DEER CREEK WATERSHED TMDL
Clearfield County

Prepared for:

Pennsylvania Department of Environmental Protection

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INTRODUCTION

This Total Maximum Daily Load (TMDL) calculation has been prepared for segments in the Deer Creek Watershed (Attachment A). It was done to address the impairments noted on the 1996, 1998, 2002, and draft 2004 Pennsylvania Section 303(d) lists required under the Clean Water Act. The TMDL covers 12 segments on these lists (Table 1). High levels of metals, and in some areas depressed pH, caused these impairments. All impairments are a result of acid drainage from abandoned coal mines. The TMDL addresses the three primary metals (iron, manganese, and aluminum) associated with abandoned mine drainage (AMD) and pH.

Table 1. Deer Creek Segments Addressed

State Water Plan (SWP) Subbasin: 08-C Clearfield Creek								
Year	*Miles*	*Segment ID*	*DEP Stream Code*	*Stream Name*	*Designated Use*	*Data Source*	*Source*	*EPA 305(b) Cause Code*
1996	5	Not placed on GIS	25978	Deer Creek	CWF	305(b) Report	RE	Metals
1998	5	Not placed on GIS	25978	Deer Creek	CWF	305(b) Report	AMD	Metals
2002	15.1*	990819-1350-LMS	25978	Deer Creek	CWF	SSWAP	AMD	Metals pH
2004	4.0	990819-1350-LMS	25978	Deer Creek	CWF	SSWAP	AMD	Metals pH
2004	0.2	20030713-1410-JLR	25978	Deer Creek	CWF	SSWAP	AMD	Metals
2004	1	990819-1350-LMS	25979	UNT to Deer Creek	CWF	SSWAP	AMD	Metals pH
2004	1.3	990819-1350-LMS	25980	UNT to Deer Creek	CWF	SSWAP	AMD	Metals pH
2004	0.9	20030929-1823-JCO	25981	UNT to Deer Creek	CWF	SSWAP	AMD	Metals pH
2004	1.5	990819-1350-LMS	25988	UNT to Deer Creek	CWF	SSWAP	AMD	Metals pH
2004	0.8	990819-1350-LMS	25989	UNT to Deer Creek	CWF	SSWAP	AMD	Metals pH
2004	1.8	990819-1350-LMS	25990	UNT to Deer Creek	CWF	SSWAP	AMD	Metals pH
2004	0.6	20030713-1410-JLR	25991	UNT to Deer Creek	CWF	SSWAP	AMD	Metals
2004	0.7	20030713-1410-JLR	25992	UNT to Deer Creek	CWF	SSWAP	AMD	Metals
2004	0.9	20030929-1823-JCO	25982	Buck Run	CWF	SSWAP	AMD	Metals pH
2004	1.3	20030929-1823-JCO	25983	UNT to Buck Run	CWF	SSWAP	AMD	Metals pH

*The 2002 Section 303(d) list includes an impairment listing of multiple streams, including: Deer Creek, Bald Hill Run, and West Branch Susquehanna River. The mileage for these streams was added together for the impairment listing.
Attachment B includes a justification of differences between the 1996, 1998, 2002, and draft 2004 Section 303(d) Lists

CWF = Cold Water Fishes
RE = Resource Extraction
AMD = Abandoned Mine Drainage
SSWAP = Statewide Surface Water Assessment Program

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[1] Pennsylvania's 1996, 1998, and 2002 lists were approved by the U.S. Environmental Protection Agency (USEPA). The 2004 Section 303(d) list was not yet approved at the time this document was written. The 1996 Section 303(d) list provides the basis for measuring progress under the 1996 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA.*

LOCATION

The Deer Creek Watershed is approximately 23.5 square miles in area. The watershed can be located on the U. S. Geological Service (USGS) 7.5 minute quadrangles of Lecontes Mills, The Knobs, Frenchville, and Devils Elbow, Pennsylvania. The headwaters of Deer Creek are located in Moshannon State Forest just south of the Caledonia Pike in Girard Township, Clearfield County, Pennsylvania. The stream flows southwest to join the West Branch Susquehanna River approximately 2 miles south of State Route 879. The villages of Lecontes Mills and Congress Hill lie to the west of the watershed. The village of Gillingham is bisected by the western edge of the watershed. Deer Creek can be accessed from State Route 879 and State Route 1009 that follow the creek along its lower portion. Billotte Road travels through the Buck Run Watershed, a tributary to Deer Creek, and north along the eastern portion of Deer Creek Watershed. A Sky Haven Coal, Inc. haul road, just north of State Route 879, allows access to Deer Creek and two of its tributaries in the middle portion of the watershed until the actively mined, permitted area begins. The headwaters and middle portion of Deer Creek are very remote and access is limited to hiking or all terrain vehicle trails.

SEGMENTS ADDRESSED IN THIS TMDL

The Deer Creek Watershed is affected by pollution from AMD. This pollution has caused high levels of metals and low pH in the mainstem of Deer Creek, unnamed tributaries to Buck Run, and seven unnamed tributaries to Deer Creek. The sources of the AMD are deep mine discharges, seeps from areas disturbed by surface mining, and discharges from unreclaimed spoil piles. Most of the discharges originate from mining on the Lower Kittanning coal seam or spoil piles associated with it. All of the discharges are considered to be nonpoint sources of pollution because they are from abandoned Pre-Act mining operations or from coal companies that have settled their bond forfeitures with the Pennsylvania Department of Environmental Protection (PADEP).

On September 23, 2003, Al Hamilton Contracting Company, Bradford Coal Company, and Manor Mining established a trust fund to treat discharges from sites formerly operated by these companies (PADEP Newsletter, October 31, 2003). The trust fund, valued at seven million dollars, will be used to fund active treatment at four sites and to maintain passive treatment at four sites. The Deer Creek Watershed includes one of these sites, the former Al Hamilton Contracting Company Buck Run #2 operation. The PADEP is currently evaluating this site for continued treatment options (Cram, 2004).

The PADEP issued a surface mining permit to Moravian Run Reclamation Company for an area near Lecontes Mills, Clearfield County in May 2003. The permitted area drains to Deer Creek and the West Branch Susquehanna River. The operation will reclaim 142 acres of abandoned mine lands and 3,100 feet of dangerous highwall. In addition, the company will use alkaline material in the backfill during reclamation to reduce the possibility of AMD emanating from the site (PADEP Update, April 25, 2003).

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 two years (April 1 of the even numbered years);

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

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

SECTION 303(D) LISTING PROCESS

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

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

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

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

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

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

WATERSHED BACKGROUND

The Deer Creek Watershed lies within the Appalachian Plateaus Province. The watershed is divided between the Mountainous High Plateau Section in the headwaters and the Pittsburgh Low Plateau Section in the lower half of Deer Creek. There is a vertical drop in the watershed of 1,180 feet from its headwaters to its mouth. The headwaters begin in Moshannon State Forest and are very remote. The rest of the watershed is highly disturbed by past coal mining operations. Numerous deep and surface mines have operated in the lower portion of the watershed. Soils throughout the Deer Creek Watershed are well drained and strongly to extremely acidic (USDA, 2004). The surficial geology is a mixture of interbedded sedimentary (41 percent) and sandstone (59 percent). Deer Creek is classified as cold-water fishery (CWF) by the PA Code, Title 25 Chapter 93 Water Quality Standards. The unnamed tributaries and Buck Run are all classified as CWF as well.

Coal mining has been the primary industry in the watershed from the 1930s to the present. Large tracts of land in the southern portion of the watershed have been disturbed by deep and strip mining operations. Disturbed land (abandoned coal mines, quarries, etc.) make up approximately 9.2 percent of the watershed. Forested land now makes up 80.7 percent of the watershed. The only forested sections of the lower watershed are the steep slopes down into the stream valley and small sections of reclaimed mine lands that now support some trees. Agriculture and grasslands makes up 9.8 percent of the land use. The watershed is thinly populated, with only 0.3 percent developed lands.

The Pennsylvania Fish and Boat Commission (PFBC) surveyed Deer Creek in 1931 and approved its lower section for stocking (PFBC, 1931). The PFBC also performed a site investigation of the Pembrook Construction Company stripping operations in Deer Creek in 1947. The records indicate that the discharges into Deer Creek appeared to be doing no harm to the stream at the time (Bradford, 1947). In 1957, the Bradford Coal Company received a mining permit for a deep mine named Andy No. 1 in the lower Deer Creek Watershed. In 1959, the Shawville Coal Company applied for a mine drainage permit for strip mining in the Little Deer Creek Watershed for the Knobs #2 Mine. The application was denied based on Little Deer Creek having a good trout fishery. The application states that Deer Creek receives AMD near the confluence of Little Deer Creek (Ogden, 1959). In 1960, the PFBC performed another survey on Deer Creek that states that much of Deer Creek is receiving AMD from the extensive strip mining in the watershed (Heyl, 1960).

Numerous Pre-Act surface and deep mines operated in the watershed from the 1950s to 1970s. The coal seams mined were the Upper and Lower Freeport and the Middle and Lower Kittanning. The deep mines were operated by Shawville Coal Company, Boron Brothers Coal Company, and Krolick Coal Company. None of these deep mines were sealed when the operations shut down and in many cases were breached by later strip mining. Surface mining operations were completed by the K&J Coal Company, Edmunds Contracting and Supply Inc., Shawville Coal Company, and Boron Brothers Coal Company.

The Ingram Coal Company operated a mine on the Clarion coal seam that caused a small but highly acidic discharge into the unnamed tributary 25992 to Deer Creek. The company dissolved in the mid-1990s and forfeited all bonds at the site in 1998. Swisher Contracting Company completed a surface mining operation of the Lower Kittanning seam in 1994 and all bonds were released from the site. Manor Mining and Contracting Company operated the Manor #44 deep mine on the Lower Kittanning coal seam. The underground mine is in the Deer Creek Watershed. However, due to the geologic dip in the region all of the water from the mine drains into Bald Hill Run, to the west of Deer Creek. Manor Mining ceased the deep mining operation in 2000 and forfeited all bonds in September 2003. Al Hamilton Contracting Company operated three strip mines in the watershed on the Mercer, Clarion, and Lower Kittanning coal seams. Two of the operations were completed without problems but one of the operations caused a discharge into the unnamed tributary 25992 to Deer Creek. The company dissolved and forfeited their bonds in September 2003. On September 23, 2003, Al Hamilton Contracting Company, Bradford Coal Company, and Manor Mining established a trust fund to treat discharges from sites formerly operated by these companies (PADEP Newsletter, October 31, 2003). The trust fund, valued at seven million dollars, will be used to fund active treatment at four sites and to maintain passive treatment at four sites. The Deer Creek Watershed includes one of these sites, the former Al Hamilton Contracting Company Buck Run #2 operation. The PADEP is currently evaluating this site for continued treatment options (Cram, 2004).

There are two current mining permits in the Deer Creek Watershed (Table 2). The Moravian Run Reclamation Company has applied to PADEP for a second mining permit in the Deer Creek Watershed. The new mining permit has not yet been approved.

Table 2. Mining Permits in the Deer Creek Watershed

Permit No.	NPDES No.	Effective Dates	Company Name	Status
17020106	PA0243264	03/03 – 03/08	Moravian Run Reclamation Company, Inc. Kyler Operation	Active
17860104	PA0611077	10/88 – 10/08	Sky Haven Coal, Inc. Deer Creek #1	Active

The mine drainage treatment facilities for the permitted areas are assigned a waste load allocation (WLA). Discharge rate and frequency vary as a function of precipitation and runoff. The method to quantify the treatment facility discharges is explained in the *Method to Quantify Treatment Pond Pollution Load* section of this report. A fourth WLA was calculated and incorporated into the allocations at DEER4.0. It is anticipated that there will be mining in the Deer Creek Watershed in the near future based on available coal reserves, mining operator interests, and other factors. A WLA that is representative of one future surface mining operation has been included to accommodate this eventuality.

It has been determined that effects from sedimentation ponds are negligible because their potential discharges are based on infrequent and temporary events and the ponds should rarely discharge if reclamation and revegetation is concurrent. In addition, sediment ponds are designed in accordance with PA Code Title 25 Chapter 87.108(h) to, at a minimum, contain runoff from a 10-year, 24-hour precipitation event.

AMD METHODOLOGY

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

The statistical analysis described below can be applied to situations where all of the pollutant loading is from nonpoint sources, as well as those where there are both point and nonpoint sources. The following defines what are considered point sources and nonpoint sources for the purposes of our evaluation; point sources are defined as permitted discharges or a discharge that has a responsible party, 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 point source impacts alone, or in combination with 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.

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

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

PR = required percent reduction for the current iteration

Cc = criterion in mg/l

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

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

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

Mean = average observed concentration

Standard Deviation = standard deviation of observed data

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

LTA = Mean * (1 – PR99) where (2)

LTA = allowable LTA source concentration in mg/l

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

For pH TMDLs, acidity is compared to alkalinity. 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 in units of milligrams per liter (mg/l) $CaCO_3$. Statistical procedures are applied, using the average value for total alkalinity at that point as the target to specify a reduction in the acid concentration. By maintaining a net alkaline stream, the pH value will be in the range between six and eight. This method negates the need to specifically compute the pH value, which for streams affected by low pH from AMD may not a true reflection of acidity. This method assures that Pennsylvania's standard for pH is met when the acid concentration reduction is met.

Information for the TMDL analysis performed using the methodology described above is contained in the "TMDLs by Segment" section of this report.

ACCOUNTING FOR UPSTREAM REDUCTIONS IN AMD TMDLS

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

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

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

METHOD TO QUANTIFY TREATMENT POND POLLUTANT LOAD

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

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

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

Discharge from treatment ponds on a mine site is intermittent and often varies as a result of precipitation events. Measured flow rates are almost never available. If accurate flow data are available, it is used along with the Best Available Technology (BAT) limits to quantify the WLA for one or more of the following: aluminum, iron, and manganese. The following formula is used:

Flow (MGD) X BAT limit (mg/l) X 8.34 = lbs/day

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

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

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

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

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

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

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

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

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

Total Average Flow = Direct Pit Precipitation + Spoil Runoff

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

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

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

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

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

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

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

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

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

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

TMDL ENDPOINTS

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

Because of the nature of the pollution sources in the watershed, the TMDLs 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 the water quality standards must be met 99 percent of the time. The iron TMDLs are expressed as total recoverable as the iron data used for this analysis was reported as total recoverable. Table 3 shows the water quality criteria for the selected parameters.

Table 3. Applicable Water Quality Criteria

Parameter	***Criterion Value (mg/l)***	***Total Recoverable/Dissolved***
Aluminum (Al)	0.75	Total Recoverable
Iron (Fe)	1.50 0.3	30-Day Average Total Recoverable Dissolved
Manganese (Mn)	1.00	Total Recoverable
pH *	6.0-9.0	N/A

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

TMDL ELEMENTS (WLA, LA, MOS)

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

TMDL ALLOCATIONS SUMMARY

Analyses of data for metals for the points below indicated that there was no single critical flow condition for pollutant sources. The Pennsylvania TMDL program has shown repeatedly that there is 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 10 paired observations).

Table 4. Correlation Between Metals and Flow for Selected Points

Point Identification	Flow vs.			Number of Samples
	Iron	Manganese	Aluminum	
TRDC7.2	0.0052	0.0280	*	36, 36
TRDC7.1	0.1349	0.1598	*	37, 37
TRDC6.0	0.0757	0.0827	0.0343	13, 13, 13
TRDC5.1	0.1422	0.2332	*	17, 17
TRBR1.1	0.0560	0.0419	*	15, 16
TRBR1.0	0.0304	0.1609	*	29, 29
TRDC3.0	0.1004	0.0073	*	29, 29

* No data

Methodology for dealing with metal and pH impairments is discussed in Attachment C. Information for the TMDL analysis using the methodology described above is contained in the TMDLs by Segment section in Attachment D.

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. Table 5 presents the estimated reductions identified for all points in the watershed. Attachment D gives detailed TMDLs by Segment analysis for each allocation point.

Table 5. Summary Table–Deer Creek Watershed

Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Reduction %
DEER7.0	*Deer Creek above mining impacts*						
	Fe	<27.7	*	0.0	*	0.0	0
	Mn	33.2	*	0.0	*	0.0	0
	Al	<46.1	*	0.0	*	0.0	0
	Acidity	1,345.9	*	0.0	*	0.0	0

Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Reduction %
TRDC7.2	*UNT 25992 to Deer Creek; Between forfeited mine discharges*						
	Fe	6.0	0.1	0.0	0.1	5.9	98
	Mn	8.7	0.1	0.0	0.1	8.6	99
	Al	3.4	0.1	0.0	0.1	3.3	97
	Acidity	70.4	0.0	0.0	0.0	70.4	100
TRDC7.1	*UNT 25992 to Deer Creek; After both forfeited mine permits*						
	Fe	18.9	0.6	0.0	0.6	12.4	95
	Mn	37.1	0.4	0.0	0.4	28.1	99
	Al	14.3	0.4	0.0	0.4	10.6	96
	Acidity	129.1	11.6	0.0	11.6	47.1	80
TRDC7.0	*UNT 25991 to Deer Creek; At the tributary's mouth*						
	Fe	ND	*	0.0	*	*	*
	Mn	29.8	5.4	0.0	5.6	0.0	0
	Al	ND	*	0.0	*	*	*
	Acidity	534.7	58.7	0.0	58.8	358.4	86
TRDC6.1	*UNT 25990 to Deer Creek; Upstream of active mine*						
	Fe	0.2	0.1	0.0	0.1	0.1	50
	Mn	0.9	0.1	0.0	0.1	0.8	89
	Al	1.6	0.1	0.0	0.1	1.5	94
	Acidity	15.2	0.0	0.0	0.0	15.2	100
TRDC6.0	*UNT 25990 to Deer Creek; At the tributary's mouth*						
	Fe	3.1	2.2	1.1	1.1	0.8	27
	Mn	13.2	2.5	0.7	1.8	9.9	80
	Al	9.2	0.8	0.7	0.1	6.9	90
	Acidity	2.5	2.5	0.0	2.5	0.0	0
DEER6.0	*Deer Creek; After UNT 25990*						
	Fe	ND	*	0.0	*	*	*
	Mn	120.0	44.4	0.0	44.4	40.5	47
	Al	80.4	37.2	0.0	37.2	34.8	48
	Acidity	2,393.0	310.6	0.0	310.7	1,606.4	84
DEER5.0	*Deer Creek; Upstream of active mine*						
	Fe	31.4	24.2	0.0	24.2	7.2	23
	Mn	217.7	8.5	0.0	8.5	133.6	94
	Al	ND	*	0.0	*	*	*
	Acidity	609.6	258.2	0.0	256.4	0.0	0
DEER4.0	*Deer Creek; Downstream of the active mines*						
	Fe	142.6	43.1	2.2	40.9	93.4	69
	Mn	234.7	49.0	1.4	47.6	0.0	0
	Al	87.7	19.3	1.4	17.9	68.7	79
	Acidity	3,030.9	393.7	0.0	393.7	2,285.8	85
TRDC5.1	*UNT 25989 to Deer Creek; Headwaters of the tributary*						
	Fe	0.05	0.03	0.0	0.03	0.02	40
	Mn	1.15	0.01	0.0	0.01	1.14	99.1
	Al	ND	*	0.0	*	*	*
	Acidity	4.78	0.02	0.0	0.02	4.76	99.6
TRDC5.0	*UNT 25989 to Deer Creek; At the tributary's mouth*						
	Fe	10.5	1.9	0.0	1.9	8.6	82
	Mn	50.6	1.5	0.0	1.5	48.0	97
	Al	26.5	1.6	0.0	1.6	24.9	94
	Acidity	430.0	0.0	0.0	0.0	425.2	100
TRDC4.0	*UNT 25988 to Deer Creek; At the tributary's mouth*						
	Fe	106.2	4.3	0.0	4.3	101.9	96
	Mn	102.3	4.1	0.0	4.1	98.2	96
	Al	46.9	3.7	0.0	3.7	43.2	92
	Acidity	981.9	0.0	0.0	0.0	981.9	100

Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Reduction %
DEER3.0	*Deer Creek; Downstream of the UNTs 25989 and 25988*						
	Fe	1,267.8	63.4	0.0	63.4	994.4	94
	Mn	1,212.7	36.7	0.0	36.7	843.0	96
	Al	ND	*	0.0	*	*	*
	Acidity	9,403.3	18.3	0.0	18.3	5,335.9	99.7
BUCK2.0	*Buck Run; Upstream of mining impacts*						
	Fe	0.4	*	0.0	*	0.0	0
	Mn	0.2	*	0.0	*	0.0	0
	Al	ND	*	0.0	*	*	*
	Acidity	9.6	*	0.0	*	0.0	0
TRBR1.1	*UNT 25983 to Buck Run; In the tributary's headwaters*						
	Fe	0.14	0.02	0.0	0.02	0.12	86
	Mn	0.30	0.02	0.0	0.02	0.28	93
	Al	ND	*	0.0	*	*	*
	Acidity	0.69	0.69	0.0	0.69	0.00	0
TRBR1.0	*UNT25983 to Buck Run; At the tributary's mouth*						
	Fe	9.6	0.7	0.7	0.0	8.8	93
	Mn	10.0	1.2	0.4	0.8	8.5	88
	Al	ND	*	0.4	*	*	*
	Acidity	85.9	7.7	0.0	7.7	78.2	91
BUCK1.0	*Buck Run; At the mouth of the stream*						
	Fe	ND	*	0.0	*	*	*
	Mn	8.7	8.7	0.0	8.7	0.0	0
	Al	ND	*	0.0	*	*	*
	Acidity	673.0	80.8	0.0	80.8	514.0	86
DEER2.0	*Deer Creek; After Buck Run*						
	Fe	515.3	77.1	0.0	77.1	0.0	0
	Mn	430.1	85.2	0.0	85.2	0.0	0
	Al	178.5	81.1	0.0	81.1	97.4	55
	Acidity	8,520.4	1,107.6	0.0	1,107.6	0.0	0
TRDC3.0	*UNT 25981 to Deer Creek; At the tributary's mouth*						
	Fe	0.7	0.2	0.0	0.2	0.5	71
	Mn	7.2	0.2	0.0	0.2	7.0	97
	Al	7.4	0.1	0.0	0.1	7.3	99
	Acidity	71.6	2.1	0.0	2.1	69.5	97
DEER1.0	*Deer Creek; At the stream's mouth*						
	Fe	470.6	94.1	0.0	94.1	0.0	0
	Mn	589.4	94.1	0.0	94.1	143.4	60
	Al	291.3	96.4	0.0	96.4	90.2	48
	Acidity	9,844.6	1,082.4	0.0	1,082.4	1,279.9	54

* not applicable based on analysis non-detect (ND)

WLAs are being assigned to the two permitted operations (Sky Haven Coal Company Deer #1, SHD1a and SHD1b, and the Moravian Run Reclamation Company Kyler permit, MRKY) and a future site for iron, manganese, and aluminum. Acidity is narratively addressed to be exceeded by the alkalinity at all times, because a numeric standard was not included in the permit, no WLA is assigned for this parameter. All WLAs were calculated using the methodology explained in the *Method to Quantify Treatment Pond Pollutant Load* section of this report. No required reduction of these permits is necessary at this time because there are nonpoint contributions upstream and downstream of discharges that when reduced will satisfy the TMDL. All necessary reductions are assigned to the nonpoint sources. Table 6 contains the WLAs for the two permitted operations, MRKY, SHD1a, SHD1b, and the future site.

