run	4/13/1998	162.00	4.30	4.17	0.73	9.04	*	27.00	4.00	405.00
	Sky Haven Coal	17793088	6 Rock Run	7/17/1998	41.00	3.80	3.49	4.95	27.80	*	69.00	<1	813.00
	Sky Haven Coal	17793088	6 Rock Run	10/23/1998	11.00	4.10	3.40	8.85	20.00	*	82.00	<1	613.00
				Avg	**907.96**	**4.13**	**4.05**	**1.62**	**17.49**	**2.76**	**62.88**	**14.35**	**578.58**
				St Dev	**1288.42**	**0.73**	**0.76**	**1.54**	**7.59**	**1.20**	**39.35**	**59.15**	**278.14**
UNT RR	Clearfield Cons. Dist.	CC45	Rock Run Near 322	9/7/2000	*	*	4.10	2.35	16.60	0.80	24.00	3.60	658.00
	Sky Haven Coal	17793088	7 UNT Rock Run	4/15/1982	500.00	4.40	4.40	0.19	2.04	*	27.00	4.00	68.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Sky Haven Coal	17793088	7 UNT Rock Run	7/2/1982	70.00	4.20	4.20	0.25	1.76	*	20.00	2.00	92.00
	Sky Haven Coal	17793088	7 UNT Rock Run	10/5/1982	20.00	3.80	3.80	0.41	5.03	*	33.00	<1	218.00
	Sky Haven Coal	17793088	7 UNT Rock Run	1/5/1983	30.00	4.75	4.75	0.16	3.87	*	28.00	9.00	135.00
	Sky Haven Coal	17793088	7 UNT Rock Run	4/4/1983	100.00	4.60	4.70	0.19	3.19	*	32.00	8.00	135.00
	Sky Haven Coal	17793088	7 UNT Rock Run	7/8/1983	40.00	4.38	4.38	0.20	6.13	*	49.00	4.00	328.00
	Sky Haven Coal	17793088	7 UNT Rock Run	10/11/1983	10.00	3.95	3.90	0.69	24.68	*	127.00	<1	843.00
	Sky Haven Coal	17793088	7 UNT Rock Run	1/23/1984	*	4.40	4.45	0.26	7.90	*	31.00	5.00	316.00
	Sky Haven Coal	17793088	7 UNT Rock Run	4/10/1984	90.00	4.35	4.35	0.14	9.76	*	47.00	5.00	397.00
	Sky Haven Coal	17793088	7 UNT Rock Run	10/3/1984	60.00	3.85	3.85	0.72	45.90	*	74.00	<1	867.00
	Sky Haven Coal	17793088	7 UNT Rock Run	1/4/1985	110.00	4.30	4.40	0.30	11.58	*	63.00	6.00	339.00
	Sky Haven Coal	17793088	7 UNT Rock Run	6/6/1985	75.00	4.55	4.60	0.66	9.34	*	32.00	6.00	158.00
	Sky Haven Coal	17793088	7 UNT Rock Run	9/20/1985	75.00	3.85	3.85	0.82	45.00	*	173.00	<1	980.00
	Sky Haven Coal	17793088	7 UNT Rock Run	12/28/1985	160.00	4.25	4.30	0.41	26.90	*	106.00	6.00	746.00
	Sky Haven Coal	17793088	7 UNT Rock Run	2/26/1986	125.00	3.95	3.95	0.57	54.90	*	107.00	3.00	1369.00
	Sky Haven Coal	17793088	7 UNT Rock Run	5/6/1986	275.00	4.40	4.45	0.19	25.08	*	105.00	9.00	746.00
	Sky Haven Coal	17793088	7 UNT Rock Run	8/25/1986	100.00	4.20	4.25	0.15	28.10	*	54.00	6.00	821.00
	Sky Haven Coal	17793088	7 UNT Rock Run	12/11/1986	50.00	3.75	4.47	0.17	14.70	*	112.00	2.00	469.00
	Sky Haven Coal	17793088	7 UNT Rock Run	2/16/1987	*	4.25	4.23	0.22	40.60	*	165.00	1.00	905.00
	Sky Haven Coal	17793088	7 UNT Rock Run	6/30/1987	*	5.15	5.90	1.11	0.43	*	4.00	19.00	35.00
	Sky Haven Coal	17793088	7 UNT Rock Run	9/30/1987	*	*	6.44	3.20	6.34	*	13.00	51.00	561.00
	Sky Haven Coal	17793088	7 UNT Rock Run	12/30/1987	*	*	4.67	0.19	5.75	*	37.00	2.00	298.00
	Sky Haven Coal	17793088	7 UNT Rock Run	2/10/1988	*	4.70	4.40	0.22	17.10	*	66.00	1.00	447.00
	Sky Haven Coal	17793088	7 UNT Rock Run	6/7/1988	29.00	4.10	4.03	0.31	36.60	*	73.00	<1	308.00
	Sky Haven Coal	17793088	7 UNT Rock Run	8/16/1988	10.00	3.50	3.46	2.43	76.00	*	167.00	<1	1480.00
	Sky Haven Coal	17793088	7 UNT Rock Run	10/4/1988	22.00	3.70	3.59	1.93	52.20	*	117.00	<1	1200.00
	Sky Haven Coal	17793088	7 UNT Rock Run	1/9/1989	125.00	4.60	4.50	0.18	16.60	*	46.00	2.00	424.00
	Sky Haven Coal	17793088	7 UNT Rock Run	4/4/1989	160.00	4.90	4.45	0.10	10.70	*	36.00	1.00	427.00
	Sky Haven Coal	17793088	7 UNT Rock Run	7/10/1989	79.00	3.80	4.05	0.61	24.30	*	72.00	<1	503.00
	Sky Haven Coal	17793088	7 UNT Rock Run	10/4/1989	38.00	4.00	3.74	1.13	49.20	*	223.00	<1	1318.00
	Sky Haven Coal	17793088	7 UNT Rock Run	1/4/1990	21.00	4.50	4.21	0.62	25.20	*	77.00	<1	627.00
	Sky Haven Coal	17793088	7 UNT Rock Run	5/3/1990	68.00	4.20	4.17	0.23	26.70	*	6.00	<1	678.00
	Sky Haven Coal	17793088	7 UNT Rock Run	7/5/1990	114.00	3.10	3.96	0.47	13.60	*	45.00	<1	641.00
	Sky Haven Coal	17793088	7 UNT Rock Run	10/1/1990	33.00	4.40	3.93	0.58	15.60	*	54.00	1.00	827.00
	Sky Haven Coal	17793088	7 UNT Rock Run	1/9/1991	204.00	5.10	4.34	0.16	17.70	*	48.00	<1	579.00
	Sky Haven Coal	17793088	7 UNT Rock Run	4/2/1991	184.00	5.20	4.37	0.16	14.40	*	35.00	<1	461.00
	Sky Haven Coal	17793088	7 UNT Rock Run	7/2/1991	21.00	4.10	3.49	1.38	47.60	*	129.00	<1	1331.00
	Sky Haven Coal	17793088	7 UNT Rock Run	10/8/1991	8.00	4.90	3.73	1.40	61.20	*	78.00	<1	1511.00
	Sky Haven Coal	17793088	7 UNT Rock Run	1/9/1992	29.00	4.80	4.00	0.54	31.40	*	83.00	<1	842.00
	Sky Haven Coal	17793088	7 UNT Rock Run	7/9/1992	12.00	3.85	3.63	1.20	43.90	*	109.00	<1	1284.00
	Sky Haven Coal	17793088	7 UNT Rock Run	10/8/1992	8.00	4.30	4.28	1.51	33.30	*	53.00	<1	899.00
	Sky Haven Coal	17793088	7 UNT Rock Run	1/7/1993	80.00	4.00	4.15	0.14	14.60	*	44.00	<1	522.00
	Sky Haven Coal	17793088	7 UNT Rock Run	4/13/1993	105.00	4.90	4.31	0.37	13.50	*	34.00	<1	490.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Sky Haven Coal	17793088	7 UNT Rock Run	10/5/1993	104.00	4.20	3.77	0.67	32.30	*	94.00	<1	887.00
	Sky Haven Coal	17793088	7 UNT Rock Run	3/17/1994	*	4.50	4.29	0.24	12.60	*	38.00	5.00	404.00
	Sky Haven Coal	17793088	7 UNT Rock Run	5/4/1994	102.00	4.70	4.17	0.23	13.40	*	31.00	4.00	498.00
	Sky Haven Coal	17793088	7 UNT Rock Run	7/5/1994	12.00	3.90	3.66	0.99	25.40	*	54.00	<1	773.00
	Sky Haven Coal	17793088	7 UNT Rock Run	10/14/1994	52.00	4.40	4.60	0.49	24.60	*	26.00	10.00	721.00
	Sky Haven Coal	17793088	7 UNT Rock Run	1/5/1995	65.00	4.50	4.28	0.33	22.70	*	36.00	4.00	658.00
	Sky Haven Coal	17793088	7 UNT Rock Run	4/21/1995	52.00	4.40	4.24	0.18	13.70	*	32.00	4.00	449.00
	Sky Haven Coal	17793088	7 UNT Rock Run	8/1/1995	27.00	3.30	3.72	1.08	21.20	*	44.00	<1	655.00
	Sky Haven Coal	17793088	7 UNT Rock Run	10/24/1995	29.00	3.60	3.98	0.32	20.40	*	34.00	2.00	576.00
	Sky Haven Coal	17793088	7 UNT Rock Run	4/16/1996	64.00	4.20	4.34	0.11	15.00	*	29.00	6.00	484.00
	Sky Haven Coal	17793088	7 UNT Rock Run	7/8/1996	72.00	4.10	3.97	0.54	15.60	*	34.00	2.00	588.00
	Sky Haven Coal	17793088	7 UNT Rock Run	10/8/1996	32.00	4.30	4.17	0.31	18.30	*	24.00	3.00	549.00
	Sky Haven Coal	17793088	7 UNT Rock Run	1/10/1997	20.00	4.60	4.35	0.18	13.40	*	27.00	5.00	550.00
	Sky Haven Coal	17793088	7 UNT Rock Run	4/14/1997	27.00	4.50	4.35	0.15	14.00	*	28.00	6.00	481.00
	Sky Haven Coal	17793088	7 UNT Rock Run	7/18/1997	5.00	3.90	3.66	1.17	24.90	*	61.00	<1	816.00
	Sky Haven Coal	17793088	7 UNT Rock Run	10/17/1997	12.00	4.60	4.26	0.34	23.60	*	21.00	5.00	912.00
