FINAL

Mill Creek Watershed TMDL

Clarion and Jefferson Counties, Pennsylvania

Prepared by:

Pennsylvania Department of Environmental Protection

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Introduction

This Total Maximum Daily Load (TMDL) calculation has been prepared for segments in the Mill Creek Watershed (Attachment A). It was done to address the impairments noted on the 1996 Pennsylvania 303(d) list, required under the Clean Water Act, and covers the one listed segment shown in Table 1. Metals in acidic discharge water from abandoned coalmines causes the impairment. The TMDL addresses the three primary metals associated with acid mine drainage (iron, manganese, aluminum), and pH.

Table 1. 303(d) Sub-List Clarion River								
HUC 05010005; State Water Plan (SWP) Subbasin: 17B								
Year	Miles	Segment ID	DEP Stream Code	Stream Name	Designated Use	Data Source	Source	EPA 305(b) Cause Code
1996	6.1 3.8	5391	49706	Mill Creek	HQ-CWF	303 (d) List	Resource Extraction	Metals & Cause Unknown
1996	1.0	5398	49789	Parks Run	HQ-CWF	SWMR	Resource Extraction	pH
1998	6.8	991112-0900-DSB	49706	Mill Creek	HQ-CWF	303 (d) List	Resource Extraction	Metals
1998	4.2	991112-1000-DSB	49706	Mill Creek	HQ-CWF	303 (d) List	Resource Extraction	Metals
1998	No additional assessment data collected			Parks Run				
2002	11.0	991112-1100-DSB	49706	Mill Creek	HQ-CWF	SWMP	AMD	Metals & pH
2002	1.0	5398	49789	Parks Run	HQ-CWF	SWMP	AMD	pH
2004	3.1	991112-1101-DSB	49706	Mill Creek	HQ-CWF	SWMP	AMD	Metals & pH
2004	3.2	991112-1100-DSB	49706	Mill Creek	HQ-CWF	SWMP	AMD	Metals & pH
2004	4.2	991112-1000-DSB	49706	Mill Creek	HQ-CWF	SWMP	AMD	Metals
2004	3.1	991112-1001-DSB	49706	Mill Creek	HQ-CWF	SWMP	AMD	Metals
2004	6.8	991112-0900	49706	Mill Creek	HQ-CWF	SWMP	AMD	Metals
2004	1.1	20030815-0950-JJM	49715	Unt Mill Creek	HQ-CWF	SWMP	AMD	Metals & pH
2004	0.8	20030815-1215-JJM	49716	Unt Mill Creek	HQ-CWF	SWMP	AMD	Metals & pH
2006	6.8	11399	49706	Mill Creek	HQ-CWF	SWMP	AMD	Metals
2006	4.3	11400	49706	Mill Creek	HQ-CWF	SWMP	AMD	Metals

2006	3.2	11401	49706	Mill Creek	HQ-CWF	SWMP	AMD	Metals
2006	3.2	11402	49706	Mill Creek	HQ-CWF	SWMP	AMD	Metals & pH
2006	3.1	11403	49706	Mill Creek	HQ-CWF	SWMP	AMD	Metals & pH
2006	1.1	5566	49715	Unt Mill Creek	HQ-CWF	SWMP	AMD	Metals & pH
2006	0.8	5573	49716	Unt Mill Creek	HQ-CWF	SWMP	AMD	Metals & pH
2006	0.6	5562	49766	Unt Mill Creek	HQ-CWF	SWMP	AMD	Metals & pH

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

Directions to the Mill Creek Watershed

The Mill Creek Watershed is approximately 59.0 square miles in area. It is located in eastern Clarion County and western Jefferson County in between the towns of Clarion, in Clarion County and Brookville, in Jefferson County, Pennsylvania. Mill Creek flows approximately 20.5 miles from its headwaters in Jefferson County to its confluence with the Clarion River in Clarion County. Mill Creek, from its source to its confluence with Little Mill Creek, is classified as a High Quality Cold Water Fishery (HQ-CWF) under Title 25 PA Code Chapter 93, Section 93.9r and can be found on the Lucinda, Strattanville, Cooksburg, Corsica, Sigel and Brookville 7-1/2 minute quadrangles. Mill Creek (stream code – 49760) is part of the Hydrologic Unit Code 5010005 - Clarion River (formerly State Water Plans 17A and 17B). State Game Lands No. 74 lies entirely within the Mill Creek Watershed.

Mill Creek can be accessed by taking exit 70 from Interstate 80 (I-80) and traveling West on Rt. 322 for approximately 4.4 miles to the town of Strattanville. In Strattanville, turn right onto Fisher Road (SR1001) and travel for approximately 0.3 miles. At this point, Fisher Road takes a sharp right turn. Continue straight onto Millcreek Road and travel for approximately 2.1 miles and you will drive over a bridge across from the PA Fish and Boat Commission boat launch on the Clarion River. Mill Creek flows under this bridge and into the Clarion River at this point. The headwaters of Mill Creek can be accessed by taking exit 73 from I-80 and traveling north on Rt. 949 for approximately 5.4 miles. The headwaters of Mill Creek flow under Rt. 949 at this point (monitoring point MC01).

Directions to the Parks Run Watershed

The Parks Run watershed is located in Jefferson County in northwest Pennsylvania (see Attachment A). It flows into Mill Creek.

Access to the mouth of Parks Run can be gained by taking Exit 12 (Corsica) of Interstate 80. Take PA Rt. 949 North 4.2 miles to LR33082. Turn right (East) 0.5 miles to T355 (Park Td.) bear to the left (NE) to where the road crosses Mill Creek. Walk upstream one eighth of a mile to monitoring point at the mouth of Parks Run.

Access to the headwaters can be gained by taking Exit 12 (Corsica) of Interstate 80. Take PA Rt. 949 North 6.2 miles to T350 (Oakdale Rd.). Turn right (SE) go one half mile to headwaters Parks Run.

Segments addressed in this TMDL Mill Creek Watershed

The Mill Creek Watershed is affected by pollution from AMD. This pollution has caused high levels of metals and low pH in the mainstem of Mill Creek below the confluence with Little Mill Creek, Whites Run, Parks Run, Jones Run and Douglass Run. The sources of the AMD are seeps and discharges from areas disturbed by surface mining. Most of the discharges originate from mining on the Lower Kittanning and Clarion coal seams or refuse piles associated with them.

There are five permitted bituminous coal surface mining permits, one small non-coal (industrial minerals) surface mining permit and a Government Financed Construction Contract (GFCC) in the Mill Creek Watershed.

Active mining has been completed on all five of the coal surface mining permits. Three of those, TDK Coal Sales, SMP No.339601009; Ben Hal Mining Company, SMP No. 33030103; and MSM Coal Company, Inc SMP No. 33020106 will not require wasteload allocations (WLA). The other two, MSM Coal Company, Inc SMP No. 33040102 and Sky Haven Coal Company SMP No. 16990105 had been assigned WLA's in the Little Mill Creek TMDL.

The small non-coal permit, Calvin Gray, SMP No. 33990810, does not produce any discharges and will not require a WLA.

The GFCC (Neiswonger Construction, Inc. 16-06-08) is currently complete and involved the reclamation of approximately 13.4 acres along with incidental coal extraction. This GFCC is currently in Stage II bond release and a WLA is not needed.

All of the remaining discharges in the watershed are from abandoned mines and are considered to be nonpoint sources of pollution because they are from abandoned Pre-Act mining operations or from coal companies that have gone out of business and forfeited their bonds with the Pennsylvania Department of Environmental Protection (PADEP). The distinction between non-point and point sources in this case is determined on the basis of whether or not there is a responsible party for the discharge. Where there is no responsible party the discharge is considered to be a non-point source and it is not assigned a WLA. Fortunately, many of these discharges are now treated through the efforts of varying non-profit organizations. Over 20 passive treatment systems have been constructed in the Mill Creek Watershed on sites where there is no liability by surface mine operators. One such discharge on C&K Coal Company Mine Drainage Permit No. 3776SM6 had been assigned a WLA in the Little Mill Creek TMDL. The mining company has since forfeited their bonds and established a trust fund that is administered by the Clean Streams Foundation Inc. Under the non-point distinction described above, this discharge is now part of the load allocation in the watershed and should not be assigned a WLA.

Each segment on the 303(d) list will be addressed as a separate TMDL. These TMDLs will be expressed as long-term, average loadings. Due to the nature and complexity of mining effects on the watershed, expressing the TMDL as a long-term average gives a better representation of the data used for the calculations.

The use designations for the stream segments in this TMDL can be found in PA Title 25 Chapter 93.

Segments addressed in this TMDL Parks Run Watershed

There are no active mining operations in the watershed. All of the discharges in the watershed are from abandoned mines and will be treated as non-point sources. The distinction between non-point and point sources in this case is determined on the basis of whether or not there is a responsible party for the discharge. Where there is no responsible party the discharge is considered to be a non-point source. Each segment on the integrated list will be addressed as a separate TMDL. These TMDLs will be expressed as long-term average loadings. Due to the nature and complexity of mining effects on the watershed, expressing the TMDL as a long term average gives a better representation of the data used for the calculations.

All of Parks Run, including the stream segment evaluated in this TMDL, has the designation of High Quality Cold Water Fishes (HQ-CWF). The use designations for the stream segments in this TMDL can be found in PA Title 25 Chapter 93.

Clean Water Act Requirements

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

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

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

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

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

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

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

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

In the cases that have been settled to date, the consent agreements require USEPA to backstop TMDL development, track TMDL development, review state monitoring programs, and fund studies on issues of concern (e.g., AMD, implementation of nonpoint source Best Management Practices (BMPs), etc.).

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

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

After the survey is completed, the biologist determines the status of the stream segment. The decision is based on the performance of the segment using a series of biological metrics. If the stream is determined to be impaired, the source and cause of the impairment is documented. An impaired stream must be listed on the state's 303(d) list with the documented source and cause. A TMDL must be developed for the stream segment. A TMDL is for only one pollutant. If a stream segment is impaired by two pollutants, two TMDLs must be developed for that stream segment. In order for the process to be more effective, adjoining stream segments with the same source and cause listing are addressed collectively, and on a watershed basis.

Basic Steps for Determining a TMDL

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

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

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

Watershed History

The Mill Creek Watershed flows through the north central most area of the main bituminous coal region in northwestern Pennsylvania. Very little coal was mined prior to the 1870’s in the Mill Creek Watershed. The development of railroads along with the need for fuel for the industrial revolution was the impetus for increased coal mining in Pennsylvania. Deep mining (small drift mines for household use) was the principal mining method in Clarion and Jefferson Counties until the 1920’s when the prominent mining process started to shift towards strip mining. The surface mining of coal in the Mill Creek watershed and the initiation of the production of AMD from surface mining probably peaked from the mid 1960’s through the late 1970’s. The permitting of coal mining at that time was done without the benefits of today’s techniques for the prediction and prevention of AMD. Several of the more prolific mining companies during that time period included W.P. Stahlman Coal Co., Inc. (later acquired by C & K Coal Company), Mauersburg Coal Company, Zacherl Coal Company, R.E.M. Coal Company, W. Paul Glen, H & G Coal Company, James Kerle Coal Co., Midway Resources, Inc., J.A. Mays (deep mine) and Bracken Construction Co.

Since the middle 1970’s, various government, industry and local organizations have collected data and developed plans to characterize the pollution sources and develop remediation plans for the Mill Creek and other impaired watersheds. The Mill Creek Coalition (MCC), the Department of Environmental Protection’s Knox District Mining Office and Bureau of Abandoned Mine Reclamation, the Clarion and Jefferson County Conservation Districts and the National Resource Conservation Service have been among the most active organizations working towards restoration of this watershed. Improved permitting and mining technologies nationally recognized passive treatment development through the MCC and over $1.5 million in state, federal and private funds and services have improved some stream reaches, but there is still much to be done.

In 1975, the Department of Environmental Resources contracted with the EADS group to perform an acid mine drainage abatement study on the Mill Creek Watershed. The ensuing report, called the Mill Creek ScarLift Report SL-133-5, established 89 sampling and flow measurement stations in the Mill Creek Watershed. 101 discharges were identified in 45 project areas of Mill Creek and its tributaries. For the location of the sampling points and project areas refer to the map contained in the ScarLift SL-133-5 Report.

The Knox District Mining Office started a comprehensive monitoring program to assess the quality of the Mill Creek Watershed and Acid Mine Drainage (AMD) discharges to the Mill Creek watershed. Monitoring of numerous stream stations and discharges in the watershed started in 1981 and continues to the present. Water quality data from this effort has been included in this TMDL.

In the mid 1980's, BAMR contracted with Earth Satellite Corp. to complete a statewide abandoned mine lands inventory. This comprehensive photo interpretive inventory known as NALIS identified 5290 "Problem Areas" statewide with a total of 45 of these "Problem Areas" within the Mill Creek Watershed. The Knox District staff reassessed all of these "Problem Areas" and the NALIS inventory was updated to reflect current conditions.

Starting in late 1980, any new surface mine permit applications in the Mill Creek Watershed required overburden analysis (OBA) and were carefully scrutinized to determine the potential for the production of AMD. On July 31, 1982, Pennsylvania was granted primacy for its coal mining regulatory program under the federal Surface Mining Control and Reclamation Act of 1977 (SMCRA). As part of SMCRA's implementation, any surface mine permit issued prior to June 1980 was required to go through a "re-permitting" process if the operator planned to continue coal mining after March 31, 1983. Based on overburden analysis results conducted as part of that re-permitting process, many of the permits in the Mill Creek watershed were either cancelled or reduced in size or scope to eliminate mining of potentially acid forming overburden.

In March 1999 the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) with the cooperative sponsorship by the Clarion County Commissioners, Jefferson County Commissioners, Clarion Conservation District, Jefferson Conservation District, the Headwaters Resource Conservation and Development and the Mill Creek Coalition submitted the "Mill Creek Watershed Plan and Environmental Assessment, PL 83-566 Report." This plan identified 75 mine drain discharges in the Mill Creek Watershed and recommended the construction of 68 passive mine water treatment systems at a cost of $7,277,000.00. The plan indicated that the sponsors would incur about forty-eight percent (48%) of the total project cost in the Mill Creek Watershed. The report projects the plan will improve water quality and will either restore or enhance the aquatic habitat of 32.8 miles of the Mill Creek Watershed.

Utilizing a variety of funding sources and partnering with various organizations, the Mill Creek Coalition has been responsible for the installation of over seventeen treatment systems in the

Mill Creek watershed, some of which have been treating AMD for over 10 years. Working with Headwaters Charitable Trust as its sponsor, the Mill Creek Coalition received a Growing Greener Grant in 2004 to develop a comprehensive Operation, Maintenance, and Replacement (OM&R) plan for treatment systems in the entire Mill Creek watershed. Existing information on the aging treatment systems along with water quality data was combined with a Geographical Information System (GIS) database for data management and system assessment that will allow the Coalition to make OM&R decisions and system evaluations. The Mill Creek Coalition received a 2005 Growing Greener grant for the site assessment and design of passive treatment systems to remediate discharges associated with two Abandoned Mine Land (AML) sites (PA1173 and PA3482) in the Little Mill Creek Watershed, known as the Glenn AMD Sites (17 and 19). The MCC also received a Growing Greener II grant in 2006 for the redesign and reconstruction of the Filson 7 passive treatment system on the headwaters of Little Mill Creek.

Since 2001, four TMDLs have been completed by the Knox DMO and approved by the EPA in the Mill Creek Watershed. They include Parks Run, Jones Run, Douglass Run and Little Mill Creek.

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 describes below can be applied to situations where all of the pollutant loading is from non-point sources as well as those where there are both point and non-point sources. The following defines what are considered point sources and non-point sources for the purposes of our evaluation; point sources are defined as permitted discharges, non-point sources are then any pollution sources that are not point sources. For situations where all of the impact is due to 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[1] by performing 5,000

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

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

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

PR = required percent reduction for the current iteration

Cc = criterion in mg/l

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

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

Mean = average observed concentration

Standard Deviation = standard deviation of observed data

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

LTA = Mean * (1 – PR99) where (2)

LTA = allowable LTA source concentration in mg/l

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

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

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

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

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

This document contains one or more future mining Waste Load Allocations (WLA) to accommodate possible future mining operations. The Knox District Mining Office determined the number of and location of the future mining WLAs. All comments and questions concerning permitting issues and future mining WLAs are to be directed to the appropriate DMO.