The fourth WLA, for the future site, was calculated and incorporated into the allocations at DEER4.0, the next downstream site on the mainstem of Deer Creek. It is anticipated that there will be mining in the Deer Creek Watershed in the near future based on available coal reserves, mining operator interests, and other factors. A WLA that is representative of one future surface mining operation has been included to accommodate this eventuality.

Table 6. Waste load Allocation of Permitted Operations

Parameter	Allowable Average Monthly Conc. (mg/l)	Average Flow (MGD)	Allowable Load (lbs/day)
MRKY			
Fe	3.0	0.0446	1.1
Mn	2.0	0.0446	0.7
Al	2.0	0.0446	0.7
SHD1a			
Fe	3.0	0.0446	1.1
Mn	2.0	0.0446	0.7
Al	2.0	0.0446	0.7
SHD1b			
Fe	3.0	0.0264	0.7
Mn	2.0	0.0264	0.4
Al	2.0	0.0264	0.4
Future WLA			
Fe	3.0	0.0446	1.1
Mn	2.0	0.0446	0.7
Al	2.0	0.0446	0.7

RECOMMENDATIONS

Two primary programs in Pennsylvania that provide reasonable assurance for maintenance and improvements of water quality in the watershed are in effect. The PADEP's efforts to reclaim abandoned mine lands, coupled with its duties and responsibilities for issuing NPDES permits, will be the focal points in water quality improvement.

Additional opportunities for water quality improvement are both ongoing and anticipated. Historically, a great deal of research into mine drainage has been conducted by PADEP's Bureau of Abandoned Mine Reclamation (BAMR) (which administers and oversees the Abandoned Mine Reclamation Program in Pennsylvania), the U. S. Office of Surface Mining, the National Mine Land Reclamation Center, the National Environmental Training Laboratory, and many other agencies and individuals. Funding from USEPA's 319 Grant program and Pennsylvania's Growing Greener program has been used extensively to remedy mine drainage impacts. These activities are expected to continue and result in water quality improvement.

The PADEP BAMR administers an environmental regulatory program for all mining activities, including mine subsidence regulation, mine subsidence insurance, and coal refuse disposal. PADEP BAMR also conducts a program to ensure safe underground bituminous mining and protect certain structures from subsidence; administers a mining license and permit program; administers a regulatory program for the use, storage, and handling of explosives; and provides for training, examination, and certification of applicant's blaster's licenses. In addition, PADEP

BAMR administers a loan program for bonding anthracite underground mines and for mine subsidence, administers the USEPA Watershed Assessment Grant Program, the Small Operator's Assistance Program (SOAP), and the Remining Operator's Assistance Program (ROAP).

Reclaim PA is PADEP's initiative designed to maximize reclamation of the state's quarter million acres of abandoned mineral extraction lands. Abandoned mineral extraction lands in Pennsylvania constitute a significant public liability - more than 250,000 acres of abandoned surface mines, 2,400 miles of stream polluted with AMD, over 7,000 orphaned and abandoned oil and gas wells, widespread subsidence problems, numerous hazardous mine openings, mine fires, abandoned structures, and affected water supplies – representing as much as one third of the total problem nationally.

Since the 1960s, Pennsylvania has been a national leader in establishing laws and regulations to ensure mine reclamation and well plugging occur after active operation is completed. Mine reclamation and well plugging refers to the process of cleaning up environmental pollutants and safety hazards associated with a site and returning the land to a productive condition, similar to PADEP's Brownfields Program. Pennsylvania is striving for complete reclamation of its abandoned mines and plugging of its orphan wells. Realizing this task is no small order, PADEP has developed Reclaim PA, a collection of concepts to make abandoned mine reclamation easier. These concepts include legislative, policy, and land management initiatives designed to enhance mine operator/volunteer/PADEP reclamation efforts. Reclaim PA has the following four objectives:

- To encourage private and public participation in abandoned mine reclamation efforts.
- To improve reclamation efficiency through better communication between reclamation partners.
- To increase reclamation by reducing remining risks.
- To maximize reclamation funding by expanding existing sources and exploring new sources.

PUBLIC PARTICIPATION

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* on November 13, 2004, and The Progress on November 13, 2004, to foster public comment on the allowable loads calculated. A public meeting was held on November 22, 2004, at the Clearfield County Conservation District Office, to discuss the proposed TMDL.

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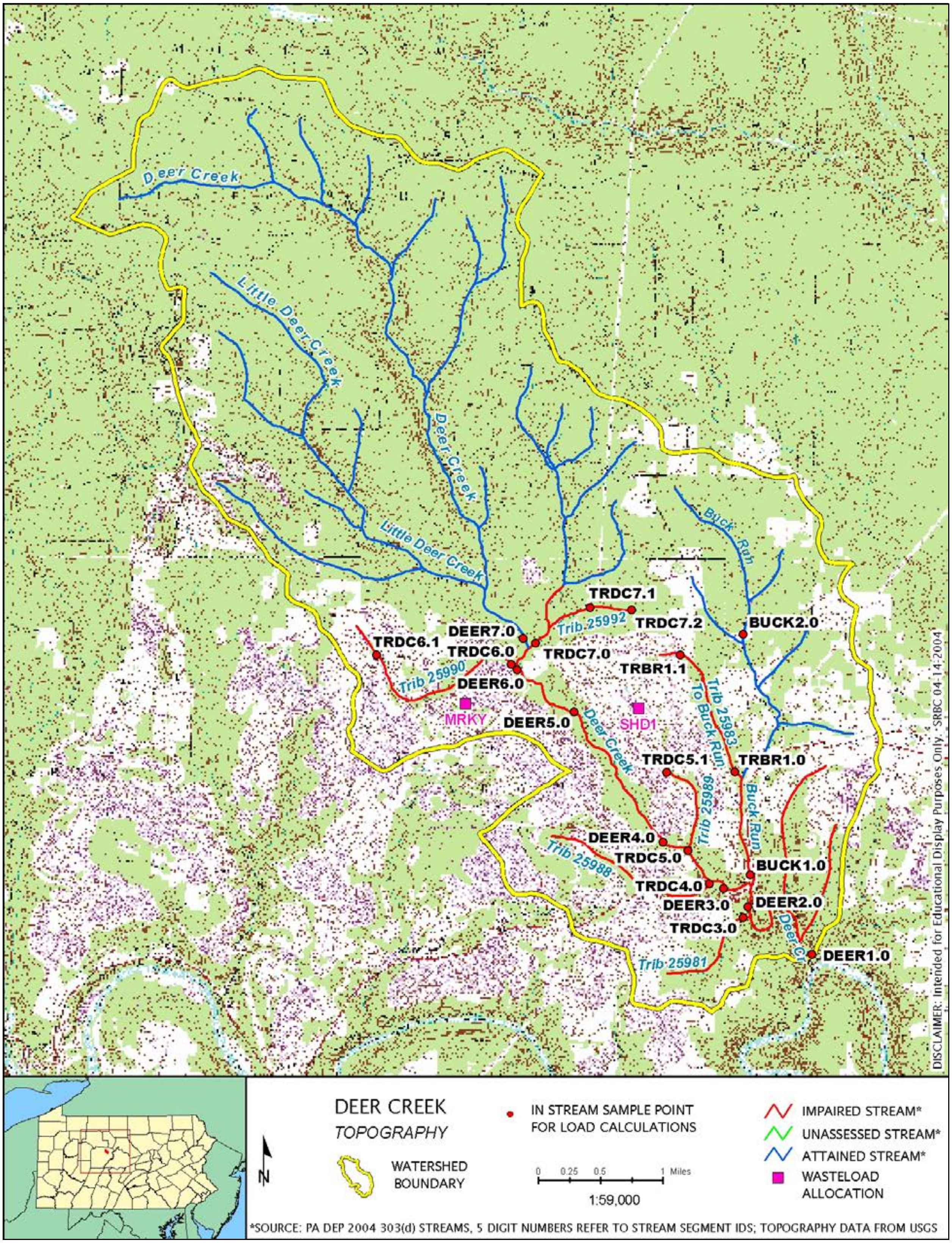
U. S. Department of Agriculture. 2004. National Resources Conservation Service: Official Soil Series Descriptions. http://soils.usda.gov/technical/classification/osd/index.html

Attachment A

Deer Creek Watershed Map



Deer Creek
Little Deer Creek
Deer Creek
Little Deer Creek
Buck Run
TRDC7.1
TRDC7.2
BUCK2.0
DEER7.0
TRDC6.1
TRDC6.0
TRDC7.0
Trib 25992
TRBR1.1
Trib 25990
DEER6.0
MRKY
DEER5.0
SHD1
Deer Creek
Trib 25983
To Buck Run
TRDC5.1
TRBR1.0
Trib 25989
Buck Run
DEER4.0
TRDC5.0
Trib 25988
BUCK1.0
TRDC4.0
DEER3.0
DEER2.0
TRDC3.0
Deer Cr
DEER1.0
Trib 25981
DISCLAIMER: Intended for Educational Display Purposes Only. SRBC 04-14-2004
DEER CREEK
TOPOGRAPHY
WATERSHED BOUNDARY
IN STREAM SAMPLE POINT FOR LOAD CALCULATIONS
0 0.25 0.5 1 Miles
1:59,000
IMPAIRED STREAM*
UNASSESSED STREAM*
ATTAINED STREAM*
WASTELOAD ALLOCATION
N
*SOURCE: PA DEP 2004 303(d) STREAMS, 5 DIGIT NUMBERS REFER TO STREAM SEGMENT IDS; TOPOGRAPHY DATA FROM USGS

Attachment B

Excerpts Justifying Changes Between the 1996, 1998, Draft 2000, and 2002 Section 303(d) Lists and the Draft 2004 Integrated List

The following are excerpts from the Pennsylvania DEP 303(d) narratives that justify changes in listings between the 1996, 1998, draft 2000, 2002, and 2004 lists. The 303(d) listing process has undergone an evolution in Pennsylvania since the development of the 1996 list.

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

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

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

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

The most notable difference between the 1998 and Draft 2000 Section 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 PADEP's five-digit stream code. As a result, the unnamed tributary records are now split out as separate records on the 2000 Section 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 USEPA and PADEP on the Draft 2000 Section 303(d) list, the 2002 Pa. Section 303(d) list was written in a manner similar to the 1998 Section 303(d) list.

In 2004, Pennsylvania developed the Integrated List of All Waters. The water quality status of Pennsylvania's waters is summarized using a five-part categorization of waters according to their water quality standard (WQS) attainment status. The categories represent varying levels of WQS attainment, ranging from Category 1, where all designated water uses are met, to Category 5, where impairment by pollutants requires a TMDL to correct. These category determinations are based on consideration of data and information consistent with the methods outlined by the Statewide Surface Water Assessment Program. Each PADEP five-digit waterbody segment is placed in one of the WQS attainment categories. Different segments of the same stream may appear on more than one list if the attainment status changes as the water flows downstream. The listing categories are as follows:

Category 1: Waters attaining all designated uses.

Category 2: Waters where some, but not all, designated uses are met. Attainment status of the remaining designated uses is unknown because data are insufficient to categorize a water consistent with the state's listing methodology.

Category 3: Waters for which there are insufficient or no data and information to determine, consistent with the state's listing methodology, if designated uses are met.

Category 4: Waters impaired for one or more designated use but not needing a TMDL. States may place these waters in one of the following three subcategories:

- TMDL has been completed.
- Expected to meet all designated uses within a reasonable timeframe.
- Not impaired by a pollutant.

Category 5: Waters impaired for one or more designated uses by any pollutant. Category 5 includes waters shown to be impaired as the result of biological assessments used to evaluate aquatic life use even if the specific pollutant is not known unless the state can demonstrate that nonpollutant stressors cause the impairment or that no pollutant(s) causes or contribute to the impairment. Category 5 constitutes the Section 303(d) list that USEPA will approve or disapprove under the Clean Water Act. Where more than one pollutant is causing the impairment, the water remains in Category 5 until all pollutants are addressed in a completed USEPA-approved TMDL or one of the delisting factors is satisfied.

Attachment C

Method for Addressing 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 Pa. Code, 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.*

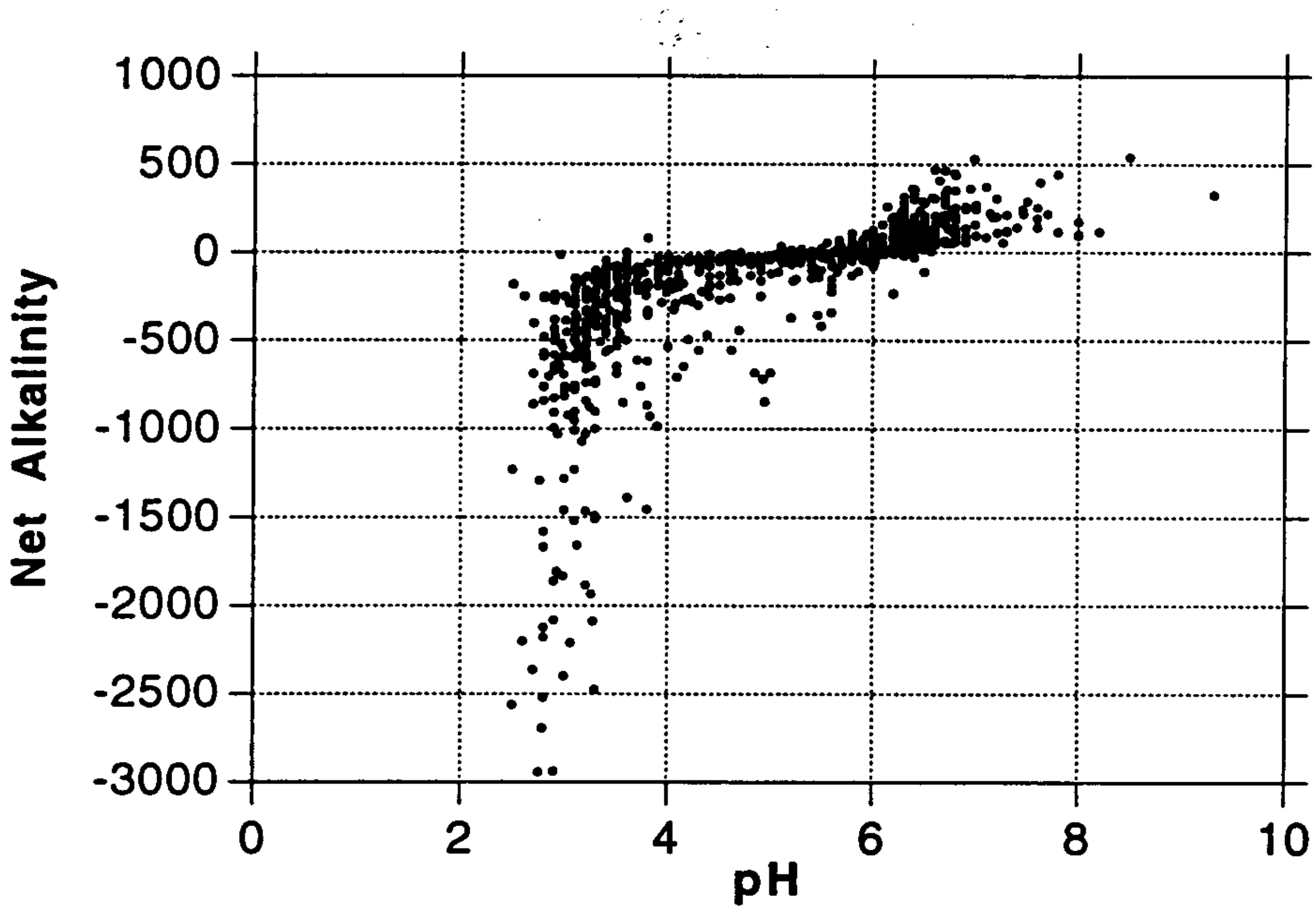


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania.

Attachment D
TMDLs By Segment

Deer Creek

The TMDL for the Deer Creek Watershed consists of load allocations to six tributaries and seven sampling sites along the stream. Waste load allocations (WLAs) are assigned to the two active mining operations in the watershed and one WLA is assigned for a possible new operation in the future.

Deer Creek is listed as impaired on the Section 303(d) list by both high metals and low pH from AMD as the cause of the degradation to the stream. For pH, the objective is to reduce acid loading to the stream that will in turn raise the pH to the acceptable range. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 2). The method and rationale for addressing pH is contained in Attachment C.

An allowable long-term average instream concentration for iron, manganese, aluminum, and acidity was determined at each sample point. 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 the percent reduction times the 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.

DEER7.0: Deer Creek Above Mining Impacts

The headwaters of Deer Creek begin in the Moshannon State Forest in Girard Township, Clearfield County, Pennsylvania, just south of the Caledonia Pike. The watershed is mostly forested and very remote in the northern portions and access is limited to hiking or use of all-terrain vehicle trails. Deer Creek flows into coal bearing strata in the southern portion of its watershed.

Deer Creek above point DEER7.0 is not listed on the Section 303(d) list as being impaired by AMD; therefore, a TMDL will not be done for this point. An average instream flow measurement was available for point DEER7.0 (11.05 mgd). The average concentrations of metals and acidity at point DEER7.0 for this stream segment are presented in Table D1.

Table D1. TMDL Calculations at Point DEER7.0				
Flow = 11.05 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	<0.30	<27.7	*	*
Mn	0.36	33.2	*	*
Al	<0.50	<46.1	*	*
Acidity	14.6	1,345.9	*	*
Alkalinity	8.13	749.5	*	*

TRDC7.2: Unnamed Tributary 25992 to Deer Creek; Between the Forfeited Mines

The Unnamed Tributary 25992 to Deer Creek at point TRDC7.2 represents the stream between the forfeited permits of the Ingram Coal Company operation and Al Hamilton Contracting Corporation, Buck Run #2 Mine. There is a low volume but highly acidic discharge from the forfeited Ingram Coal Company mine permit that enters the stream before this point.

The TMDL for this section of the UNT 25992 Deer Creek consists of a load allocation to the watershed area above TRDC7.2. Addressing the mining impacts above this point addresses the impairment for the stream segment. An average instream flow measurement was available for point TRDC7.2 (0.04 mgd). The load allocations made at point TRDC7.2 for this stream segment are presented in Table D2.

There is currently no entry for this segment on the Pennsylvania Section 303(d) list for impairment due to pH. Sample data for point TRDC7.2 shows pH ranging between 2.87 and 3.5, with an average pH of 3.11; therefore, pH will be addressed in this TMDL. Load reductions for acidity were calculated using the instream average alkalinity as the water quality standard for acidity at point TRDC7.2. The objective is to reduce acid loading to the stream, which will, in turn, raise the pH to the desired range and keep a net alkalinity above zero 99 percent of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see Table 3). The method and rationale for addressing pH is contained in Attachment C.

Table D2. TMDL Calculations at Point TRDC7.2				
Flow = 0.04 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	17.69	6.0	0.35	0.1
Mn	25.65	8.7	0.26	0.1
Al	9.98	3.4	0.20	0.1
Acidity	206.46	70.4	0.00	0.0
Alkalinity	0.00	0.0		

Table D3. Calculation of Load Reduction Necessary at Point TRDC7.2				
	***Fe* (lbs/day)**	***Mn* (lbs/day)**	***Al* (lbs/day)**	***Acidity* (lbs/day)**
Existing load	6.0	8.7	3.4	70.4
Existing load from upstream points (none)	0	0	0	0
Difference of existing load and upstream existing load	6.0	8.7	3.4	70.4
Allowable loads from upstream points	0	0	0	0
Total load at TRDC7.2	6.0	8.7	3.4	70.4
Allowable load at TRDC7.2	0.1	0.1	0.1	0.0
Waste load allocation	0	0	0	0
Remaining load at TRDC7.2	0.1	0.1	0.1	0.0
Load Reduction at TRDC7.2 (Total load at TRDC7.2 - Allowable load at TRDC7.2)	5.9	8.6	3.3	70.4
Percent reduction required at TRDC7.2	98	99	97	100

The TMDL for point TRDC7.2 requires a load allocation for total iron, total manganese, total aluminum, and acidity.

TRDC7.1: UNT 25992 Deer Creek; After Both of the Forfeited Mine Permits

The UNT 25992 to Deer Creek at point TRDC7.1 represents the stream after the addition of a second discharge caused by the Al Hamilton Contracting Company Buck Run #2 job, in addition to the discharge from the forfeited Ingram Coal Company permit. The Al Hamilton Contracting Company forfeited all bond on September 23, 2003, and established a trust fund to treat discharges from sites formerly operated by the company (PADEP Newsletter, October 31, 2003). The trust fund, valued at seven million dollars, will be used to fund active treatment at four sites and to maintain passive treatment at four sites. The PADEP is currently evaluating the Buck Run #2 discharge for continued treatment options (Cram, 2004).