	Sky Haven Coal	17793088	7 UNT Rock Run	1/15/1998	43.00	5.00	4.69	<0.07	11.00	*	22.00	1.00	426.00
	Sky Haven Coal	17793088	7 UNT Rock Run	4/13/1998	34.00	4.70	4.63	<0.07	10.20	*	17.00	7.00	437.00
	Sky Haven Coal	17793088	7 UNT Rock Run	7/17/1998	10.00	4.10	3.88	0.81	23.90	*	34.00	<1	825.00
	Sky Haven Coal	17793088	7 UNT Rock Run	10/23/1998	10.00	4.60	4.64	0.60	37.10	*	21.00	7.00	1037.00
	Sky Haven Coal	17793088	7 UNT Rock Run	4/15/1982	900.00	3.70	3.75	1.06	1.52	*	95.00	<1	312.00
				Avg	**86.18**	**4.29**	**4.22**	**0.62**	**22.03**	**0.80**	**59.38**	**5.99**	**635.71**
				St Dev	**135.64**	**0.44**	**0.48**	**0.62**	**15.83**	*****	**44.50**	**8.23**	**345.73**
RR 3	Clearfield Cons. Dist.	CC43	Rock Run at Swamp	9/19/2000	*	*	4.00	*	19.00	0.56	52.00	2.00	503.00
	Sky Haven Coal	17793088	19 Rock Run	7/2/1982	175.00	3.20	3.20	2.28	31.66	*	195.00	<1	731.00
	Sky Haven Coal	17793088	19 Rock Run	10/5/1982	110.00	3.10	3.10	0.01	27.42	*	129.00	<1	577.00
	Sky Haven Coal	17793088	19 Rock Run	1/5/1983	150.00	3.90	3.90	1.58	21.90	*	93.00	<1	445.00
	Sky Haven Coal	17793088	19 Rock Run	4/4/1983	300.00	4.00	4.00	0.81	23.70	*	64.00	2.00	355.00
	Sky Haven Coal	17793088	19 Rock Run	7/8/1983	275.00	3.78	3.75	1.29	27.80	*	114.00	<1	811.00
	Sky Haven Coal	17793088	19 Rock Run	10/11/1983	85.00	3.55	3.50	3.62	37.70	*	200.00	<1	955.00
	Sky Haven Coal	17793088	19 Rock Run	1/23/1984	*	3.50	3.55	6.12	34.20	*	111.00	<1	873.00
	Sky Haven Coal	17793088	19 Rock Run	4/10/1984	300.00	3.70	3.70	1.53	22.50	*	97.00	<1	612.00
	Sky Haven Coal	17793088	19 Rock Run	10/3/1984	175.00	3.25	3.25	8.48	36.10	*	103.00	<1	659.00
	Sky Haven Coal	17793088	19 Rock Run	1/4/1985	225.00	3.70	3.70	3.18	22.38	*	98.00	<1	641.00
	Sky Haven Coal	17793088	19 Rock Run	6/6/1985	175.00	3.65	3.65	4.29	35.50	*	160.00	<1	826.00
	Sky Haven Coal	17793088	19 Rock Run	9/20/1985	175.00	3.50	3.50	3.72	28.88	*	142.00	<1	746.00
	Sky Haven Coal	17793088	19 Rock Run	12/28/1985	450.00	3.50	3.45	5.17	30.36	*	135.00	<1	788.00
	Sky Haven Coal	17793088	19 Rock Run	2/26/1986	700.00	3.70	3.70	3.29	23.80	*	69.00	<1	669.00
	Sky Haven Coal	17793088	19 Rock Run	5/6/1986	300.00	3.40	3.45	3.79	27.80	*	105.00	<1	891.00
	Sky Haven Coal	17793088	19 Rock Run	8/25/1986	325.00	3.40	3.40	3.91	30.86	*	82.00	<1	788.00
	Sky Haven Coal	17793088	19 Rock Run	12/11/1986	480.00	3.85	3.43	0.67	3.73	*	23.00	1.00	267.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Sky Haven Coal	17793088	19 Rock Run	2/16/1987	*	3.50	3.45	5.93	29.50	*	216.00	<1	696.00
	Sky Haven Coal	17793088	19 Rock Run	6/30/1987	*	7.00	7.32	4.77	3.59	*	13.00	140.00	766.00
	Sky Haven Coal	17793088	19 Rock Run	9/30/1987	*	*	5.14	2.09	3.70	*	10.00	4.00	236.00
	Sky Haven Coal	17793088	19 Rock Run	12/30/1987	*	*	5.83	0.30	2.62	*	5.00	6.00	70.00
	Sky Haven Coal	17793088	19 Rock Run	2/10/1988	240.00	4.00	3.80	2.41	15.70	*	75.00	<1	478.00
	Sky Haven Coal	17793088	19 Rock Run	6/7/1988	46.00	3.60	3.48	2.98	19.80	*	68.00	<1	513.00
	Sky Haven Coal	17793088	19 Rock Run	8/16/1988	80.00	3.40	3.39	4.20	22.50	*	116.00	<1	507.00
	Sky Haven Coal	17793088	19 Rock Run	10/4/1988	200.00	3.60	3.49	3.58	23.90	*	67.00	<1	511.00
	Sky Haven Coal	17793088	19 Rock Run	1/9/1989	1160.00	4.30	3.95	2.26	10.60	*	33.00	<1	244.00
	Sky Haven Coal	17793088	19 Rock Run	4/4/1989	1720.00	4.60	3.99	0.81	8.82	*	41.00	<1	458.00
	Sky Haven Coal	17793088	19 Rock Run	7/10/1989	536.00	3.40	3.82	2.28	21.10	*	112.00	<1	520.00
	Sky Haven Coal	17793088	19 Rock Run	10/4/1989	205.00	3.80	3.51	2.38	25.30	*	204.00	<1	758.00
	Sky Haven Coal	17793088	19 Rock Run	1/4/1990	235.00	3.90	3.84	3.34	15.90	*	68.00	<1	467.00
	Sky Haven Coal	17793088	19 Rock Run	5/3/1990	655.00	3.60	3.57	1.66	23.50	*	76.00	<1	713.00
	Sky Haven Coal	17793088	19 Rock Run	7/5/1990	908.00	3.50	3.48	3.52	22.20	*	88.00	<1	796.00
	Sky Haven Coal	17793088	19 Rock Run	10/1/1990	1680.00	4.10	3.66	1.94	11.00	*	46.00	<1	647.00
	Sky Haven Coal	17793088	19 Rock Run	1/9/1991	1385.00	4.50	3.76	2.13	14.40	*	46.00	<1	579.00
	Sky Haven Coal	17793088	19 Rock Run	4/2/1991	1225.00	4.80	3.76	1.77	17.50	*	53.00	<1	540.00
	Sky Haven Coal	17793088	19 Rock Run	7/2/1991	127.00	3.80	3.22	3.46	24.30	*	94.00	<1	820.00
	Sky Haven Coal	17793088	19 Rock Run	10/8/1991	31.00	4.40	3.53	1.57	25.80	*	62.00	<1	753.00
	Sky Haven Coal	17793088	19 Rock Run	1/9/1992	143.00	4.50	3.91	2.16	16.90	*	71.00	<1	668.00
	Sky Haven Coal	17793088	19 Rock Run	7/9/1992	740.00	3.60	3.50	2.35	26.20	*	108.00	<1	825.00
	Sky Haven Coal	17793088	19 Rock Run	10/8/1992	2870.00	4.10	3.57	1.44	21.80	*	73.00	<1	722.00
	Sky Haven Coal	17793088	19 Rock Run	1/7/1993	222.00	3.80	3.96	1.26	10.80	*	40.00	<1	399.00
	Sky Haven Coal	17793088	19 Rock Run	4/13/1993	980.00	4.30	4.03	0.90	15.70	*	74.00	<1	675.00
	Sky Haven Coal	17793088	19 Rock Run	7/21/1993	75.00	3.40	3.35	2.85	30.20	*	163.00	<1	1284.00
	Sky Haven Coal	17793088	19 Rock Run	10/5/1993	140.00	4.20	3.66	1.04	15.60	*	38.00	<1	558.00
	Sky Haven Coal	17793088	19 Rock Run	5/4/1994	240.00	4.50	3.76	1.14	21.90	*	41.00	<1	681.00
	Sky Haven Coal	17793088	19 Rock Run	7/5/1994	298.00	3.90	3.53	1.31	23.40	*	107.00	<1	776.00
	Sky Haven Coal	17793088	19 Rock Run	10/14/1994	45.00	3.80	3.42	16.50	16.80	*	47.00	<1	579.00
	Sky Haven Coal	17793088	19 Rock Run	4/21/1995	410.00	5.00	3.75	2.41	14.00	*	39.00	<1	470.00
	Sky Haven Coal	17793088	19 Rock Run	8/1/1995	140.00	3.20	3.54	2.23	21.10	*	84.00	<1	654.00
	Sky Haven Coal	17793088	19 Rock Run	10/24/1995	180.00	3.60	3.83	1.31	15.60	*	31.00	<1	482.00
	Sky Haven Coal	17793088	19 Rock Run	1/29/1996	159.00	5.00	4.32	0.60	7.62	*	21.00	5.00	326.00
	Sky Haven Coal	17793088	19 Rock Run	4/16/1996	120.00	3.90	4.12	0.24	13.80	*	27.00	4.00	453.00
	Sky Haven Coal	17793088	19 Rock Run	7/8/1996	781.00	3.80	3.73	1.83	20.20	*	46.00	<1	708.00
	Sky Haven Coal	17793088	19 Rock Run	10/8/1996	151.00	3.80	3.79	1.82	19.00	*	58.00	<1	610.00
	Sky Haven Coal	17793088	19 Rock Run	1/10/1997	168.00	4.10	3.87	2.89	17.80	*	58.00	<1	668.00
	Sky Haven Coal	17793088	19 Rock Run	4/14/1997	92.00	3.90	3.81	2.81	18.40	*	37.00	<1	616.00
	Sky Haven Coal	17793088	19 Rock Run	7/18/1997	19.00	3.60	3.36	2.90	23.30	*	94.00	<1	783.00
	Sky Haven Coal	17793088	19 Rock Run	10/17/1997	19.00	4.10	3.62	2.65	16.60	*	56.00	<1	667.00
	Sky Haven Coal	17793088	19 Rock Run	1/15/1998	434.00	4.00	3.83	1.78	13.90	*	45.00	<1	487.00