The following are examples of what is or is not intended by the inclusion of future mining WLAs. This list is by way of example and is not intended to be exhaustive or exclusive:

1 The inclusion of one or more future mining WLAs is not intended to exclude the issuance of future non-mining NPDES permits in this watershed or any waters of the Commonwealth.
2 The inclusion of one or more future mining WLAs in specific segments of this watershed is not intended to exclude future mining in any segments of this watershed that does not have a future mining WLA.
3 The inclusion of future mining WLAs does not preclude the amending of this AMD TMDL to accommodate additional NPDES permits.

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 are 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 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 instream limits to be exceeded.

Standard Treatment Pond Effluent Limits:
Alkalinity > Acidity
6.0 <= pH <= 9.0
Al <= 0.75 mg/l (Criteria)
Fe <= 3.0 mg/l (BAT)
Mn <= 2.0 mg/l (BAT)

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 WLA 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 WLA 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 1,500 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 1,500’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 instream 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 1,500’x300’/pit x 7.48 gal/ft^3 x 1yr/365days x 1day/24hr x 1hr/60 min x 15 in. runoff/100 in. precip =

= 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 Aluminum WLA:
30.9 gal/min x 0.75 mg/l x 0.01202 = 0.3 lbs/day

Allowable Iron WLA:
30.9 gal/min x 3 mg/l x 0.01202 = 1.1 lbs/day

Allowable Manganese WLA:
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 (MOS) in the methodology. County specific precipitation rates can be used in place of the long-term state average rate, although the MOS 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, 1,500 ft x 300 ft 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 WLA is very generous and likely high compared to actual conditions that are generally encountered. A large MOS is included in the WLA 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 instream limits. When a mining operation is concluded its WLA is available for a different operation. Where there are indications that future mining in a watershed is greater than the current level of mining activity, an additional WLA amount may be included to allow for future mining.

Derivation of the flow used in the future mining WLAs:

30.9 gal/min X 2 (assume two pits) X 0.00144 = 0.09 MGD

Future TMDL Modifications

In the future, the Department may adjust the load and/or wasteload allocations in this TMDL to account for new information or circumstances that are developed or discovered during the implementation of the TMDL when a review of the new information or circumstances indicate that such adjustments are appropriate. Adjustment between the load and wasteload allocation will only be made following an opportunity for public participation. A wasteload allocation adjustment will be made consistent and simultaneous with associated permit(s) revision(s)/reissuances (i.e., permits for revision/reissuance in association with a TMDL revision will be made available for public comment concurrent with the related TMDL's availability for public comment). New information generated during TMDL implementation may include, among other things, monitoring data, BMP effectiveness information, and land use information. All changes in the TMDL will be tallied and once the total changes exceed 1% of the total original TMDL allowable load, the TMDL will be revised. The adjusted TMDL, including its LAs and WLAs, will be set at a level necessary to implement the applicable WQS and any adjustment increasing a WLA will be supported by reasonable assurance demonstration that load allocations will be met. The Department will notify EPA of any adjustments to the TMDL within 30 days of its adoption and will maintain current tracking mechanisms that contain accurate loading information for TMDL waters.

Changes in TMDLs That May Require EPA Approval

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

Changes in TMDLs That May Not Require EPA Approval

- Total loading shift less than or equal to 1% of the total load.
- Increase of WLA results in greater LA reductions provided reasonable assurance of implementation is demonstrated (a compliance/implementation plan and schedule).
- Changes among WLAs with no other changes; TMDL public notice concurrent with permit public notice.
- Removal of a pollutant source that will not be reallocated.
- Reallocation between LAs.
- Changes in land use.

TMDL Endpoints

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

Because of the nature of the pollution sources in the watershed, the 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 a minimum 99 percent level of protection is required. All metals criteria evaluated in this TMDL are specified as total recoverable. Pennsylvania does have dissolved criteria for iron; however, the data used for this analysis report iron as total recoverable. Table 2 shows the water quality criteria for the selected parameters.

Table 2 Applicable Water Quality Criteria

Parameter	***Criterion Value (mg/l)***	***Total Recoverable/Dissolved***
Aluminum (Al)	0.75	Total Recoverable
Iron (Fe)	1.50	Total Recoverable
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).

For High Quality and EV waters, applicable water-quality criteria are determined using the unimpaired segment of the TMDL water or the 95th percentile of a reference WQN stream. For Mill Creek, WQN310 Wapwallopen Creek is used as the reference water. The following table shows the criteria used in the Mill Creek TMDL development. Attachment D explains how to select a reference stream for HQ TMDL development.

Table 3. Reference Stream Wapwallopen Creek Criteria

Parameter	Criterion Value (mg/l)
Aluminum (Al)	0.2
Iron (Fe)	0.12
Area	43.8 sq. mi.
Alkalinity	10.2

TMDL Elements (WLA, LA, MOS)

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

TMDL Allocations Summary

There were not enough samples at any sample point to check for correlation between metals and flow for Mill Creek.

Allocation Summary

This TMDL will focus remediation efforts on the identified numerical reduction targets for each watershed. The reduction schemes in Table 3 for each segment are based on the assumption that all upstream allocations are achieved and take in to account all upstream reductions. Attachment C contains the TMDLs by segment analysis for each allocation point in a detailed discussion. As changes occur in the watershed, the TMDLs may be re-evaluated to reflect current conditions. An implicit MOS based on conservative assumptions in the analysis is included in the TMDL calculations.

The allowable LTA concentration in each segment is calculated using Monte Carlo Simulation as described previously. The allowable load is then determined by multiplying the allowable concentration by the flow and a conversion factor at each sample point. The allowable load is the TMDL.

In some instances, instream processes, such as settling, are taking place within a stream segment. These processes are evidenced by a decrease in measured loading between consecutive sample points. It is appropriate to account for these losses when tracking upstream loading through a segment. The calculated upstream load lost within a segment is proportional to the difference in the measured loading between the sampling points.

Table 4. Summary Table–Mill 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 %
MC02	Most Upstream Sample Point on Mill Creek (49708)						
	Al	9.2	1.2	0.0	1.2	8.0	87
	Fe	8.8	0.44	0.0	0.44	8.36	95
	Mn	42.0	3.8	0.0	3.8	38.2	91
	Acidity	384.0	38.4	0.0	38.4	349.4	90
PO1	Mouth of Parks Run (49789)						
	Al	5.8	1.34	0.0	1.34	4.46	77
	Fe	3.8	0.42	0.0	0.42	3.38	89
	Mn	3.14	3.13	0.0	3.13	0.01	0.2
	Acidity	72.6	32.7	0.0	32.7	47.2	55
MC03	Mill Creek (49708) Downstream of Confluence with Parks Run						
	Al	15.8	1.9	0.0	1.9	1.5	44
	Fe	14.6	0.58	0.0	0.58	2.3	79
	Mn	23.0	11.5	0.0	11.5	0.0	0
	Acidity	488.8	58.7	0.0	58.7	44.6	43
MC03C	Mill Creek (49708) Upstream of Confluence with Unt (49782)						
	Al	25.8	2.1	0.0	2.1	9.8	83
	Fe	25.5	1.8	0.0	1.8	9.7	85
	Mn	20.3	20.3	0.0	20.3	0.0	0
	Acidity	540.7	70.3	0.0	70.3	40.3	36
MC05	Mill Creek (49708) Upstream of Confluence with Unt (49777)						
	Al	31.6	8.5	0.0	8.5	0.0	0
	Fe	233.1	2.3	0.0	2.3	207.0	99
	Mn	202.0	18.2	0.0	18.2	183.9	91
	Acidity	1184.2	106.6	0.0	106.6	607.3	85
MC07	Mill Creek (49708) Upstream of Confluence with Unt (49767)						
	Al	37.8	7.9	0.0	7.9	6.8	46
	Fe	115.3	4.6	0.0	4.6	0.0	0
	Mn	168.0	28.6	0.0	28.6	0.0	0
	Acidity	1444.4	173.3	0.0	173.3	193.4	53
MC08	Mill Creek (49708) Downstream of Confluence with Unt (49752)						
	Al	41.0	9.0	0.0	9.0	2.1	19
	Fe	73.4	2.9	0.0	2.9	0.0	0
	Mn	142.4	34.2	0.0	34.2	0.0	0
	Acidity	1902.0	228.2	0.0	228.2	402.7	64
LMC06	Mouth of Little Mill Creek (49727) Upstream of Confluence with Mill Creek						
	Al	79.1	14.2	0.0	11.4	0.0	0
	Fe	202.8	26.4	0.0	15.15	0.1	0.4
	Mn	471.4	23.6	0.0	16.1	36.8	61
	Acidity	3041.7	60.8	0.0	60.8	765.4	93
MC08B	Mill Creek (49708) Downstream of Confluence with Little Mill Creek (49727)						
	Al	107.4	107.4	*2.8*	104.6	0.0	0
	Fe	402.3	68.4	*11.25*	57.15	87.0	56
	Mn	768.5	61.5	*7.5*	54.0	150.9	71
	Acidity	7909.8	711.9	0.0	711.9	2543.3	78
DR2	Mouth of Douglas Run (49720) Upstream of Confluence with Mill Creek						
	Al	542.8	43.4	0.0	40.6	415.7	91
	Fe	1624.0	32.5	0.0	21.25	184.5	85

Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Reduction %
	Mn	1325.9	53.0	0.0	45.5	629.1	92
	Acidity	12889.1	0.0	0.0	0.0	1602.9	100
MC09	Mill Creek (49708) Upstream of Confluence with Unt (49717)						
	Al	280.8	61.8	*2.8*	59.0	3.4	5
	Fe	692.4	138.5	*11.25*	128.25	0.0	0
	Mn	860.8	77.5	*7.5*	70.0	0.0	0
	Acidity	8947.3	536.8	0.0	536.8	0.0	0
UNT31	Unt (49716) Mill Creek Upstream of Confluence with Mill Creek						
	Al	2.1	0.3	0.0	0.3	1.8	88
	Fe	6.0	0.2	0.0	0.2	5.8	97
	Mn	16.6	1.0	0.0	0.05	16.55	94
	Acidity	67.6	6.1	0.0	6.1	61.5	91
UNT30	UNT (49715) Mill Creek Upstream of Confluence with Mill Creek						
	Al	1.9	0.5	0.0	0.5	1.4	74
	Fe	54.8	0.2	0.0	0.2	54.6	99.7
	Mn	20.7	1.0	0.0	1.0	19.7	95
	Acidity	220.3	11.0	0.0	11.0	209.3	95
MC10	Mill Creek (49708) Downstream of Confluence with Unt (49713)						
	Al	325.8	88.0	*2.8*	85.2	15.6	15
	Fe	677.2	182.8	*11.25*	171.55	0.0	0
	Mn	1058.2	95.2	*7.5*	87.7	144.5	60
	Acidity	10471.9	628.3	0.0	628.3	1162.4	65
WR1	Mouth of Whites Run (49707) Upstream of Confluence with Mill Creek						
	Al	23.2	0.8	0.0	0.8	22.4	97
	Fe	165.2	1.0	0.0	1.0	164.2	99
	Mn	96.1	0.7	0.0	0.7	95.4	99
	Acidity	953.4	0.0	0.0	0.0	953.4	100
MC11	Mouth of Mill Creek						
	Al	283.0	79.2	*2.8*	76.4	0.0	0
	Fe	493.2	138.1	*11.25*	126.85	0.0	0
	Mn	791.3	79.1	*7.5*	71.6	0.0	0
	Acidity	8209.3	985.1	0.0	985.1	0.0	0

The italicized values in the WLA column in table four are future mining wlas.

Recommendations

Various methods to eliminate or treat pollutant sources and to provide a reasonable assurance that the proposed TMDLs can be met exist in Pennsylvania. These methods include PADEP's primary efforts to improve water quality through reclamation of abandoned mine lands (for abandoned mining) and through the National Pollution Discharge Elimination System (NPDES) permit program (for active mining). Funding sources available that are currently being used for projects designed to achieve TMDL reductions include the Environmental Protection Agency (EPA) 319 grant program and Pennsylvania's Growing Greener Program. Federal funding is through the Department the Interior, Office of Surface Mining (OSM), for reclamation and mine drainage treatment through the Appalachian Clean Streams Initiative and through Watershed Cooperative Agreements.

OSM reports that nationally, of the $8.5 billion of high priority (defined as priority 1&2 features or those that threaten public health and safety) coal related AML problems in the AML inventory, $6.6 billion (78%) have yet to be reclaimed; $3.6 billion of this total is attributable to Pennsylvania watershed costs. Almost 83 percent of the $2.3 billion of coal related environmental problems (priority 3) in the AML inventory are not reclaimed.

The Bureau of Abandoned Mine Reclamation, Pennsylvania's primary bureau in dealing with abandoned mine reclamation (AMR) issues, has established a comprehensive plan for abandoned mine reclamation throughout the Commonwealth to prioritize and guide reclamation efforts for throughout the state to make the best use of valuable funds (www.dep.state.pa.us/dep/deputate/minres/bamr/complan1.htm). In developing and implementing a comprehensive plan for abandoned mine reclamation, the resources (both human and financial) of the participants must be coordinated to insure cost-effective results. The following set of principles is intended to guide this decision making process:

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

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

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

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

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

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

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

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

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

In addition to the abandoned mine reclamation program, regulatory programs also are assisting in the reclamation and restoration of Pennsylvania's land and water. PADEP has been effective in implementing the NPDES program for mining operations throughout the Commonwealth. This reclamation was done, through the use of remining permits which have the potential for reclaiming abandoned mine lands, at no cost to the Commonwealth or the federal government. Long-term treatment agreements were initialized for facilities/operators who need to assure treatment of post-mining discharges or discharges they degraded which will provide for long-term treatment of discharges. According to OSM, "PADEP is conducting a program where active mining sites are, with very few exceptions, in compliance with the approved regulatory program".

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

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

Since 1990, the Mill Creek Coalition has been active in assessing the water quality and completing AMD remediation projects in the Mill Creek Watershed. Working with local partnerships and local, state and federal agencies, the Mill Creek Coalition has been responsible for the installation of approximately 17 passive treatment systems; 13 of which are located in the Little Mill Creek Watershed. The Coalition is currently working with Headwaters Charitable Trust to redesign and reconstruct the Filson 7 passive treatment system. The Coalition has completed the design for two passive treatment systems in the Little Mill Creek watershed on the

Glenn AMD Sites (17 and 19) and has also applied for funding through the Growing Greener program in order to construct passive treatment systems on the Glenn 17 site. Based on information obtained through the completion of the Operation, Maintenance and Replacement Plan, funded by a Growing Greener grant, the Coalition has also applied for funding through the Growing Greener program in order to perform upgrades to the Bog, Morrow, Filson 4 and Filson 5/6 passive treatment systems.