The TMDL for the UNT 25992 Deer Creek at point TRDC7.1 consists of a load allocation to the watershed area between points TRDC7.2 and TRDC7.1. Addressing the mining impacts between these point addresses the impairment for the segment. An instream flow measurement was available for point TRDC7.1 (0.25 mgd). The load allocations made at point TRDC7.1 for this stream segment are presented in Table D4.

There is currently no entry for this segment on the Pennsylvania Section 303(d) list for impairment due to pH. Sample data for point TRDC7.1 shows pH ranging between 3.02 and 7.02, with an average pH of 5.29; therefore, pH will be addressed in this TMDL. Load reductions for acidity were calculated using the instream average alkalinity as the water quality standard for acidity at point TRDC7.1. The objective is to reduce acid loading to the stream, which will, in turn, raise the pH to the desired range and keep a net alkalinity above zero 99 percent of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see Table 3). The method and rationale for addressing pH is contained in Attachment C.

Table D4. TMDL Calculations at Point TRDC7.1				
Flow = 0.25 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	9.15	18.9	0.27	0.6
Mn	18.00	37.1	0.18	0.4
Al	6.92	14.3	0.21	0.4
Acidity	62.56	129.1	5.63	11.6
Alkalinity	37.53	77.4		

The calculated load reductions for all the loads that enter point TRDC7.1 must be accounted for in the calculated reductions at sample point TRDC7.1, shown in Table D5. A comparison of measured loads between points TRDC7.2 and TRDC7.1 show that there is additional loading entering the segment for all parameters.

Table D5. Calculation of Load Reduction Necessary at Point TRDC7.1				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	18.9	37.1	14.3	129.1
Existing load from upstream points (TRDC7.2)	6.0	8.7	3.4	70.4
Difference of existing load and upstream existing load	12.9	28.4	10.9	58.7
Allowable loads from upstream points	0.1	0.1	0.1	0.0
Total load at TRDC7.1	13.0	28.5	11.0	58.7
Allowable load at TRDC7.1	0.6	0.4	0.4	11.6
Waste load allocation	0	0	0	0
Remaining load at TRDC7.1	0.6	0.4	0.4	11.6
Load Reduction at TRDC7.1 (Total load at TRDC7.1 - Allowable load at TRDC7.1)	12.4	28.1	10.6	47.1
Percent reduction required at TRDC7.1	95	99	96	80

The TMDL for point TRDC7.1 requires a load allocation for total iron, total manganese, total aluminum, and acidity.

TRDC7.0: UNT 25991 to Deer Creek at its mouth

The UNT 25991 to Deer Creek at point TRDC7.0 represents conditions at the mouth of the tributary after the mixing of the polluted waters from UNT 25992 and the unimpaired waters of UNT 25991.

There were fewer total iron and total aluminum data above the detection limit than necessary for this allocation point to conduct Monte Carlo analysis; therefore, it was not evaluated for this TMDL. However, the observations for iron and aluminum, shown in Attachment E, indicate that the stream is meeting water quality standards for iron and aluminum at this site.

The TMDL for this section of the UNT 25991 to Deer Creek consists of a load allocation to all of the watershed area between points TRDC7.1 and TRDC7.0. Addressing the mining impacts between these points addresses the impairment for the segment. An instream flow measurement was available for point TRDC7.0 (2.24 mgd). The load allocations made at point TRDC7.2 for this stream segment are presented in Table D6.

There is currently no entry for this segment on the Pennsylvania Section 303(d) list for impairment due to pH. Sample data for point TRDC7.0 shows pH ranging between 5.1 and 6.6, with an average pH of 5.73; therefore, pH will be addressed in this TMDL. Load reductions for acidity were calculated using the instream average alkalinity as the water quality standard for acidity at point TRDC7.0. The objective is to reduce acid loading to the stream, which will, in turn, raise the pH to the desired range and keep a net alkalinity above zero 99 percent of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see Table 3). The method and rationale for addressing pH is contained in Attachment C.

Table D6. TMDL Calculations at Point TRDC7.0

Flow =2.24 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	ND	*	*	*
Mn	1.59	29.8	0.29	5.4
Al	ND	*	*	*
Acidity	28.57	534.7	3.14	58.8
Alkalinity	13.30	248.9		

The calculated load reductions for all the loads that enter point TRDC7.0 must be accounted for in the calculated reductions at sample point TRDC7.0, shown in Table D7. A comparison of measured loads between points TRDC7.1 and TRDC7.0 show that there is additional loading of acidity entering the segment; the other parameters show a decrease in loading.

Table D7. Calculation of Load Reduction Necessary at Point TRDC7.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	ND	29.8	ND	534.7
Existing load from upstream points (TRDC7.1)	18.9	37.1	14.3	129.1
Difference of existing load and upstream existing load	*	-7.3	*	405.6
Allowable loads from upstream points	0.6	0.4	0.4	11.6
Percent load loss due to instream processes	*	20	*	0
Percent load remaining at TRDC7.0	*	80	*	100
Total load at TRDC7.0	0.3	0.3	0.3	417.2
Allowable load at TRDC7.0	*	5.4	*	58.8
Waste load allocation	0	0	0	0
Remaining load at TRDC7.0	*	5.4	*	58.8
Load Reduction at TRDC7.0 (Total load at TRDC7.0 - Allowable load at TRDC7.0)	0	0	0	358.4
Percent reduction required at TRDC7.0	0	0	0	86

The TMDL for UNT 25991 to Deer Creek at point TRDC7.0 requires a load reduction for all areas between TRDC7.1 and TRDC7.0 for acidity. TRDC7.0 does not require a load reduction for total manganese. All necessary reductions have been made upstream of this point. Also, there is no load reduction for total iron or total aluminum because the data set, found in Attachment E, shows that the average concentrations for these parameters are below detection limits and thus are meeting water quality standards.

TRDC6.1: The Unnamed Tributary to Deer Creek above Moravian Run Kyler Operation

The headwaters of the UNT 25990 to Deer Creek begin to the southeast of Gillingham. Pre-Act mining operations placed coal refuse over the headwaters of the stream above this point. The coal spoils add metals and acidity to the stream.

The TMDL for the headwaters of the UNT 25990 to Deer Creek consists of a load allocation to all of the watershed area above point TRDC6.1. Addressing the mining impacts above this point addresses the impairment for the segment. An instream flow measurement was available for point TRDC6.1 (0.02 mgd). The load allocations made at point TRDC6.1 for this stream segment are presented in Table D8.

Table D8. TMDL Calculations at Point TRDC6.1				
Flow = 0.02 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	0.97	0.2	0.54	0.1
Mn	4.68	0.9	0.51	0.1
Al	8.14	1.6	0.57	0.1
Acidity	78.86	15.2	0.00	0.0
Alkalinity	0.00	0.0		

Table D9. Calculation of Load Reduction Necessary at Point TDC6.1				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	0.2	0.9	1.6	15.2
Existing load from upstream points (none)	0	0	0	0
Difference of existing load and upstream existing load	0.2	0.9	1.6	15.2
Allowable loads from upstream points	0	0	0	0
Total load at TRDC6.1	0.2	0.9	1.6	15.2
Allowable load at TRDC6.1	0.1	0.1	0.1	0.0
Waste load allocation	0	0	0	0
Remaining load at TRDC6.1	0.1	0.1	0.1	0.0
Load Reduction at TRDC6.1 (Total load at TRDC6.1 - Allowable load at TRDC6.1)	0.1	0.8	1.5	15.2
Percent reduction required at TRDC6.1	50	89	94	100

The TMDL for point TRDC6.1 requires that a load reduction be applied to all areas of UNT 25990 above TRDC6.1 for total iron, total manganese, total aluminum, and acidity.

MRKY: Moravian Run Kyler Operation

The Moravian Run Reclamation Company, Inc., MP#17020106 operates a surface mine along the banks of the UNT 25990 to Deer Creek. The permit is considered to be Sub-F since the operation will reclaim 142 acres of abandoned mine lands and 3,100 feet of dangerous highwall. In addition, the company will use alkaline material in the backfill during reclamation to reduce the possibility of AMD emanating from the site (PADEP Update, April 25, 2003). Any discharge from the operations treatment pond is treated to the Best Available Technology (BAT) limits, assigned in the mining permit, before entering the UNT 25990 Deer Creek.

MRKY is considered to be a point source discharge in the watershed; therefore, the allocation made at this point is a waste load allocation (WLA). The WLAs for iron, manganese, and aluminum were calculated using the methodology explained in the *Method to Quantify Treatment Pond Pollutant Load* section of this report. The Kyler operation, permit #17020106, does not have a BAT limit for aluminum for UNT 25900. It has an aluminum standard of 1.8 mg/L for a tributary to UNT 25900. The standard BAT limit of 2.0 mg/L was used to determine the WLA for the UNT 25900. Table D10 shows the waste load allocations for the discharge.

Table D10. Waste load Allocations at MRKY			
Parameter	***Monthly Avg. Allowable Conc. (mg/l)***	***Average Flow (MGD)***	***Allowable Load (lbs/day)***
MRKY			
Fe	3.0	0.0446	1.1
Mn	2.0	0.0446	0.7
Al	2.0	0.0446	0.7

TRDC6.0: The UNT 25990 to Deer Creek at its mouth

The UNT 25990 to Deer Creek at point TRDC6.0 represents the stream at its mouth, after the Moravian Run Reclamation Company Kyler permit. Several discharges from Pre-Act mining also enter the stream before the mouth.

The TMDL for this section of the UNT 25990 to Deer Creek consists of a load allocation to all of the watershed area between points TRDC6.1 and TRDC6.0. Addressing the mining impacts between these points addresses the impairment for the segment. An average instream flow measurement was available for point TRDC6.0 (0.52 mgd). Load reductions for acidity were calculated using the instream average alkalinity as the water quality standard for acidity at point TRDC6.0. The load allocations made at point TRDC6.0 for this stream segment are presented in Table D11.

Table D11. TMDL Calculations at Point TRDC6.0				
Flow = 0.52 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	0.71	3.1	0.50	2.2
Mn	3.06	13.2	0.58	2.5
Al	2.13	9.2	0.19	0.8
Acidity	0.59	2.5	0.59	2.5
Alkalinity	82.96	357.4		

The calculated load reductions for all the loads that enter point TRDC6.0 must be accounted for in the calculated reductions at sample point TRDC6.0, shown in Table D12. A comparison of measured loads between points TRDC6.1 and TRDC6.0 shows that there is additional loading entering the segment for all parameters except acidity.

Table D12. Calculation of Load Reduction Necessary at Point TRDC6.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	3.1	13.2	9.2	2.5
Existing load from upstream points (TRDC6.1)	0.2	0.9	1.6	15.2
Difference of existing load and upstream existing load	2.9	12.3	7.6	-12.7
Allowable loads from upstream points	0.1	0.1	0.1	0.0
Percent load loss due to instream processes	0	0	0	84
Percent load remaining at TRDC6.0	100	100	100	16
Total load at TRDC6.0	3.0	12.4	7.7	0.0
Allowable load at TRDC6.0	2.2	2.5	0.8	2.5
Waste load allocation (MRKY)	1.1	0.7	0.7	0.0
Remaining load at TRDC6.0	1.1	1.8	0.1	2.5
Load Reduction at TRDC6.0 (Total load at TRDC6.0 - Allowable load at TRDC6.0)	0.8	9.9	6.9	0.0
Percent reduction required at TRDC6.0	27	80	90	0

The TMDL for the segment of UNT Deer Creek between TRDC6.1 and TRDC6.0 requires a load reduction for total iron, total manganese, and total aluminum. A load reduction is not needed for acidity. All necessary reductions have been made upstream of this point.

DEER6.0: Deer Creek after the UNT 25990

Deer Creek at point DEER6.0 represents the stream after the first additions of AMD from the two unnamed tributaries 25991 and 25990.

There were fewer total iron data above the detection limit than necessary for this allocation point to conduct Monte Carlo analysis; therefore, it was not evaluated for this TMDL. However, the observations for iron, shown in Attachment E, indicate that the stream is meeting water quality standards for iron at this site.

The TMDL for this section of Deer Creek consists of a load allocation to all of the watershed area between points DEER7.0 and DEER6.0. Addressing the mining impacts between these points addresses the impairment for the segment. An instream flow measurement was available for point DEER6.0 (14.38 mgd). Load reductions for acidity were calculated using the instream average alkalinity as the water quality standard for acidity at point DEER6.0. The load allocations made at point DEER6.0 for this stream segment are presented in Table D13.

Table D13. TMDL Calculations at Point DEER6.0				
Flow = 14.38 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	ND	*	*	*
Mn	1.00	120.0	0.37	44.4
Al	0.67	80.4	0.31	37.2
Acidity	19.95	2,393.0	2.59	310.7
Alkalinity	12.25	1,469.4		

The calculated load reductions for all the loads that enter point DEER6.0 must be accounted for in the calculated reductions at sample point DEER6.0, shown in Table D14. A comparison of measured loads between points TRDC7.0, TRDC6.0, and DEER6.0 shows that there is additional loading entering the segment for all parameters.

Table D14. Calculation of Load Reduction Necessary at Point DEER6.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	ND	120.0	80.4	2,393.0
Existing load from upstream points (TRDC7.0, TRDC6.0)	3.1	43.0	9.2	537.2
Difference of existing load and upstream existing load	*	77.0	71.2	1,855.8
Allowable loads from upstream points	2.2	7.9	0.8	61.2
Total load at DEER6.0	*	84.9	72.0	1,917.0
Allowable load at DEER6.0	*	44.4	37.2	310.7
Waste load allocation	0	0	0	0
Remaining load at DEER6.0	*	44.4	37.2	310.7
Load Reduction at DEER6.0 (Total load at DEER6.0 - Allowable load at DEER6.0)	*	40.5	34.8	1,606.3
Percent reduction required at DEER6.0	*	47	48	84

The TMDL for Deer Creek at point DEER6.0 requires a load reduction for total manganese, total aluminum, and acidity. No load reduction is made for total iron. The data set, found in Attachment E, shows that total iron is below detection limits and thus is meeting water quality standards at this point.

DEER5.0: Deer Creek Upstream of the Sky Haven Deer Creek #1 Mine

Deer Creek at point DEER5.0 represents the stream before the Sky Haven Coal Company Deer Creek #1 permit and a discharge from an abandoned deep mine. Several AMD seeps and a possible deep mine discharge enters the stream between DEER6.0 and DEER5.0

There were fewer total aluminum data above the detection limit than necessary for this allocation point to conduct Monte Carlo analysis; therefore, it was not evaluated for this TMDL. However, the observations for aluminum, shown in Attachment E, indicate that the stream is meeting water quality standards for total aluminum at this site.

The TMDL for this section of Deer Creek consists of a load allocation to all of the watershed area between points DEER6.0 and DEER5.0. Addressing the mining impacts between these points addresses the impairment for the segment. An instream flow measurement was available for point DEER5.0 (14.50 mgd). Load reductions for acidity were calculated using the instream average alkalinity as the water quality standard for acidity at point DEER5.0. The load allocations made at point DEER5.0 for this stream segment are presented in Table D15.

Table D15. TMDL Calculations at Point DEER5.0

Flow = 14.50 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	0.26	31.4	0.20	24.2
Mn	1.80	217.7	0.07	8.5
Al	ND	*	*	*
Acidity	5.04	609.6	2.12	256.4
Alkalinity	11.18	1,352.3		

The calculated load reductions for all the loads that enter point DEER5.0 must be accounted for in the calculated reductions at sample point DEER5.0, shown in Table D16. A comparison of measured loads between points DEER6.0 and DEER5.0 shows that the loading for the parameters has decreased in the segment except for manganese, which has increased.

Table D16. Calculation of Load Reduction Necessary at Point DEER5.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	31.4	217.7	*	609.6
Existing load from upstream points (DEER6.0)	*	120.0	80.4	2,393.0
Difference of existing load and upstream existing load	*	97.7	*	-1,783.4
Allowable loads from upstream points	*	44.4	37.2	310.6
Percent load loss from instream processes	*	0	*	75
Percent load remaining at DEER5.0	*	100	*	25
Total load at DEER5.0	31.4	142.1	*	77.7
Allowable load at DEER5.0	24.2	8.5	*	256.4
Waste load allocation	0	0	0	0
Remaining load at DEER5.0	24.2	8.5	*	256.4
Load Reduction at DEER5.0 (Total load at DEER5.0 - Allowable load at DEER5.0)	7.2	133.6	*	0
Percent reduction required at DEER5.0	23	94	*	0

The TMDL for Deer Creek at point DEER5.0 does not require a load reduction for acidity. All necessary reductions have been made upstream of this point. Also, there is no load reduction for total aluminum because the data set, found in Attachment E, shows that aluminum is below detection limits at this site and thus is meeting water quality standards. DEER5.0 requires a load reduction for total iron and total manganese.

SHD1a: Sky Haven Deer Run #1 Operation

Sky Haven Coal, Inc., MP#17860104 operates a surface mine along the banks on the eastern hill of the Deer Creek valley. The permitted area straddles the watershed divide between the mainstem of Deer Creek and its tributary Buck Run. Two WLAs are being assigned to this permit because of the divide. One of the WLAs, SHD1a, will be assigned upstream of DEER4.0. The second WLA, SHD1b, will be assigned to UNT 25983 to Buck Run. Any discharge from the operations treatment pond is treated to the BAT limits, assigned in the mining permit, before entering Deer Creek.

SHD1a is considered to be a point source discharge in the watershed; therefore, the allocation made at this point is a WLA. The WLAs for iron, manganese, and aluminum were calculated using the methodology explained in the *Method to Quantify Treatment Pond Pollutant Load* section of this report. Table D17 shows the WLAs for the discharge.

Table D17. Waste load Allocations at SHD1a			
Parameter	***Monthly Avg. Allowable Conc. (mg/l)***	***Average Flow (MGD)***	***Allowable Load (lbs/day)***
SHD1a			
Fe	3.0	0.0446	1.1
Mn	2.0	0.0446	0.7
Al	2.0	0.0446	0.7

Future Mining Waste Load Allocation

It is anticipated that there will be mining in the Deer Creek Watershed in the near future based on available coal reserves, mining operator interests, 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 of this report. Table D18 shows the WLAs for the discharge.

Table D18. Waste load Allocations for Future Mining Site			
Parameter	***Monthly Avg. Allowable Conc. (mg/l)***	***Average Flow (MGD)***	***Allowable Load (lbs/day)***
SHD1			
Fe	3.0	0.0446	1.1
Mn	2.0	0.0446	0.7
Al	2.0	0.0446	0.7

DEER4.0: Deer Creek Downstream of the Sky Haven Deer Creek #1 Mine

Deer Creek at point DEER4.0 represents the stream after the Sky Haven Coal Company Deer Creek #1 permit and a discharge from an abandoned deep mine.

The TMDL for this section of Deer Creek consists of a load allocation to all of the watershed area between points DEER5.0 and DEER4.0. Addressing the mining impacts between these points addresses the impairment for the segment. An instream flow measurement was available for point DEER4.0 (17.81 mgd). Load reductions for acidity were calculated using the instream average alkalinity as the water quality standard for acidity at point DEER4.0. The load allocations made at point DEER4.0 for this stream segment are presented in Table D19.

Table D19. TMDL Calculations at Point DEER4.0				
Flow = 17.81 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	0.96	142.6	0.29	43.1
Mn	1.58	234.7	0.33	49.0
Al	0.59	87.7	0.13	19.3
Acidity	20.40	3,030.9	2.65	393.7
Alkalinity	11.48	1,705.6		

The calculated load reductions for all the loads that enter point DEER4.0 must be accounted for in the calculated reductions at sample point DEER4.0, shown in Table D20. A comparison of measured loads between points DEER5.0 and DEER4.0 show that there is additional loading entering the segment for all parameters.

Table D20. Calculation of Load Reduction Necessary at Point DEER4.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	142.6	234.7	87.7	3,030.9
Existing load from upstream points (DEER5.0)	31.4	217.7	*	609.6
Difference of existing load and upstream existing load	111.2	17.0	*	2,421.3
Allowable loads from upstream points	24.2	8.5	*	258.2
Total load at DEER4.0	135.4	25.5	87.7	2,679.5
Allowable load at DEER4.0	43.1	49.0	19.3	393.7
Waste load allocation (SHD1A, WLA)	1.1, 1.1	0.7, 0.7	0.7, 0.7	0.0, 0.0
Remaining load at DEER4.0	40.9	47.6	17.9	393.7
Load Reduction at DEER4.0 (Total load at DEER4.0 – (Allowable load at DEER4.0 – WLA))	93.4	0.0	68.7	2,285.8
Percent reduction required at DEER4.0	69	0	79	85

The TMDL for Deer Creek at point DEER4.0 does not require a load reduction for total manganese. All necessary reductions have been made upstream of this point. DEER4.0 requires a load reduction for total iron, total aluminum, and acidity.

TRDC5.1: The UNT 25989 to Deer Creek South of the Sky Haven Deer Creek #1 Mine

The headwaters of the UNT 25989 to Deer Creek begin to the south of Sky Haven Deer Creek #1 Mine. Pre-Act mining operations placed coal refuse over the headwaters of the stream above this point. The coal spoils add metals and acidity to the stream. There is also a seep zone from Lower Kittanning spoil that enters the stream above this point.

The TMDL for the headwaters of the UNT 25989 to Deer Creek consists of a load allocation to all of the watershed area above point TRDC5.1. Addressing the mining impacts above this point addresses the impairment for the segment. An instream flow measurement was available for point TRDC5.1 (0.01 mgd). Load reductions for acidity were calculated using the instream average alkalinity as the water quality standard for acidity at point TRDC5.1. The load allocations made at point TRDC5.1 for this stream segment are presented in Table D21.