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	Sky Haven Coal	17793088	19 Rock Run	4/13/1998	68.00	4.10	3.95	1.93	14.80	*	56.00	<1	522.00
	Sky Haven Coal	17793088	19 Rock Run	7/17/1998	22.00	3.80	3.48	1.66	26.00	*	102.00	<1	769.00
	Sky Haven Coal	17793088	19 Rock Run	10/23/1998	10.00	3.70	3.53	1.99	28.10	*	59.00	<1	748.00
	Clearfield Cons. Dist.	CC44	Rock Run below Farm	9/7/2000	*	*	5.60	1.37	8.95	0.51	7.80	8.80	324.00
	Clearfield Cons. Dist.	CC44	Rock Run below Farm	3/14/1996	*	*	4.50	0.71	7.67	1.70	16.00	6.00	251.00
	ScarLift Report	12-A	Rock Run- Mouth	10//1972	2244.00	*	3.30	1.80	*	*	60.00	*	235.00
	ScarLift Report	12-A	Rock Run- Mouth	10//1972	3366.00	*	6.00	1.36	*	*	25.00	*	156.00
				Avg	**491.00**	**3.90**	**3.83**	**2.61**	**20.20**	**0.92**	**76.85**	**17.88**	**601.57**
				St Dev	**684.17**	**0.59**	**0.70**	**2.30**	**8.27**	**0.67**	**48.51**	**42.97**	**210.54**
LA2	Clearfield Cons. Dist.	CC33	Little Anderson after Rock Run	5/13/1999	*	*	3.40	4.56	5.98	7.17	102.00	0.00	207.00
	Clearfield Cons. Dist.	CC33	Little Anderson after Rock Run	9/19/2000	*	*	3.60	8.40	5.56	6.17	76.00	0.00	168.00
	Clearfield Cons. Dist.	CC37	Little Anderson at Railroad Bed	3/14/1996	*	*	3.50	4.13	3.84	4.47	60.00	0.00	113.00
	Clearfield Cons. Dist.	CC37	Little Anderson at Railroad Bed	4/24/1996	*	*	3.60	3.16	3.58	4.08	74.00	0.00	139.00
				Avg	*	*	**3.53**	**5.06**	**4.74**	**5.47**	**78.00**	**0.00**	**156.75**
				St Dev	*	*	**0.10**	**2.30**	**1.21**	**1.45**	**17.51**	**0.00**	**40.34**
341-343	Clearfield Cons. Dist.	Smouse	Smouse	10/20/1982	*	*	3.20	203.68	69.54	35.91	790.00	0.00	780.00
	Clearfield Cons. Dist.	Smouse	Smouse	12/29/1999	*	*	3.40	35.10	33.10	34.50	324.00	0.00	167.00
	Clearfield Cons. Dist.	Smouse	Smouse	11/9/1990	*	*	3.40	81.70	51.30	42.30	522.00	0.00	1056.00
	Clearfield Cons. Dist.	Smouse	Smouse	3/15/1991	*	*	3.40	77.70	53.90	40.50	434.00	0.00	1254.00
	Clearfield Cons. Dist.	Smouse	Smouse	9/19/1991	*	*	3.00	46.40	45.80	31.00	422.00	0.00	942.00
	Clearfield Cons. Dist.	Smouse	Smouse	3/24/1992	*	*	3.10	40.00	46.60	44.90	408.00	0.00	966.00
	Clearfield Cons. Dist.	Smouse	Smouse	6/3/1992	*	*	3.20	46.70	53.50	51.60	652.00	0.00	1415.00
	Clearfield Cons. Dist.	Smouse	Smouse	8/25/1992	*	*	2.70	28.80	47.70	41.60	534.00	0.00	1447.00
	Clearfield Cons. Dist.	Smouse	Smouse	10/15/1992	*	*	3.30	66.00	51.80	43.50	594.00	0.00	881.00
	Clearfield Cons. Dist.	Smouse	Smouse	1/7/1993	*	*	3.30	51.50	37.30	47.40	648.00	0.00	1406.00
	Clearfield Cons. Dist.	Smouse	Smouse	4/15/1993	*	*	3.20	62.60	55.10	70.70	612.00	0.00	1431.00
	Clearfield Cons. Dist.	Smouse	Smouse	7/14/1993	*	*	3.30	76.20	55.70	61.40	478.00	0.00	950.00
	Clearfield Cons. Dist.	Smouse	Smouse	4/27/1994	*	*	3.20	66.10	82.00	107.00	906.00	0.00	1540.00
	Clearfield Cons. Dist.	Smouse	Smouse	9/6/1994	*	*	3.30	73.60	57.30	49.10	540.00	0.00	1232.00
	Clearfield Cons. Dist.	Smouse	Smouse	5/31/1995	*	*	3.20	52.00	41.20	35.00	386.00	0.00	685.00
	Clearfield Cons. Dist.	Smouse	Smouse	11/8/1995	*	*	3.20	36.60	38.50	31.70	426.00	0.00	803.00
	Hawk Run Mining Office	Smouse	Smouse	11/5/2000	*	*	3.40	35.10	33.10	34.50	324.00	0.00	167.00
				Avg	*	*	**3.22**	**63.52**	**50.20**	**47.21**	**529.41**	**0.00**	**1007.18**
				St Dev	*	*	**0.18**	**39.85**	**12.56**	**18.66**	**158.84**	**0.00**	**413.08**
Irvin	NA Refractories Co.	4573SM2	irvin run down O	3/16/1995	*	*	4.40	0.30	0.97	1.63	22.00	6.60	27.00
Branch	DEP WQ	P	Irvin Branch Mouth	6/1/1983	*	*	4.70	0.06	0.39	0.80	22.00	6.00	5.00
	DEP WQ	P	Irvin Branch Mouth	3/1/1991	*	*	4.60	0.05	0.16	0.35	1.60	1.00	20.00
	DEP WQ			**Avg**	*	*	**4.57**	**0.14**	**0.51**	**0.93**	**15.20**	**4.53**	**17.33**