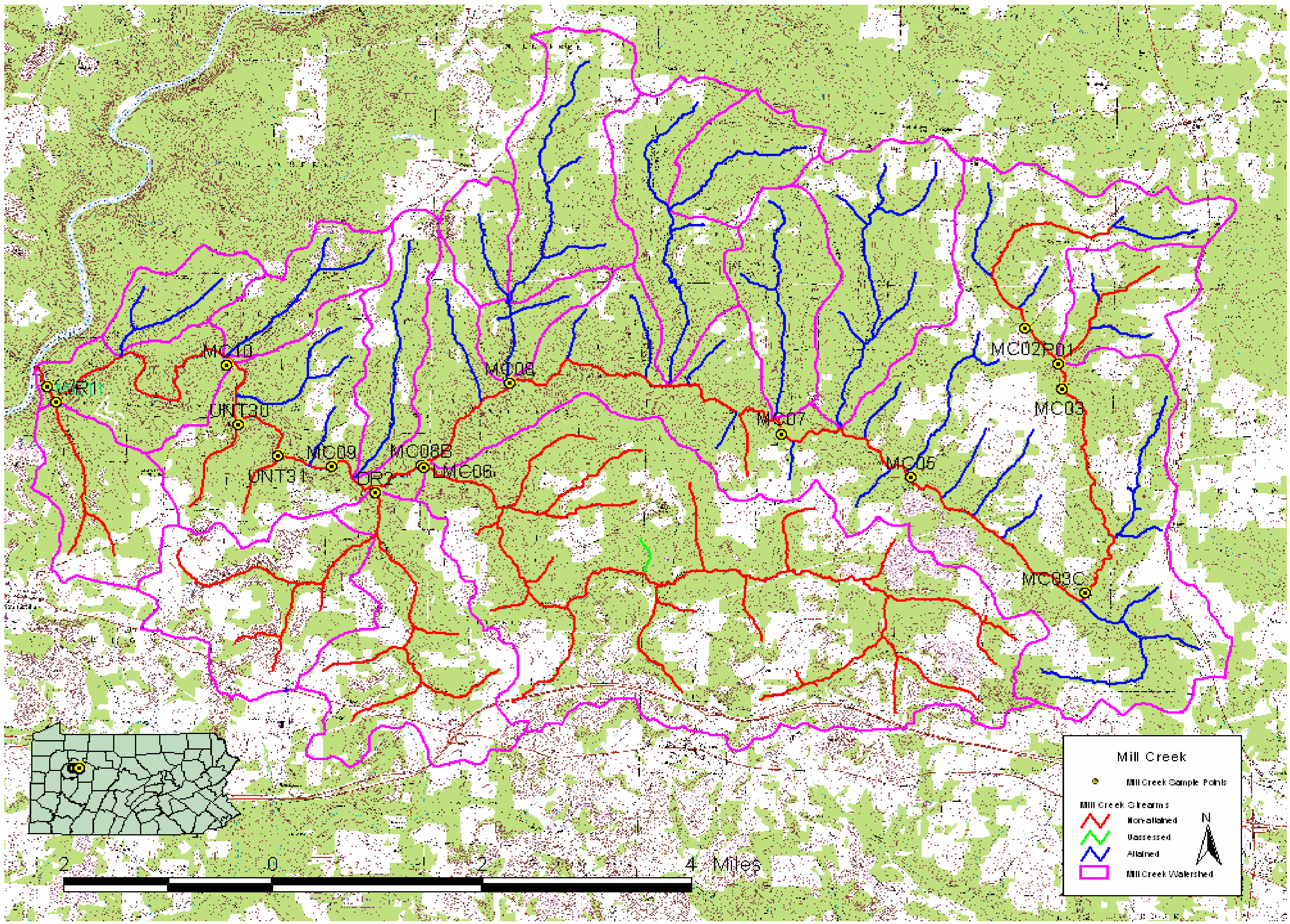
Candidate or federally-listed threatened and endangered species may occur in or near the watershed. While implementation of the TMDL should result in improvements to water quality, they could inadvertently destroy habitat for candidate or federally-listed species. TMDL implementation projects should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

Public Participation

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* on September 27, 2008 to foster public comment on the allowable loads calculated. A public meeting was held on October 2, 2008 beginning at 10:00a.m., at the Knox District Mining Office in Knox, Pennsylvania, to discuss the proposed TMDL.

Attachment A

Mill Creek Watershed Maps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UNT31
MC09
MC08B
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DR2
MC08
MC07
MC05
MC02
P01
MC03
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Mill Creek
Mill Creek Sample Points
Mill Creek Streams
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Unassessed
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Mill Creek Watershed
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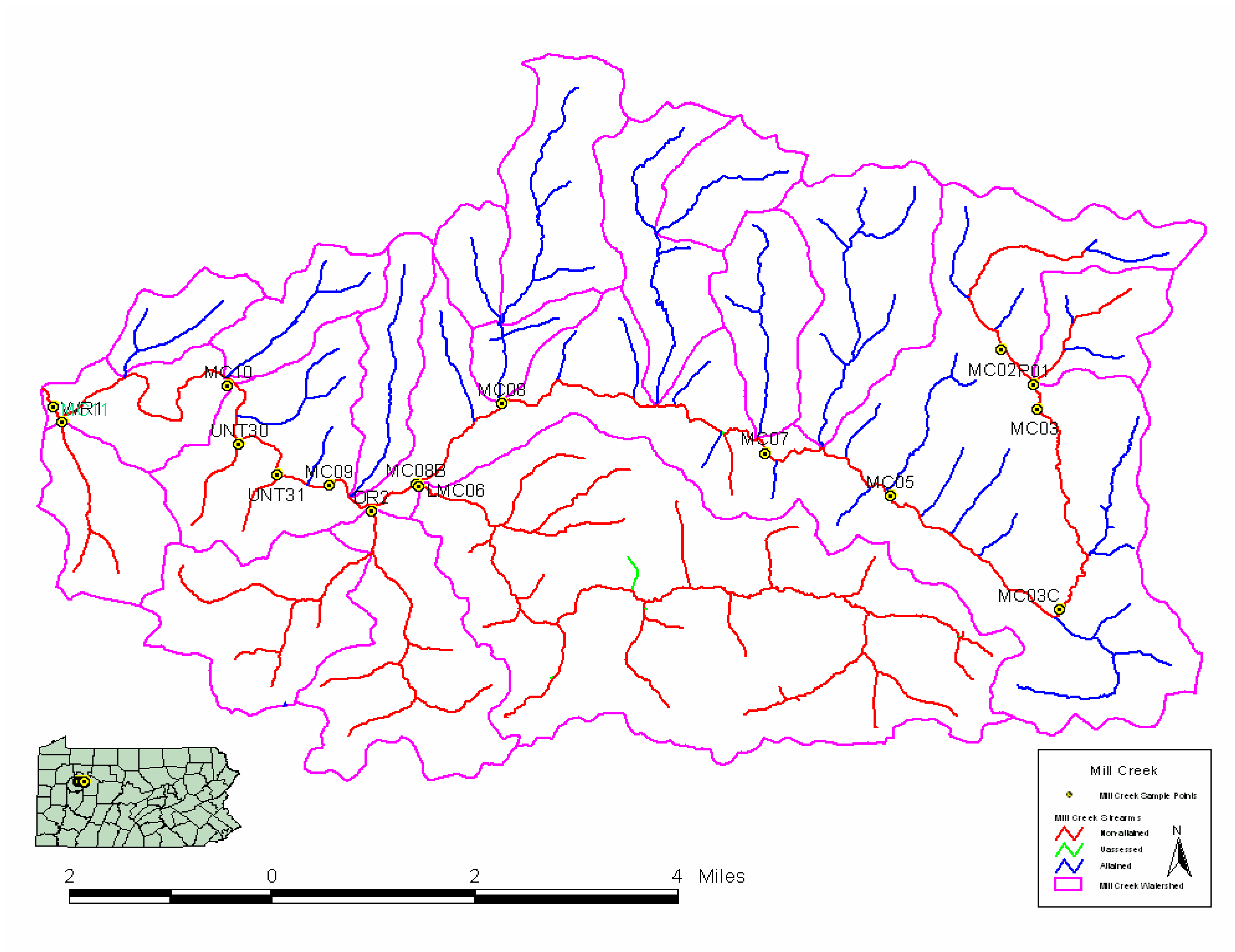
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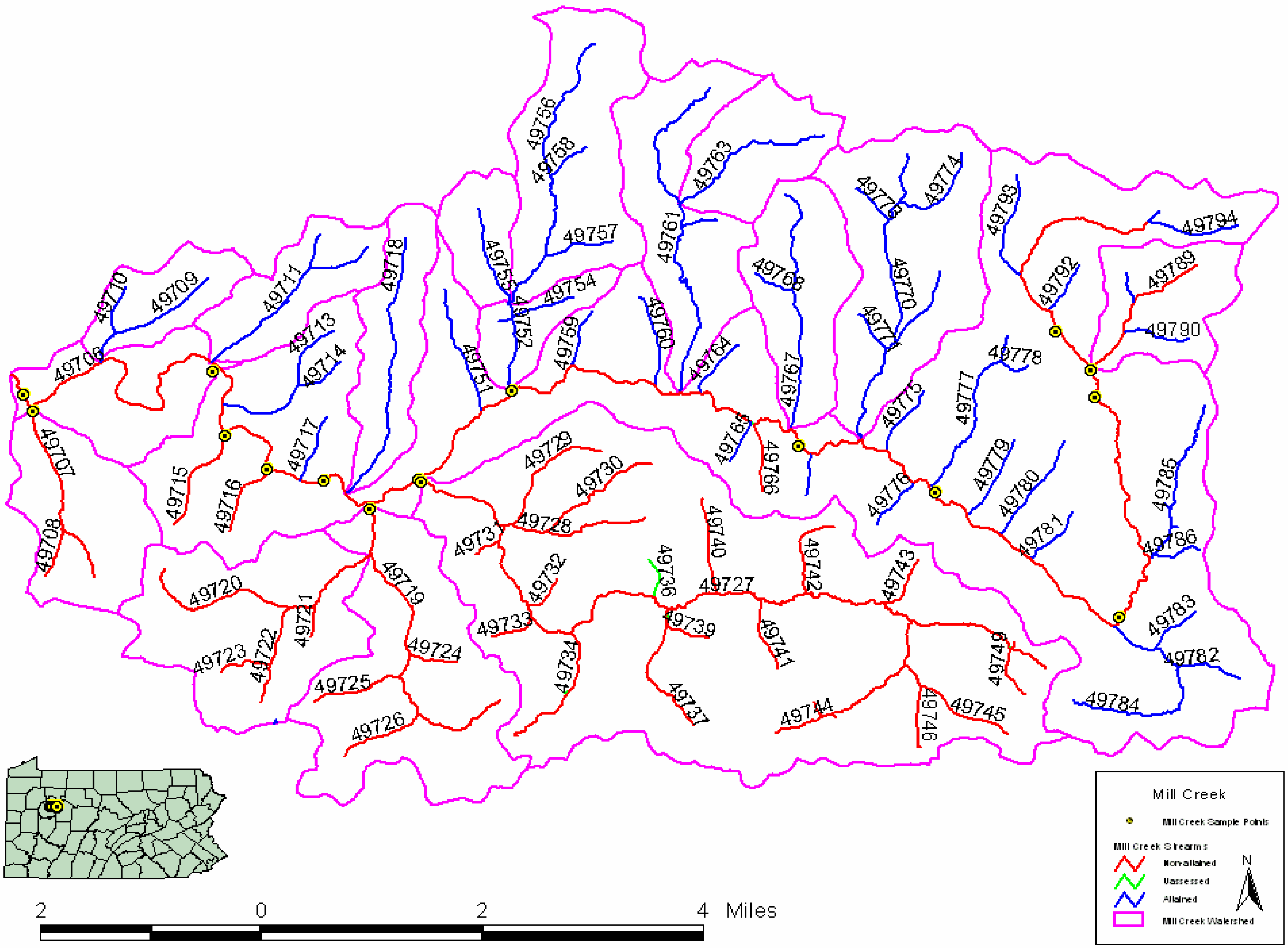
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Attachment B

Method for Addressing Section 303(d) Listings for pH

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 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.

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

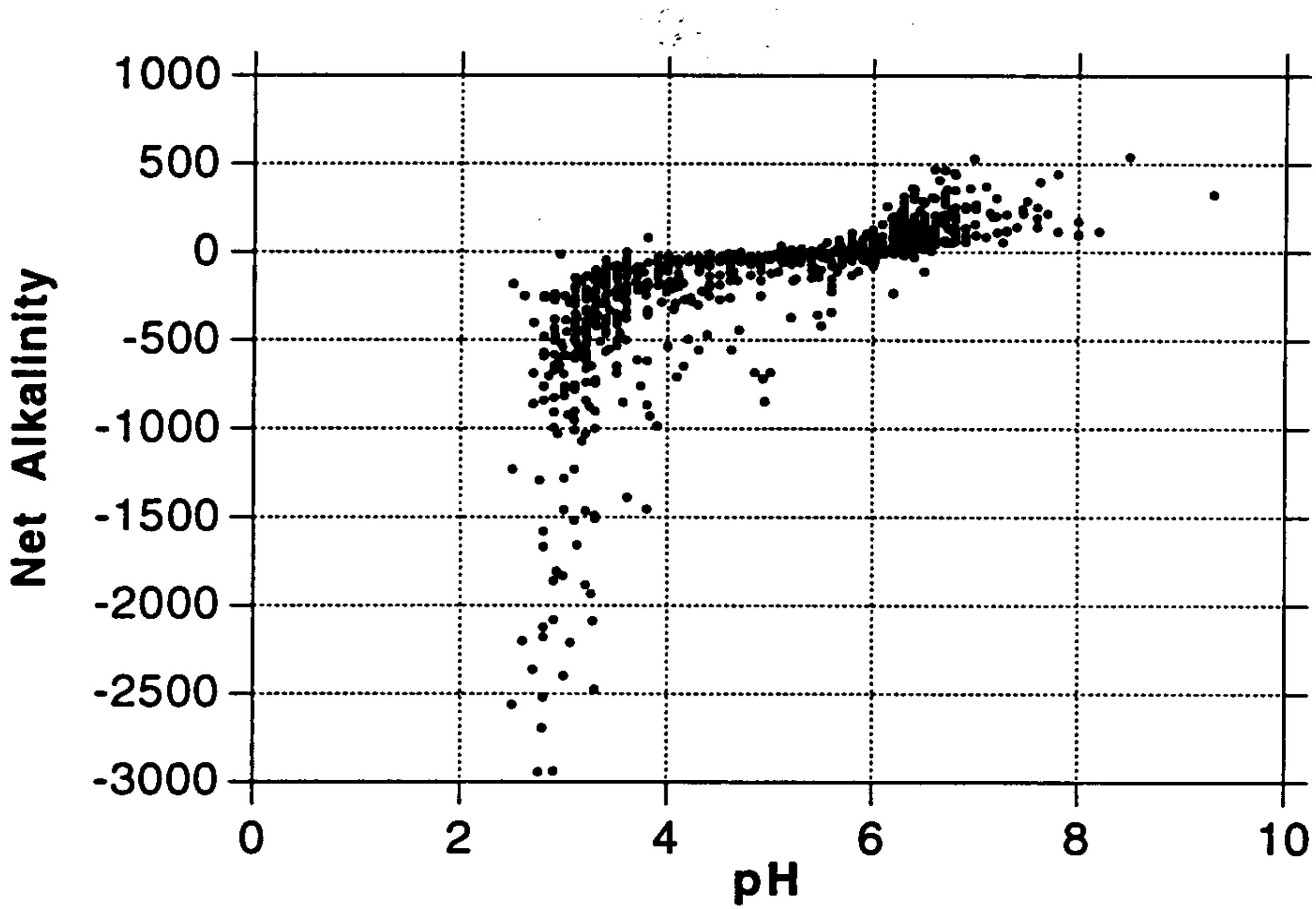

Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

Attachment C

TMDLs By Segment

Mill Creek

The TMDL for Mill Creek consists of load allocations for sixteen sampling sites along Mill Creek, Parks Run, Jones Run, Douglas Run, Whites Run, Little Mill Creek and various unnamed tributaries.

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

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

MC02 Most Upstream Sample Point on Mill Creek (49706)

The TMDL for this sample point on Mill Creek consists of a load allocation to the segment upstream. The load allocation for this segment was computed using water-quality sample data collected at point MC02. The average flow, measured at the sampling point MC02 (1.99 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point MC02 shows pH ranging between 4.1 and 6.6; pH will be addressed in this TMDL because of the affects of mining.

Table C1. Load Allocations for Point MC02

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Al	0.55	9.2	0.07	1.2
Fe	0.53	8.8	0.03	0.44
Mn	2.53	42.0	0.23	3.8
Acid	23.08	384.0	2.31	38.4
Alk	10.2	169.7		

Table C2. Calculation of Load Reductions Necessary at Point MC02				
	Al (lbs/day)	(Fe lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	9.2	8.8	42.0	384.0
Allowable Load = TMDL	1.2	0.44	3.8	38.4
Load Reduction	8.0	8.36	38.2	349.4
% Reduction Segment	87%	95%	91%	90%

PO1 Mouth of Parks Run (49789)

The data presented here is newer than that presented in the existing Parks Run watershed TMDL. This data is not considered or used to rewrite the previous TMDL and this not considered a TMDL at sample point PO1. The average flow, measured at the sampling point PO1 (1.34 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point PO1 shows pH ranging between 5.2 and 6.3; pH will be addressed in this TMDL because of the affects of mining.

