# DRAFT

# COON RUN WATERSHED TMDL
## Crawford County

For Metals Affected Segments


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# DRAFT

## [1]TMDL

**Coon Run Watershed**
**Crawford County, Pennsylvania**

| **Table 1. 303(d) Sub-List** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **State Water Plan (SWP) Subbasin: 16-E Upper Allegheny River** | | | | | | | | |
| **Year** | **Miles** | **Segment ID Assessment ID** | **DEP Stream Code** | **Stream Name** | **Designated Use** | **Data Source** | **Source** | **EPA 305(b) Cause Code** |
| 1996 | 0.7 | | 54551 | Coon Run | CWF | 305(b) Report | Industrial Point Source | Metals |
| 1998 | 2.49 | 5517 | 54551 | Coon Run | CWF | SWMP | Industrial Point Source | Metals |
| 2002 | 2.5 | 5517 | | Coon Run | CWF | SWMP | Industrial Point Source | Metals |
| 2004 | 2.52 | 5517b | | Coon Run | CWF | Aquatic Life | Industrial Point Source | Metals |

Cold Water Fishery= CWF
Surface Water Monitoring Program = SWMP
See Attachment D, *Excerpts Justifying Changes Between the 1996, 1998, 2002 and 2004 Section 303(d) Lists.*
The use designations for the stream segments in this TMDL can be found in PA Title 25 Chapter 93

### Introduction

This Total Maximum Daily Load (TMDL) calculation has been prepared for one segment in the Coon Run Watershed (Attachment A). It was done to address the impairments noted on the 1996 Pennsylvania 303(d) list, required under the Clean Water Act, and covers one segment on this list (shown in Table 1). High levels of metals caused these impairments. Impairments appear to be from non point sources as there are no identifiable point sources in the watershed. The TMDL addresses the three primary metals associated with metals impairments (iron, manganese, aluminum) and pH.

### Directions to the Coon Run Watershed

The Coon Run watershed is located in Northwestern Pennsylvania in Rome and Sparta Townships in eastern Crawford County. Coon Run can be found on the Spartansburg 7.5-Minute Quadrangle United States Geological Survey map. The total basin area is 1.12 square miles containing 4.4 miles of streams. Land use in the watershed is dominated by forest, followed by agriculture (hay/pasture and cropland) with a small portion as unpaved roads, transitional land and low intensity development. The watershed is largely rural.
Traveling on Interstate 79 to exit 147A can access Coon Run. Bear right at the end of the ramp to US-322 east. Continue on Park Avenue approximately 0.8 miles, turn right on North Street

[1] Pennsylvania's 1996, 1998, 2002 and 2004 Section 303(d) lists were approved by the Environmental Protection Agency (EPA). The 1996 Section 303(d) list provides the basis for measuring progress under the 1996 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA.*

and bear left at State Street. Bear left at Hickory Street, continue on Blooming Valley Road, continue on State Street then follow Route 77 east. Turn right (south) on Route 89. Turn right (west) on Fairview Road. Continue on Fairview Road past the intersection of Fairview Road and Coon Road (location of Spartansburg Forest Products facility) to Coon Run, which flows northwest under Fairview Road.

**Topography and Geology**

Coon Run originates slightly southeast of the Spartansburg Forest Products facility and flows for about 2.5 miles before entering the East Branch of Oil Creek at RMI 5.78 by Glynden in Sparta Township, Crawford County. Coon Run is designated as Cold Water Fisheries (CWF) under Title 25 PA Code Chapter 93, Section 93.9q. Elevation ranges from 421 m to 517 m above sea level. Coon Run (stream code – 54551) is part of the Hydrologic Unit Code 05010003, Middle Allegheny – Tionesta, (formerly State Water Plan 16E-Oil Creek).

The Coon Run watershed is located in the Glaciated Pittsburgh Plateau Physiographic section of the Appalachian Plateaus Physiographic Province. The Glaciated Pittsburgh Plateau Section consists of many broad, rounded uplands cut by many long, linear, flat-floored valleys. The narrow to wide valleys are separated from adjacent uplands by steep slopes on one or both sides. The valley floors are often wetlands and there is frequently a considerable depth of unconsolidated material beneath the valley floor. The bedrock is largely covered by glacial deposits, and consists of a variety of sandstones, siltstones, and shales, as well as some conglomerates and coal.