TMDL Pt.	Company	Permit #	Location	Date	Flow	pH (f)	pH (l)	Fe	Mn	Al	Acid	Alk.	Sulf.
	DEP WQ			**St dev**	*	*	**0.15**	**0.14**	**0.42**	**0.65**	**11.78**	**3.07**	**11.24**
Bear Run	DEP WQ	T	Bear Run	6/1/1983	*	*	5.20	1.82	0.08	0.20	30.00	7.00	15.00
	DEP WQ	T	Bear Run	3/1/1991	*	*	5.00	1.05	0.09	0.20	1.60	2.00	14.00
	DEP WQ	U	Bear Run	6/1/1983	*	*	5.50	0.11	0.04	0.14	34.00	7.00	<5
				Avg	*	*	**5.23**	**0.99**	**0.07**	**0.18**	**21.87**	**5.33**	**14.50**
				St Dev	*	*	**0.25**	**0.86**	**0.03**	**0.04**	**17.67**	**2.89**	**0.71**

Note: All flow data are shown in units of gallons per minute (gpm); all concentration data are shown in units of milligrams per liter (mg/l); pH(f) - field pH; pH(l) - laboratory pH

Attachment I

AVGWLF Model Overview & GIS-Based Derivation of Input Data

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

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

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

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

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

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

Adjustments made to specific AVGWLF model parameters, based on existing land use practices in each of the watersheds, included:

Anderson Creek Watershed

- Reset default C factor for Cropland (0.21) to 0.10 for Subbasin 2 to reflect the presence of cover crops.
- Reset default P factors for Cropland and Hay/Pasture land uses (0.45) to 0.30 for Subbasin 2 to account for the presence of riparian buffers in some areas.

Curry Creek Watershed

- No adjustments made.