Table C3. Load Allocations for Point PO1				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Al	0.52	5.8	0.12	1.3
Fe	0.34	3.8	0.04	0.4
Mn	0.28	3.14	0.28	3.1
Acid	6.51	72.6	2.93	32.7
Alk	10.2	113.75		

Table C4. Calculation of Load Reductions Necessary at Point PO1				
	Al (lbs/day)	(Fe lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	5.8	3.8	3.14	72.6
Allowable Load = TMDL	1.3	0.4	3.1	32.7
Load Reduction	4.5	3.4	0.04	39.9
% Reduction Segment	77%	89%	0.2%	55%

MC03 Mill Creek (49706) Downstream of Confluence with Parks Run

The TMDL for this sample point on Mill Creek consists of a load allocation to all of the area between sample points MC02, PO1 and MC03. The load allocation for this segment was computed using water-quality sample data collected at point MC03. The average flow, measured at the sampling point MC03 (3.71 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point MC03 shows pH ranging between 3.8 and 6.7; pH will be addressed in this TMDL because of the affects of mining.

Table C5. Load Allocations for Point MC03				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Al	0.51	15.8	0.06	1.9
Fe	0.47	14.6	0.02	0.6
Mn	0.74	23.0	0.37	11.55
Acid	15.81	488.8	1.90	58.7
Alk	10.20	315.4		

The calculated load reductions for all the loads that enter point MCO3 must be accounted for in the calculated reductions at sample point MC03 shown in Table C8. A comparison of measured loads between points MC02, PO1 and MC03 shows that there is no additional loading entering the segment for manganese. For manganese the percent decrease in existing loads are applied to the allowable upstream loads entering the segment. There is additional loading entering the segment for aluminum, iron and acidity. The total segment aluminum, iron and acidity loads are the sum of the upstream allocated loads and any additional loading within the segment.

Table C6. Calculation of Load Reduction at Point MC03				
	Al	Fe	Mn	Acidity
Existing Load	15.8	14.6	23.0	488.8
Difference in Existing Load between MC02, PO1 & MC03	0.8	2.0	-22.2	32.2
Load tracked from MC02 & PO1	2.5	0.9	6.9	71.1
Percent loss due to instream process	-	-	49	-
Percent load tracked from MC02 & PO1	-	-	51	-
Total Load tracked from MC02 & PO1	3.4	2.8	3.5	103.3
Allowable Load at MC03	1.9	0.6	11.5	58.7
Load Reduction at MC03	1.5	2.3	0.0	44.6
% Reduction required at MC03	44	79	0	43

MC03C Mill Creek (49706) Downstream of Confluence with Unt (49782)

The TMDL for this sample point on Mill Creek consists of a load allocation to all of the area upstream of sample point MC03C. The load allocation for this segment was computed using water-quality sample data collected at point MC03C. The average flow, measured at the sampling point MC03C (5.42 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point MC03C shows pH ranging between 6.1 and 6.9; pH will be addressed in this TMDL because of the affects of mining. The method and rationale for addressing pH is contained in Attachment B.

Table C7. Load Allocations for Point MC03C

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. mg/l	Load Lbs/day
Al	0.57	25.8	0.05	2.1
Fe	0.56	25.5	0.04	1.8
Mn	0.45	20.3	0.45	20.3
Acid	11.95	540.7	1.55	70.3
Alk	10.20	461.4		

The calculated load reductions for all the loads that enter point MCO3 must be accounted for in the calculated reductions at sample point MC03C shown in Table C8. A comparison of measured loads between points MC03 and MC03C shows that there is no additional loading entering the segment for manganese. For manganese the percent decrease in existing loads are applied to the allowable upstream loads entering the segment. There is additional loading entering the segment for aluminum, iron and acidity. The total segment aluminum, iron and acidity loads are the sum of the upstream allocated loads and any additional loading within the segment.

Table C8. Calculation of Load Reduction at Point MC03c				
	Al	Fe	Mn	Acidity
Existing Load	25.8	25.5	20.3	540.7
Difference in Existing Load between MC03 & MC03C	10.0	10.9	-2.6	51.9
Load tracked from MC03	1.9	0.6	11.5	58.7
Percent loss due to instream process	-	-	12	-
Percent load tracked from MC03	-	-	88	-
Total Load tracked from MC03	11.9	11.5	10.2	110.5
Allowable Load at MC03C	2.1	1.8	20.3	70.3
Load Reduction at MC03C	9.8	9.7	0.0	40.3
% Reduction required at MC03C	83	85	0	36

MC05 Mill Creek (49706) Upstream of Confluence with Unt (49777)

The TMDL for this unnamed tributary of Mill Creek consists of a load allocation to the watershed area between sample points MC03C and MC05. The load allocation for this segment was computed using water-quality sample data collected at point MC05. The average flow, measured at the sampling point MC05 (7.87 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point MC05 shows pH ranging between 6.0 and 6.7; pH will be addressed in this TMDL because of the affects of mining. The method and rationale for addressing pH is contained in Attachment B.

Table C9. Load Allocations at Point MC05				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.48	31.6	0.13	8.5
Fe	3.55	233.1	0.04	2.3
Mn	3.08	202.0	0.28	18.2
Acid	18.05	1184.2	1.62	106.6
Alk	10.20	669.3		

The calculated load reductions for all the loads that enter point MC05 must be accounted for in the calculated reductions at sample point MC05 shown in Table C10. A comparison of measured loads between points MC03C and MC05 shows that there is additional loading entering the segment for aluminum iron, manganese and acidity. The total segment aluminum, iron, manganese and acidity loads are the sum of the upstream allocated loads and any additional loading within the segment.

Table C10. Calculation of Load Reduction at Point MC05				
	Al	Fe	Mn	Acidity
Existing Load	31.6	233.1	202.0	1184.2
Difference in Existing Load between MC03C & MC05	5.7	207.6	181.7	643.5
Load tracked from MC03C	2.1	1.8	20.3	70.3
Percent loss due to instream process	-	-	-	-
Percent load tracked from MC03C	-	-	-	-
Total Load tracked from MC03C	7.8	209.3	202.0	713.8
Allowable Load at MC05	8.5	2.3	18.2	106.6
Load Reduction at MC05	0.0	207.0	183.9	607.3
% Reduction required at MC05	0	99	91	85

MC07 Mill Creek (49706) Upstream of Confluence with Unt (49767)

The TMDL for sampling point MC07 consists of a load allocation to the area upstream of point MC07. The load allocation for this tributary was computed using water-quality sample data collected at point MC07. The average flow, measured at the sampling point MC07 (9.72 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point MC07 shows pH ranging between 5.9 and 7.3; pH will be addressed in this TMDL because of the affects of mining. The method and rationale for addressing pH is contained in Attachment B.

Table C11. Load Allocations at Point MC07				
	Measured Sample Data		**Allowable**	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.47	37.8	0.10	7.9
Fe	1.42	115.3	0.06	4.6
Mn	2.07	168.0	0.35	28.6
Acid	17.81	1444.4	2.14	173.3
Alk	10.20	827.2		

The calculated load reductions for all the loads that enter point MCO7 must be accounted for in the calculated reductions at sample point MC07 shown in Table C12. A comparison of measured loads between points MC05 and MC07 shows that there is no additional loading entering the segment for iron and manganese. For iron and manganese the percent decrease in existing loads are applied to the allowable upstream loads entering the segment. There is additional loading entering the segment for aluminum and acidity. The total segment aluminum and acidity loads are the sum of the upstream allocated loads and any additional loading within the segment.

Table C12. Calculation of Load Reduction at Point MC07				
	Al	Fe	Mn	Acidity
Existing Load	37.8	115.3	168.0	1444.4
Difference in Existing Load between MC05 & MC07	6.2	-117.8	-34.0	260.2
Load tracked from MC05	8.5	2.3	18.2	106.6
Percent loss due to instream process	-	51	17	-
Percent load tracked from MC05	-	49	83	-
Total Load tracked from MC05	14.8	1.2	15.1	366.8
Allowable Load at MC07	7.9	4.6	28.6	173.3
Load Reduction at MC07	6.8	0.0	0.0	193.4
% Reduction required at MC07	46	0	0	53

MC08 Mill Creek (49706) Downstream of Confluence with Unt (49752)

The TMDL for sampling point MC08 consists of a load allocation to all of the area upstream of point MC08. The load allocation for this tributary was computed using water-quality sample data collected at point MC08. The average flow, measured at the sampling point MC08 (11.81 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point MC08 shows pH ranging between 5.7 and 6.6; pH will be addressed in this TMDL because of the affects of mining. The method and rationale for addressing pH is contained in Attachment B.

Table C13. Load Allocations at Point MC08				
	Measured Sample Data		**Allowable**	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.42	41.0	0.09	9.0
Fe	0.75	73.4	0.03	2.9
Mn	1.45	142.4	0.35	34.2
Acid	19.31	1902.0	2.32	228.2
Alk	10.20	1004.5		

The calculated load reductions for all the loads that enter point MCO8 must be accounted for in the calculated reductions at sample point MC08 shown in Table C14. A comparison of measured loads between points MC07 and MC08 shows that there is no additional loading entering the segment for iron and manganese. For iron and manganese the percent decrease in existing loads are applied to the allowable upstream loads entering the segment. There is additional loading entering the segment for aluminum and acidity. The total segment aluminum and acidity loads are the sum of the upstream allocated loads and any additional loading within the segment.

Table C14. Calculation of Load Reduction at Point MC08

	Al	Fe	Mn	Acidity
Existing Load	41.0	73.4	142.4	1902.0
Difference in Existing Load between MC07 & MC08	3.2	-41.8	-25.6	457.6
Load tracked from MC07	7.9	4.6	28.6	173.3
Percent loss due to instream process	-	36	15	-
Percent load tracked from MC07	-	64	85	-
Total Load tracked from MC07	11.1	2.9	24.2	630.9
Allowable Load at MC08	9.0	2.9	34.2	228.2
Load Reduction at MC08	2.1	0.0	0.0	402.7
% Reduction required at MC08	19	0	0	64

LMC06 Mouth of Little Mill Creek (49727) Upstream of Confluence with Mill Creek

The data presented here is from the existing Little Mill Creek watershed TMDL. This data is not considered or used to rewrite the previous TMDL and this not considered a TMDL at sample point LMC06. The average flow, measured at the sampling point LMC06 (7.41 MGD), is used for these computations.

There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point LMC06 shows pH ranging between 3.4 and 6.2; pH will be addressed in this TMDL because of the mining impairment. The method and rationale for addressing pH is contained in Attachment B.

Table C15. Load Allocations at Point LMC06				
	Measured Sample Data		**Allowable**	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	1.37	79.1	0.25	14.2
Fe	3.52	202.8	0.46	26.4
Mn	8.19	471.4	0.41	23.6
Acid	52.84	3041.7	1.06	60.8
Alk	2.65	152.7		

The calculated load reductions for all the loads that enter point LMCO6 must be accounted for in the calculated reductions at sample point LMC06 shown in Table C16. A comparison of measured loads between points LMC05, UNT12, UNT12B, UNT13 and LMC06 shows that there is no additional loading entering the segment for aluminum. For aluminum the percent decrease in existing loads are applied to the allowable upstream loads entering the segment. There is additional loading entering the segment for iron, manganese and acidity. The total segment iron, manganese and acidity loads are the sum of the upstream allocated loads and any additional loading within the segment.

Table C16. Calculation of Load Reduction at Point LMC06				
	Al	Fe	Mn	Acidity
Existing Load	79.1	202.8	471.4	3041.7
Difference in Existing Load between LMC05, Unt12, Unt12B, Unt13 & LMC06	-5.7	9.0	38.6	714.9
Load tracked from LMC06	14.3	17.4	21.8	111.4
Percent loss due to instream process	7	-	-	-
Percent load tracked from LMC05, Unt12, Unt12B and Unt13	93	-	-	-
Total Load tracked from LMC05, Unt12, Unt12B and Unt13	13.4	26.5	60.4	862.2
Allowable Load at LMC06	14.2	26.4	23.6	60.8
Load Reduction at LMC06	0.0	0.1	36.8	765.4
% Reduction required at LMC06	0	0.4	61	93

A waste load allocation for future mining was included for this segment of Mill Creek (MC08B) allowing for five operations with two active pits (1500’ x 300’) to be permitted in the future on this segment (page 13 for the method used to quantify treatment pond load).

Table C17. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 3			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 4			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 5			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

MC08B Mill Creek (49706) Downstream of Confluence with Little Mill Creek (49727)

The TMDL for this segment of Mill Creek consists of a load allocation to the area upstream of sample point MC08B. The load allocation for this segment was computed using water-quality sample data collected at point MC08B. The average flow, measured at the sampling point MC08B (24.9 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point MC08B shows pH ranging between 3.9 and 6.3; pH will be addressed in this TMDL because of the mining impacts. The method and rationale for addressing pH is contained in Attachment B.

Allocations were not calculated for aluminum because WQS were met, a TMDL for aluminum is not necessary. Although a TMDL is not necessary, the measured load is considered at the next downstream point MC09.

Table C18. Load Allocations at Point MC08B				
	Measured Sample Data		**Allowable**	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.52	107.4	0.52	107.4
Fe	1.94	402.3	0.33	68.4
Mn	3.70	768.5	0.30	61.5
Acid	38.09	7909.8	3.43	711.9
Alk	8.24	1710.0		

The calculated load reductions for all the loads that enter point MCO8B must be accounted for in the calculated reductions at sample point MC08B shown in Table C19. A comparison of measured loads between points LMC06, MC08 and MC08B shows that there is additional loading entering the segment for aluminum iron, manganese and acidity. The total segment aluminum iron, manganese and acidity loads are the sum of the upstream allocated loads and any additional loading within the segment.

Table C19. Calculation of Load Reduction at Point MC08B				
	Al	Fe	Mn	Acidity
Existing Load	107.4	402.3	768.5	7909.8
Difference in Existing Load between LMC06, MC08 & MC08B	-12.6	126.1	154.6	2966.1
Load tracked from LMC06 & MC08	23.2	29.3	57.8	289.0
Percent loss due to instream process	11	-	-	-
Percent load tracked from LMC06 & MC08	89	-	-	-
Total Load tracked from LMC06 & MC08	20.8	155.4	212.4	3255.1
Allowable Load at MC08B	107.4	68.4	61.5	711.9
Load Reduction at MC08B	0.0	87.0	150.9	2543.3
% Reduction required at MC08B	0	56	71	78

DR2 Mouth of Douglas Run (49720) Upstream of Confluence with Mill Creek

The data presented here is from the existing Jones and Douglas Run watershed TMDL. This data is not considered or used to rewrite the previous TMDL and this not considered a TMDL at sample point DR2. The average flow, measured at the sampling point DR2 (3.73 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point DR2 shows pH ranging between 3.0 and 3.7, pH will be addressed in this TMDL because the mining impairment. The method and rationale for addressing pH is contained in Attachment B.

Table C20. Load Allocations at Point DR2				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	6.78	542.8	0.54	43.4
Fe	20.27	1624.0	0.41	32.5
Mn	16.55	1325.9	0.66	53.0
Acid	160.89	12889.1	0.00	0.0
Alk	0.0	0.0		

The calculated load reductions for all the loads that enter point DR2 must be accounted for in the calculated reductions at sample point DR2 shown in Table C21. A comparison of measured loads between points JR1, DR1 and DR2 shows that there is no additional loading entering the segment for iron and manganese. For iron and manganese the percent decrease in existing loads are applied to the allowable upstream loads entering the segment. There is additional loading entering the segment for aluminum and acidity. The total segment aluminum and acidity loads are the sum of the upstream allocated loads and any additional loading within the segment.

Table C21. Calculation of Load Reduction at Point DR2				
	Al	Fe	Mn	Acidity
Existing Load	542.8	1624.0	1325.9	12889.1
Difference in Existing Load between JR1, DR1 & DR2	451.4	182.5	664.5	1602.9
Load tracked from JR1 & DR1	7.7	34.5	17.6	0.0
Percent loss due to instream process	-	-	-	-
Percent load tracked from JR1 and DR1	-	-	-	-
Total Load tracked from JR1 and DR2	459.1	217.0	682.1	1602.9
Allowable Load at DR2	43.4	32.5	53.0	0.0
Load Reduction at DR2	415.7	184.5	629.1	1602.9
% Reduction required at DR2	91	85	92	100

A waste load allocation for future mining was included for this segment of Mill Creek (MC09) allowing for five operations with two active pits (1500’ x 300’) to be permitted in the future on this segment (page 13 for the method used to quantify treatment pond load).