Table D21. TMDL Calculations at Point TRDC5.1				
Flow = 0.01 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	0.92	0.05	0.60	0.03
Mn	23.39	1.15	0.12	0.01
Al	*	*	*	*
Acidity	97.20	4.78	0.39	0.02
Alkalinity	0.77	0.04		

Table D22. Calculation of Load Reduction Necessary at Point TRDC5.1				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	0.05	1.15	*	4.78
Existing load from upstream points (none)	0	0	0	0
Difference of existing load and upstream existing load	0.05	1.15	*	4.78
Allowable loads from upstream points	0	0	0	0
Total load at TRDC5.1	0.05	1.15	*	4.78
Allowable load at TRDC5.1	0.03	0.01	*	0.02
Waste load allocation	0	0	0	0
Remaining load at TRDC5.1	0.03	0.01	*	0.02
Load Reduction at TRDC5.1 (Total load at TRDC5.1 - Allowable load at TRDC5.1)	0.02	1.14	*	4.76
Percent reduction required at TRDC5.1	40	99.1	*	99.6

The TMDL for point TRDC5.1 requires that a load allocation be applied to all areas of UNT 25989 above TRDC5.1 for total iron, total manganese, and acidity.

TRDC5.0: The UNT 25989 to Deer Creek at its mouth

The UNT 25989 to Deer Creek at point TRDC5.0 represents the stream at its mouth. Large areas of the watershed were disturbed by Pre-Act mining, it is possible that AMD enters the stream from these disturbed areas.

The TMDL for this section of the UNT 25989 to Deer Creek consists of a load allocation to all of the watershed area between points TRDC5.1 and TRDC5.0. Addressing the mining impacts between these points addresses the impairment for the segment. An average instream flow measurement was available for point TRDC5.0 (0.42 mgd). Load reductions for acidity were calculated using the instream average alkalinity as the water quality standard for acidity at point TRDC5.0. The load allocations made at point TRDC5.0 for this stream segment are presented in Table D23.

Table D23. TMDL Calculations at Point TRDC5.0				
Flow = 0.42 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	2.98	10.5	0.54	1.9
Mn	14.33	50.6	0.43	1.5
Al	7.51	26.5	0.45	1.6
Acidity	121.72	430.0	0.00	0.0
Alkalinity	0.00	0.0		

The calculated load reductions for all the loads that enter point TRDC5.0 must be accounted for in the calculated reductions at sample point TRDC5.0, shown in Table D24. A comparison of measured loads between points TRDC5.1 and TRDC5.0 show that there is additional loading entering the segment for all parameters.

Table D24. Calculation of Load Reduction Necessary at Point TRDC5.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	10.5	50.6	26.5	430.0
Existing load from upstream points (TRDC5.1)	0.05	1.15	*	4.78
Difference of existing load and upstream existing load	10.45	49.45	26.5	425.22
Allowable loads from upstream points	0.03	0.01	*	0.02
Total load at TRDC5.0	10.5	49.5	26.5	425.2
Allowable load at TRDC5.0	1.9	1.5	1.6	0.0
Waste load allocation	0	0	0	0
Remaining load at TRDC5.0	1.9	1.5	1.6	0.0
Load Reduction at TRDC5.0 (Total load at TRDC5.0 - Allowable load at TRDC5.0)	8.6	48.0	24.9	425.2
Percent reduction required at TRDC5.0	82	97	94	100

The TMDL for the segment of UNT 25989 to Deer Creek between TRDC5.1 and TRDC5.0 requires a load reduction for total iron, total manganese, total aluminum, and acidity.

TRDC4.0: The UNT 25988 to Deer Creek Southeast of Congress Hill at its Mouth

The headwaters of the UNT 25988 to Deer Creek begin to the southeast of Congress Hill. Pre-Act mining operations placed coal refuse over the headwaters of the stream above this point. The coal spoils add metals and acidity to the stream. There is also a large discharge zone along the Lower Kittanning crop line on the southern side of the tributary that adds numerous additions of AMD before the mouth of the stream.

The TMDL for the headwaters of the UNT 25988 to Deer Creek consists of a load allocation to all of the watershed area above point TRDC4.0. Addressing the mining impacts above this point addresses the impairment for the segment. An instream flow measurement was available for point TRDC4.0 (1.12 mgd). Load reductions for acidity were calculated using the instream average alkalinity as the water quality standard for acidity at point TRDC4.0. The load allocations made at point DEER5.0 for this stream segment are presented in Table D25.

Table D25. TMDL Calculations at Point TRDC4.0				
Flow = 1.12 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	11.38	106.2	0.46	4.3
Mn	10.96	102.3	0.44	4.1
Al	5.02	46.9	0.40	3.7
Acidity	105.18	981.9	0.00	0.0
Alkalinity	0.00	0.0		

Table D26. Calculation of Load Reduction Necessary at Point TRDC4.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	106.2	102.3	46.9	981.9
Existing load from upstream points (none)	0	0	0	0
Difference of existing load and upstream existing load	106.2	102.3	46.9	981.9
Allowable loads from upstream points	0	0	0	0
Total load at TRDC4.0	106.2	102.3	46.9	981.9
Allowable load at TRDC4.0	4.3	4.1	3.7	0.0
Waste load allocation	0	0	0	0
Remaining load at TRDC4.0	4.3	4.1	3.7	0.0
Load Reduction at TRDC4.0 (Total load at TRDC4.0 - Allowable load at TRDC4.0)	101.9	98.2	43.2	981.9
Percent reduction required at TRDC4.0	96	96	92	100

The TMDL for point TRDC4.0 requires that a load allocation be applied to all areas of the Unnamed Tributary 25988 to Deer Creek above TRDC4.0 for total iron, total manganese, total aluminum, and acidity.

DEER3.0: Deer Creek Downstream of the Unnamed Tributaries 25989 and 25988

Deer Creek at point DEER3.0 represents the stream after the AMD additions from the two unnamed tributaries at 25989 and 25988.

There were fewer total aluminum data than necessary for this allocation point to conduct Monte Carlo analysis; therefore, it was not evaluated for this TMDL. However, the observations for aluminum in upstream locations indicate that aluminum may also be exceeding water quality standards at this site.

The TMDL for this section of Deer Creek consists of a load allocation to all of the watershed area between points DEER4.0 and DEER3.0. Addressing the mining impacts between these points addresses the impairment for the segment. An instream flow measurement was available for point DEER3.0 (20.00 mgd). Load reductions for acidity were calculated using the instream average alkalinity as the water quality standard for acidity at point DEER3.0. The load allocations made at point DEER3.0 for this stream segment are presented in Table D27.

Table D27. TMDL Calculations at Point DEER3.0				
Flow = 20.00 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	7.60	1,267.8	0.38	63.4
Mn	7.27	1,212.7	0.22	36.7
Al	*	*	*	*
Acidity	56.37	9,403.3	0.11	18.3
Alkalinity	0.54	90.1		

The calculated load reductions for all the loads that enter point DEER3.0 must be accounted for in the calculated reductions at sample point DEER3.0, shown in Table D28. A comparison of measured loads between points DEER4.0, TRDC5.0, TRDC4.0, and DEER3.0 shows that there is additional loading entering the segment for all parameters.

Table D28. Calculation of Load Reduction Necessary at Point DEER3.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	1,267.8	1,212.7	*	9,403.3
Existing load from upstream points (DEER4.0, TRDC5.0, TRDC4.0)	259.3	387.6	161.1	4,442.8
Difference of existing load and upstream existing load	1,008.5	825.1	*	4960.5
Allowable loads from upstream points	49.3	54.6	24.6	393.7
Total load at DEER3.0	1,057.8	879.7	*	5,354.2
Allowable load at DEER3.0	63.4	36.7	*	18.3
Waste load allocation	0	0	0	0
Remaining load at DEER3.0	63.4	36.7	*	18.3
Load Reduction at DEER3.0 (Total load at DEER3.0 - Allowable load at DEER3.0)	994.4	843.0	*	5,335.9
Percent reduction required at DEER3.0	94	96	*	99.7

The TMDL for point DEER3.0 requires that a load allocation be applied to all areas of Deer Creek between DEER3.0 and DEER4.0 for total iron, total manganese, and acidity. There are fewer aluminum data than necessary to run the Monte Carlo analysis; however, upstream data indicates that total aluminum may also be exceeding water quality standards at this site.

BUCK2.0: Buck Run Above Mining Impacts

The headwaters of Buck Run begin to the east of Billotte Rd in Girard Township, Clearfield County. The watershed is mostly forested with sparse residential development. Buck Run enters the coal bearing strata approximately halfway down its reach. A large section of the western portion of its watershed was disturbed by deep and surface mining. However, due to the geologic dip in the region, most of the drainage from the mined lands flows to the west away from Buck Run into Deer Creek and its unnamed tributaries.

Buck Run above the first unnamed tributary, at TRBR1.0, is not listed on the Section 303(d) list as being impaired by AMD; therefore, a TMDL will not be done for this point. An average instream flow measurement was available for point BUCK2.0 (0.28 mgd). The average concentrations of metals and acidity at point BUCK2.0 for this stream segment are presented in Table D29.

Table D29. TMDL Calculations at Point BUCK2.0

Flow = 0.28 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	0.17	0.4	*	*
Mn	0.10	0.2	*	*
Al	*	*	*	*
Acidity	4.16	9.6	*	*
Alkalinity	7.08	16.3		

TRBR1.1: The UNT 25983 to Buck Run to the Northeast of the Sky Haven Deer Creek #1 Mine

The headwaters of the UNT 25983 to Buck Run begin to the Northeast of Sky Haven, Inc., Deer Creek #1 operation. Previous mining operations disturbed the headwaters of the stream above TRBR1.1.

There were fewer total aluminum data above the detection limit than necessary for this allocation point to conduct Monte Carlo analysis; therefore, it was not evaluated for this TMDL. However, the observations for aluminum, shown in Attachment E, indicate that the stream is meeting water quality standards for aluminum at this site.

The TMDL for the headwaters of the UNT 25983 to Buck Run consists of a load allocation to all of the watershed area above point TRBR1.1. Addressing the mining impacts above this point addresses the impairment for the segment. An instream flow measurement was available for point TRBR1.1 (0.01 mgd). Load reductions for acidity were calculated using the instream average alkalinity as the water quality standard for acidity at point TRBR1.1. The load allocations made at point TRBR1.1 for this stream segment are presented in Table D30.

Table D30. TMDL Calculations at Point TRBR1.1				
Flow = 0.01 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	1.67	0.14	0.20	0.02
Mn	3.49	0.30	0.21	0.02
Al	ND	*	*	*
Acidity	8.09	0.69	8.09	0.69
Alkalinity	29.19	2.48		

Table D31. Calculation of Load Reduction Necessary at Point TRBR1.1				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	0.14	0.30	ND	0.69
Existing load from upstream points (none)	0	0	0	0
Difference of existing load and upstream existing load	0.14	0.30	*	0.69
Allowable loads from upstream points	0	0	0	0
Total load at TRBR1.1	0.14	0.30	*	0.69
Allowable load at TRBR1.1	0.02	0.02	*	0.69
Waste load allocation	0	0	0	0
Remaining load at TRBR1.1	0.02	0.02	*	0.69
Load Reduction at TRBR1.1 (Total load at TRBR1.1 - Allowable load at TRBR1.1)	0.12	0.28	*	0.00
Percent reduction required at TRBR1.1	86	93	*	0

The TMDL for point TRBR1.1 requires that a load allocation be applied to all areas of the Unnamed Tributary 25983 to Buck Run above TRBR1.1 for total iron and total manganese. A load reduction is not necessary for acidity at this point.

SHD1b: Sky Haven Deer Run #1 Operation

Sky Haven Coal, Inc., MP#17860104 operates a surface mine along the banks on the eastern hill of the Deer Creek valley. The permitted area straddles the watershed divide between the mainstem of Deer Creek and its tributary Buck Run. Two WLAs are being assigned to this permit because of the divide. One of the WLAs, SHD1a, will be assigned to DEER4.0. The second WLA, SHD1b, will be assigned to the UNT 25983 to Buck Run. Any discharge from the operations treatment pond is treated to the BAT limits, assigned in the mining permit, before entering UNT 25983 to Buck Run.

SHD1b is considered to be a point source discharge in the watershed; therefore, the allocation made at this point is a WLA. The WLAs for iron, manganese, and aluminum were calculated using the methodology explained in the *Method to Quantify Treatment Pond Pollutant Load* section of this report. The UNT 25983 has a relatively small flow, and therefore a smaller capacity to accept pollution loading. The WLA for SHD1b was based on a site-specific pit area of 1,500 feet by 180 feet, as stated in the mining permit. Table D32 shows the WLAs for the discharge.

Table D32. Waste load Allocations at SHD1b			
Parameter	***Monthly Avg. Allowable Conc. (mg/l)***	***Average Flow (MGD)***	***Allowable Load (lbs/day)***
SHD1b			
Fe	3.0	0.0264	0.7
Mn	2.0	0.0264	0.4
Al	2.0	0.0264	0.4

TRBR1.0: The UNT 25983 to Buck Run at the Mouth

The UNT 25983 to Buck Run at point TRBR1.0 represents the stream at its mouth. Deep and surface mining has disturbed large areas of the watershed to the west of the stream; it is possible that AMD enters the stream from these disturbed areas.

There were fewer total aluminum data than necessary for this allocation point to conduct Monte Carlo analysis; therefore, it was not evaluated for this TMDL.

The TMDL for this section of the UNT 25983 to Buck Run consists of a load allocation to all of the watershed area between points TRBR1.1 and TRBR1.0. Addressing the mining impacts between these points addresses the impairment for the segment. An average instream flow measurement was not available for point TRBR1.0, the flow was calculated by the unit-area method from the measured flow at the mouth of Buck Run (0.48 mgd). Load reductions for acidity were calculated using the instream average alkalinity as the water quality standard for acidity at point TRBR1.0. The load allocations made at point TRBR1.0 for this stream segment are presented in Table D33.

Table D33. TMDL Calculations at Point TRBR1.0				
Flow = 0.48 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	2.40	9.6	0.17	0.7
Mn	2.50	10.0	0.30	1.2
Al	*	*	*	*
Acidity	21.43	85.9	1.93	7.7
Alkalinity	6.77	27.1		

The calculated load reductions for all the loads that enter point TRBR1.0 must be accounted for in the calculated reductions at sample point TRBR1.0, shown in Table D34. A comparison of measured loads between points TRBR1.1 and TRBR1.0 show that there is additional loading entering the segment for all parameters.

Table D34. Calculation of Load Reduction Necessary at Point TRBR1.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	9.6	10.0	*	85.9
Existing load from upstream points (TRBR1.1)	0.14	0.30	*	0.69
Difference of existing load and upstream existing load	9.46	9.70	*	85.21
Allowable loads from upstream points	0.02	0.02	*	0.69
Total load at TRBR1.0	9.5	9.7	*	85.9
Allowable load at TRBR1.0	0.7	1.2	*	7.7
Waste load allocation (SHD1b)	0.7	0.4	0.4	0.0
Remaining load at TRBR1.0	0.0	0.8	*	7.7
Load Reduction at TRBR1.0 (Total load at TRBR1.0 - Allowable load at TRBR1.0)	8.8	8.5	*	78.2
Percent reduction required at TRBR1.0	93	88	*	91

The TMDL for the segment of UNT 25983 to Buck Run between TRBR1.1 and TRBR1.0 requires a load reduction for total iron, total manganese, and acidity.

BUCK1.0: Buck Run at the Mouth

Buck Run at point BUCK1.0 represents the conditions at the mouth of the stream. In 1995, the Pennsylvania Fish and Boat Commission surveyed Buck Run and found that it has acceptable water quality, but has low alkalinity and siltation problems resulting from logging, agriculture, and residential development in its watershed (Hollender, 1996). The water quality sampling performed by the Susquehanna River Basin Commission in 2002 shows similar results. The concentrations of total iron, total manganese, and total aluminum were all below water quality standards. Buck Run did have low alkalinity but the pH of the stream samples were never below pH 6.0.

There were fewer total iron and total aluminum data above the detection limit than necessary for this allocation point to conduct Monte Carlo analysis; therefore, it was not evaluated for this TMDL. However, the observations for iron and aluminum, shown in Attachment E, indicate that the stream is meeting water quality standards for iron and aluminum at this site.

The TMDL for this section of Buck Run consists of a load allocation to all of the watershed area between points TRBR1.0 and BUCK1.0. Addressing the mining impacts between these points addresses the impairment for the segment. An instream flow measurement was available for point BUCK1.0 (2.91 mgd). Load reductions for acidity were calculated using the instream average alkalinity as the water quality standard for acidity at point BUCK1.0. The load allocations made at point BUCK1.0 for this stream segment are presented in Table D35.

Table D35. TMDL Calculations at Point BUCK1.0				
Flow = 2.91 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	ND	*	*	*
Mn	0.36	8.7	0.36	8.7
Al	ND	*	*	*
Acidity	27.77	673.0	3.33	80.8
Alkalinity	11.13	269.7		

The calculated load reductions for all the loads that enter point BUCK1.0 must be accounted for in the calculated reductions at sample point BUCK1.0, shown in Table D36. A comparison of measured loads between points TRBR1.0 and BUCK1.0 shows that there is additional acidity loading entering the segment while the loading for total manganese has decreased.

Table D36. Calculation of Load Reduction Necessary at Point BUCK1.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	ND	8.7	ND	673.0
Existing load from upstream points (TRBR1.0)	9.6	10.0	*	85.9
Difference of existing load and upstream existing load	*	-1.3	*	587.1
Allowable loads from upstream points	0.7	1.2	*	7.7
Percent load loss due to instream processes	*	13	*	0
Percent load remaining at BUCK1.0	*	87	*	100
Total load at BUCK1.0	*	1.0	*	594.8
Allowable load at BUCK1.0	*	8.7	*	80.8
Waste load allocation	0	0	0	0
Remaining load at BUCK1.0	*	8.7	*	80.8
Load Reduction at BUCK1.0 (Total load at BUCK1.0 - Allowable load at BUCK1.0)	*	0	*	514.0
Percent reduction required at BUCK1.0	*	0	*	86

The TMDL for Buck Run at point BUCK1.0 requires a load reduction for acidity. A load reduction is not necessary for total manganese. Also there is no load reduction required for total iron or total aluminum since the data set, found in Attachment E, shows that total iron and total aluminum was below detection limits and thus meeting water quality standards.

DEER2.0: Deer Creek Downstream of the Buck Run

Deer Creek at point DEER2.0 represents the stream after the confluence of Buck Run.

The TMDL for this section of Deer Creek consists of a load allocation to all of the watershed area between points DEER3.0 and DEER2.0. Addressing the mining impacts between these points addresses the impairment for the segment. An instream flow measurement was available for point DEER2.0 (24.32 mgd). Load reductions for acidity were calculated using the instream average alkalinity as the water quality standard for acidity at point DEER2.0. The load allocations made at point DEER2.0 for this stream segment are presented in Table D37.

Table D37. TMDL Calculations at Point DEER2.0				
Flow = 24.32 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	2.54	515.3	0.38	77.1
Mn	2.12	430.1	0.42	85.2
Al	0.88	178.5	0.40	81.1
Acidity	42.00	8,520.4	5.46	1,107.6
Alkalinity	8.53	1,730.4		

The calculated load reductions for all the loads that enter point DEER2.0 must be accounted for in the calculated reductions at sample point DEER2.0, shown in Table D38. A comparison of measured loads between points DEER3.0, BUCK1.0, and DEER2.0 shows that there is a reduction in loading along the segment for all parameters.

Table D38. Calculation of Load Reduction Necessary at Point DEER2.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	515.3	430.1	178.5	8,520.4
Existing load from upstream points (DEER3.0, BUCK1.0)	1,267.8	1,221.4	*	10,076.3
Difference of existing load and upstream existing load	-752.5	-791.3	*	-1,555.9
Allowable loads from upstream points	63.4	45.4	*	99.1
Percent load loss due to instream processes	59	65	*	15
Percent load remaining at DEER2.0	41	35	*	85
Total load at DEER2.0	26.0	15.9	178.5	84.2
Allowable load at DEER2.0	77.1	85.2	81.1	1,107.6
Waste load allocation	0	0	0	0
Remaining load at DEER2.0	77.1	85.2	81.1	1,107.6
Load Reduction at DEER2.0 (Total load at DEER2.0 - Allowable load at DEER2.0)	0	0	97.4	0
Percent reduction required at DEER2.0	0	0	55	0

The TMDL for Deer Creek at point DEER2.0 requires a load reduction for total aluminum. A load reduction is not necessary for total iron, total manganese, and acidity; all necessary reductions have been made upstream of this point.

TRDC3.0: The UNT 25981 to Deer Creek at its Mouth

The UNT 25981 to Deer Creek at point TRDC3.0 represents the tributary at its mouth. The headwaters of the stream begin in the mined areas to the east of Congress Hill Cemetery.

The TMDL for this section of the UNT 25981 to Deer Creek consists of a load allocation to all of the watershed area above TRDC3.0. Addressing the mining impacts above this point addresses the impairment for the segment. An average instream flow measurement was available for point TRDC3.0 (0.08 mgd). Load reductions for acidity were calculated using the instream average alkalinity as the water quality standard for acidity at point TRDC3.0. The load allocations made at point TRDC3.0 for this stream segment are presented in Table D39.

Table D39. TMDL Calculations at Point TRDC3.0				
Flow = 0.08 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	0.99	0.7	0.31	0.2
Mn	10.23	7.2	0.31	0.2
Al	10.51	7.4	0.21	0.1
Acidity	101.53	71.6	3.05	2.1
Alkalinity	11.67	8.2		

Table D40. Calculation of Load Reduction Necessary at Point TRDC3.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	0.7	7.2	7.4	71.6
Existing load from upstream points (none)	0	0	0	0
Difference of existing load and upstream existing load	0.7	7.2	7.4	71.6
Allowable loads from upstream points	0	0	0	0
Total load at TRDC3.0	0.7	7.2	7.4	71.6
Allowable load at TRDC3.0	0.2	0.2	0.1	2.1
Waste load allocation	0	0	0	0
Remaining load at TRDC3.0	0.2	0.2	0.1	2.1
Load Reduction at TRDC3.0 (Total load at TRDC3.0 - Allowable load at TRDC3.0)	0.5	7.0	7.3	69.5
Percent reduction required at TRDC3.0	71	97	99	97

The TMDL for the segment of UNT 25981 to Deer Creek at TRDC3.0 requires a load reduction for total iron, total manganese, total aluminum, and acidity.