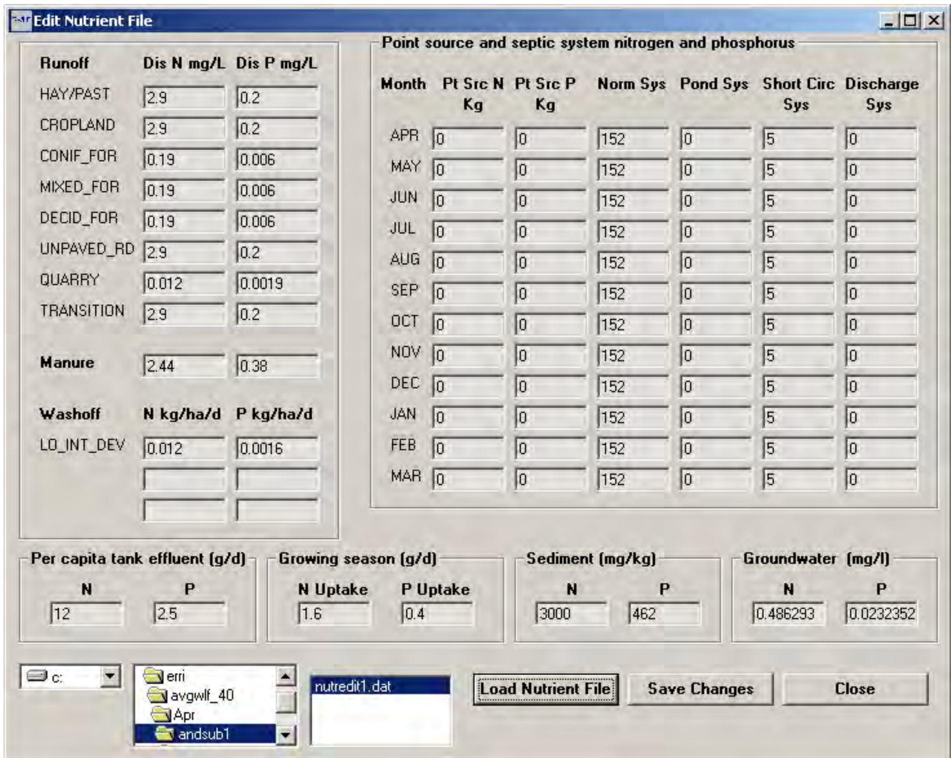
The following table lists the statewide GIS data sets and provides an explanation of how they were used for development of the input files for the GWLF model.

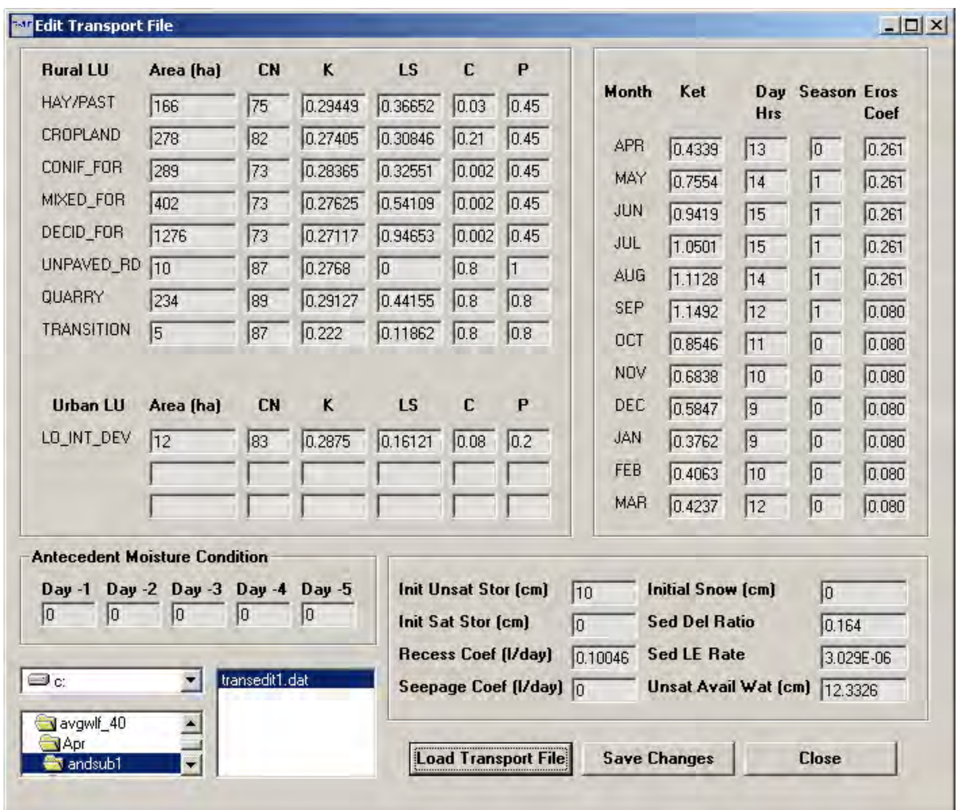
GIS Data Sets	
DATASET	**DESCRIPTION**
Censustr	Coverage of Census data including information on individual homes septic systems. The attribute *usew_sept* includes data on conventional systems, and *sew_other* provides data on short-circuiting and other systems.
County	The County boundaries coverage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

Attachment J

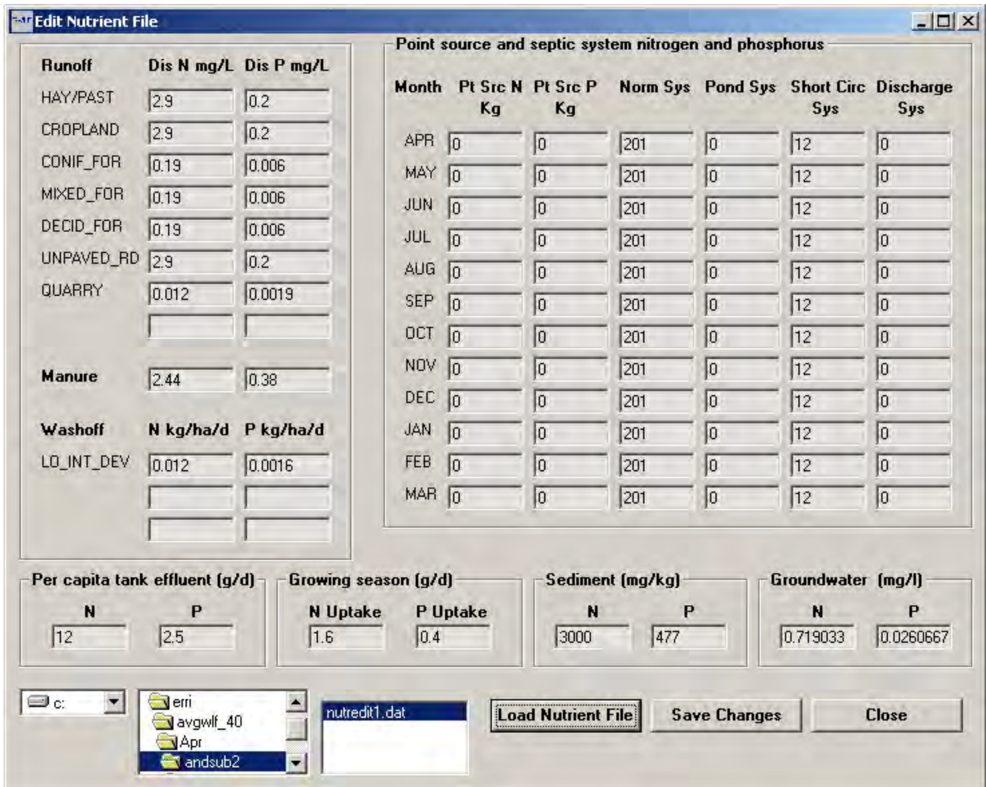
AVGWLF Model Outputs for the Anderson Creek Watershed