Table C22. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 3			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 4			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation5			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

MC09 Mill Creek Upstream of Confluence with Unt (49717)

The TMDL for this segment of Mill Creek consists of a load allocation to the area between sample pointsMC08B, DR2 & MC09. The load allocation for this segment was computed using water-quality sample data collected at point MC09. The average flow, measured at the sampling point MC09 (25.86 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point MC09 shows pH ranging between 3.5 and 5.42, pH will be addressed in this TMDL because the mining impairment. The method and rationale for addressing pH is contained in Attachment B.

Table C23. Load Allocations for Point MC09				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	1.30	280.8	0.29	61.8
Fe	3.21	692.4	0.64	138.5
Mn	3.99	860.8	0.36	77.5
Acid	41.48	8947.3	2.49	536.8
Alk	5.34	1151.5		

The calculated load reductions for all the loads that enter point MC09 must be accounted for in the calculated reductions at sample point MC09 shown in Table C24. A comparison of measured loads between points MC08B, DR2 and MC09 shows that there is no additional loading entering the segment for aluminum, iron, manganese and acidity. For aluminum, iron manganese and acidity the percent decrease in existing loads are applied to the allowable upstream loads entering the segment.

Table C24 Calculation of Load Reduction at Point MC09				
	Al	Fe	Mn	Acidity
Existing Load	280.8	692.4	860.8	8947.3
Difference in Existing Load between MC08B, DR2 & MC09	-369.5	-1333.9	-1233.5	-11851.6
Load tracked from MC08B & DR2	150.8	100.9	114.5	711.9
Percent loss due to instream process	57	66	59	57
Percent load tracked from MC08B & DR2	43	34	41	42
Total Load tracked from MC08B & DR2	65.1	34.5	47.1	306.2
Allowable Load at MC09	61.8	138.5	77.5	536.8
Load Reduction at MC09	3.4	0.0	0.0	0.0
% Reduction required at MC09	5	0	0	0

UNT31 Unt (49716) Mill Creek Upstream of Confluence with Mill Creek

The TMDL for this segment of Mill Creek consists of a load allocation to the area upstream of sample point Unt31. The load allocation for this segment was computed using water-quality sample data collected at point Unt31. The average flow, measured at the sampling point Unt31 (0.30 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point Unt31 shows pH ranging between 5.4 and 7.2; pH will be addressed in this TMDL because of the mining impairment. The method and rationale for addressing pH is contained in Attachment B.

Table C25. Load Allocations for Point Unt31				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.85	2.1	0.10	0.3
Fe	2.39	6.0	0.07	0.2
Mn	6.62	16.6	0.40	1.0
Acid	27.03	67.6	2.43	6.1
Alk	10.20	25.0		

Table C25. Calculation of Load Reduction Necessary at Point Unt31				
	Al	Fe	Mn	Acidity
	(#/day)	(#/day)	(#/day)	(#/day)
Existing Load	2.1	6.0	16.6	67.6
Allowable Load=TMDL	0.3	0.2	1.0	6.1
Load Reduction	1.8	5.8	15.6	61.5
Total % Reduction	88	97	94	91

UNT30 Unt (49715) Mill Creek Upstream of Confluence with Mill Creek

The TMDL for this unnamed tributary of Mill Creek consists of a load allocation to all of the watershed area upstream of sample point Unt30. The load allocation for this segment was computed using water-quality sample data collected at point Unt30. The average flow, measured at the sampling point Unt30 (0.42 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point Unt30 shows pH ranging between 3.2 and 5.2; pH will be addressed in this TMDL because of the mining impairment. The method and rationale for addressing pH is contained in Attachment B.

Table C26. Load Allocations at Point Unt30				
	Measured Sample Data		**Allowable**	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.54	1.9	0.14	0.5
Fe	15.72	54.8	0.05	0.2
Mn	5.92	20.7	0.30	1.0
Acid	63.13	220.3	3.16	11.0
Alk	10.20	35.6		

Table C27. Calculation of Load Reduction Necessary at Point Unt30				
	Al	Fe	Mn	Acidity
	(#/day)	(#/day)	(#/day)	(#/day)
Existing Load	1.9	54.8	20.7	220.3
Allowable Load=TMDL	0.5	0.2	1.0	11.0
Load Reduction	1.4	54.6	19.7	209.3
Total % Reduction	74	99.7	95	95

A waste load allocation for future mining was included for this segment of Mill Creek (MC10) allowing for five operations with two active pits (1500’ x 300’) to be permitted in the future on this segment (page 13 for the method used to quantify treatment pond load).

Table C28. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 3			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 4			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation5			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

MC10 Mill Creek (49706) Downstream of Confluence with Unt (49713)

The TMDL for this segment of Cherry Run consists of a load allocation to the area between sample points MC09, UNT31, UNT30 and MC10. The load allocation for this segment was computed using water-quality sample data collected at point MC10. The average flow, measured at the sampling point MC10 (32.91 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point MC10 shows pH ranging between 3.4 and 5.3; pH will be addressed in this TMDL because of the mining impairment. The method and rationale for addressing pH is contained in Attachment B.

Table C29. Load Allocations at Point MC10				
	Measured Sample Data		**Allowable**	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	1.19	325.8	0.32	88.0
Fe	2.47	677.2	0.67	182.8
Mn	3.86	1058.2	0.35	95.2
Acid	38.16	10471.9	2.29	628.3
Alk	5.12	1405.2		

The calculated load reductions for all the loads that enter point MC10 must be accounted for in the calculated reductions at sample point MC10 shown in Table C30. A comparison of measured loads between points MC09, UNT31, UNT30 and MC10 shows that there is no additional loading entering the segment for iron. For iron the percent decrease in existing loads are applied to the allowable upstream loads entering the segment. There is additional loading entering the segment for aluminum, manganese and acidity. The total segment aluminum, manganese and acidity loads are the sum of the upstream allocated loads and any additional loading within the segment.

Table C31 Calculation of Load Reduction at Point MC10				
	Al	Fe	Mn	Acidity
Existing Load	325.8	677.2	1058.2	10471.9
Difference in Existing Load between MC09, UNT31, UNT30 & MC10	41.0	-76.1	160.2	1236.7
Load tracked from MC09, UNT31 & UNT30	62.5	138.8	77.6	553.9
Percent loss due to instream process	-	10	-	-
Percent load tracked from MC09, UNT31 & UNT30	-	90	-	-
Total Load tracked from MC09, UNT31 & UNT30	103.5	124.8	237.8	1790.7
Allowable Load at MC10	88.0	182.8	95.2	628.3
Load Reduction at MC10	15.6	0.0	144.5	1162.4
% Reduction required at MC10	15	0	60	65

WR1 Mouth of Whites Run (49707) Upstream of Confluence with Mill Creek

The TMDL for sampling point WR1 consists of a load allocation to segment upstream of the sample point. The load allocation for this tributary was computed using water-quality sample data collected at point WR1. The average flow, measured at the sampling point WR1 (0.82 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point WR1 shows pH ranging between 3.0 and 3.4; pH will be addressed in this TMDL because of the mining impairment. The method and rationale for addressing pH is contained in Attachment B.

Table C32 Load Allocations for Point WR1				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	9.65	23.2	0.34	0.8
Fe	68.85	165.2	0.40	1.0
Mn	40.05	96.1	0.30	0.7
Acid	397.23	953.4	0.0	0.0
Alk	0.00	0.0		

Table C33. Calculation of Load Reduction Necessary at Point WR1				
	Al	Fe	Mn	Acidity
	(#/day)	(#/day)	(#/day)	(#/day)
Existing Load	23.2	165.2	96.1	953.4
Allowable Load=TMDL	0.8	1.0	0.7	0.0
Load Reduction	22.4	164.2	95.4	953.4
Total % Reduction	97	99	99	100

A waste load allocation for future mining was included for this segment of Mill Creek (MC11) allowing for five operations with two active pits (1500' x 300') to be permitted in the future on this segment (page 13 for the method used to quantify treatment pond load).

Table C34. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 2			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 3			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation 4			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50
Future Operation5			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

MC11 Mouth of Mill Creek

The TMDL for this segment of Mill Creek consists of a load allocation to all of the watershed area between sample points MC10, WR1 and MC11. The load allocation for this segment was computed using water-quality sample data collected at point MC11. The average flow, measured at the sampling point MC11 (37.85 MGD), is used for these computations.

There currently is no entry for this segment on the Pa Section 303(d) list for impairment due to pH. Sample data at point MC11 shows pH ranging between 4.1 and 7.4, pH be addressed in this TMDL because of the mining impairment. The method and rationale for addressing pH is contained in Attachment B.

Table 35. Load Allocations for Point MC11

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	Conc. (mg/l)	Load (lbs/day)
Al	0.90	283.0	0.25	79.2
Fe	1.56	493.2	0.44	138.1
Mn	2.51	791.3	0.25	79.1
Acid	26.01	8209.3	3.12	985.1
Alk	12.55	3961.4		

The calculated load reductions for all the loads that enter point MC11 must be accounted for in the calculated reductions at sample point MC11 shown in Table C36. A comparison of measured loads between points MC10, WR1 and MC11 shows that there is no additional loading entering the segment for aluminum, iron, manganese and acidity. For aluminum, iron, manganese and acidity the percent decrease in existing loads are applied to the allowable upstream loads entering the segment.

Table C36 Calculation of Load Reduction at Point MC11

	Al	Fe	Mn	Acidity
Existing Load	283.0	493.2	791.3	8209.3
Difference in Existing Load between MC10, WR1 & MC11	-66.0	-349.1	-363.1	-3216.0
Load tracked from MC10 & WR1	88.8	183.8	95.9	628.3
Percent loss due to instream process	19	41	31	28
Percent load tracked from MC10 & WR1	81	59	69	72
Total Load tracked from MC10 & WR1	72.0	107.6	65.8	451.5
Allowable Load at MC11	79.2	138.1	79.1	985.1
Load Reduction at MC11	0.0	0.0	0.0	0.0
% Reduction required at MC11	0	0	0	0.0

Margin of Safety (MOS)

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

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

- A MOS is added when the calculations were performed with a daily iron average instead of the 30-day average.

Seasonal Variation

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

Critical Conditions

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

Attachment D

Use of reference stream for High Quality waters

Streams placed on the 1996 303(d) list with a designated use of High Quality (HQ) will be subject to Pennsylvania's anti degradation policy. Therefore, DEP must establish instream goals for TMDLs that restore the waterbody to existing (pre-mining) quality.

This is accomplished by sampling an unaffected stretch of stream to use as a reference. This stretch typically is the headwaters segment of the High Quality stream question. If an unaffected stretch isn't available, a nearby unimpaired stream will function as a surrogate.

The reference stream data will be selected from statewide ambient Water Quality Network (WQN) stations. To determine which WQN station represents existing water quality appropriate for use in developing TMDLs for HQ waters, alkalinity and drainage area are considered.

1. First step is to match alkalinities of TMDL stream and WQN reference stream. If alkalinities for candidate stream are not available, use ph as a surrogate. As a last resort, if neither pH or alkalinity are not available match geologies using current geological maps.
2. The second consideration is drainage area.
3. Finally, from the subset of stations with similar alkalinity and drainage area select the station nearest the TMDL stream.

Once a reference stream is selected, the 95^{th} percentile confidence limit on the median for aluminum, iron and manganese is used as the applicable water quality criteria needed for the @Risk model.

Attachment E

Excerpts Justifying Changes Between the 1996, 1998, and 2002 Section 303(d) Lists and Integrated Report/List (2004, 2006)

The following are excerpts from the Pennsylvania DEP Section 303(d) narratives that justify changes in listings between the 1996, 1998, 2002, 2004 and 2006 303(d) Lists and Integrated Report/List (2006). The Section 303(d) listing process has undergone an evolution in Pennsylvania since the development of the 1996 list.

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

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

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

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

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

New to the 2006 report is use of the 1/24,000 National Hydrography Data (NHD) streams GIS layer. Up until 2006 the Department relied upon its own internally developed stream layer. Subsequently, the United States Geologic Survey (USGS) developed 1/24,000 NHD streams layer for the Commonwealth based upon national geodatabase standards. In 2005, DEP contracted with USGS to add missing streams and correct any errors in the NHD. A GIS contractor transferred the old DEP stream assessment information to the improved NHD and the old DEP streams layer was archived. Overall, this marked an improvement in the quality of the streams layer and made the stream assessment data compatible with national standards but it necessitated a change in the Integrated Listing format. The NHD is not attributed with the old DEP five digit stream codes so segments can no longer be listed by stream code but rather only by stream name or a fixed combination of NHD fields known as reachcode and ComID. The NHD is aggregated by Hydrologic Unit Code (HUC) watersheds so HUCs rather than the old State Water Plan (SWP) watersheds are now used to group streams together. The map in

Appendix E illustrates the relationship between the old SWP and new HUC watershed delineations. A more basic change was the shift in data management philosophy from one of “dynamic segmentation” to “fixed segments”. The dynamic segmentation records were proving too difficult to mange from an historical tracking perspective. The fixed segment methods will remedy that problem. The stream assessment data management has gone through many changes over the years as system requirements and software changed. It is hoped that with the shift to the NHD and OIT’s (Office of Information Technology) fulltime staff to manage and maintain SLIMS the systems and formats will now remain stable over many Integrated Listing cycles.

Attachment F

Water Quality Data Used In TMDL Calculations

Project ID: **MILL** **MILL CREEK TMDL MONITORING POINTS**

Monitoring Point: **MC02** **Mill Creek at Rt 949**

Lat. *41-14-38* *Long.* *079-08-27*

Coll ID Seq	Date Collected	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4204 870	5/6/1999		5.7	9	2.8	0.3	3.09	0.5
4211 539	6/10/1999		5.2	7.2	4.2	0.3	2.87	0.5
4211 553	6/29/1999		5.4	8.2	8	0.773	3.05	0.5
4211 601	7/19/1999		4.4	7.2	10.2	0.3	10.5	0.5
4211 643	9/20/1999		4.5	6.6	18	0.3	7.15	0.5
4211 680	10/27/1999		5.4	8.8	4	0.3	2.75	0.5
4211 694	11/8/1999		5.7	10	0.4	0.3	0.96	0.5
4211 708	12/6/1999		5.9	11.6	4.6	0.513	0.512	0.5
4204 134	1/20/2000		5.5	9.6	3.8	0.826	1.92	0.5
4204 186	2/23/2000		6.1	10.4	5.4	0.3	0.945	0.5
4204 241	3/15/2000		5.9	8.8	0.6	0.3	1.96	0.5
4204 334	4/25/2000		6.3	12.8	8.4	0.3	1.57	0.5
4204 383	5/15/2000		6	10.8	0.4	0.3	2.81	0.5
4211 773	5/24/2000		5.9	12	0.2	0.569	0.539	0.5
4211 821	6/8/2000		5.9	11	4.8	0.312	1.17	0.5
4204 438	6/15/2000		6.2		1.2	0.649	0.411	0.5
4204 491	7/28/2000		4.9	7.8	28	3.27	5.2	1.12
4204 543	8/22/2000		4.7	8.6	14.2	0.3	7.42	0.5
4204 582	9/19/2000		5.7	9.2	7	1.14	4.08	0.5
4204 645	10/19/2000		6	11.4	4.2	0.383	1.8	0.5
4204 714	12/5/2000		5.4	10	3.6	0.377	1.32	0.5
4204 856	3/28/2001		5.6	10.4	4	0.3	2.62	0.5
4204 902	4/23/2001		6.1	11.4	0	0.3	1.59	0.5
4204 935	5/3/2001		6	9.2	0	0.3	2.53	0.5
4204 022	6/26/2001		5.5	6.6	44	0.584	3.24	0.5
4204 062	7/31/2001		4.2	3.8	53.4	0.373	8.61	0.554
4204 092	8/28/2001		4.5	9.2	46	0.436	9	0.53
4215 670	10/17/2001		4.1	4.4	107.2	0.553	8.32	0.569
4215 750	1/4/2002		4.2	9	42.8	1.35	1.13	0.677
4215 973	4/26/2002		5.8	8.2	29	0.3	1.42	0.5
4215 147	7/31/2002		6	9.4	35.6	0.52	1.9	0.5
4215 285	10/18/2002		4.6	6.6	52.6	0.536	3.89	0.5
4215 611	4/25/2003		5.8	9.4	33.8	0.3	2.15	0.5
4215 495	7/11/2003		6.5	13.2	0	1.05	1.89	0.5
4227 044	7/30/2003		6.3	10	36.8	0.444	0.597	0.5
4227 062	8/11/2003		6.5	11.8	0	1.59	1.49	0.649
4227 070	9/16/2003		6.6	12.8	0	0.63	1.32	0.5
4227 070	9/16/2003		6.6	12.8	0	0.63	1.32	0.5