DEER1.0: Deer Creek at its Mouth

Deer Creek at point DEER1.0 represents the stream at its mouth. Two unnamed tributaries, 25980 and 25979, enter Deer Creek from the east. These headwaters of these tributaries begin in a large area of Pre-Act mining on the eastern hillside before the mouth of Deer Creek. It is possible that additional AMD enters the stream from these tributaries.

The TMDL for this section of Deer Creek consists of a load allocation to all of the watershed area between points DEER2.0 and DEER1.0, including the unnamed tributaries. Addressing the mining impacts between these points addresses the impairment for the segment. An instream flow measurement was available for point DEER1.0 (26.87 mgd). Load reductions for acidity were calculated using the instream average alkalinity as the water quality standard for acidity at point DEER1.0. The load allocations made at point DEER1.0 for this stream segment are presented in Table D41.

Table D41. TMDL Calculations at Point DEER1.0				
Flow = 26.87 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	2.10	470.6	0.42	94.1
Mn	2.63	589.4	0.42	94.1
Al	1.30	291.3	0.43	96.4
Acidity	43.93	9,844.6	4.83	1,082.4
Alkalinity	7.17	1,606.8		

The calculated load reductions for all the loads that enter point DEER1.0 must be accounted for in the calculated reductions at sample point DEER1.0, shown in Table D42. A comparison of measured loads between points DEER2.0, TRDC3.0, and DEER1.0 shows that there is additional loading entering the segment for all parameters except for total iron.

Table D42. Calculation of Load Reduction Necessary at Point DEER1.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	470.6	589.4	291.3	9,844.6
Existing load from upstream points (DEER2.0, TRDC3.0)	516.0	437.3	185.9	8,592.0
Difference of existing load and upstream existing load	-45.4	152.1	105.4	1,252.6
Allowable loads from upstream points	77.3	85.4	81.2	1,109.7
Percent load loss due to instream processes	9	0	0	0
Percent load remaining at DEER1.0	91	100	100	100
Total load at DEER1.0	70.3	237.5	186.6	2,362.3
Allowable load at DEER1.0	94.1	94.1	96.4	1,082.4
Waste load allocation	0	0	0	0
Remaining load at DEER1.0	94.1	94.1	96.4	1,082.4
Load Reduction at DEER1.0 (Total load at DEER1.0 - Allowable load at DEER1.0)	0	143.4	90.2	1,279.9
Percent reduction required at DEER1.0	0	60	48	54

The TMDL for Deer Creek at point DEER1.0 requires a load reduction for total manganese, total aluminum, and acidity. A load reduction is not necessary for total iron; all necessary reductions have been made upstream of this point.

Margin of Safety (MOS)

An implicit MOS was used in these TMDLs derived from the Monte Carlo statistical analysis employing the @Risk software. Pennsylvania Title 25 Chapter 96.3(c) states that water quality criteria must be met at least 99 percent of the time. All of the @Risk analyses results surpass the minimum 99 percent level of protection. Other MOS used for this TMDL analyses are:

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

- An additional MOS is that the calculations were performed using a daily iron average, instead of the 30-day average.

- The method used to calculate a flow for a WLA using the area of the pit and ungraded portions of an active mine is conservative and an implicit MOS.

Seasonal Variation

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

Critical Conditions

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

Attachment E

Water Quality Data Used In TMDL Calculations

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
Deer7.0	SRBC	DEER5.0	12/4/02	1.8039	4.5	5	<0.300	0.325	<0.500	13.2	7.8	55.2
	SRBC	DEER5.0	1/29/03	*	5	5.1	<0.300	0.351	<0.500	13.4	7.8	22
	SRBC	DEER5.0	4/10/03	25.3839	4.5	4.9	<0.300	0.29	<0.500	15.6	8.6	28.4
	SRBC	DEER5.0	5/22/03	17.2891	4.1	5	<0.300	0.288	<0.500	14	7	<20
	SRBC	DEER5.0	6/26/03	7.9689	4	5.3	<0.300	0.271	<0.500	14	8.8	31.2
	SRBC	DEER5.0	7/24/03	2.8209	4.1	5	<0.300	0.66	0.566	17.4	8.8	47.5
			Average	**11.05**	**4.37**	**5.05**	**<0.300**	**0.36**	**0.57**	**14.60**	**8.13**	**36.86**
			St Dev	**10.09**	**0.38**	**0.14**	**0.00**	**0.15**	*****	**1.61**	**0.72**	**13.91**
Deer6.0	SRBC	DEER4.0	12/4/02	2.0726	6.5	6.3	<0.300	0.806	0.805	36.8	11.6	86.6
	SRBC	DEER4.0	1/29/03	*	7	6.2	<0.300	0.885	0.81	39	13.4	80.8
	SRBC	DEER4.0	4/10/03	31.507	5.3	5.2	<0.300	0.593	0.693	32.4	9	56.9
	SRBC	DEER4.0	5/22/03	23.8253	4.9	5.4	<0.300	0.467	<0.500	22.2	7.8	36.5
	SRBC	DEER4.0	6/26/03	10.5564	5.8	6.6	<0.300	0.725	0.524	0	13	71.4
	SRBC	DEER4.0	7/24/03	3.952	6	5.7	<0.300	1.28	0.652	29.2	13.2	102.6
	M.R. 17020106	MP24	10/22/02	*	7	6.9	0.22	2	0.56	0	18	168
	M.R. 17020106	MP24	11/18/02	*	7	6.4	0.16	1.23	0.67	0	12	83
			Average	**14.38**	**6.19**	**6.09**	**0.19**	**1.00**	**0.67**	**19.95**	**12.25**	**85.73**
			St Dev	**12.82**	**0.82**	**0.60**	**0.04**	**0.49**	**0.11**	**17.26**	**3.09**	**38.81**
Deer4.0	SRBC	DEER3.0	12/9/02	1.8541	6	6.4	1.14	1.65	0.794	37	10.8	184.4
	SRBC	DEER3.0	1/30/03	*	6.4	6.5	0.7	1.39	0.759	41.4	13.2	154.5
	SRBC	DEER3.0	4/9/03	37.0517	5.3	5.4	<0.300	0.713	0.656	42.6	7.6	82.4
	SRBC	DEER3.0	5/21/03	33.315	5	5.8	<0.300	0.623	<0.500	38.6	9.4	50.5
	SRBC	DEER3.0	6/25/03	10.4581	5.9	6.8	0.365	0.949	<0.500	0	13	112.8
	SRBC	DEER3.0	7/23/03	6.3928	6	6.1	0.478	1.58	<0.500	34.2	11.8	169.3
	S.H. 17860104	MP10	5/23/95	*	*	5.4	0.404	0.876	0.44	28	7.6	81
	S.H. 17860104	MP10	3/27/96	*	*	5.2	<0.3	1.14	0.863	15.6	7.6	87
	S.H. 17860104	MP10	5/14/96	*	*	5.4	0.364	0.647	<0.5	6	8.6	61
	S.H. 17860104	MP10	6/27/97	*	*	6	0.576	1.19	<0.5	7.4	12.4	191
	S.H. 17860104	MP10	9/29/97	*	*	5.4	0.918	2.36	0.505	6.8	8	181.1
	S.H. 17860104	MP10	12/18/97	*	*	5.7	0.994	1.64	0.684	7.8	11.6	137.8
	S.H. 17860104	MP10	8/21/97	*	*	6.1	2.7	3.16	<0.5	0	20	465
	S.H. 17860104	MP10	7/19/99	*	*	6.2	2.25	2.57	<0.5	2	16	383.8
	S.H. 17860104	MP10	10/1/01	*	*	6.4	2.65	3.14	<0.5	38.6	14.6	290
			Average	**17.81**	**5.77**	**5.92**	**1.13**	**1.58**	**0.67**	**20.40**	**11.48**	**175.44**
			St Dev	**16.20**	**0.52**	**0.49**	**0.89**	**0.86**	**0.15**	**16.97**	**3.58**	**119.72**

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
Deer2.0	SRBC	DEER2.0	12/4/02	2.4954	5.4	5.4	5.34	3.11	0.94	47.4	8.6	227.4
	SRBC	DEER2.0	1/30/03	*	5.6	5.4	4.07	2.7	1.33	53	8.8	225.8
	SRBC	DEER2.0	4/9/03	54.9353	4.7	5	0.647	1.1	0.906	32.8	7.4	106.6
	SRBC	DEER2.0	5/21/03	41.1244	4.5	5.4	0.75	0.988	0.554	33.6	9.2	71.1
	SRBC	DEER2.0	6/25/03	13.6739	4.5	5.3	1.78	1.88	0.74	41.8	9.4	160.4
	SRBC	DEER2.0	7/23/03	9.3931	4.3	5	2.67	2.96	0.781	43.4	7.8	227.6
			Average	**24.32**	**4.83**	**5.25**	**2.54**	**2.12**	**0.88**	**42.00**	**8.53**	**169.82**
			St Dev	**22.54**	**0.54**	**0.20**	**1.87**	**0.94**	**0.26**	**7.84**	**0.79**	**68.73**
Deer1.0	SRBC	DEER1.0	12/4/02	1.6846	4.4	4.7	4.69	3.93	1.48	49	7.4	248.4
	SRBC	DEER1.0	1/30/03	*	4.7	4.9	3.18	3.34	1.76	50.8	8.4	226.6
	SRBC	DEER1.0	4/9/03	53.3458	4.3	4.9	0.627	1.4	1.19	35	7.4	117.5
	SRBC	DEER1.0	5/21/03	49.6479	4	4.8	0.778	1.23	0.795	50	6.8	74.8
	SRBC	DEER1.0	6/25/03	17.6195	4.1	4.8	1.5	2.31	1.17	39.6	7.2	172.5
	SRBC	DEER1.0	7/23/03	12.053	3.7	4.4	1.82	3.59	1.39	39.2	5.8	233
			Average	**26.87**	**4.20**	**4.75**	**2.10**	**2.63**	**1.30**	**43.93**	**7.17**	**178.80**
			St Dev	**23.23**	**0.35**	**0.19**	**1.56**	**1.16**	**0.33**	**6.79**	**0.85**	**70.26**
Buck1.0	SRBC	BUCK1.0	12/4/02	0.2812	6.4	6.4	0.555	0.424	<0.500	43	10.8	53.7
	SRBC	BUCK1.0	1/30/03	0.9022	6.7	6.3	0.425	0.404	<0.500	48.8	10.6	69
	SRBC	BUCK1.0	4/9/03	8.0819	6.1	6.2	<0.300	0.286	<0.500	25.8	8.4	42.1
	SRBC	BUCK1.0	5/21/03	5.1535	5.4	6.3	<0.300	0.31	<0.500	26.6	11.6	29.2
	SRBC	BUCK1.0	6/25/03	2.2308	5.6	6.8	<0.300	0.276	<0.500	0	11.8	39.6
	SRBC	BUCK1.0	7/23/03	0.7866	6	6.4	<0.300	0.454	<0.500	22.4	13.6	72.1
			Average	**2.91**	**6.03**	**6.40**	**0.49**	**0.36**	**<0.500**	**27.77**	**11.13**	**50.95**
			St Dev	**3.09**	**0.48**	**0.21**	**0.09**	**0.08**	*****	**17.20**	**1.71**	**17.09**

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
TRDC4.0	SRBC	DCTR1.0	12/9/02	0.1848	3.4	3.4	25.8	14.4	4.93	134.4	0	627.5
	SRBC	DCTR1.0	1/30/03	0.5881	3.3	3.5	17.5	12.4	5.64	131.2	0	639.8
	SRBC	DCTR1.0	4/9/03	2.5665	3.6	3.9	4.94	6.45	4.76	72.8	0	331.8
	SRBC	DCTR1.0	5/21/03	1.4144	3.3	3.7	7.89	7.6	3.37	79.4	0	418.4
	SRBC	DCTR1.0	6/25/03	1.105	3	3.4	8.57	11.4	5.33	120	0	476
	SRBC	DCTR1.0	7/23/03	0.8574	3.1	3.3	13.3	12.9	5.1	118.8	0	635.9
	S.H. 17860104	MP8	8/29/94	*	*	3.3	10.6	14.2	5.36	126	0	432
	S.H. 17860104	MP8	3/27/96	*	*	3.6	8.51	12	7.23	112	0	506
	S.H. 17860104	MP8	5/14/96	*	*	3.7	5.347	7.3	3.5	52	0	306
			Average	**1.12**	**3.28**	**3.53**	**11.38**	**10.96**	**5.02**	**105.18**	**0.00**	**485.93**
			St Dev	**0.83**	**0.21**	**0.21**	**6.67**	**3.05**	**1.15**	**29.49**	**0.00**	**127.63**

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
TRDC5.0	SRBC	DCTR2.0	12/9/02	0.0663	3.3	3.3	8.02	18.5	10.2	143.8	0	801.2
	SRBC	DCTR2.0	1/30/03	0.563	3.3	3.5	4.53	13.3	8.89	124.8	0	929.3
	SRBC	DCTR2.0	4/9/03	0.9406	3.5	3.7	1.43	8.87	8.34	93.8	0	693.3
	SRBC	DCTR2.0	5/21/03	0.4985	3.3	3.5	1.51	9.62	6.05	102.4	0	759.2
	SRBC	DCTR2.0	6/25/03	0.2717	3.2	3.4	1.45	10.7	7.07	118.6	0	881.2
	SRBC	DCTR2.0	7/23/03	0.2012	3.2	3.3	2.27	12.3	6.78	98.6	0	859
	S.H. 17860104	MP17	8/29/94	*	*	3.4	1.87	13.5	8.63	148	0	765
	S.H. 17860104	MP17	5/23/95	*	*	3.4	1.62	12.7	6.22	128	0	811
	S.H. 17860104	MP17	7/25/96	*	*	3.2	3.2	16.3	7.8	124	0	980
	S.H. 17860104	MP17	6/27/97	*	*	3.4	1.72	16.8	8.33	124	0	984.7
	S.H. 17860104	MP17	9/29/97	*	*	3.3	2.33	18.3	5.85	106	0	863.8
	S.H. 17860104	MP17	12/18/97	*	*	3.6	3.94	14	7.72	114	0	768.6
	S.H. 17860104	MP17	8/21/98	*	*	3.2	3.2	15.1	5.42	120	0	1077.2
	S.H. 17860104	MP17	7/19/99	*	*	3.2	2.67	15.8	6.11	120	0	1262
	S.H. 17860104	MP17	10/1/01	*	*	3.2	4.95	19.1	9.18	159.8	0	784
			Average	**0.42**	**3.30**	**3.37**	**2.98**	**14.33**	**7.51**	**121.72**	**0.00**	**881.30**
			St Dev	**0.31**	**0.11**	**0.15**	**1.80**	**3.19**	**1.42**	**18.32**	**0.00**	**147.40**

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
TRDC6.0	SRBC	DCTR3.0	12/4/02	0.1701	6.5	7	1.21	4.61	3.97	0	50	335.5
	SRBC	DCTR3.0	1/29/03	0.6094	6.8	6.8	0.878	4.07	5.05	0	72.8	373.4
	SRBC	DCTR3.0	4/10/03	2.4099	6	6.5	0.32	2.53	3.73	0	21	241.1
	SRBC	DCTR3.0	5/22/03	1.0234	6.1	6.4	0.692	3.16	4.08	8.2	33	243.3
	SRBC	DCTR3.0	6/26/03	0.8419	7.1	7.5	0.396	3.14	2.15	0	63.8	391.3
	SRBC	DCTR3.0	7/24/03	0.5801	7.1	6.7	0.53	3.46	1.56	0	79.8	365.4
	M.R. 17020106	MP15	8/27/01	0.1152	7.5	7.7	0.6	2.49	0.51	0	120	433
	M.R. 17020106	MP15	9/19/01	0.11808	7.5	7.6	0.94	2.61	0.77	0	134	424
	M.R. 17020106	MP15	10/25/01	0.1296	7.5	7.5	1.13	3.37	1.52	0	104	371
	M.R. 17020106	MP15	11/19/01	0.11952	7.5	7.4	0.04	3.29	0.05	0	11	357
	M.R. 17020106	MP15	12/7/01	0.144	7	7.2	0.36	2.72	0.92	0	82	322
	M.R. 17020106	MP15	1/20/02	0.1656	7.5	7.4	0.4	2.68	1.07	0	88	306
	M.R. 17020106	MP15	7/15/03	0.288	*	7.6	1.38	2.61	3.43	0	138	430
	M.R. 17020106	MP15	7/30/02	*	*	8	1.13	2.11	0.974	0	164	515.3
			Average	**0.52**	**7.01**	**7.24**	**0.71**	**3.06**	**2.13**	**0.59**	**82.96**	**364.88**
			St Dev	**0.65**	**0.55**	**0.48**	**0.40**	**0.67**	**1.60**	**2.19**	**45.68**	**74.50**
TRDC7.0	SRBC	DCTR4.0	12/4/02	0.2586	6.3	6.6	0.568	1.35	<0.500	0	22	113.7
	SRBC	DCTR4.0	1/29/03	1.0679	6.9	6.6	0.958	2.03	0.532	0	22.8	112.1
	SRBC	DCTR4.0	4/10/03	6.4324	4.9	5.1	<0.300	0.716	<0.500	46	9	47.6
	SRBC	DCTR4.0	5/22/03	3.6681	4.8	5.4	<0.300	0.513	<0.500	37.8	7.6	37.9
	SRBC	DCTR4.0	6/26/03	1.4224	4.4	5.5	<0.300	1.56	<0.500	34.8	9.2	72.9
	SRBC	DCTR4.0	7/24/03	0.6143	4.6	5.2	<0.300	3.38	0.502	52.8	9.2	138.3
			Average	**2.24**	**5.32**	**5.73**	**0.76**	**1.59**	**0.52**	**28.57**	**13.30**	**87.08**
			St Dev	**2.38**	**1.03**	**0.69**	**0.28**	**1.04**	**0.02**	**23.01**	**7.08**	**40.34**
TRDC 7.2	A. H. 4578BC4	MP 18	07/07/1994	*	*	3.1	16.91	23.42	7.76	222	0	345
	A. H. 4578BC4	MP 18	01/31/1995	*	*	3.3	19.1	23.2	9.1	214	0	454
	A. H. 4578BC4	MP 18	04/21/1995	*	*	3.3	9.68	16.5	6.5	152	0	288
	A. H. 4578BC4	MP 18	09/26/1995	*	*	3	26.9	41.9	18.5	382	0	860
	A. H. 4578BC4	MP 18	06/06/1997	*	*	3.3	4.84	11.6	4.11	100	0	268
	A. H. 4578BC4	MP 18	09/19/1997	*	*	2.9	20.7	33.6	11.8	294	0	750.3
	A. H. 4578BC4	MP 18	10/17/1997	*	*	3	22.4	31.8	12.3	296	0	760
	A. H. 4578BC4	MP 18	05/27/1998	*	*	3	18.8	25.8	7.69	248	0	592
	A. H. 4578BC4	MP 18	09/17/1998	*	*	3	39.7	32.5	9.47	292	0	859.1
	A. H. 4578BC4	MP 18	11/20/1998	*	*	3.2	24.4	41.6	20.8	268	0	829.3

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
	A. H. 4578BC4	MP 18	03/17/1999	*	*	3.4	4.55	11.7	5.52	74	0	216.3
	A. H. 4578BC4	MP 18	12/12/2001	*	*	3.4	9.16	16.2	6.98	154	0	299.4
	A. H. 4578BC4	MP 18	04/29/1994	0.1728	4.3	3.07	12.1	22.1	*	204	0	487
	A. H. 4578BC4	MP 18	06/08/1994	0.03024	3.5	2.94	19.7	31.1	*	275	0	668
	A. H. 4578BC4	MP 18	09/13/1994	0.0216	3.1	2.92	33.3	38.1	*	376	0	768
	A. H. 4578BC4	MP 18	11/02/1994	0.03888	3.4	3.03	14.8	24.4	*	172	0	454
	A. H. 4578BC4	MP 18	03/12/1995	0.1584	3.3	3.43	8.65	15.2	*	95	0	301
	A. H. 4578BC4	MP 18	05/23/1995	0.1008	3.3	3.17	10.3	16.7	*	106	0	408
	A. H. 4578BC4	MP 18	08/29/1995	0.01728	2.2	2.89	36.3	41.9	*	327	0	868
	A. H. 4578BC4	MP 18	01/23/1996	0.1008	5	3.44	5.51	11.2	*	68	0	240
	A. H. 4578BC4	MP 18	03/26/1996	0.10368	4.3	3.29	8.93	13.8	*	81	0	339
	A. H. 4578BC4	MP 18	05/24/1996	0.1224	4.5	3.06	14.9	23.2	*	193	0	625
	A. H. 4578BC4	MP 18	09/25/1996	0.04176	3.7	3.18	14.6	20.8	*	177	0	495
	A. H. 4578BC4	MP 18	12/06/1996	0.03744	3.3	3.34	9.85	14.3	*	85	0	316
	A. H. 4578BC4	MP 18	03/20/1997	0.0288	3.6	3.2	11	15.2	*	138	0	384
	A. H. 4578BC4	MP 18	06/12/1997	0.00576	3.5	3.1	9.02	18.8	*	153	0	443
	A. H. 4578BC4	MP 18	09/17/1997	0.00432	3.7	2.89	23.1	48.4	*	328	0	857
	A. H. 4578BC4	MP 18	12/12/1997	0.00576	3.6	3.1	13	21.4	*	152	0	456
	A. H. 4578BC4	MP 18	03/27/1998	0.0144	3.2	3.1	12.8	18.6	*	205	0	472
	A. H. 4578BC4	MP 18	06/10/1998	0.00864	3	2.91	25.6	38.3	*	332	0	780
	A. H. 4578BC4	MP 18	09/04/1998	0.00432	3.1	2.87	35.2	43.2	*	358	0	866
	A. H. 4578BC4	MP 18	11/19/1998	0.00288	3	2.98	33.5	53.8	*	314	0	903
	A. H. 4578BC4	MP 18	03/18/1999	0.0864	3.7	3.45	3.23	8.77	*	88	0	206
	A. H. 4578BC4	MP 18	06/17/1999	0.0072	2.9	2.9	24.1	35.5	*	374	0	884
	A. H. 4578BC4	MP 18	08/05/1999	*	3.2	2.87	57.7	33.8	*	388	0	931
	A. H. 4578BC4	MP 18	11/18/1999	0.00576	3.3	3.09	12.6	28.4	*	191	0	598
	A. H. 4578BC4	MP 18	03/24/2000	0.02304	3.6	3.27	5	12.1	*	92	0	271
	A. H. 4578BC4	MP 18	06/09/2000	0.0072	3.2	3.03	12.4	25.6	*	175	0	764
	A. H. 4578BC4	MP 18	09/08/2000	0.0072	3.1	2.95	24.8	35.5	*	263	0	833
	A. H. 4578BC4	MP 18	11/17/2000	0.01296	3.1	3.1	17.3	22.9	*	166	0	508
	A. H. 4578BC4	MP 18	03/28/2001	0.02016	3.4	3.2	9.75	13.8	*	85	0	323
	A. H. 4578BC4	MP 18	06/15/2001	0.01152	3.2	2.9	16	26.9	*	246	0	672
	A. H. 4578BC4	MP 18	09/22/2001	0.00576	3.2	3	23	33.1	*	299	0	690
	A. H. 4578BC4	MP 18	11/16/2001	0.00432	3.3	3	16.6	30.3	*	183	0	691
	A. H. 4578BC4	MP 18	03/29/2002	0.06048	3.9	3.2	4.91	8.6	*	48	0	189
	A. H. 4578BC4	MP 18	07/01/2002	0.0144	2.9	2.9	20.8	31.2	*	246	0	764