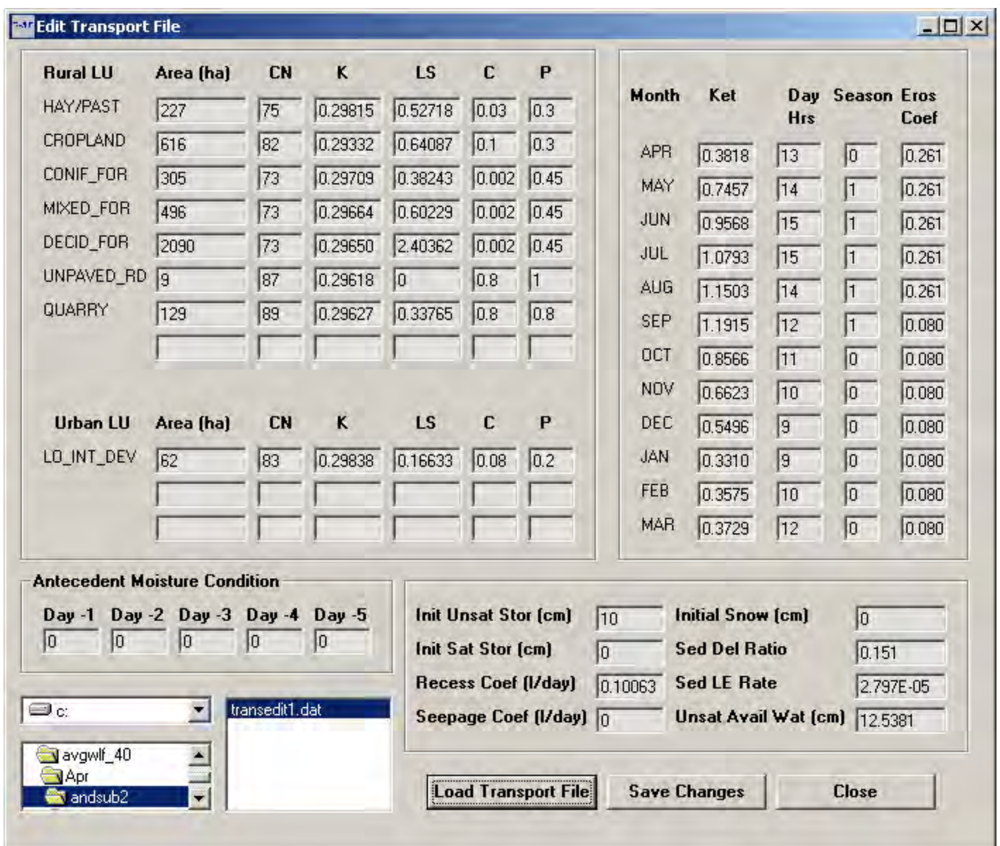
SUBBASIN 1


Edit Nutrient File
Runoff Dis N mg/L Dis P mg/L
HAY/PAST 2.9 0.2
CROPLAND 2.9 0.2
CONIF_FOR 0.19 0.006
MIXED_FOR 0.19 0.006
DECID_FOR 0.19 0.006
UNPAVED_RD 2.9 0.2
QUARRY 0.012 0.0019
TRANSITION 2.9 0.2
Manure 2.44 0.38
Washoff N kg/ha/d P kg/ha/d
LO_INT_DEV 0.012 0.0016
Point source and septic system nitrogen and phosphorus
Month Pt Src N Kg Pt Src P Kg Norm Sys Pond Sys Short Circ Sys Discharge Sys
APR 0 0 152 0 5 0
MAY 0 0 152 0 5 0
JUN 0 0 152 0 5 0
JUL 0 0 152 0 5 0
AUG 0 0 152 0 5 0
SEP 0 0 152 0 5 0
OCT 0 0 152 0 5 0
NOV 0 0 152 0 5 0
DEC 0 0 152 0 5 0
JAN 0 0 152 0 5 0
FEB 0 0 152 0 5 0
MAR 0 0 152 0 5 0
Per capita tank effluent (g/d) N 12 P 2.5
Growing season (g/d) N Uptake 1.6 P Uptake 0.4
Sediment (mg/kg) N 3000 P 462
Groundwater (mg/l) N 0.486293 P 0.0232352
c:
erri
avgwlf_40
Apr
andsub1
nutredit1.dat
Load Nutrient File
Save Changes
Close


Edit Transport File
Rural LU Area (ha) CN K LS C P
HAY/PAST 166 75 0.29449 0.36652 0.03 0.45
CROPLAND 278 82 0.27405 0.30846 0.21 0.45
CONIF_FOR 289 73 0.28365 0.32551 0.002 0.45
MIXED_FOR 402 73 0.27625 0.54109 0.002 0.45
DECID_FOR 1276 73 0.27117 0.94653 0.002 0.45
UNPAVED_RD 10 87 0.2768 0 0.8 1
QUARRY 234 89 0.29127 0.44155 0.8 0.8
TRANSITION 5 87 0.222 0.11862 0.8 0.8
Urban LU Area (ha) CN K LS C P
LO_INT_DEV 12 83 0.2875 0.16121 0.08 0.2
Month Ket Day Hrs Season Eros Coef
APR 0.4339 13 0 0.261
MAY 0.7554 14 1 0.261
JUN 0.9419 15 1 0.261
JUL 1.0501 15 1 0.261
AUG 1.1128 14 1 0.261
SEP 1.1492 12 1 0.080
OCT 0.8546 11 0 0.080
NOV 0.6838 10 0 0.080
DEC 0.5847 9 0 0.080
JAN 0.3762 9 0 0.080
FEB 0.4063 10 0 0.080
MAR 0.4237 12 0 0.080
Antecedent Moisture Condition
Day -1 0 Day -2 0 Day -3 0 Day -4 0 Day -5 0
Init Unsat Stor (cm) 10
Init Sat Stor (cm) 0
Recess Coef (l/day) 0.10046
Seepage Coef (l/day) 0
Initial Snow (cm) 0
Sed Del Ratio 0.164
Sed LE Rate 3.029E-06
Unsat Avail Wat (cm) 12.3326
c:
avgwlf_40
Apr
andsub1
transedit1.dat
Load Transport File
Save Changes
Close