4215 756	10/8/2003		6.4	10	37.8	0.533	1.43	0.5
4227 099	11/24/2003		6.3	9.4	32.8	0.3	0.751	0.5
4227 112	12/23/2003		6.5	10.4	0	0.722	0.777	0.5
4215 859	1/9/2004		6	8.8	33.6	0.421	2.07	0.5
4227 182	4/27/2004		6.5	9.6	40.2	0.339	0.815	0.5
4227 191	6/3/2004		6.3	9.8	51.4	0.41	1.64	0.5
4215 992	7/7/2004		6	9	34.4	0.433	1.53	0.5
4227 295	8/25/2004		6.3	10	34	0.3	0.898	0.5
4227 328	9/16/2004		6.3	9.6	40.8	0.3	1.32	0.5
4227 406	10/22/2004		6.1	9.6	37.8	0.311	1.85	0.5
4227 447	11/2/2004		6.2	10	40	0.3	1.68	0.5
4215 031	11/22/2004		6.2	9.6	47	0.4	1.29	0.5
4227 541	12/21/2004		6.4	13.6	45.8	0.446	1.12	0.5
4215 076	1/19/2005		6.2	10.4	42.8	0.403	1.54	0.5
4227 582	2/24/2005		6.4	10.2	40	0.3	1.04	0.5
7317 054	3/22/2005		3.8	0	43.8	3.02	1.24	2.9
4227 599	3/31/2005		6.3	10.8	33	0.3	0.623	0.5
4215 209	4/15/2005		6.1	9.2	41	0.3	1.67	0.5
4227 606	5/31/2005	259	6.3	9.2	45.2	0.35	1.5	0.5
4215 289	7/15/2005		5.3	8	24.8	0.3	3.83	0.5
4251 461	8/11/2005	47	4.8	7.6	16	0.3	5.29	0.5
4211 466	9/28/2005		5.6	8.6	32.2	0.3	2.39	0.5
4215 328	10/5/2005		5.2	7.8	34.8	0.3	4.93	0.5
4211 526	10/19/2005		5.4	9	23.2	0.3	3.15	0.5
4227 637	11/1/2005		6.3	10.6	31.2	0.3	1.06	0.5
4251 625	1/5/2005	4926	6.1	9	23	0.398	3.94	0.5
4251 779	4/19/2006	905	6.2	8.8	16.8	0.3	1.18	0.5
4251 909	7/27/2006	645	5.8	9	1.6	0.3	2.06	0.5
4251 030	11/8/2006	1529	6.3	9.8	2.4	0.3	1.67	0.5
	avg=	1385.17	5.75	9.34	23.08	0.53	2.53	0.55
	stdev=				20.79	0.53	2.21	0.30

Monitoring Point:		P01	Mouth Parks Run					
	Lat.	*41-14-19*	*Long.*	*079-08-05*				
Coll	**Date**	**Final**	**pH**	**ALK**	**HOT A**	**FE**	**MN**	**AL**
ID Seq	**Collected**	**Flow**	**pH units**	**MG/L**	**MG/L**	**MG/L**	**MG/L**	**MG/L**
4204 187	2/23/2000		5.7	8.2	4.6	0.3	0.274	0.5
4204 242	3/15/2000		5.7	7.6	0	0.3	0.107	0.5
4204 335	4/25/2000		5.9	10.8	8.4	0.3	0.249	0.5
4204 384	5/15/2000		5.7	9.4	0	1.61	0.381	1.25
4204 439	6/15/2000		5.6	9.2	1.4	0.326	0.237	0.5
4204 544	8/22/2000		5.3	9.4	1	0.3	0.052	0.5
4204 646	10/19/2000		5.9	10.2	2	0.3	<.05	0.5
4204 857	3/28/2001		5.6	10	1.4	0.3	0.05	0.5
4204 903	4/23/2001		5.5	10.2	1.2	0.3	0.281	0.5
4204 936	5/3/2001		5.4	6.6	1.2	0.3	0.219	0.5
4204 023	6/26/2001		5.3	5.6	5.4	0.3	<.05	0.5
4227 046	7/30/2003		5.6	6.8	9	0.3	0.233	0.5
4227 061	8/11/2003		5.5	7.4	9.4	0.3	0.342	0.5
4227 068	9/10/2003		5.6	6.6	5.4	0.3	0.904	0.5
4227 073	10/8/2003		5.7	7.6	10	0.3	0.238	0.5
4227 097	11/24/2003		5.8	7.2	6.2	0.3	0.172	0.5
4227 113	12/23/2003		5.9	7	16.2	0.551	0.896	0.511
4227 131	1/9/2004		5.5	7.6	11.2	0.3	0.512	0.5
4227 168	3/18/2004		5.5	7.4	10.8	0.3	0.633	0.5
4227 184	4/27/2004		5.7	7	17.8	0.3	0.357	0.5
4227 194	6/3/2004		5.4	7	11.4	0.3	0.303	0.5
4227 218	7/7/2004		5.2	7	7.4	0.3	0.195	0.5
4227 293	8/25/2004		6	8	9.8	0.3	0.182	0.5
4227 331	9/16/2004		5.6	7.4	9.2	0.3	0.209	0.5
4227 408	10/22/2004		5.5	7.4	6.2	0.3	0.306	0.5
4227 450	11/2/2004		5.5	7.4	4.6	0.3	0.224	0.5
4227 543	12/21/2004		6.3	10	7.8	0.3	0.22	0.5
4227 585	2/24/2005		5.5	8.2	8.2	0.3	0.411	0.5
4227 596	3/31/2005		5.8	7.6	7.8	0.3	0.294	0.5
4227 609	5/31/2005		5.4	7.2	11	0.3	0.164	0.5
4251 462	8/11/2005	65	5.2	7.4	6.6	0.3	0.143	0.5
4211 469	9/28/2005		5.5	8	5.4	0.3	0.132	0.5
4211 529	10/19/2005		5.6	8.6	4.8	0.3	0.095	0.5
4251 624	1/5/2006	2645	5.6	7.2	12.8	0.3	0.166	0.5
4251 778	4/19/2006	583	6	8.8	3.2	0.3	0.158	0.5
4251 908	7/27/2006	234	5.4	7.4	0.4	0.3	0.108	0.5
4251 034	11/8/2006	1116	5.6	9	1.6	0.3	0.392	0.5
	avg=	928.60	5.61	7.98	6.51	0.34	0.28	0.52
	stdev=				4.51	0.22	0.20	0.12

Monitoring Point: **MC03** **Mill Creek at Park Road, TWP 355**

Lat. *41-14-06* *Long.* *079-08-02*

Coll ID Seq	Date Collected	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4204 888	7/10/1996		6.7	20	0.00	0.3	0.352	0.5
4204 942	8/6/1996		6.0	11.4	1.80	0.39	1.73	0.5
4211 744	9/30/1996		6.0	11.2	5.60	0.386	0.483	0.254
4211 768	10/9/1996		6.6	32	0.00	0.392	1.13	0.245
4211 810	11/14/1996		5.9	10.4	2.20	0.325	0.826	0.135
4211 843	12/9/1996		6.1	9.2	6.60	0.309	0.862	0.14
4211 855	1/6/1997		6.1	12.2	4.00	0.397	0.608	0.213
4211 880	2/6/1997		5.9	10.8	4.80	0.295	0.325	0.254
4211 911	3/5/1997		6.1	10.8	1.00	0.335	0.729	0.328
4211 963	4/16/1997		6.0	11.4	2.80	0.317	0.625	0.135
4211 012	5/19/1997		6.3	12.4	1.40	1.99	0.361	1.26
4211 052	6/9/1997		6.0	10.6	1.40	0.447	0.564	0.154
4211 540	6/10/1999		5.9	9.8	0.00	0.3	0.483	0.5
4211 554	6/29/1999		6.0	10.4	2.00	0.36	0.84	0.5
4211 602	7/19/1999		6.0	11.4	0.00	0.3	0.718	0.5
4211 644	9/20/1999		6.2		0.60	0.3	0.793	0.5
4211 679	10/27/1999		6.0	12.4	0.00	0.3	0.978	0.5
4211 693	11/8/1999		6.0	9.2	1.20	0.36	0.409	0.5
4211 709	12/6/1999		5.8	10.2	1.60	0.354	0.316	0.5
4204 135	1/20/2000		5.9	10.2	2.20	0.3	0.899	0.5
4204 188	2/23/2000		6.1	12.8	4.80	0.3	0.627	0.5
4204 243	3/15/2000		5.9	9	1.80	0.3	0.977	0.5
4204 336	4/25/2000		6.1	11.6	9.80	0.3	0.785	0.5
4204 385	5/15/2000		6.1	10.8	0.00	0.3	1.1	0.5
4211 774	5/24/2000		5.8	11	2.20	0.582	0.413	0.5
4211 822	6/8/2000		6.1	11.8	1.40	0.3	0.412	0.5
4204 440	6/15/2000		6.1	10.8	2.00	0.59	0.321	0.5
4204 492	7/28/2000		6.0	11.6	15.80	3.84	1.91	0.708
4204 545	8/22/2000		6.0	11.6	0.00	0.3	1.25	0.5
4204 583	9/19/2000		6.2	11.2	0.00	0.3	1.16	0.5
4204 647	10/19/2000		6.2	11.2	0.80	1.37	0.538	0.5
4204 715	12/5/2000		5.9	10.2	1.00	0.3	0.542	0.5
4204 858	3/28/2001		5.8	10.4	1.20	0.3	1.35	0.5
4204 904	4/23/2001		6.0	11	0.80	0.3	0.865	0.5
4204 937	5/3/2001		5.8	7.6	0.00	0.3	1.13	0.5
4204 024	6/26/2001		6.2	8.4	25.60	0.3	1.02	0.5
4204 063	7/31/2001		6.3	10.4	22.20	0.3	1.25	0.5
4204 094	8/28/2001		6.1	11.8	30.00	0.3	1.92	0.5
4227 045	7/30/2003		6.2	8.6	35.00	0.417	0.32	0.5
4227 060	8/11/2003		6.4	10.2	39.80	0.392	0.648	0.5

4227 067	9/10/2003		6.2	8.6	32.60	0.3	0.256	0.5
4227 072	10/8/2003		6.3	9.6	29.60	0.3	0.674	0.5
4227 096	11/24/2003		6.3	9	35.6	0.3	0.421	0.5
4227 114	12/23/2003		6.3	10.6	43	0.761	0.779	0.5
4227 130	1/9/2004		5.9	8.4	26.6	0.303	1.2	0.5
4227 167	3/18/2004		6.2	8.8	45.4	0.3	1.04	0.5
4227 183	4/27/2004		6.1	9.4	46.2	0.3	0.501	0.5
4227 193	6/3/2004		6.3	9	49.6	0.324	0.798	0.5
4227 217	7/7/2004		6.3	10	20.6	0.3	0.433	0.5
4227 292	8/25/2004		6.3	9.2	37.6	0.3	0.389	0.5
4227 330	9/16/2004		6.4	9.6	46.4	0.3	0.539	0.5
4227 409	10/22/2004		6.3	10	31.8	0.3	0.903	0.5
4227 449	11/2/2004		6.4	10	32.4	0.3	0.605	0.5
4227 542	12/21/2004		6.3	11.2	45.8	0.435	0.63	0.5
4227 584	2/24/2005		6.3	9.8	38.2	0.3	0.814	0.5
7317 055	3/22/2005		3.8	0	39.8	3.01	1.26	2.96
4227 595	3/31/2005		6.2	8.6	34.2	0.3	0.434	0.5
4227 608	5/31/2005	996	6.3	9.6	38	0.354	0.604	0.5
4251 460	8/11/2005	133	6.2	12.6	15.6	0.3	0.63	0.5
4211 468	9/28/2005		6.3	12.2	31	0.3	0.658	0.5
4211 528	10/19/2005		6.6	13.8	15.2	0.3	0.389	0.5
4227 639	11/1/2005		6.4	11	29	0.3	0.447	0.5
4251 623	1/5/2006	8751	6	8.2	24.4	0.3	0.197	0.5
4251 777	4/19/2006	1709	6.2	9.2	17.2	0.3	0.467	0.5
4251 907	7/27/2006	987	5.8	9.2	-0.4	0.3	0.505	0.5
4251 033	11/8/2006	2871	6.2	10.8	4.6	0.359	0.936	0.5
	avg=	2574.50	6.10	10.71	15.81	0.47	0.74	0.51
	stdev=				16.78	0.59	0.38	0.34

Monitoring Point: **MC03C** **Mill Creek at TR 353**

Lat. *41-12-17* *Long.* *079-07-45*

Coll ID Seq	Date Collected	Final Flow	pH pH units	ALK MG/L	HOT A MG/L	FE MG/L	MN MG/L	AL MG/L
4211 543	6/10/1999		6.2	22	0	0.752	0.512	0.5
4211 557	6/29/1999		6.3	22	0	1.06	0.708	0.5
4211 605	7/19/1999		6.5	32	0	0.944	0.538	0.5
4211 647	9/20/1999		6.6	28	0	1.15	0.513	0.5
4211 676	10/27/1999		6.4	20	0	0.609	0.516	0.5
4211 690	11/8/1999		6.2	13.2	0	0.847	0.306	0.5
4211 712	12/6/1999		6.2	14.8	5.2	0.547	0.312	0.5
4204 138	1/20/2000		6.3	14	0	0.423	0.536	0.5
4204 191	2/23/2000		6.2	13.8	2.6	0.471	0.5	0.5
4204 246	3/15/2000		6.3	12.6	0	0.357	0.566	0.5
4204 339	4/25/2000		6.4	15	6.2	0.315	0.439	0.5
4204 388	5/15/2000		6.4	17	0	0.328	0.645	0.5
4211 777	5/24/2000		6.1	14.8	0	0.977	0.401	0.5
4211 825	6/8/2000		6.5	19.8	0	0.674	0.498	0.5
4204 443	6/15/2000		6.3	13.6	0	0.913	0.256	0.5
4204 495	7/28/2000		6.4		0	0.79	0.646	0.5
4204 548	8/22/2000		6.4	28	0	0.641	0.571	0.5
4204 586	9/19/2000		6.6	22	0	0.636	0.62	0.5
4204 650	10/19/2000		6.5	18.8	0	0.392	0.397	0.5
4204 718	12/5/2000		6.2	15.6	0	0.381	0.339	0.5
4204 861	3/28/2001		6.3	12	1	0.379	0.821	0.5
4204 908	4/23/2001		6.3	13.2	0	0.386	0.52	0.5
4204 940	5/3/2001		6.3	11.4	0	0.3	0.564	0.5
4204 027	6/26/2001		6.8	19.2	0	0.736	0.628	0.5
4227 059	8/11/2003		6.6	14.6	0	0.512	0.344	0.5
4227 066	9/10/2003		6.6	13.2	0	0.389	0.403	0.5
4227 074	10/8/2003		6.6	14.4	0	0.364	0.364	0.5
4227 100	11/24/2003		6.6	11	0	0.323	0.241	0.5
4227 115	12/23/2003		6.5	11.6	0	1.3	0.496	0.522
4227 132	1/9/2004		6.3	10	25.4	0.325	0.726	0.5
4227 166	3/18/2004		6.5	11.2	38.8	0.309	0.643	0.5
4227 185	4/27/2004		6.4	10.4	40.6	0.52	0.292	0.5
4227 195	6/3/2004		6.6	13.2	57.4	0.416	0.391	0.5
4227 219	7/7/2004		6.6	20.2	24.8	0.425	0.267	0.5
4227 291	8/25/2004		6.5	14.4	37.8	0.449	0.234	0.5
4227 332	9/16/2004		6.6	14.6	50.2	0.366	0.267	0.5
4227 410	10/22/2004		6.6	17.2	29.2	0.418	0.418	0.5
4227 451	11/2/2004		6.6	18	29.4	0.369	0.318	0.5
4227 544	12/21/2004		6.5	16	39	0.3	0.353	0.5
4227 586	2/25/2005		6.7	12.6	29.2	0.3	0.439	0.5