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
	A. H. 4578BC4	MP 18	09/13/2002	*	*	3	40.9	40.8	13.9	343.2	0	793.7
	A. H. 4578BC4	MP 18	09/26/2002	0.00144	3.1	3.1	24.8	41.2	*	268	0	1001
	A. H. 4578BC4	MP 18	12/20/2002	0.16128	3.8	3.5	2.47	6.6	*	42	0	170
	A. H. 4578BC4	MP 18	04/02/2003	0.02304	3.1	3.1	8.19	17.2	*	88	0	451
	A. H. 4578BC4	MP 18	09/08/2003	*	*	3.2	8.23	15.8	5.24	109.4	0	283.8
			Average	**0.04**	**3.42**	**3.11**	**17.69**	**25.65**	**9.98**	**206.46**	**0.00**	**562.25**
			St Dev	**0.05**	**0.51**	**0.18**	**11.31**	**11.57**	**4.98**	**101.14**	**0.00**	**243.38**
TRDC7.1	A.H. 4578BC4	BR17	09/19/1997	*	*	3.2	16.7	31.6	10.3	226	0	690.7
	A.H. 4578BC4	BR17	10/17/1997	*	*	3.2	19.1	30.6	10.3	236	0	712
	A.H. 4578BC4	BR17	05/27/1998	*	*	7.2	8.63	11.6	2.86	0	152	867
	A.H. 4578BC4	BR17	09/17/1998	*	*	3.2	17.3	35.1	8.44	200	0	1042.1
	A.H. 4578BC4	BR17	11/20/1998	*	*	3.3	19	35.4	11.5	186	0	786.9
	A.H. 4578BC4	BR17	03/17/1999	*	*	5.9	8.44	10.2	6.72	10	15.6	308.8
	A.H. 4578BC4	BR17	12/12/2001	*	*	7.2	8.36	11.7	4.17	0	124	518.8
	A.H. 4578BC4	BR17	09/13/2002	*	*	3.9	29.6	31.4	5.6	191	0	869
	A.H. 4578BC4	BR17	09/08/2003	*	*	3.7	5.08	16.8	2.39	70.6	0	407.1
	A.H. 4578BC4	BR17	04/29/1994	2.16	6.6	6.7	0.69	1.88	*	4	76	217
	A.H. 4578BC4	BR17	06/08/1994	0.08064	8.3	5.48	9.39	21.5	*	11	11	510
	A.H. 4578BC4	BR17	09/13/1994	0.4032	6.7	6.23	0.68	1.11	*	4	14	101
	A.H. 4578BC4	BR17	11/02/1994	0.1656	5.5	4.86	0.78	3.96	*	9	7	124
	A.H. 4578BC4	BR17	03/12/1995	0.8784	4.3	4.36	0.42	0.99	*	11	5	41
	A.H. 4578BC4	BR17	05/23/1995	0.87984	4.5	4.37	0.18	0.47	*	9	5	30
	A.H. 4578BC4	BR17	08/29/1995	0.108	5	5.62	0.42	0.46	*	4	8	22
	A.H. 4578BC4	BR17	01/23/1996	1.1448	5.1	3.43	5.48	11.2	*	67	0	236
	A.H. 4578BC4	BR17	03/25/1996	0.42912	4.8	5.2	0.03	0.66	*	4	6	43
	A.H. 4578BC4	BR17	05/24/1996	0.3744	5.9	4.49	12.9	20.9	*	54	8	645
	A.H. 4578BC4	BR17	09/25/1996	0.05904	7.5	7.57	8.75	13.9	*	4	75	586
	A.H. 4578BC4	BR17	12/06/1996	0.05472	3.8	3.7	6.79	11.1	*	52	0	261
	A.H. 4578BC4	BR17	03/20/1997	0.0576	7.1	6.57	6.39	8.98	*	3	63	481
	A.H. 4578BC4	BR17	06/12/1997	0.0504	7.5	7.34	7.14	11.5	*	5	78	604
	A.H. 4578BC4	BR17	09/17/1997	0.01296	3.8	3.16	16.5	49	*	174	0	831
	A.H. 4578BC4	BR17	12/12/1997	0.02592	7.2	6.8	9.67	13.6	*	8	54	503
	A.H. 4578BC4	BR17	03/27/1998	0.03024	3.9	3.78	8.58	13.8	*	58	0	355
	A.H. 4578BC4	BR17	06/10/1998	0.01728	8.7	7.87	11.9	14.6	*	0	211	960
	A.H. 4578BC4	BR17	09/04/1998	0.00864	3.3	3.02	17.9	44.4	*	244	0	834

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
	A.H. 4578BC4	BR17	11/19/1998	0.00864	3.2	3.08	21	43.7	*	217	0	813
	A.H. 4578BC4	BR17	03/18/1999	0.14544	4.7	4.08	2.34	6.14	*	30	3	165
	A.H. 4578BC4	BR17	06/17/1999	0.01728	7.2	6.78	11.2	21	*	6	108	959
	A.H. 4578BC4	BR17	08/05/1999	0.00576	3.4	3.16	12.5	42.1	*	189	0	1088
	A.H. 4578BC4	BR17	11/18/1999	0.01152	3.5	3.17	16.8	29.4	*	172	0	654
	A.H. 4578BC4	BR17	03/24/2000	0.06912	6.7	6.45	4.33	7.46	*	5	23	310
	A.H. 4578BC4	BR17	06/09/2000	0.03024	7.5	7.02	9.48	12.7	*	6	95	749
	A.H. 4578BC4	BR17	09/08/2000	0.02016	6.6	6.44	11.6	39.3	*	14	70	780
	A.H. 4578BC4	BR17	11/17/2000	0.04752	5.6	5.2	12.7	15.2	*	22	9	472
	A.H. 4578BC4	BR17	03/28/2001	0.04896	9.9	9.2	6.08	6.59	*	79	79	412
	A.H. 4578BC4	BR17	06/15/2001	0.03456	7.5	7	7.44	12.4	*	16	123	676
	A.H. 4578BC4	BR17	09/22/2001	0.01296	6.9	6	11.8	21.7	*	27	54	651
	A.H. 4578BC4	BR17	11/16/2001	0.01728	6.6	7.1	15.1	23.5	*	6	53	639
	A.H. 4578BC4	BR17	03/29/2002	0.2016	10.6	10	3.8	5.27	*	0	180	251
	A.H. 4578BC4	BR17	07/01/2002	0.07344	3.7	3.5	6.17	30.5	*	86	0	889
	A.H. 4578BC4	BR17	09/26/2002	0.00576	3.4	3.1	1.56	32.3	*	120	0	738
	A.H. 4578BC4	BR17	12/20/2002	0.8136	6	6.2	3.61	5.46	*	6	11	188
	A.H. 4578BC4	BR17	04/02/2003	0.65088	4.6	4.6	6.63	15	*	32	6	461
			Average	**0.25**	**5.87**	**5.29**	**9.15**	**18.00**	**6.92**	**62.56**	**37.53**	**532.20**
			St Dev	**0.44**	**1.91**	**1.82**	**6.60**	**13.49**	**3.40**	**80.41**	**53.59**	**298.64**
DEER5.0	S.H. 17860104	MP3	01/07/1994	*	8.3	5.94	2.36	2.23	*	3	7	200
	S.H. 17860104	MP3	04/30/1994	*	6.8	6.27	0.18	1.65	*	3	28	136
	S.H. 17860104	MP3	06/08/1994	*	6.3	5.97	0.33	0.9	*	3	12	87
	S.H. 17860104	MP3	09/13/1994	*	6.8	6.21	0.41	1.47	*	5	16	107
	S.H. 17860104	MP3	11/02/1994	*	6.1	5.87	0.56	2.46	*	4	9	114
	S.H. 17860104	MP3	03/12/1995	*	4.3	4.7	0.64	0.77	*	10	6	38
	S.H. 17860104	MP3	05/23/1995	*	4.5	4.25	0.08	0.65	*	11	4	43
	S.H. 17860104	MP3	08/29/1995	*	5.7	6.28	0.45	1.45	*	4	21	139
	S.H. 17860104	MP3	01/23/1996	*	5.6	4.87	0.71	0.99	*	9	7	71
	S.H. 17860104	MP3	03/26/1996	*	4.6	4.93	0.12	0.68	*	6	6	54
	S.H. 17860104	MP3	05/30/1996	*	6.5	6.01	0.62	1.62	*	3	12	154
	S.H. 17860104	MP3	09/25/1996	*	5.7	5.28	0.16	0.95	*	4	5	68
	S.H. 17860104	MP3	12/06/1996	*	5.1	4.94	0.19	0.89	*	6	5	56
	S.H. 17860104	MP3	03/20/1997	*	6.1	5.54	0.11	0.8	*	3	7	66
	S.H. 17860104	MP3	06/12/1997	*	6.8	5.76	0.07	0.57	*	2	8	56

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
	S.H. 17860104	MP3	09/17/1997	*	6.8	6.06	0.11	2.6	*	3	13	191
	S.H. 17860104	MP3	12/12/1997	*	6.2	5.21	0.15	1.03	*	5	6	66
	S.H. 17860104	MP3	03/25/1998	*	5.4	5.53	0.12	0.7	*	4	7	55
	S.H. 17860104	MP3	06/10/1998	*	7.3	6.2	0.13	1.1	*	4	22	149
	S.H. 17860104	MP3	09/04/1998	*	7	6.16	0.19	0.99	*	5	24	208
	S.H. 17860104	MP3	11/19/1998	*	7	6.05	0.11	1.38	*	4	23	259
	S.H. 17860104	MP3	03/18/1999	*	5.1	4.99	0.11	0.9	*	6	6	61
	S.H. 17860104	MP3	06/17/1999	*	6.7	6.18	0.07	0.7	*	4	16	118
	S.H. 17860104	MP3	08/05/1999	*	6.7	6.25	0.07	35	*	5	19	231
	S.H. 17860104	MP3	11/18/1999	*	6.1	4.08	0.08	1.11	*	2	2	143
	S.H. 17860104	MP3	03/24/2000	11.26368	4.9	5.04	<0.07	0.57	*	8	6	45
	S.H. 17860104	MP3	06/09/2000	*	6.2	5.98	0.1	0.54	*	4	9	78
	S.H. 17860104	MP3	09/08/2000	*	6.2	5.88	0.13	1	*	0	12	121
	S.H. 17860104	MP3	11/17/2000	*	5.7	5.5	0.12	0.71	*	1	8	52
	S.H. 17860104	MP3	03/28/2001	12.09744	4.6	5.2	0.09	0.58	*	7	6	50
	S.H. 17860104	MP3	06/15/2001	*	6.5	5.6	<0.07	0.55	*	8	8	69
	S.H. 17860104	MP3	09/22/2001	*	6.7	5.8	0.1	1.2	*	5	15	171
	S.H. 17860104	MP3	11/16/2001	*	6.2	6.6	0.13	1.09	*	2	13	112
	S.H. 17860104	MP3	03/29/2002	26.99424	5.2	4.9	0.09	0.48	*	4	5	37
	S.H. 17860104	MP3	06/20/2002	12.27888	5.1	6	0.13	0.85	*	2	9	76
	S.H. 17860104	MP3	09/26/2002	*	5.9	6.7	<0.07	0.96	*	2	23	214
	S.H. 17860104	MP3	12/23/2002	13.27392	5.1	5.3	0.09	0.53	*	5	8	54
	S.H. 17860104	MP3	04/02/2003	11.39904	4.9	5.2	<0.07	0.95	*	6	6	106
	S.H. 17860104	MP3	06/17/2003	14.21712	5.9	5.8	<0.07	0.74	*	2	7	73
	S.H. 17860104	MP3	08/29/1994	*	*	5.8	<0.3	1.11	<0.5	26	8.2	65
	S.H. 17860104	MP3	05/23/1995	*	*	5.3	0.131	0.745	0.356	28	7.4	65
	S.H. 17860104	MP3	05/14/1996	*	*	5.3	0.435	0.626	<0.5	4	9	54
	S.H. 17860104	MP3	07/25/1996	*	*	6.1	0.325	1.91	<0.5	0	11.8	182
	S.H. 17860104	MP3	07/19/1999	*	*	6.6	<0.3	0.789	<0.5	0	26	112.4
	S.H. 17860104	MP3	10/01/2001	*	*	6.6	0.762	2.33	<0.5	0	14.8	270
	S.H. 17860104	MP3	11/15/2002	*	*	6.5	<0.3	1.158	<0.5	0	11.2	156
			Average	**14.50**	**5.96**	**5.68**	**0.28**	**1.80**	**0.36**	**5.04**	**11.18**	**109.40**
			St Dev	**5.60**	**0.89**	**0.62**	**0.40**	**5.03**	*****	**5.38**	**6.52**	**63.01**

DEER3.0	S.H. 17860104	MP90	01/07/1994	*	5	3.73	6.27	6.49	*	82	0	408
	S.H. 17860104	MP90	04/30/1994	*	4.3	3.4	7.92	18	*	163	0	610

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
	S.H. 17860104	MP90	06/08/1994	*	4.7	3.61	6.89	7.5	*	44	0	403
	S.H. 17860104	MP90	09/13/1994	*	3.7	3.25	21.6	18.7	*	101	0	711
	S.H. 17860104	MP90	11/02/1994	*	3.5	3.18	16	14.7	*	81	0	641
	S.H. 17860104	MP90	03/12/1995	*	3.7	3.55	7.15	7.67	*	48	0	346
	S.H. 17860104	MP90	05/23/1995	*	3.6	3.54	8.66	8.45	*	54	0	456
	S.H. 17860104	MP90	08/29/1995	*	2.5	3.06	27.7	24.2	*	219	0	1031
	S.H. 17860104	MP90	01/23/1996	*	5.7	4.78	0.63	0.99	*	9	7	73
	S.H. 17860104	MP90	03/26/1996	*	3.4	3.68	7.4	9.6	*	54	0	465
	S.H. 17860104	MP90	05/24/1996	*	4.5	3.45	9.31	7.96	*	50	0	403
	S.H. 17860104	MP90	09/25/1996	*	4.2	3.44	5.15	5.9	*	63	0	309
	S.H. 17860104	MP90	12/06/1996	*	4.1	3.82	5.16	5.7	*	37	0	326
	S.H. 17860104	MP90	03/20/1997	13.84272	4.3	3.69	4.94	6.48	*	44	0	365
	S.H. 17860104	MP90	06/12/1997	*	4.4	3.64	3.57	4.01	*	24	0	236
	S.H. 17860104	MP90	09/17/1997	*	4	3.35	11.3	9.87	*	91	0	648
	S.H. 17860104	MP90	12/12/1997	*	4.2	3.79	7.44	6.11	*	42	0	327
	S.H. 17860104	MP90	03/25/1998	*	4.4	4.24	4.18	4.52	*	32	4	222
	S.H. 17860104	MP90	06/10/1998	*	4.5	3.68	7.36	7.49	*	44	0	512
	S.H. 17860104	MP90	09/04/1998	*	3.8	3.28	13.8	11.1	*	138	0	669
	S.H. 17860104	MP90	11/19/1998	*	3.9	3.35	14.4	8.83	*	81	0	694
	S.H. 17860104	MP90	03/18/1999	*	4.5	3.9	2.51	3.39	*	28	0	208
	S.H. 17860104	MP90	06/17/1999	*	3.9	3.52	7.29	7.03	*	75	0	485
	S.H. 17860104	MP90	08/05/1999	*	3.6	3.28	12.3	11.1	*	135	0	980
	S.H. 17860104	MP90	11/18/1999	*	4.3	3.94	8.87	6.05	*	29	0	458
	S.H. 17860104	MP90	03/24/2000	*	4.1	3.81	3.23	3.54	*	38	0	186
	S.H. 17860104	MP90	06/09/2000	*	4	3.57	5.28	5.51	*	32	0	305
	S.H. 17860104	MP90	09/06/2000	*	3.9	3.69	7.62	6.17	*	72	0	414
	S.H. 17860104	MP90	11/17/2000	*	4.1	3.8	6.59	4.05	*	26	0	212
	S.H. 17860104	MP90	03/28/2001	21.17088	3.9	3.9	3.87	3.44	*	25	0	198
	S.H. 17860104	MP90	06/15/2001	*	4.1	3.7	4.31	4.14	*	26	0	250
	S.H. 17860104	MP90	09/22/2001	*	4.2	3.5	8.39	7.26	*	65	0	501
	S.H. 17860104	MP90	11/16/2001	*	4.5	3.7	7.76	5.8	*	25	0	330
	S.H. 17860104	MP90	03/29/2002	27.91872	4.5	3.8	4.31	3.85	*	22	0	192
	S.H. 17860104	MP90	06/20/2002	19.85328	4	3.8	3.39	5.01	*	29	0	279
	S.H. 17860104	MP90	09/26/2002	*	3.7	3.4	12.2	9.16	*	59	0	870
	S.H. 17860104	MP90	12/23/2002	13.86144	4.1	3.9	3.7	2.87	*	18	0	163
	S.H. 17860104	MP90	04/02/2003	25.59168	4.1	4	1.96	3.06	*	19	2	164

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
	S.H. 17860104	MP90	06/17/2003	17.77248	3.9	3.8	2.45	3.42	*	17	0	194
	S.H. 17860104	MP90	12/13/1996	*	*	4.7	1.06	1.67	1.27	13.6	8.6	86.6
			Average	**20.00**	**4.10**	**3.68**	**7.60**	**7.27**	**1.27**	**56.37**	**0.54**	**408.27**
			St Dev	**5.41**	**0.50**	**0.35**	**5.40**	**4.73**	*****	**44.13**	**1.83**	**232.45**
TRDC5.1	S.H. 17860104	MP16	06/08/1994	*	4.5	3.88	0.53	12.6	*	119	0	1157
	S.H. 17860104	MP16	05/24/1996	0.00864	4.6	3.57	0.33	9.67	*	56	0	1099
	S.H. 17860104	MP16	09/25/1996	*	4.1	3.57	0.38	153	*	100	0	999
	S.H. 17860104	MP16	12/06/1996	0.00288	4	3.89	0.71	12.7	*	85	0	962
	S.H. 17860104	MP16	03/20/1997	0.00864	4.3	3.9	0.54	12.4	*	113	0	1147
	S.H. 17860104	MP16	06/12/1997	*	4	3.6	0.46	16.3	*	92	0	1175
	S.H. 17860104	MP16	09/17/1997	*	4.5	3.75	1.3	16.8	*	80	0	1171
	S.H. 17860104	MP16	12/12/1997	*	4.2	4	1.5	15.9	*	107	2	1104
	S.H. 17860104	MP16	03/25/1998	0.00432	4.1	4	0.67	14.5	*	121	2	1195
	S.H. 17860104	MP16	06/10/1998	*	4	3.87	0.91	9.69	*	83	0	1188
	S.H. 17860104	MP16	09/04/1998	*	3.7	3.54	0.56	15.2	*	101	0	1236
	S.H. 17860104	MP16	11/19/1998	*	3.9	3.9	0.6	15	*	62	0	1599
	S.H. 17860104	MP16	03/18/1999	0.00864	4.2	3.92	1.31	14.3	*	93	0	959
	S.H. 17860104	MP16	06/17/1999	0.00288	3.7	3.57	1.82	13.3	*	98	0	1260
	S.H. 17860104	MP16	08/05/1999	*	4.1	3.77	1.91	17.2	*	82	0	1529
	S.H. 17860104	MP16	11/18/1999	*	4.3	4.18	0.37	14.9	*	53	4	1218
	S.H. 17860104	MP16	03/24/2000	0.00576	4.1	3.9	1.06	19.3	*	105	0	1081
	S.H. 17860104	MP16	06/09/2000	0.00144	4.1	3.7	1.33	13.1	*	106	0	1371
	S.H. 17860104	MP16	09/06/2000	*	3.8	3.68	1.4	17.6	*	111	0	2047
	S.H. 17860104	MP16	11/17/2000	0.00288	3.7	3.8	1.09	15.3	*	92	1	1092
	S.H. 17860104	MP16	03/28/2001	0.00288	3.9	3.7	1.6	17	*	152	0	1132
	S.H. 17860104	MP16	06/15/2001	0.00144	3.9	3.7	1.31	13.3	*	106	0	1209
	S.H. 17860104	MP16	09/22/2001	0.00144	4.1	3.8	0.74	13.8	*	95	0	1116
	S.H. 17860104	MP16	11/16/2001	*	4.3	4.1	0.45	16.1	*	75	4	1070
	S.H. 17860104	MP16	03/29/2002	0.01728	4.3	4	0.83	20.3	*	120	4	1122
	S.H. 17860104	MP16	06/20/2002	0.0072	3.8	3.9	0.68	11.4	*	104	1	1177
	S.H. 17860104	MP16	09/26/2002	*	4	3.7	0.59	15	*	82	0	1298
	S.H. 17860104	MP16	12/23/2002	0.00576	4.1	4.1	0.71	18.8	*	106	5	1099
	S.H. 17860104	MP16	04/02/2003	0.01152	3.7	3.8	1.2	11.2	*	98	0	1167
	S.H. 17860104	MP16	06/17/2003	0.0072	3.6	3.8	0.6	136	*	119	0	1179
			Average	**0.01**	**4.05**	**3.82**	**0.92**	**23.39**	*****	**97.20**	**0.77**	**1205.27**
			St Dev	**0.00**	**0.26**	**0.17**	**0.45**	**33.10**	*****	**20.77**	**1.50**	**210.23**