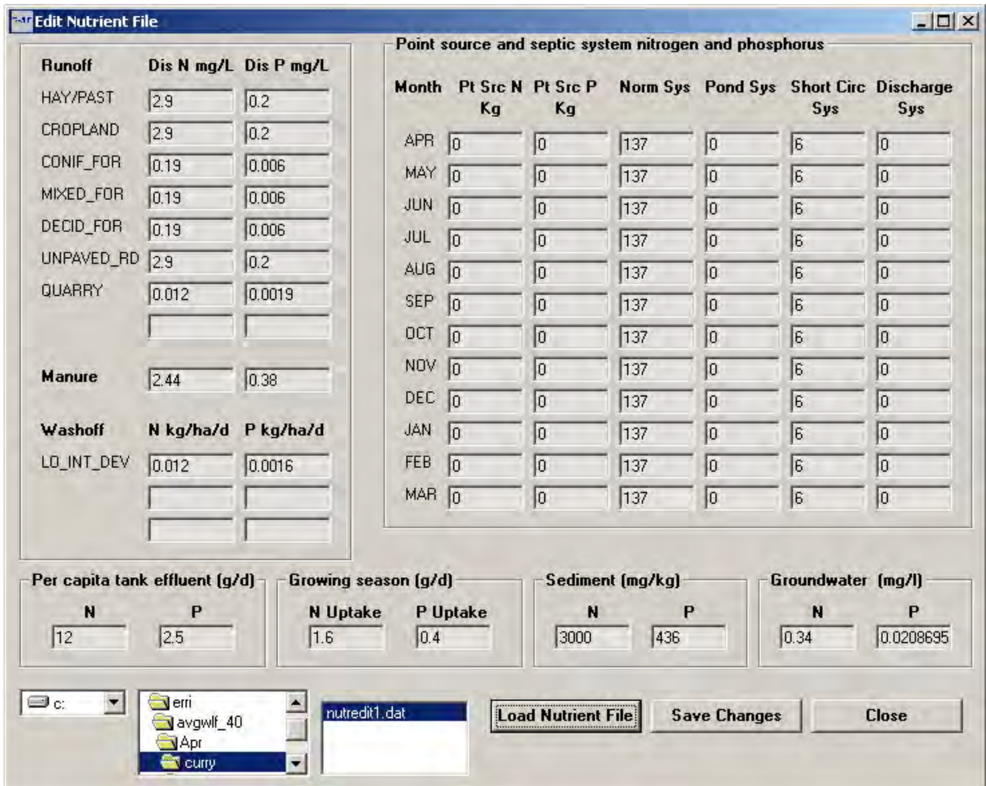
SUBBASIN 2

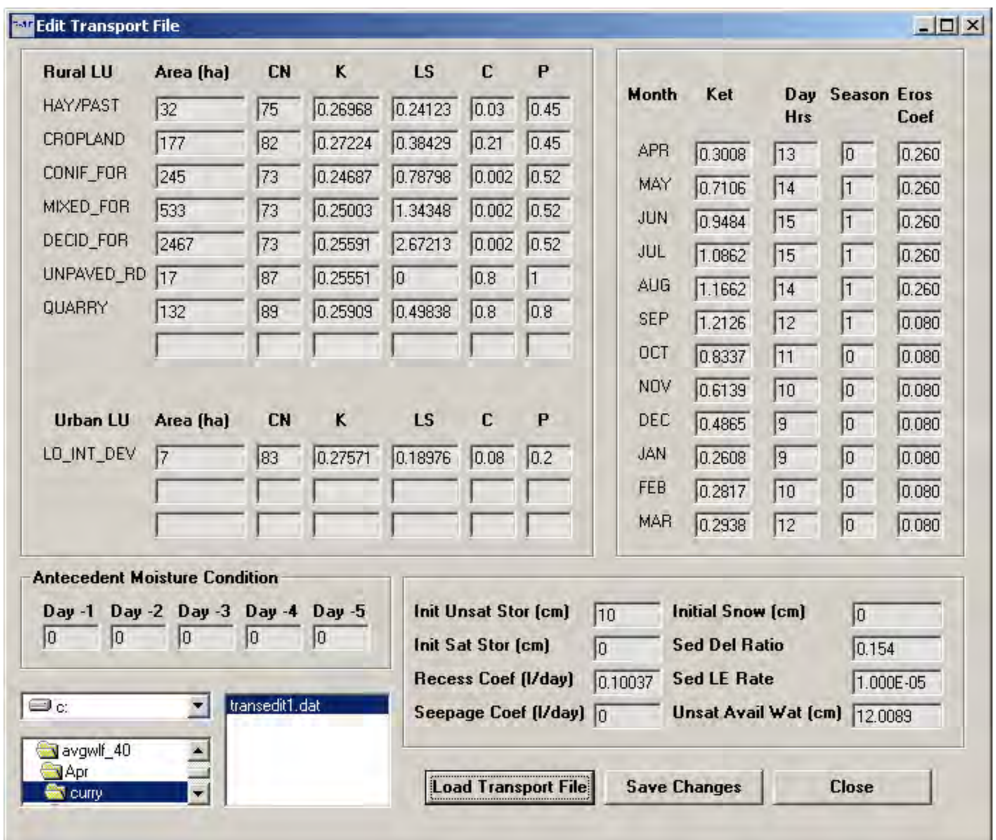

Edit Nutrient File
Runoff Dis N mg/L Dis P mg/L
HAY/PAST 2.9 0.2
CROPLAND 2.9 0.2
CONIF_FOR 0.19 0.006
MIXED_FOR 0.19 0.006
DECID_FOR 0.19 0.006
UNPAVED_RD 2.9 0.2
QUARRY 0.012 0.0019
Manure 2.44 0.38
Washoff N kg/ha/d P kg/ha/d
LO_INT_DEV 0.012 0.0016
Point source and septic system nitrogen and phosphorus
Month Pt Src N Kg Pt Src P Kg Norm Sys Pond Sys Short Circ Sys Discharge Sys
APR 0 0 201 0 12 0
MAY 0 0 201 0 12 0
JUN 0 0 201 0 12 0
JUL 0 0 201 0 12 0
AUG 0 0 201 0 12 0
SEP 0 0 201 0 12 0
OCT 0 0 201 0 12 0
NOV 0 0 201 0 12 0
DEC 0 0 201 0 12 0
JAN 0 0 201 0 12 0
FEB 0 0 201 0 12 0
MAR 0 0 201 0 12 0
Per capita tank effluent (g/d) N 12 P 2.5
Growing season (g/d) N Uptake 1.6 P Uptake 0.4
Sediment (mg/kg) N 3000 P 477
Groundwater (mg/l) N 0.719033 P 0.0260667
c:
erri
avgwlf_40
Apr
andsub2
nutredit1.dat
Load Nutrient File
Save Changes
Close


Edit Transport File
Rural LU Area (ha) CN K LS C P
HAY/PAST 227 75 0.29815 0.52718 0.03 0.3
CROPLAND 616 82 0.29332 0.64087 0.1 0.3
CONIF_FOR 305 73 0.29709 0.38243 0.002 0.45
MIXED_FOR 496 73 0.29664 0.60229 0.002 0.45
DECID_FOR 2090 73 0.29650 2.40362 0.002 0.45
UNPAVED_RD 9 87 0.29618 0 0.8 1
QUARRY 129 89 0.29627 0.33765 0.8 0.8
Urban LU Area (ha) CN K LS C P
LO_INT_DEV 62 83 0.29838 0.16633 0.08 0.2
Month Ket Day Hrs Season Eros Coef
APR 0.3818 13 0 0.261
MAY 0.7457 14 1 0.261
JUN 0.9568 15 1 0.261
JUL 1.0793 15 1 0.261
AUG 1.1503 14 1 0.261
SEP 1.1915 12 1 0.080
OCT 0.8566 11 0 0.080
NOV 0.6623 10 0 0.080
DEC 0.5496 9 0 0.080
JAN 0.3310 9 0 0.080
FEB 0.3575 10 0 0.080
MAR 0.3729 12 0 0.080
Antecedent Moisture Condition
Day -1 0 Day -2 0 Day -3 0 Day -4 0 Day -5 0
Init Unsat Stor (cm) 10
Init Sat Stor (cm) 0
Recess Coef (l/day) 0.10063
Seepage Coef (l/day) 0
Initial Snow (cm) 0
Sed Del Ratio 0.151
Sed LE Rate 2.797E-05
Unsat Avail Wat (cm) 12.5381
c:
avgwlf_40
Apr
andsub2
transedit1.dat
Load Transport File
Save Changes
Close