4227 600	3/31/2005		6.4	11.6	32.8	0.333	0.273	0.5
4227 610	5/31/2005	1417	6.7	15.8	33.2	0.326	0.372	0.5
4251 459	8/11/2005	373	6.6	38	2.6	0.855	0.618	0.5
4211 470	9/28/2005		6.6	26.2	22.4	0.557	0.583	0.5
4211 530	10/19/2005		6.9	35.6	13.8	0.492	0.423	0.5
4227 640	11/1/2005		6.9	19.6	32.8	0.417	0.414	0.5
4251 622	1/5/2006	10744	6.1	10.2	36	0.351	0.15	0.5
4251 776	4/19/2006	2695	6.5	13	24.2	0.3	0.28	0.5
4251 906	7/27/2006	2570	6.3	26.6	-15	2.05	0.263	4.03
4251 032	11/8/2006	4802	6.7	15	-2	0.411	0.562	0.5
	avg=	3766.83	6.46	17.29	11.95	0.56	0.45	0.57
	stdev=				17.35	0.33	0.15	0.50

Monitoring Point: **MC05** **Mill Creek at Rt 949**

S3612 **Mill Creek at Rt 949** **(C&K SMP#3874SM15)**

Lat. *41-13-18* *Long.* *079-09-41*

Coll ID Seq	**Date Collected**	**Final Flow**	**pH pH units**	**ALK MG/L**	**HOT A MG/L**	**FE MG/L**	**MN MG/L**	**AL MG/L**
4211 746	9/30/1996		6	12.4	5	1.43	1.08	0.329
4211 766	10/9/1996		6.2	20	14.2	4.51	3.74	0.27
4211 812	11/14/1996		6.1	13.8	3.2	1.78	1.31	0.162
4211 841	12/9/1996		6.1	12.6	11.4	2.28	2.02	0.219
4211 857	1/6/1997		6.1	14.6	1.6	1.87	1.26	0.544
4211 882	2/6/1997		6	13.4	4	0.991	0.698	0.274
4211 913	3/5/1997		6.1	14.2	0.8	1.31	1.02	0.469
4211 965	4/16/1997		6.1	16.8	7	2.26	2.37	0.17
4211 010	5/19/1997		6.3	17.2	7.4	3.12	2.32	0.585
4211 054	6/9/1997		6.2	19.4	3.6	3.62	2.87	0.191
4211 545	6/10/1999		6	24	3.8	5.89	7.49	0.5
4211 559	6/29/1999		6.4	24	0	5.06	5.21	0.5
4211 607	7/19/1999		6.3	34	0	10.8	8.95	0.5
4211 649	9/20/1999		6.3	32	2.6	9.2	5.53	0.5
4211 674	10/27/1999		6.2	24	0	6.6	3.36	0.5
4211 688	11/8/1999		6.2		168	2.8	1.55	0.5
4211 714	12/6/1999		6.2	16	1.8	1.6	1.21	0.5
4204 140	1/20/2000		6.3	18.6	0	2.59	2.45	0.5
4204 193	2/23/2000		6.2	15.8	20	1.96	1.2	0.5
4204 248	3/15/2000		6.2	14.4	10	1.73	1.69	0.5
4204 341	4/25/2000		6.3	14	11.6	1.01	1.47	0.5
4204 390	5/15/2000		6.4	22	0	4.69	6.11	0.5
4211 779	5/24/2000		6.1	15	2.6	1.92	1.59	0.5
4211 827	6/8/2000		6.4	24	1.4	5.51	4.98	0.5
4204 445	6/15/2000		6.2	14.2	2.4	1.8	1.33	0.5
4204 497	7/28/2000		6.2	32	18.8	10.3	8.91	0.5

4204 550	8/22/2000		6.2	30	2.6	8.27	6.71	0.5
4204 588	9/19/2000		6.3	24	3.6	6.23	4.04	0.5
4204 652	10/19/2000		6.4	22	0	3.38	2.52	0.5
4204 720	12/5/2000		6.2	18	0	2.64	1.83	0.5
4204 910	4/23/2001		6.3	14.2	1.2	1.1	1.3	0.5
4204 942	5/3/2001		6.2	14	0	2.26	3.11	0.5
4204 029	6/26/2001		6.3	20	30.8	5.51	4.74	0.5
4204 065	7/31/2001		6.4	36	28.4	12.3	11	0.5
4215 672	10/17/2001		6.2	38	54.4	10.7	6.06	0.5
4215 752	1/4/2002		6.1	20	33.2	3.65	2.61	0.5
4215 975	4/26/2002		6.2	12.8	31.6	1.2	2.25	0.5
4215 149	7/31/2002		6.4	16.2	38	2.81	2.98	0.5
4215 287	10/18/2002		6.6	28	0	7	4.81	0.5
4215 386	1/9/2003		6.5	11.4	0	1.4	1.77	0.5
4215 613	4/25/2003		6.5	18.2	0	5.97	4.12	0.737
4215 497	7/11/2003		6.5	18.6	0	2.68	2.36	0.5
4227 048	7/30/2003		6.4	12	45.6	1.13	1.05	0.5
4227 064	9/10/2003		6.5	17	0	2.03	2.47	0.5
4215 758	10/8/2003		6.5	17.2	0	2.21	2.3	0.5
4227 102	11/24/2003		6.6	12.2	0	0.966	1.02	0.5
4227 117	12/23/2003		6.6	14.2	0	1.83	1.21	0.681
4215 861	1/9/2004		6.4	12.2	17.2	1.09	2.04	0.5
4227 187	4/27/2004		6.4	11.4	57.6	0.975	0.981	0.5
4227 190	6/3/2004		6.4	15.8	45.4	1.55	2.2	0.5
4215 994	7/7/2004		6.3	24.8	21.4	3.72	4.79	0.5
4227 289	8/25/2004		6.2	15	37	1.41	1.36	0.5
4227 327	9/16/2004		6.5	17	46.8	1.73	2.02	0.5
4227 405	10/22/2004		6.4	20.4	33.2	2.9	3.21	0.5
4227 446	11/2/2004		6.5	22.6	31.2	3.3	3.39	0.5
4215 033	11/22/2004		6.3	22.2	26.2	3.12	3.07	0.5
4227 546	12/21/2004		6.6	18.6	30.8	1.78	2.03	0.5
4215 078	1/19/2005		6.5	14.4	16.2	1.15	2.11	0.5
4227 581	2/24/2005		6.6	15	23	1.4	2.05	0.5
4227 594	3/31/2005		6.4	11.8	34.8	0.964	1.19	0.5
4215 211	4/15/2005		6.4	15.8	36.6	1.62	2.4	0.5
4227 605	5/31/2005	2391	6.6	19.6	37.2	2.61	2.82	0.5
4215 291	7/15/2005		6.5	30	27.2	8.17	5.47	0.5
4251 458	8/11/2005	542	6.4	38.4	27.4	8.4	7.51	0.5
4211 465	9/28/2005		6.4	28.4	20.8	5.02	3.37	0.5
4215 330	10/5/2005		6.4	32.8	29.6	7.63	5.1	0.5
4211 525	10/19/2005		6.7	35.6	31.2	6.02	3.67	0.5
4227 636	11/1/2005		6.6	21.6	29	3.05	1.99	0.5
4251 621	1/5/2006	12517	6.1	11	45.4	0.667	0.488	0.5
4251 775	4/19/2006	5000	6.4	14.6	26.2	1.71	1.71	0.5
4251 905	7/27/2006	4032	6.1	17.2	-5.6	2.22	2.28	0.5
4251 031	11/8/2006	8301	6.4	14	3	1.628	2.464	0.5
	avg=	5463.83	6.33	19.61	18.05	3.55	3.08	0.48
	stdev=				24.38	2.80	2.15	0.09

Monitoring Point:		**MC07**	**Mill Creek at Howe Bridge**					
	Lat.	*41-13-40*	*Long.*	*079-11-07*				
Coll ID Seq	**Date Collected**	**Final Flow**	**pH pH units**	**ALK MG/L**	**HOT A MG/L**	**FE MG/L**	**MN MG/L**	**AL MG/L**
4204 894	7/10/1996		6.5	15.8	0	2.03	4.42	0.5
4204 946	8/6/1996		6	12.8	10.2	1.86	3.69	0.5
4211 748	9/30/1996		6	11	3	1.05	0.839	0.38
4211 764	10/9/1996		6.2	16.2	9.2	2.53	2.69	0.296
4211 814	11/14/1996		6	11.4	1.4	1.24	0.976	0.162
4211 839	12/9/1996		6.1	10.6	10.4	1.53	1.43	0.29
4211 859	1/6/1997		6.1	12.8	2	1.38	0.997	0.471
4211 884	2/6/1997		5.9	10.6	18.2	0.692	0.523	1.12
4211 915	3/5/1997		5.9	11.4	4.4	0.851	0.792	0.364
4211 967	4/16/1997		6.1	13.4	6.2	1.58	1.66	0.174
4211 008	5/19/1997		6.2	14.2	5.4	2.57	2.36	0.417
4211 056	6/9/1997		6.2	15	4.8	1.72	1.66	0.173
4215 674	10/17/2001		6.2	24	65.6	1.88	4.38	0.5
4215 754	1/4/2002		5.9	17.2	29	2.42	1.96	0.5
4215 977	4/26/2002		5.9	11.6	42.4	0.929	1.85	0.5
4215 151	7/31/2002		6.4		41.4	1.34	2.12	0.5
4215 289	10/18/2002		6.8	22	0	2.37	3.55	0.5
4215 387	1/9/2003		6.5	9.8	0	1.02	1.36	0.5
4215 499	4/25/2003	5634	6.6	13.2	0	1.64	3.05	0.5
4215 615	7/11/2003		7.3	306.6	0	0.529	1.01	0.5
4215 760	10/8/2003		6.6	13.2	0	1.29	1.68	0.5
4215 863	1/9/2004		6.3	10.2	19.2	1.08	1.45	0.5
4215 996	7/7/2004		6.5	16.2	26.8	1.18	2.91	0.5
4215 035	11/22/2004		6.5	16	28	1.57	2.15	0.5
4215 080	1/19/2005		6.3	11.4	29	0.899	1.39	0.5
4215 213	4/15/2005		6.4	12	37.2	0.845	1.59	0.5
4251 355	6/2/2005	3451	6.6	14.4	42.8	1.13	2.24	0.5
4215 293	7/15/2005		6.4	18.2	32.8	1.13	2.98	0.5
4251 457	8/11/2005	919	6.4	23	30.8	1.85	3.94	0.5
4215 332	10/5/2005		6.5	21.8	30.8	1.84	3.39	0.5
4251 620	12/29/2005	13088	6.5	13.6	41.8	1.56	0.782	0.5
4251 774	4/19/2006	7644	6.4	12	29.2	0.849	1.27	0.5
4251 904	7/27/2006	4321	6.1	14.6	-1.4	0.864	1.54	0.5
4251 029	11/8/2006	12210	6.4	11	5	1.086	1.823	0.5
	avg=	6752.43	6.31	23.25	17.81	1.42	2.07	0.47
	stdev=				17.54	0.54	1.07	0.16

Monitoring Point:		MC08	Stream					
	Lat.	*41-14-05*	*Long.*	*079-14-06*				
Coll	**Date**	**Initial**	**pH**	**ALK**	**HOT A**	**FE**	**MN**	**AL**
ID Seq	**Collected**	**Flow**	**pH units**	**MG/L**	**MG/L**	**MG/L**	**MG/L**	**MG/L**
4211 646	7/8/1996		6.3	11.4	5.6	0.176	2.24	0.135
4211 674	8/8/1996		5.7	9.8	4.4	0.418	2.22	0.135
4211 707	9/4/1996		6	10.4	9.4	0.785	2.2	0.135
4211 773	10/9/1996		6.1	12.4	10	1.1	1.74	0.164
4211 820	11/14/1996		6	11.2	2	0.818	0.638	0.136
4211 833	12/9/1996		6	10.4	6.8	1.06	1.08	0.21
4211 865	1/6/1997		6.1	14.2	5.2	0.966	0.699	0.363
4211 889	2/6/1997		5.8	10	15.8	0.896	0.58	0.384
4211 921	3/5/1997		5.9	10.4	4.6	0.691	0.66	0.287
4211 973	4/16/02		6	11.8	4.6	3.63	1.22	0.718
4211 002	5/19/1997		6	10.2	4	2.15	1.16	0.586
4211 062	6/9/1997		6.1	12	0.6	0.69	1.11	0.143
4211 319	11/1/2001		6.2	13	32	0.465	2.59	0.5
4211 471	4/24/2002		6.1	9.8	40.8	0.559	1.17	0.5
4211 518	5/29/2002		5.9	8.2	39.8	0.475	2.15	0.5
4211 566	8/6/2002	3528		10.4		0.3	3.18	0.5
4211 645	10/3/2002		6.4	10.6	28.6	0.3	3.79	0.5
4211 801	5/15/2003		6.3	11.8	41	0.408	0.896	0.5
4227 042	7/30/2003		6.2	8.6	44.8	0.628	0.628	0.5
4211 885	9/9/2003		6.6	9.8	0	0.47	0.973	0.5
4211 085	4/22/2004		6.3	9.8	55	0.398	1.09	0.5
4211 275	10/6/2004		6.5	14	29.2	0.6	2.29	0.5
4211 301	11/18/2004		6.3	13	28.8	0.655	1.8	0.5
4251 354	6/2/2005	5649	6.5	11	23.8	0.3	1.42	0.5
4251 456	8/9/2005	1311	6.6	13.4	17.4	0.3	1.37	0.5
4211 460	9/28/2005		6.6	20	27.2	0.731	0.962	0.5
4211 520	10/19/2005		6.3	16.6	18.4	<.3	1.34	0.5
4251 619	12/29/2005	13934	6.5	11.8	39.2	1.14	0.7	0.5
4251 773	4/18/2006	10977	6.4	10.8	38.8	0.3	0.781	0.5
4251 903	7/27/2006	4597	6	12.4	0	0.3	0.848	0.5
4251 028	11/8/2006	17406	6.4	10.2	1.6	0.662	1.302	0.5
	avg=	8200.29	6.20	11.59	19.31	0.75	1.45	0.42
	stdev=				16.52	0.67	0.80	0.16

Monitoring Point:		MC08B	Mill Creek Below Confluence of Little Mill Creek					
	Lat.	*41-13-21*	*Long.*	*079-15-04*				
Coll ID Seq	**Date Collected**	**Final Flow**	**pH pH units**	**ALK MG/L**	**HOT A MG/L**	**FE MG/L**	**MN MG/L**	**AL MG/L**
4211 317	11/1/2001		4.5	5.8	44.0	1.500	3.76	0.5
4211 468	4/24/2002		5.0	8.2	33.0	1.250	2.33	0.5
4211 515	5/29/2002		4.8	6.6	50.8	0.653	3.33	0.51
4211 563	8/6/2002		3.9	0.4	55.2	1.480	6.52	0.723
4211 642	10/3/2002		4.0	2.4	69.0	1.700	4.82	0.5
4211 800	5/15/2003		6.0	10	39.4	0.733	1.52	0.5
4211 882	9/9/2003		6.3	9.4	37.0	1.150	1.70	0.5
4211 083	4/22/2004		5.3	8	30.8	1.59	2.98	0.562
4211 274	10/6/2004		6.1	11.2	33.2	3.06	5.64	0.5
4211 300	11/18/2004		6.2	11.4	24.6	3.2	3.77	0.5
4251 464	8/12/2005	2710	4.2	4.4	48.6	0.992	5.84	0.5
4211 459	9/28/2005		6.3	14.2	42.4	2.85	4.19	0.5
4211 517	10/19/2005		4.4	6.8	51.8	7.85	9.55	0.5
4251 616	12/29/2005	21147	6.5	11.4	44.8	1.01	0.615	0.5
4251 770	4/18/2006	18299	6.3	11.2	33	0.363	1.35	0.5
4251 900	7/27/2006	11266	5.7	9.2	5.2	2.41	3.23	0.5
4251 027	11/7/2006	33025	6.3	9.4	4.8	1.15	1.77	0.5
	avg=	17289.40	5.40	8.24	38.09	1.94	3.70	0.52
	stdev=				16.41	1.74	2.27	0.06