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
TRDC3.0	S.C. 17783109	MP12	03/26/1994	0.18	6.8	7	0.47	0.29	*	0	20	80
	S.C. 17783109	MP12	06/25/1994	0.00144	4.3	3.5	1.8	10.8	*	112	0	489
	S.C. 17783109	MP12	09/17/1994	0.001152	3.3	3.3	2.85	24.65	*	270	0	878
	S.C. 17783109	MP12	12/02/1994	0.58032	3.9	3.8	1.49	7.36	*	88	0	367
	S.C. 17783109	MP12	01/13/1995	0.40032	3.7	3.7	1.56	10.11	*	122	0	294
	S.C. 17783109	MP12	05/15/1995	0.108	4.1	3.6	1.22	10.58	*	106	0	347
	S.C. 17783109	MP12	08/25/1995	0.0504	3.3	3.2	4.63	13.71	*	148	0	546
	S.C. 17783109	MP12	11/08/1995	0.0216	3.8	3.2	5.1	27.82	*	196	0	823
	S.C. 17783109	MP12	01/30/1996	0.1152	3.5	3.8	0.83	6.89	*	90	0	264
	S.C. 17783109	MP12	05/28/1996	0.07488	3.5	3.8	0.56	14.47	*	136	0	540
	S.C. 17783109	MP12	09/26/1996	0.08928	3.5	3.9	0.58	9.69	*	66	0	287
	S.C. 17783109	MP12	10/29/1996	0.0864	3.5	3.9	0.55	9.94	*	86	0	285
	S.C. 17783109	MP12	04/22/1997	0.02592	2.7	3.7	1.01	18.65	*	166	0	658
	S.C. 17783109	MP12	09/17/1997	0.01728	3.5	3.5	0.38	11.79	*	120	0	414
	S.C. 17783109	MP12	10/29/1997	0.01152	3.5	3.7	0.4	10.16	*	90	0	310
	S.C. 17783109	MP12	01/19/1998	0.1008	3.5	4	0.72	7.79	*	100	0	259
	S.C. 17783109	MP12	04/20/1998	0.108	3.6	4	0.37	4.44	*	84	0	153
	S.C. 17783109	MP12	02/05/1999	0.108	4.5	4	0.17	2.62	*	32	0	110
	S.C. 17783109	MP12	06/10/1999	0.00144	3.3	3.5	0.62	21.14	*	180	0	761
	S.C. 17783109	MP12	09/01/1999	*	3.4	3.5	0.47	18.46	*	144	0	588
	S.C. 17783109	MP12	10/21/1999	0.00576	3.8	3.6	0.22	9.92	*	78	0	284
	S.C. 17783109	MP12	01/03/2000	0.036	3.3	3.9	0.23	4.86	*	46	0	206
	S.C. 17783109	MP12	06/23/2000	0.04032	*	3.7	0.94	9	*	86	0	276
	S.C. 17783109	MP12	10/20/2000	0.036	3.8	3.8	0.45	5.54	*	54	0	188
	S.C. 17783109	MP12	03/16/2001	0.108	4.1	4	0.25	2.7	*	34	0	121
	S.C. 17783109	MP12	06/01/2001	0.01728	3.5	3.7	0.51	13.71	*	150	0	562
	S.C. 17783109	MP12	02/15/2002	0.01728	*	3.8	0.32	4	*	50	0	145
	S.C. 17783109	MP12	10/08/2002	0.00288	*	3.6	0.45	7.05	*	72	0	235
	S.C. 17783109	MP12	03/17/2003	0.1008	*	4	1.19	3.35	*	30	0	103
	S.C. 17783109	MP12	05/09/2003	0.00288	3.8	3.6	0.81	12.3	*	138	0	493
	S.C. 17783109	MP12	12/26/1996	*	*	3.8	1.35	14.6	18.9	126	0	613
	S.C. 17783109	MP12	06/26/1997	*	*	3.5	0.598	9.26	9.15	100	0	348.9
	S.C. 17783109	MP12	09/29/1997	*	*	3.5	0.662	6.57	6.58	70	0	261.1
	S.C. 17783109	MP12	12/18/1997	*	*	3.9	0.803	7.87	8.6	74	0	242.3
	S.C. 17783109	MP12	06/29/2000	*	*	3.6	0.693	7.69	9.43	86	400	226.5
	S.C. 17783109	MP12	11/14/2001	*	*	3.8	0.444	8.4	10.4	125	0	261.6
			Average	**0.08**	**3.75**	**3.79**	**0.99**	**10.23**	**10.51**	**101.53**	**11.67**	**361.65**
			St Dev	**0.12**	**0.72**	**0.59**	**1.09**	**6.08**	**4.30**	**52.71**	**66.65**	**208.18**

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
TRDC6.1	M.R. 17020106	MP4	08/27/2001	0.00576	3.5	3.4	0.7	5.28	6.62	72	0	180
	M.R. 17020106	MP4	09/19/2001	0.00216	3.5	3.5	0.65	7.16	8.99	82	0	237
	M.R. 17020106	MP4	10/25/2001	0.0072	3.5	3.7	0.81	4.34	8.36	70	0	170
	M.R. 17020106	MP4	11/19/2001	0.00288	2	3.7	0.82	4.39	8.4	70	0	155
	M.R. 17020106	MP4	12/27/2001	0.0144	3.5	3.6	0.9	3.57	8.91	78	0	144
	M.R. 17020106	MP4	01/20/2002	0.0216	3.5	3.7	0.79	3.14	7.8	76	0	140
	M.R. 17020106	MP4	07/15/2003	0.108	*	3.3	2.11	4.88	7.92	104	0	241
			Average	**0.02**	**3.25**	**3.56**	**0.97**	**4.68**	**8.14**	**78.86**	**0.00**	**181.00**
			St Dev	**0.04**	**0.61**	**0.16**	**0.51**	**1.31**	**0.81**	**11.94**	**0.00**	**42.00**
TRBR1.0	S.H. 17860104	MP14	05/23/1995	*	*	4.4	0.359	2.08	2.01	42	6.2	105
	S.H. 17860104	MP14	06/08/1994	0.06624	5.5	4.3	1	3.75	*	29	5	197
	S.H. 17860104	MP14	03/12/1995	0.30384	4.5	4.42	0.58	2.5	*	18	6	163
	S.H. 17860104	MP14	05/23/1995	0.06048	5.9	5.8	0.3	0.37	*	3	8	41
	S.H. 17860104	MP14	08/29/1995	0.03456	5.5	6.21	0.05	0.04	*	3	16	104
	S.H. 17860104	MP14	01/23/1996	0.18	5.5	5.38	0.11	0.31	*	5	7	35
	S.H. 17860104	MP14	03/26/1996	0.108	5.1	5.42	0.22	0.38	*	3	7	40
	S.H. 17860104	MP14	05/24/1996	0.3888	6.2	5.99	0.03	0.13	*	2	10	22
	S.H. 17860104	MP14	03/20/1997	0.27072	5	4.42	0.19	2.66	*	24	5	159
	S.H. 17860104	MP14	03/25/1998	0.0432	4.5	4.52	0.25	2.19	*	25	5	137
	S.H. 17860104	MP14	09/04/1998	0.00432	6	5.54	9.23	5.01	*	40	12	263
	S.H. 17860104	MP14	11/19/1998	0.00432	6.1	5.7	7	2.58	*	20	13	234
	S.H. 17860104	MP14	03/18/1999	0.22752	4.53	4.53	0.19	1.61	*	19	5	129
	S.H. 17860104	MP14	06/17/1999	0.0072	4.6	4.13	2.77	3.8	*	27	3	235
	S.H. 17860104	MP14	08/05/1999	0.00432	6.2	5.15	16.5	6.74	*	72	10	573
	S.H. 17860104	MP14	11/18/1999	0.00864	5.1	5.06	2.43	2.85	*	13	3	161
	S.H. 17860104	MP14	03/24/2000	0.15408	4.6	4.52	0.18	1.83	*	17	5	121
	S.H. 17860104	MP14	06/09/2000	0.03744	4.6	4.45	0.34	2.26	*	21	6	178
	S.H. 17860104	MP14	09/06/2000	0.00576	5	4.89	1.87	3.71	*	16	6	160
	S.H. 17860104	MP14	11/17/2000	0.02592	4.2	4.6	0.77	2.43	*	19	6	123
	S.H. 17860104	MP14	03/28/2001	0.15408	4.4	4.5	0.23	1.94	*	27	7	142
	S.H. 17860104	MP14	06/15/2001	0.02016	4.4	4.3	1.13	3.44	*	30	7	166
	S.H. 17860104	MP14	09/22/2001	0.01152	4.9	4.4	1.18	3.26	*	26	4	130
	S.H. 17860104	MP14	11/16/2001	0.01584	4.8	4.6	0.86	2.41	*	14	6	113
	S.H. 17860104	MP14	03/29/2002	0.23184	4.7	4.5	0.17	1.54	*	14	6	93
	S.H. 17860104	MP14	06/20/2002	0.09648	4.3	4.3	0.59	3.19	*	24	5	231

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
	S.H. 17860104	MP14	09/26/2002	0.00144	5.8	5.2	22.7	5.59	*	28	8	279
	S.H. 17860104	MP14	12/23/2002	0.14832	4.6	4.6	0.25	1.45	*	15	7	119
	S.H. 17860104	MP14	04/02/2003	0.7776	4.1	4.5	0.15	2.26	*	23	5	113
	S.H. 17860104	MP14	06/17/2003	0.17424	4.1	4.3	0.34	2.7	*	24	4	138
			Average	**0.12**	**4.99**	**4.82**	**2.40**	**2.50**	**2.01**	**21.43**	**6.77**	**156.80**
			St Dev	**0.16**	**0.66**	**0.58**	**5.16**	**1.56**	*****	**13.87**	**2.91**	**101.54**

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
TRBR1.1	S.H. 17860104	MP6	05/23/1995	*	*	6	0.956	0.469	0.816	9.6	14.2	67
	S.H. 17860104	MP6	05/14/1996	*	*	5.4	<0.3	0.382	<0.5	4.4	9.4	62
	S.H. 17860104	MP6	11/15/2002	*	*	5.5	<0.3	0.06	<0.5	6.4	9	66.7
	S.H. 17860104	MP6	10/01/2001	*	*	5.3	0.378	0.476	<0.5	27	8.4	72
	S.H. 17860104	MP6	06/08/1994	*	7.3	6.39	2.98	6.67	*	9	39	153
	S.H. 17860104	MP6	09/13/1994	*	6.6	6.46	6.91	8.81	*	8	50	152
	S.H. 17860104	MP6	11/02/1994	0.00432	6.3	6.37	4.41	8.51	*	12	45	137
	S.H. 17860104	MP6	03/12/1995	0.036	5.5	6.41	1.19	3.19	*	9	29	130
	S.H. 17860104	MP6	05/23/1995	0.01008	6.2	6.48	1.8	3.29	*	11	47	154
	S.H. 17860104	MP6	03/26/1996	0.03168	5.1	6.09	2.52	2.47	*	9	31	86
	S.H. 17860104	MP6	09/25/1996	0.00288	7	6.56	2.24	2.52	*	3	40	140
	S.H. 17860104	MP6	12/06/1996	0.00288	7	6.16	1.46	1.93	*	7	35	90
	S.H. 17860104	MP6	03/20/1997	*	6.5	6.12	1.53	2.55	*	4	20	102
	S.H. 17860104	MP6	06/12/1997	*	7	6.66	2.45	1.6	*	4	48	167
	S.H. 17860104	MP6	09/17/1997	*	6.9	6.42	<0.07	3.55	*	7	55	148
	S.H. 17860104	MP6	12/12/1997	*	6.7	6.27	<0.07	2.12	*	9	46	100
	S.H. 17860104	MP6	03/27/1998	*	6.3	6.17	0.42	1.69	*	9	31	99
	S.H. 17860104	MP6	06/10/1998	*	6.6	6.37	1.92	2.91	*	6	43	132
	S.H. 17860104	MP6	09/04/1998	*	6.5	6.23	8.42	7.04	*	10	43	115
	S.H. 17860104	MP6	11/19/1998	*	6.4	5.92	12	6.88	*	18	26	191
	S.H. 17860104	MP6	03/18/1999	*	6.1	6.2	0.46	0.79	*	3	22	74
	S.H. 17860104	MP6	06/17/1999	*	6.2	6.35	0.36	0.6	*	4	35	146
	S.H. 17860104	MP6	11/18/1999	*	6.5	4.11	1.72	2.06	*	3	41	164
	S.H. 17860104	MP6	03/24/2000	0.00288	6.3	6.49	0.1	0.79	*	4	26	92
	S.H. 17860104	MP6	06/09/2000	0.00144	6.2	5.96	0.37	3.64	*	6	11	217
	S.H. 17860104	MP6	09/08/2000	*	6.4	6.28	<0.07	8.66	*	11	60	273
	S.H. 17860104	MP6	11/17/2000	0.00432	6.1	6.2	<0.07	2.01	*	3	25	175
	S.H. 17860104	MP6	03/28/2001	0.00144	5.9	6	0.34	1.13	*	5	25	106
	S.H. 17860104	MP6	06/15/2001	*	6	6.2	0.19	2.62	*	15	28	165

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
	S.H. 17860104	MP6	09/22/2001	*	6.4	6	<0.07	9.4	*	22	43	139
	S.H. 17860104	MP6	11/16/2001	0.00288	6.1	7	1.67	2.66	*	3	30	146
	S.H. 17860104	MP6	03/29/2002	0.0216	6	6.3	0.41	2.65	*	2	10	148
	S.H. 17860104	MP6	06/20/2002	0.00432	5.9	6.5	1.57	4.22	*	3	20	181
	S.H. 17860104	MP6	09/26/2002		6.3	7.1	<0.07	9.15	*	4	100	143
	S.H. 17860104	MP6	12/23/2002	0.01584	5.9	5.7	0.52	2.45	*	8	9	174
	S.H. 17860104	MP6	04/02/2003	0.00864	4.8	5	0.33	3.87	*	15	7	160
	S.H. 17860104	MP6	06/17/2003	0.01152	5	5.7	1.26	5.41	*	6	9	160
			Average	**0.01**	**6.24**	**6.12**	**2.10**	**3.49**	**0.82**	**8.09**	**31.62**	**135.86**
			St Dev	**0.01**	**0.56**	**0.54**	**2.71**	**2.77**	*****	**5.54**	**18.85**	**45.11**

BUCK2.0	A.H. 4578BC4	FO17	01/07/1994	*	6.9	5.1	0.1	0.07	*	3	2	16
	A.H. 4578BC4	FO17	04/29/1994	0.432	6.8	4.83	0.54	0.18	*	4	6	14
	A.H. 4578BC4	FO17	06/08/1994	0.2304	5.5	5.22	0.27	0.12	*	4	8	12
	A.H. 4578BC4	FO17	09/13/1994	0.12528	5.5	5.26	0.12	0.1	*	4	7	19
	A.H. 4578BC4	FO17	11/02/1994	0.12528	5.1	5.14	0.26	0.13	*	5	7	14
	A.H. 4578BC4	FO17	03/12/1995	0.5616	4.5	4.68	<0.02	0.13	*	7	6	16
	A.H. 4578BC4	FO17	05/23/1995	0.5544	6.2	5.1	0.15	0.11	*	5	7	20
	A.H. 4578BC4	FO17	08/29/1995	0.04464	4	5.11	0.47	0.11	*	4	7	10
	A.H. 4578BC4	FO17	01/23/1996	0.2304	5.5	5.5	<0.02	0.19	*	7	6	24
	A.H. 4578BC4	FO17	03/26/1996	0.5616	5.2	4.83	0.06	0.14	*	6	6	17
	A.H. 4578BC4	FO17	05/24/1996	0.2448	6	5.03	0.75	0.13	*	5	7	51
	A.H. 4578BC4	FO17	09/25/1996	0.19872	5.8	4.92	0.08	0.09	*	4	5	24
	A.H. 4578BC4	FO17	12/06/1996	0.6048	5.3	5.02	0.07	0.12	*	5	6	15
	A.H. 4578BC4	FO17	03/20/1997	0.46512	4.9	4.92	0.07	0.1	*	4	6	20
	A.H. 4578BC4	FO17	06/12/1997	0.18288	5.7	5.1	0.08	0.08	*	4	7	20
	A.H. 4578BC4	FO17	09/17/1997	0.0144	5.8	5.21	0.35	0.12	*	4	6	19
	A.H. 4578BC4	FO17	12/12/1997	0.03456	5.4	4.82	<0.07	0.07	*	6	6	10
	A.H. 4578BC4	FO17	03/27/1998	0.2592	5.2	5.05	0.08	0.09	*	4	6	11
	A.H. 4578BC4	FO17	06/10/1998	0.04608	5.7	5.08	0.14	0.08	*	4	6	20
	A.H. 4578BC4	FO17	09/04/1998	0.0072	5.8	5.4	0.09	0.12	*	5	7	12
	A.H. 4578BC4	FO17	11/19/1998	0.00432	5.6	5.44	<0.07	0.11	*	5	7	16
	A.H. 4578BC4	FO17	03/18/1999	0.28224	5.4	5.03	0.08	0.08	*	4	6	16
	A.H. 4578BC4	FO17	06/17/1999	0.00576	5.8	5.38	0.14	0.06	*	3	7	16
	A.H. 4578BC4	FO17	08/05/1999	0.00432	6	5.26	0.51	0.1	*	4	7	7
	A.H. 4578BC4	FO17	11/18/1999	0.0288	6.2	5.64	<0.07	<0.05	*	2	6	36

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
	A.H. 4578BC4	FO17	03/24/2000	0.30672	5.4	5.4	0.07	0.11	*	4	6	15
	A.H. 4578BC4	FO17	06/09/2000	0.07056	6.2	5.94	0.19	<0.05	*	3	9	10
	A.H. 4578BC4	FO17	09/08/2000	0.02736	6.1	5.7	0.19	<0.05	*	<1	11	15
	A.H. 4578BC4	FO17	11/17/2000	0.13392	5.5	5.6	0.09	<0.05	*	3	8	17
	A.H. 4578BC4	FO17	03/28/2001	0.50112	5.2	5.1	<0.07	0.11	*	3	7	14
	A.H. 4578BC4	FO17	06/15/2001	0.08928	6.3	5.7	0.18	<0.05	*	2	10	19
	A.H. 4578BC4	FO17	09/22/2001	0.036	6.2	5.5	0.2	<0.05	*	8	9	11
	A.H. 4578BC4	FO17	11/16/2001	0.0432	6.2	6.2	0.23	<0.05	*	3	9	17
	A.H. 4578BC4	FO17	03/29/2002	1.53504	5	5	0.13	0.15	*	3	6	18
	A.H. 4578BC4	FO17	07/01/2002	0.04752	5.6	6.2	0.14	<0.05	*	3	9	25
	A.H. 4578BC4	FO17	09/26/2002	0.00432	5.6	6.2	0.23	<0.05	*	2	11	43
	A.H. 4578BC4	FO17	12/20/2002	1.16208	5.6	5.7	<0.07	0.11	*	4	9	17
	A.H. 4578BC4	FO17	04/02/2003	1.03392	5.2	5.4	<0.07	0.1	*	4	8	31
			Average	**0.28**	**5.63**	**5.31**	**0.20**	**0.11**	*****	**4.16**	**7.08**	**18.61**
			St Dev	**0.35**	**0.57**	**0.39**	**0.17**	**0.03**	*****	**1.36**	**1.70**	**8.88**
	TRBR4.0											
	A.H. 4578BC4	LMO14	01/07/1994	*	6.6	5.85	0.2	0.37	*	3	4	38
	A.H. 4578BC4	LMO14	04/29/2004	0.2592	6.8	6	1.16	0.43	*	3	12	32
	A.H. 4578BC4	LMO14	06/05/1994	0.01728	6.1	6	0.34	0.35	*	5	12	38
	A.H. 4578BC4	LMO14	09/13/1994	0.01872	5.8	6.13	0.68	0.44	*	4	12	45
	A.H. 4578BC4	LMO14	11/02/1994	0.02016	6.3	6.19	0.44	0.52	*	6	13	40
	A.H. 4578BC4	LMO14	03/12/1995	0.2016	5.7	5.3	0.13	0.32	*	5	7	26
	A.H. 4578BC4	LMO14	05/23/1995	0.08784	5.6	5.92	0.18	0.33	*	4	9	29
	A.H. 4578BC4	LMO14	08/29/1995	0.00864	5.2	6.07	0.66	0.69	*	8	17	13
	A.H. 4578BC4	LMO14	01/23/1996	0.2736	5.5	5.69	0.14	0.2	*	5	8	30
	A.H. 4578BC4	LMO14	03/26/1996	0.1584	5.8	5.69	0.09	0.08	*	3	8	27
	A.H. 4578BC4	LMO14	05/24/1996	0.05328	6.4	6.11	0.23	0.28	*	3	10	36
	A.H. 4578BC4	LMO14	09/25/1996	0.02592	6.5	5.93	0.13	0.14	*	3	8	20
	A.H. 4578BC4	LMO14	12/09/1996	0.05472	6	5.7	0.23	0.17	*	7	7	21
	A.H. 4578BC4	LMO14	03/20/1997	0.04896	6.2	6.2	<0.07	0.12	*	3	8	32
	A.H. 4578BC4	LMO14	06/12/1997	0.02592	6.5	5.96	0.13	0.22	*	3	9	21
	A.H. 4578BC4	LMO14	09/17/1997	0.00432	20	6.07	0.18	0.16	*	3	12	27
	A.H. 4578BC4	LMO14	12/12/1997	0.00864	6.6	5.79	0.1	0.16	*	4	10	12
	A.H. 4578BC4	LMO14	03/27/1998	0.0432	5.8	5.73	0.11	0.17	*	4	7	25
	A.H. 4578BC4	LMO14	06/10/1998	0.00432	6.6	5.89	0.19	0.27	*	4	9	38