Attachment K

AVGWLF Model Outputs for the Curry Creek Watershed


Edit Nutrient File
Runoff
Dis N mg/L
Dis P mg/L
HAY/PAST 2.9 0.2
CROPLAND 2.9 0.2
CONIF_FOR 0.19 0.006
MIXED_FOR 0.19 0.006
DECID_FOR 0.19 0.006
UNPAVED_RD 2.9 0.2
QUARRY 0.012 0.0019
Manure 2.44 0.38
Washoff
N kg/ha/d
P kg/ha/d
LO_INT_DEV 0.012 0.0016
Point source and septic system nitrogen and phosphorus
Month
Pt Src N Kg
Pt Src P Kg
Norm Sys
Pond Sys
Short Circ Sys
Discharge Sys
APR 0 0 137 0 6 0
MAY 0 0 137 0 6 0
JUN 0 0 137 0 6 0
JUL 0 0 137 0 6 0
AUG 0 0 137 0 6 0
SEP 0 0 137 0 6 0
OCT 0 0 137 0 6 0
NOV 0 0 137 0 6 0
DEC 0 0 137 0 6 0
JAN 0 0 137 0 6 0
FEB 0 0 137 0 6 0
MAR 0 0 137 0 6 0
Per capita tank effluent (g/d)
N 12
P 2.5
Growing season (g/d)
N Uptake 1.6
P Uptake 0.4
Sediment (mg/kg)
N 3000
P 436
Groundwater (mg/l)
N 0.34
P 0.0208695
c:
erri
avgwlf_40
Apr
curry
nutredit1.dat
Load Nutrient File
Save Changes
Close


Edit Transport File
Rural LU
Area (ha)
CN
K
LS
C
P
HAY/PAST 32 75 0.26968 0.24123 0.03 0.45
CROPLAND 177 82 0.27224 0.38429 0.21 0.45
CONIF_FOR 245 73 0.24687 0.78798 0.002 0.52
MIXED_FOR 533 73 0.25003 1.34348 0.002 0.52
DECID_FOR 2467 73 0.25591 2.67213 0.002 0.52
UNPAVED_RD 17 87 0.25551 0 0.8 1
QUARRY 132 89 0.25909 0.49838 0.8 0.8
Urban LU
Area (ha)
CN
K
LS
C
P
LO_INT_DEV 7 83 0.27571 0.18976 0.08 0.2
Month
Ket
Day Hrs
Season
Eros Coef
APR 0.3008 13 0 0.260
MAY 0.7106 14 1 0.260
JUN 0.9484 15 1 0.260
JUL 1.0862 15 1 0.260
AUG 1.1662 14 1 0.260
SEP 1.2126 12 1 0.080
OCT 0.8337 11 0 0.080
NOV 0.6139 10 0 0.080
DEC 0.4865 9 0 0.080
JAN 0.2608 9 0 0.080
FEB 0.2817 10 0 0.080
MAR 0.2938 12 0 0.080
Antecedent Moisture Condition
Day -1 Day -2 Day -3 Day -4 Day -5
0 0 0 0 0
Init Unsat Stor (cm) 10
Init Sat Stor (cm) 0
Recess Coef (l/day) 0.10037
Seepage Coef (l/day) 0
Initial Snow (cm) 0
Sed Del Ratio 0.154
Sed LE Rate 1.000E-05
Unsat Avail Wat (cm) 12.0089
c:
avgwlf_40
Apr
curry
transedit1.dat
Load Transport File
Save Changes
Close

Attachment L

Equal Marginal Percent Reduction Method

The Equal Marginal Percent Reduction (EMPR) allocation method was used to distribute Adjusted Load Allocations (ALAs) between the appropriate contributing nonpoint sources. The sediment and phosphorus ALAs were distributed between cropland, hay/pasture, developed, and abandoned-mine lands. The EMPR process is summarized below:

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

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

3. The load allocation and EMPR procedures were performed using MS Excel and results are presented in Attachment M.

Attachment M

Equal Marginal Percent Reduction Calculations for the Anderson Creek Watershed

Step 1:	TMDL Total Load		Step 2:	Adjusted LA = (TMDL total load - MOS) - uncontrollable
	Load = TP loading rate in ref. * Acres in Impaired		591416.05	591416
	686685			

Step 3:		Annual Average Load	Load Sum	Check	Initial Adjust	Recheck	% reduction allocation	Load Reduction	Initial LA	Acres	Allowable Loading Rate	% Reduction
	Hay/Past.	17200.00	1561648.6	good	17200	ADJUST	0.02	3934	13266	399	33.27	22.9%
	Cropland	157600.00		good	157600	175400	0.21	36049	121551	672	180.85	22.9%
	Lo_int_urb	600.00		good	600		0.00	137	463	41	11.19	22.9%
	Disturbed	1386248.60		bad	591416		0.77	135279	456137	661	689.67	67.1%
					766816.0548		1		591416			

Step 4:	All Ag. Loading Rate	125.89

Step 5:		Acres	Allowable (Target) Loading Rate	Final LA	Current Loading Rates	Current Load	% Red.
	Final Hay/Past. LA	398.78	33.27	13265.71	43.13	17200	23%
	Final Cropland LA	672.10	180.85	121550.89	234.49	157600	23%
	Lo_int_urb	41.37	11.19	462.76	14.50	600	23%
	Disturbed	661.38	689.67	456136.71	2095.99	1386249	67%
				591416		1561649	

Subbasin 1

Step 1:	TMDL				Step 2:	Adjusted LA = TMDL total load - ((MOS) - loads not reduced)						
	TMDL =Total P loading rate in ref. * Impaired Acres					346.0	346.0					
	1590.9											
Step 3:		Annual				Recheck	% reduction	Load			Allowable	%
		Avg. Load	Load Sum	Check	Initial Adjust	Adjust	allocation	Reduction	Initial LA	Acres	Loading Rate	Reduction
	CROPLAND	558.1	982.4	bad	346.0		0.4	190.6	155.4	1522.2	0.1	72.2%
	HAY/PASTURE	103.5		good	103.5	424.3	0.1	57.0	46.5	560.9	0.1	55.1%
	TRANSITIONAL	320.8		good	320.8		0.4	176.7	144.1	341.0	0.4	55.1%
	DISTRURBED											
					770.3		1.0		346.0			
Step 4:	All Ag. Loading Rate	0.14										
			Allowable		Current	Current						
		Acres	loading rate	Final LA	Loading Rate	Load	% Red.		CURRENT LOAD		FINAL LA	
Step 5:	CROPLAND	1522.2	0.1	155.4	0.4	558.1	72.2%		CROPLAND	558	155	
	HAY/PASTURE	560.9	0.1	46.5	0.2	103.5	55.1%		HAY/PASTURE	104	46	
	TRANSITIONAL	341.0	0.4	144.1	0.9	320.8	55.1%		TRANSITIONAL	321	144	
	DISTRURBED											
				346.0		982.4	64.8%					
	Subbasin 2											

Attachment N

Comment and Response Document
Anderson Creek Watershed TMDLs

(No comments were received during the 30 days after the December 20 posting.)