Monitoring Point:		MC09	Stream					
	Lat.	*41-13-20*	*Long.*	*079-16-03*				
Coll ID Seq	**Date Collected**	**Final Flow**	**pH pH units**	**ALK MG/L**	**HOT A MG/L**	**FE MG/L**	**MN MG/L**	**AL MG/L**
4211 645	7/8/1996		3.8	0	42	2.61	6.31	2.06
4211 000	8/8/1996	0						
4211 706	9/4/1996		3.7	0	48	3.38	7.46	2.2
4211 774	10/9/1996		4.2	4.8	32	2.51	4.77	1.84
4211 821	11/14/1996		4.7	8.2	12.6	2.07	2.27	1
4211 832	12/9/1996		4.6	7.4	19.6	2.24	2.76	1.23
4211 866	1/6/97		4.8	11	16.4	1.51	2.16	0.842
4211 922	3/5/1997		4.8	9	13.2	1.43	1.84	0.969
4211 974	4/16/1997		4.5	8	20	2.31	2.767	1.35
4211 001	5/19/1997		4.5	7.2	17.6	2.87	2.99	1.5
4211 063	6/9/1997		4.3	5	17.2	2.15	3.12	1.11
4211 310	11/1/2001		3.7	0	54	6.2	7.37	1.49
4211 464	4/24/2002		4.4	5.6	50.4	2.4	2.79	1.32
4211 512	5/29/2002		4.1	4	51.8	1.95	4.52	1.92
4211 560	8/6/2002		3.5	0	64.4	3.91	8.63	2.31
4211 639	10/3/2002		3.4		68.6	5.44	9.08	1.84

4211 795	5/15/2003		4.4	7	53	2.18	2.53	0.962
4227 049	7/30/2003		4.6	6	42.8	1.69	1.81	0.889
4227 054	8/11/2003		4.4	5.6	44.2	2.54	3.72	1.03
4211 879	9/9/2003		4.4	5.6	43.6	2.53	2.88	1.09
4227 075	10/8/2003		4.5	5	48	4.01	3.64	1.11
4227 105	11/24/2003		4.9	6.8	36.4	1.78	1.48	0.797
4227 120	12/23/2003		5	6.6	38.2	2.67	2.21	1.18
4227 133	1/9/2004		4.9	7.4	27.4	1.89	2.06	1.34
4227 171	3/18/2004		4.9	7.6	48	3.44	3.08	1.33
4211 079	4/22/2004		4.6	6.4	42.2	2.33	2.84	1.21
4227 199	6/3/2004		4.5	5.8	62.2	2.38	3.24	1.06
4227 220	7/7/2004		4	1.4	40.2	3.69	5.01	1.32
4227 336	9/16/2004		4.5	6	55	2.22	2.62	1.06
4211 269	10/6/2004		4.1	5	54	4.7	6.1	1.81
4227 404	10/22/2004		4.1	3.4	59.2	4.26	4.81	1.22
4227 443	11/2/2004		4.1	3.2	42.6	4.61	5.19	1.24
4211 295	11/18/2004		4.3	5	40.8	5.8	5.35	1.29
4227 538	12/21/2004		5.2	10.4	44.2	4.31	2.94	0.967
4227 592	3/24/2005		5.2	8	43.4	1.87	1.71	0.745
4227 602	5/31/2005	16377	4.5	6	54.8	4.01	3.54	0.879
4251 453	8/9/2005	4290	3.5	0	57.4	3.98	7.99	1.6
4211 454	9/28/2005		3.9	0.6	57.2	4.85	5.81	0.837
4211 514	10/19/2005		3.7	0	53.2	6.02	5.95	1.05
4227 633	11/1/2005		4.6	7.2	52.6	4.71	3.58	0.65
4251 612	12/29/2005	27615	5.4	8.2	39	3.67	2.69	0.545
4251 768	4/18/2006	21360	4.8	6.8	46.2	3.97	4.49	4.23
4251 898	7/25/2006	16022	4.3	5.6	16.6	2.845	3.123	0.654
4251 021	11/7/2006	40064	5	7.4	13.4	2.1	2.37	0.894
	avg=	17961.14	4.40233	5.3380952	41.4791	3.2101	3.9907	1.3016
	stdev=				15.65	1.31	1.97	0.62

Monitoring Point: **UNT31** **Stream**

Lat. *41-13-25* *Long.* *079-16-39*

Coll ID Seq	**Date Collected**	**Final Flow**	**pH pH units**	**ALK MG/L**	**HOT A MG/L**	**FE MG/L**	**MN MG/L**	**AL MG/L**
4251 351	6/2/2005	85	5.6	9.6	45.6	3.12	7.66	1.34
4251 541	8/9/2005	61	5.8	11.8	61.8	1.57	11.4	0.576
4251 614	12/29/2005	404	7.2	38.8	14.4	1.93	3.15	0.955
4251 767	4/18/2006	395	6.9	38.6	18	2.99	4.36	0.834
4251 987	7/25/2006	52	6.3	14.6	5.8	1.885	9.133	0.605
4251 023	11/7/2006	252	5.4	8.6	16.6	2.87	4.04	0.799
	avg=	208.17	6.20	20.33	27.03	2.39	6.62	0.85
	stdev=				21.70	0.67	3.29	0.28

Monitoring Point:		UNT30	Stream					
	Lat.	*41-13-41*	*Long.*	*079-17-05*				
Coll ID Seq	**Date Collected**	**Final Flow**	**pH pH units**	**ALK MG/L**	**HOT A MG/L**	**FE MG/L**	**MN MG/L**	**AL MG/L**
4251 352	6/2/2005	169	4	2.2	65.8	17.9	5.42	0.5
4251 452	8/9/2005	171	3.2	0	141.2	27	13.7	0.723
4251 613	12/29/2005	572	5.2	7.4	50.6	8.66	2.48	0.5
4251 766	4/18/2006	314	4.5	5.8	40.4	12.6	4.05	0.5
4251 896	7/25/2006	107	3.4	0	55	18.41	7.415	0.5
4251 022	11/7/2006	410	4.5	5.6	25.8	9.73	2.45	0.5
	avg=	290.50	4.13	3.50	63.13	15.72	5.92	0.54
	stdev=				40.58	6.85	4.25	0.09

Monitoring Point:		MC10	Stream					
	Lat.	*41-14-13*	*Long.*	*079-17-13*				
Coll ID Seq	**Date Collected**	**Final Flow**	**pH pH units**	**ALK MG/L**	**HOT A MG/L**	**FE MG/L**	**MN MG/L**	**AL MG/L**
4211 644	7/8/1996		3.8	0	40	1.45	6.13	1.92
4211 673	8/8/1996		3.8	0	40	1.08	6.97	2.64
4211 705	9/4/1996		3.7	0	46	1.63	7.82	2.29
4211 776	10/9/1996		4.2	5	32	2.07	4.7	1.7
4211 822	11/14/1996		4.7	8.2	13.2	1.95	2.23	0.964
4211 831	12/9/1996		4.7	7.2	20	2.27	2.77	1.26
4211 867	1/6/1997		4.8	11	14.4	1.59	2.12	0.907
4211 890	2/6/1997		4.7	7.6	28	1.7	1.53	0.985
4211 923	3/5/1997		4.8	8.8	14	1.43	1.8	0.95
4211 975	4/16/1997		4.5	8.2	17.8	2.06	2.56	1.24
4211 999	5/19/1997		4.4	6.6	22	3.64	3.07	1.87
4211 064	6/9/1997		4.3	5.2	16.2	1.78	3.06	1.07
4211 313	11/1/2001		3.6	0	52	4.88	7.63	1.55
4211 465	4/24/2002		4.4	5.2	32.8	2.16	2.65	1.19
4211 511	5/29/2002		4.1	4	49	1.51	4.32	1.81
4211 558	8/6/2002		3.4		57.2	1.89	8.52	2.27
4211 638	10/3/2002		3.4	0	60.4	2.79	8.33	1.73
4211 794	5/15/2003		4.4	6.4	36	1.94	2.51	0.951
4227 041	7/30/2003		4.8	6.2	44.6	1.59	1.57	0.89
4227 053	8/11/2003		4.4	5.2	38	2.24	3.6	0.988
4211 878	9/9/2003		4.4	5.4	40.6	2.22	2.79	1.05
4227 076	10/8/2003		4.4	4.8	44.4	3.52	3.58	0.997
4227 106	11/24/2003		5.1	7.2	33.4	1.53	1.37	0.657
4227 121	12/23/2003		5	6.8	36.2	2.76	2.22	1.19
4227 134	1/9/2004		5	7.6	24	1.75	1.94	1.21

4227 170	3/18/2004		4.9	7.4	48.8	3.41	3.18	1.3
4211 078	4/22/2004		4.5	6.4	38	2.11	2.77	1.15
4227 200	6/3/2004		4.5	5.8	71.6	2.03	3.11	0.977
4227 221	7/7/2004		3.9	0	32.6	1.92	4.85	1.26
4227 337	9/16/2004		4.5	6	44.8	2.15	2.76	1.08
4211 268	10/6/2004		4.1	4.2	47	3.6	6.06	1.73
4227 403	10/22/2004		4.1	2.6	58.8	3.17	4.7	1.16
4227 442	11/2/2004		4	2.4	34	3.28	5.27	1.22
4211 294	11/18/2004		4.2	4.2	33.2	5.32	5.3	1.29
4227 539	12/21/2004		5.2	9.4	38.8	3.97	2.74	0.834
4227 589	2/25/2005		5	8.2	40.4	2.55	2.25	0.5
4227 593	3/24/2005		5.3	7.8	38.4	1.76	1.68	0.654
4227 601	5/31/2005	18670	4.4	5.4	52	3.12	3.46	0.788
4251 454	8/9/2005	5095	3.4	0	86.4	1.87	7.81	1.62
4211 453	9/28/2005		3.9	0	40.2	2.14	5.55	0.768
4211 513	10/19/2005		3.7	0	45.2	3.08	5.99	0.93
4227 632	11/1/2005		4.5	6.6	56	4.53	3.75	0.577
4251 611	12/29/2005	31026	5.3	7.8	32	3.62	2.61	0.519
4251 765	4/18/2006	23435	4.8	6.8	36	2.07	2.27	0.5
4251 895	7/25/2006	16524	4.3	5.4	13.6	2.227	3.152	0.61
4251 020	11/7/2006	42363	5	7.4	15.2	2.14	2.32	0.858
	avg=	22852.17	4.40	5.12	38.16	2.47	3.86	1.19
	stdev=				15.57	0.96	2.01	0.49

Monitoring Point: **MC11** **Stream**

Lat. *41-14-00* *Long.* *079-19-12*

Coll ID Seq	**Date Collected**	**Final Flow**	**pH pH units**	**ALK MG/L**	**HOT A MG/L**	**FE MG/L**	**MN MG/L**	**AL MG/L**
4211 643	7/8/1996		6.9	34	0	0.825	0.523	0.231
4211 672	8/8/1996		6.3	38	0	0.269	0.248	0.135
4211 704	9/4/1996		6.6	40		0.402	0	
4211 777	10/9/1996		4.1	3.2	30	2.56	4.95	1.78
4211 823	11/14/1996		4.6	7.4	13.8	2.29	2.4	0.974
4211 830	12/9/1996		4.7	7.2	20	2.26	2.87	1.21
2411 868	1/6/1997		4.6	10.4	17	1.8	2.22	0.883
4211 924	3/5/1997		4.7	8.8	13.2	1.39	1.76	0.927
4211 976	4/16/1997		4.5	7.6	22	0	0	0
4211 998	5/19/97		4.1	3.6	26	2.7	3.78	1.5
4211 065	6/9/1997		4.2	4	17.8	1.98	3.29	1.04
4211 309	11/1/2001		6.5	34	0	0.367	0.365	0.5
4211 461	4/24/2002		4.4	5	36.6	2.27	2.81	1.21
4211 508	5/29/2002		4.1	3.2	29.4	1.68	4.58	1.81
4211 559	8/6/2002		7.4	38	0	0.506	0.416	0.5
4211 635	10/3/2002		7.4		0	0.369	0.33	0.5
4211 790	5/15/2003		4.4	6.6	54.8	1.45	2.56	0.923
4211 874	9/9/2003		4.3	4.6	35	1.94	3.02	1

4211 075	4/22/2004		4.4	4.8	45.6	0.398	1.09	0.5
4211 265	10/6/2004		3.9	0	42.6	3.12	6.34	1.79
4211 291	11/18/2004		4	1.8	39.2	3.87	5.52	1.33
4251 353	6/2/2005	19506	4.2	3.2	44	1.89	3.61	0.958
4251 455	8/9/2005	5420	3.5	0	90.2	0.99	7.8	1.8
4211 450	9/28/2005		7.3	32.2		0.324	0.555	0.5
4211 510	10/19/2005		7	30	15.6	0.303	0.753	0.5
4251 610	12/29/2005	35291	5.1	7.8	39.6	3.5	2.6	0.547
4251 763	4/18/2006	27905	4.4	5.2	37.6	1.75	2.43	0.514
4251 893	7/25/2006	23334	4.2	4.2	14.4	1.572	3.377	0.658
4251 019	11/7/2006	46244	4.6	6.6	17.8	2.54	2.5	0.885
	avg=	26283.33	5.05	12.55	26.01	1.56	2.51	0.90
	stdev=				20.43	1.06	2.00	0.51

Attachment G
TMDLs and NPDES Permitting Coordination

NPDES permitting is unavoidably linked to TMDLs through waste load allocations and their translation, through the permitting program, to effluent limits. Primary responsibility for NPDES permitting rests with the District Mining Offices (for mining NPDES permits) and the Regional Offices (for industrial NPDES permits). Therefore, the DMOs and Regions will maintain tracking mechanisms of available waste load allocations, etc. in their respective offices. The TMDL program will assist in this effort. However, the primary role of the of the TMDL program is TMDL development and revision/amendment (the necessity for which is as defined in the Future Modifications section) at the request of the respective office. All efforts will be made to coordinate public notice periods for TMDL revisions and permit renewals/reissuances.

Load Tracking Mechanisms

The Department has developed tracking mechanisms that will allow for accounting of pollution loads in TMDL watersheds. This will allow permit writers to have information on how allocations have been distributed throughout the watershed in the watershed of interest while making permitting decisions. These tracking mechanisms will allow the Department to make minor changes in WLAs without the need for EPA to review and approve a revised TMDL. Tracking will also allow for the evaluation of loads at downstream points throughout a watershed to ensure no downstream impairments will result from the addition, modification or movement of a permit.

Options for Permittees in TMDL Watersheds

The Department is working to develop options for mining permits in watersheds with approved TMDLs.

Options identified

- Build excess WLA into the TMDL for anticipated future mining. This could then be used for a new permit. Permittee must show that there has been actual load reduction in the amount of the proposed permit or must include a schedule to guarantee the reductions using current data referenced to the TMDL prior to permit issuance.
- Use WLA that is freed up from another permit in the watershed when that site is reclaimed. If no permits have been recently reclaimed, it may be necessary to delay permit issuance until additional WLA becomes available.
- Re-allocate the WLA(s) of existing permits. WLAs could be reallocated based on actual flows (as opposed to design flows) or smaller than approved pit/spoil areas (as opposed to default areas). The "freed-up" WLA could be applied to the new permit. This option would require the simultaneous amendment of the permits involved in the reallocation.
- Non-discharge alternative.

Other possible options

The following two options have also been identified for use in TMDL watersheds. However, before recommendation for use as viable implementation options, a thorough regulatory (both state and federal) review must be completed. These options should not be implemented until the completion of the regulatory review and development of any applicable administrative mechanisms.

- Issue the permit with in-stream water quality criteria values as the effluent limits. The in-stream criteria value would represent the monthly average, with the other limits adjusted accordingly (e.g., for Fe, the limits would be 1.5 mg/L monthly average, 3.0 mg/L daily average and 4.0 instantaneous max mg/L).

- The applicant would agree to treat an existing source (point or non-point) where there is no responsible party and receive a WLA based on a portion of the load reduction to be achieved. The result of using these types of offsets in permitting is a net improvement in long-term water quality through the reclamation or treatment of an abandoned source.

Attachment G

Comment and Response