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
	A.H. 4578BC4	LMO14	09/04/1998	*	6.2	5.89	0.23	0.26	*	6	12	20
	A.H. 4578BC4	LMO14	11/19/1998	0.00144	5.8	5.7	0.07	0.11	*	7	11	25
	A.H. 4578BC4	LMO14	03/18/1999	0.16848	6.6	5.92	0.12	0.15	*	3	9	20
	A.H. 4578BC4	LMO14	06/17/1999	0.00432	6.1	5.92	0.16	0.21	*	3	10	26
	A.H. 4578BC4	LMO14	08/05/1999	0.00144	6.3	6.02	0.13	0.15	*	5	11	25
	A.H. 4578BC4	LMO14	11/18/1999	0.0072	6.3	6.15	0.08	0.21	*	2	8	40
	A.H. 4578BC4	LMO14	03/24/2000	0.06336	6.7	6.13	<0.07	0.18	*	2	8	15
	A.H. 4578BC4	LMO14	06/09/2000	0.0144	6.2	6.03	0.1	0.25	*	2	9	20
	A.H. 4578BC4	LMO14	09/08/2000	0.00288	6.4	5.9	<0.07	0.05	*	1	11	23
	A.H. 4578BC4	LMO14	11/17/2000	0.01728	5.7	5.7	<0.07	0.15	*	3	9	18
	A.H. 4578BC4	LMO14	03/28/2001	0.04608	5.6	5.7	<0.07	0.2	*	3	4	26
	A.H. 4578BC4	LMO14	06/15/2001	0.01152	5.7	5.9	0.18	0.23	*	5	7	26
	A.H. 4578BC4	LMO14	09/22/2001	0.00576	6.4	5.8	<0.07	0.09	*	7	10	20
	A.H. 4578BC4	LMO14	11/16/2001	0.00864	5.7	6.3	<0.07	0.14	*	2	9	20
	A.H. 4578BC4	LMO14	03/29/2002	0.27072	6	6.3	0.08	0.18	*	4	7	22
	A.H. 4578BC4	LMO14	07/01/2002	0.00864	5.6	6.3	0.15	0.18	*	3	11	31
	A.H. 4578BC4	LMO14	09/26/2002	*	4.7	6.2	<0.07	<0.05	*	2	14	37
	A.H. 4578BC4	LMO14	12/20/2002	0.44352	6	6.2	0.1	2.95	*	4	11	20
	A.H. 4578BC4	LMO14	04/02/2003	0.03024	5.6	6.3	<0.07	0.22	*	2	9	31
			Average	**0.07**	**6.41**	**5.96**	**0.23**	**0.31**	*****	**3.84**	**9.53**	**26.71**
			St Dev	**0.10**	**2.31**	**0.22**	**0.23**	**0.47**	*****	**1.65**	**2.54**	**8.08**
	Deep Mine Discharge											
	S.H. 17860104	MP15	01/07/1994	*	6.2	6.21	1.3	3.57	*	6	29	942
	S.H. 17860104	MP15	04/30/1994	0.03168	5.3	6.01	0.98	0.97	*	6	19	523
	S.H. 17860104	MP15	06/08/1994	*	6.6	6.28	1.43	1.72	*	4	31	756
	S.H. 17860104	MP15	09/13/1994	*	6.3	6.27	0.61	1.24	*	4	26	643
	S.H. 17860104	MP15	11/02/1994	*	6	6.35	0.36	6.44	*	18	53	1184
	S.H. 17860104	MP15	03/12/1995	0.00864	5.5	6.26	1.49	1.09	*	11	25	623
	S.H. 17860104	MP15	05/23/1995	0.01728	6.3	6.35	32.8	15.3	*	22	69	1928
	S.H. 17860104	MP15	08/29/1995	*	5.7	6.24	4.53	17.5	*	27	62	1986
	S.H. 17860104	MP15	01/23/1996	0.08784	6.1	5.95	3.81	2.86	*	15	22	872
	S.H. 17860104	MP15	03/26/1996	0.0504	6	5.99	10.8	6.03	*	14	30	1068
	S.H. 17860104	MP15	05/24/1996	0.08496	6.7	6.05	14.8	8.98	*	7	27	1422
	S.H. 17860104	MP15	09/25/1996	0.07488	6.9	6.2	15	7.27	*	5	24	1225
	S.H. 17860104	MP15	12/06/1996	0.0432	6.7	5.9	15.9	7.63	*	20	28	1201

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
	S.H. 17860104	MP15	03/20/1997	0.14688	6.7	5.83	9.3	5.71	*	7	16	1075
	S.H. 17860104	MP15	06/12/1997	0.02448	6.9	6.19	12.7	9.96	*	6	25	1430
	S.H. 17860104	MP15	09/17/1997	0.01152		5.96	21	14.8	*	8	28	1838
	S.H. 17860104	MP15	12/12/1997	0.01872	6.6	5.85	8.81	7.87	*	24	24	1546
	S.H. 17860104	MP15	03/25/1998	0.03456	63	5.59	22.3	8	*	23	12	1342
	S.H. 17860104	MP15	06/10/1998	0.04608	6.7	5.63	25.8	12.4	*	17	15	1780
	S.H. 17860104	MP15	09/04/1998	0.02592	6.5	5.97	13.1	14.9	*	29	33	1900
	S.H. 17860104	MP15	11/19/1998	0.01152	6.5	6	4.15	8.77	*	10	31	2118
	S.H. 17860104	MP15	03/18/1999	0.04032	6	4.49	7.4	4.5	*	21	6	1444
	S.H. 17860104	MP15	06/17/1999	0.03456	5.6	5.47	2.64	17	*	16	12	1710
	S.H. 17860104	MP15	08/05/1999	0.01296	6	5.58	8.4	12	*	31	21	1900
	S.H. 17860104	MP15	11/18/1999	0.01728	6.2	6.44	20.6	9.41	*	20	13	1661
	S.H. 17860104	MP15	03/24/2000	0.04608	5.2	3.65	15.8	5.49	*	57	0	1220
	S.H. 17860104	MP15	06/09/2000	0.0216	6.2	4.67	16.1	9.29	*	36	8	1476
	S.H. 17860104	MP15	09/06/2000	0.02592	6.3	5.59	15.1	10.7	*	30	15	1954
	S.H. 17860104	MP15	11/17/2000	0.04608	6.4	5.6	17.1	7.54	*	25	18	1574
	S.H. 17860104	MP15	03/28/2001	0.07632	5.9	5.5	12.5	3.52	*	35	10	1189
	S.H. 17860104	MP15	06/15/2001	0.04896	6.3	5.3	16.5	8.95	*	41	12	1765
	S.H. 17860104	MP15	09/22/2001	0.02016	6.4	5.5	6.4	8.1	*	26	13	1656
	S.H. 17860104	MP15	11/16/2001	0.03888	6.4	5.8	18	7.48	*	16	20	1460
	S.H. 17860104	MP15	03/29/2002	0.08208	5.9	6.1	2.29	4.73	*	7	12	1733
	S.H. 17860104	MP15	06/20/2002	0.10944	5.8	6.9	5.64	2.37	*	7	30	1408
	S.H. 17860104	MP15	09/26/2002	0.02016	5.9	5.8	20.2	11.4	*	8	17	2038
	S.H. 17860104	MP15	12/23/2002	0.02592	6.2	6.2	20.2	8.26	*	33	24	2291
	S.H. 17860104	MP15	04/02/2003	0.12816	5.4	5.1	13.5	3.63	*	26	9	1415
	S.H. 17860104	MP15	06/17/2003	0.38736	5.7	5	10.9	5.67	*	8	9	1254
	S.H. 17860104	MP15	08/29/1994	*	*	6.5	0.492	1.11	<0.5	0	30	556
	S.H. 17860104	MP15	05/23/1995	*	*	6.5	7.42	11.4	<0.135	0	74	1559
	S.H. 17860104	MP15	03/27/1996	*	*	6.1	9.8	6.83	<0.5	38	34	1106
	S.H. 17860104	MP15	05/14/1996	*	*	6.4	4.85	4.79	<0.5	2	26	947
	S.H. 17860104	MP15	07/25/1996	*	*	6.2	8.91	10.6	<0.5	0	44	1393
	S.H. 17860104	MP15	12/13/1996	*	*	6.2	11.2	5.59	<0.5	12.4	42	1011.5
	S.H. 17860104	MP15	02/20/1997	*	*	6.1	8.15	6.59	<0.5	5	36	122.1
	S.H. 17860104	MP15	06/27/1997	*	*	6.2	16.9	13.3	<0.5	36	42	1553
	S.H. 17860104	MP15	09/29/1997	*	*	6	12.1	9.19	<0.5	12	32	1376
	S.H. 17860104	MP15	12/18/1997	*	*	6.1	23.6	9.17	<0.5	48	56	1657.7

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
	S.H. 17860104	MP15	08/21/1998	*	*	6.2	11.5	11.9	<0.5	0	42	1826.7
	S.H. 17860104	MP15	07/19/1999	*	*	5.9	14.4	10	<0.5	10.6	40	281
	S.H. 17860104	MP15	03/21/2000	*	*	5.5	4.24	1.89	0.516	30	11.4	1004.7
	S.H. 17860104	MP15	10/01/2001	*	*	6.5	15.1	8.33	<0.5	0	32	1405
	S.H. 17860104	MP15	11/15/2002	*	*	6.5	<0.3	0.208	<0.5	0	50	1861.9
			Average	**0.06**	**7.66**	**5.90**	**11.30**	**7.67**	**0.52**	**17.04**	**27.21**	**1374.27**
			St Dev	**0.07**	**9.23**	**0.56**	**7.39**	**4.25**	**#DIV/0!**	**13.60**	**15.94**	**475.35**
	Seep at DCTR2.0 headwaters (under LK spoil)											
	S.H. 17860104	MP99	06/08/1994	0.00144	5.7	4.07	0.16	22	*	204	4	1081
	S.H. 17860104	MP99	03/20/1997	0.00144	4.4	3.95	0.14	15.6	*	143	1	905
	S.H. 17860104	MP99	03/25/1998	0.00432	4.1	4.09	0.11	14.1	*	134	3	789
	S.H. 17860104	MP99	06/10/1998	*	4.1	3.98	0.08	32.8	*	194	2	1162
	S.H. 17860104	MP99	03/18/1999	0.00576	4.2	4.2	0.07	11.2	*	2	2	653
	S.H. 17860104	MP99	06/17/1999	*	4	3.9	0.45	18.2	*	221	0	985
	S.H. 17860104	MP99	11/18/1999	*	4	3.83	0.83	18.7	*	191	0	1040
	S.H. 17860104	MP99	03/24/2000	0.00576	4.2	4.1	<0.07	9.22	*	73	3	491
	S.H. 17860104	MP99	06/09/2000	0.00144	4.2	3.86	0.29	18	*	206	0	1025
	S.H. 17860104	MP99	11/17/2000	*	3.8	4	0.48	17.3	*	203	2	991
	S.H. 17860104	MP99	03/28/2001	0.00864	4	4.1	0.11	11.8	*	142	4	696
	S.H. 17860104	MP99	06/15/2001	0.00144	4	4	<0.07	15.8	*	248	4	963
	S.H. 17860104	MP99	09/22/2001	*	4.1	3.8	0.21	19.9	*	275	0	1034
	S.H. 17860104	MP99	11/16/2001	*	4.2	3.8	0.19	18.5	*	178	0	938
	S.H. 17860104	MP99	03/29/2002	0.02592	4.5	4.1	0.18	7.92	*	56	4	417
	S.H. 17860104	MP99	06/20/2002	0.00576	3.9	4	0.25	18.2	*	186	3	1292
	S.H. 17860104	MP99	12/23/2002	0.00576	4	3.9	0.26	9.84	*	111	0	728
	S.H. 17860104	MP99	04/02/2003	0.00864	3.7	3.8	0.23	14.6	*	143	0	844
	S.H. 17860104	MP99	06/17/2003	0.00432	3.7	3.9	0.26	17.7	*	196	0	927
			Average	**0.01**	**4.15**	**3.97**	**0.25**	**16.39**	*****	**163.47**	**1.68**	**892.68**
			St Dev	**0.01**	**0.43**	**0.12**	**0.19**	**5.57**	*****	**67.54**	**1.67**	**220.75**
	Seep into TRDC6.0											
	M.R. 17020106	MP11	08/27/2001	0.00144	5.5	5.5	25.4	14.8	0.18	54	10	381
	M.R. 17020106	MP11	09/19/2001	0.00144	4	3.9	28.7	14	0.17	60	0	332
	M.R. 17020106	MP11	10/25/2001	0.00072	5.5	5.4	16.8	13.5	0.4	54	8	347
	M.R. 17020106	MP11	11/19/2001	0.00072	4	4.1	13.4	13.5	0.33	46	2	323

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
	M.R. 17020106	MP11	12/27/2001	0.00144	5.5	5.3	18	10.7	0.32	56	10	304
	M.R. 17020106	MP11	01/20/2002	0.00288	4	3.8	13.1	12.5	0.63	60	0	291
	M.R. 17020106	MP11	02/14/2002	0.00216	4	3.8	5.62	9.78	1.26	44	0	278
	M.R. 17020106	MP11	03/11/2002	0.002592	5	5.2	14.4	10.1	0.67	52	8	275
	M.R. 17020106	MP11	04/22/2002	0.001296	3.7	3.8	0.9	6.72	5.5	36	0	323
	M.R. 17020106	MP11	05/15/2002	0.011664	3.8	3.7	1.3	4.51	2.8	42	0	287
	M.R. 17020106	MP11	06/22/2002	0.00072	3.8	3.6	8.15	9.63	0.54	30	0	296
	M.R. 17020106	MP11	07/31/2002	0.000288	3.8	3.7	1.17	9.25	1.38	30	0	320
	M.R. 17020106	MP11	08/27/2002	0.000144	3.8	3.6	2.72	7.38	2.17	34	0	303
	M.R. 17020106	MP11	09/19/2002	0.000144	4.5	5.2	30.3	16.6	0.07	64	12	365
	M.R. 17020106	MP11	10/22/2002	0.00036	4.9	6.1	27.6	16.6	0.21	60	20	396
	M.R. 17020106	MP11	11/18/2002	0.00072	5.9	5.6	17.6	13.7	0.53	50	12	358
	M.R. 17020106	MP11	04/30/2003	0.001224	3.8	3.9	0.36	5.46	3.46	34	0	356
	M.R. 17020106	MP11	07/15/2003	0.0012096	*	5.4	16.8	10.3	0.42	49	10	316
	M.R. 17020106	MP11	08/07/2003	0.0072	2.9	3.6	13.5	11	0.41	41	0	298
	M.R. 17020106	MP11	09/18/2003	0.00216	3.8	5.2	26.5	10.2	0.19	52	9	297
			Average	**0.00**	**4.33**	**4.52**	**14.12**	**11.01**	**1.08**	**47.40**	**5.05**	**322.30**
			St Dev	**0.00**	**0.81**	**0.88**	**10.04**	**3.41**	**1.40**	**10.62**	**6.03**	**34.73**
	Seep into TRDC6.0											
	M.R. 17020106	MP13	08/27/2001	0.00288	3.5	3.4	2.65	9.62	5.65	68	0	458
	M.R. 17020106	MP13	09/19/2001	0.00288	3.5	3.5	2.23	8.38	5.41	70	0	415
	M.R. 17020106	MP13	10/25/2001	0.0036	3.5	3.6	1.96	8.35	5.42	68	0	427
	M.R. 17020106	MP13	11/19/2001	0.00144	3.5	3.6	2.05	8.71	5.64	66	0	409
	M.R. 17020106	MP13	12/27/2001	0.00144	3.5	3.5	1.57	7.81	5.74	66	0	393
	M.R. 17020106	MP13	01/20/2002	0.00576	3.5	3.6	1.45	7.43	5.31	74	0	384
	M.R. 17020106	MP13	02/14/2002	0.01728	3.6	3.7	1	6.05	4.55	50	0	337
	M.R. 17020106	MP13	03/11/2002	0.03168	3.5	3.6	1.11	6.53	5.04	60	0	341
	M.R. 17020106	MP13	04/22/2002	0.036	3.5	3.7	0.82	6.18	5.03	50	0	372
	M.R. 17020106	MP13	05/15/2002	0.0504	4	3.7	0.57	4.66	3.67	40	0	290
	M.R. 17020106	MP13	06/22/2002	0.03888	3.5	3.6	1.28	7.3	4.89	54	0	368
	M.R. 17020106	MP13	07/31/2002	0.01728	3.9	3.7	0.86	6.22	4.25	44	0	353
	M.R. 17020106	MP13	08/27/2002	0.01152	3.7	3.7	0.94	6.09	4.63	48	0	374
	M.R. 17020106	MP13	09/19/2002	0.00504	3.6	3.5	2.68	9.88	6.4	84	0	427
	M.R. 17020106	MP13	10/22/2002	0.0072	3.4	3.5	2.27	8.35	5.32	66	0	429
	M.R. 17020106	MP13	11/18/2002	0.1044	3.4	3.5	2.07	8.92	5.9	60	0	378

TMDL Pt	Data Source	Sample Site	Date	Flow mgd	Field pH	pH	TFe mg/l	TMn mg/l	TAl mg/l	Acidity mg/l	Alk mg/l	TSO4 mg/l
	M.R. 17020106	MP13	04/30/2003	0.0036	3.7	3.7	0.68	6.85	5	48	0	400
	M.R. 17020106	MP13	05/09/2003	0.0036	*	3.7	0.71	7.02	5.3	54	0	400
	M.R. 17020106	MP13	07/15/2003	0.00216	*	3.6	1.48	7.29	4.71	68	0	396
	M.R. 17020106	MP13	08/07/2003	0.00648	3.6	3.6	31	7.56	5.06	55	0	437
	M.R. 17020106	MP13	09/18/2003	0.0036	3.9	3.7	1.48	5.9	3.91	56	0	304
			Average	**0.02**	**3.59**	**3.60**	**2.90**	**7.39**	**5.09**	**59.48**	**0.00**	**385.33**
			St Dev	**0.02**	**0.17**	**0.09**	**6.47**	**1.33**	**0.66**	**11.01**	**0.00**	**43.06**
	Seep into TRDC6.0											
	M.R. 17020106	MP22	12/27/2001	0.00072	4	4	0.25	3.99	3.2	34	0	383
	M.R. 17020106	MP22	01/20/2002	0.00288	4.3	4.2	25	4.14	3.29	36	4	368
	M.R. 17020106	MP22	02/14/2002	0.00432	4	4	0.22	4.77	3.83	34	0	387
	M.R. 17020106	MP22	03/11/2002	0.0036	4	4.1	0.15	4.21	3.6	38	2	395
	M.R. 17020106	MP22	04/22/2002	0.00324	4	4	0.14	4.36	3.59	34	0	376
	M.R. 17020106	MP22	05/15/2002	0.007632	4	4	0.39	3.91	3.01	30	0	330
	M.R. 17020106	MP22	06/22/2002	0.004608	4	4	0.34	4.13	2.65	28	0	339
	M.R. 17020106	MP22	07/31/2002	0.00216	3.9	4.1	0.25	4.85	3.48	30	2	370
	M.R. 17020106	MP22	08/27/2002	0.00144	4	4	0.22	4.3	3.29	30	0	348
	M.R. 17020106	MP22	09/19/2002	0.000288	4.1	3.5	14.7	4.5	1.13	52	0	422
	M.R. 17020106	MP22	10/22/2002	0.00072	3.7	3.9	2.24	4.47	2.1	32	0	402
	M.R. 17020106	MP22	11/18/2002	0.00324	4.1	4	0.86	4.34	2.81	3	0	364
	M.R. 17020106	MP22	04/30/2003	0.0014544	4	4.1	0.18	4.09	2.91	28	2	363
	M.R. 17020106	MP22	05/09/2003	0.00216	*	4.1	0.17	3.79	2.84	60	4	349
	M.R. 17020106	MP22	07/15/2003	0.00216	*	4	0.44	3.74	3.08	45	0	366
	M.R. 17020106	MP22	08/07/2003	0.00216	3.6	4.1	0.33	3.65	3.27	29	1	333
	M.R. 17020106	MP22	09/18/2003	0.0036	4.1	4.1	0.36	3.48	2.57	34	1	315
			Average	**0.00**	**3.99**	**4.01**	**2.72**	**4.16**	**2.98**	**33.94**	**0.94**	**365.29**
			St Dev	**0.00**	**0.16**	**0.15**	**6.72**	**0.38**	**0.64**	**11.86**	**1.39**	**27.90**

TMDL Pt = Load allocation point
Sample Site = Site identifier in data collection

Attachment F
Comment and Response

No public comments were received for the Deer Creek Watershed TMDL document.