Source: http://www.dcnr.state.pa.us/topogeo/map13/13ngps.aspx

Surface geology is equally divided by three groups and consists of the Shenango Formation comprised of shale, the Cuyahoga Group comprised of interbedded sedimentary rock, and Corry Sandstone comprised of sandstone.

Soil types in the watershed include Venango-Frenchtown-Cambridge and Chenango-Cambridge-Holly. The dominant hydrological soil group is C, which is characterized as having a slow infiltration rate when thoroughly wetted. "The Venango series consists of very deep, somewhat poorly drained soils formed in low-lime Wisconsinan age till on till plains and moraines. It is shallow or moderately deep to a fragipan. Saturated hydraulic conductivity is moderately high-to-high above the fragipan and moderately low or low in the fragipan and in the substratum. The Frenchtown series consists of very deep, poorly drained soils formed in loamy Wisconsinan age till on till plains. Some pedons have a thin mantle of loess. Permeability is moderate above the fragipan and slow or very slow in the fragipan. The Cambridge series consists of very deep, moderately well drained soils formed in low-lime Wisconsinan age till on till plains and moraines. It is shallow or moderately deep to a fragipan. Permeability is moderate above the fragipan and slow or very slow in the fragipan. The Chenango series consists of very deep, well and somewhat excessively drained soils formed in water-sorted material on outwash plains, kames, eskers, terraces, and alluvial fans. The Holly series consists of very deep, very poorly and poorly drained soils formed in loamy alluvium on flood plains. Permeability is moderate or moderately slow in the solum and moderate or moderately rapid in the underlying material."

Source: Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Official Soil Series Descriptions [Online WWW]
Available URL: "http://soils.usda.gov/technical/classification/osd/index.html" [Accessed 15 September 2006].

**Segments addressed in this TMDL**

Coon Run is affected by pollution from metals. A seep was identified as one possible source of having caused high levels of metals in the watershed. Each segment on the Section 303(d) list will be addressed as a separate TMDL. These TMDLs will be expressed as long-term, average loadings. Due to the nature and complexity of pollution effects on the watershed, expressing the TMDL as a long-term average gives a better representation of the data used for the calculations. See Table 3 for TMDL calculations and see Attachment C for TMDL explanations.

**Clean Water Act Requirements**

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

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

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

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

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

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

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

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

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

These TMDLs were developed in partial fulfillment of the 1996 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA.*

**Section 303(d) Listing Process**

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

The primary method adopted by the Pennsylvania Department of Environmental Protection (DEP) for evaluating waters changed between the publication of the 1996 and 1998 Section 303(d) lists. Prior to 1998, data used to list streams were in a variety of formats, collected under differing protocols. Information also was gathered through the Section 305(b)[2] reporting process. DEP is now using the Statewide Surface Waters Assessment Protocol (SSWAP), a modification of the EPA's 1989 Rapid Bioassessment Protocol II (RBP-II), as the primary mechanism to assess Pennsylvania's waters. The SSWAP provides a more consistent approach to assessing Pennsylvania's streams.

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

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

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

**Basic Steps for Determining a TMDL**

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

1. Collection and summarization of pre-existing data (watershed characterization, inventory contaminant sources, determination of pollutant loads, etc.);
2. Calculating TMDL for the waterbody using EPA approved methods and computer models;
3. Allocating pollutant loads to various sources;
4. Determining critical and seasonal conditions;
5. Public review and comment period on draft TMDL;
6. Submittal of final TMDL to EPA.
7. EPA approval of the TMDL.

**Watershed History**

This TMDL addresses the metals impairment as non-point source pollution as there are no identifiable sources of the impairment. A spring seep located along the bank of Coon Run discharges elevated levels of metals, specifically iron and manganese, into Coon Run. The seep is located downstream of the Spartansburg Forest Products Facility and appears to flow underneath a field on the facility property, although the exact origin of the seep is not known. The water flowing downstream from the seep is orange in color most likely due to the activity of iron bacteria. There is no history of mining in this watershed, so the stream impairment is not likely due to an abandoned mine.

In June of 1998, the Spartansburg Forest Products Facility, known at the time as Spartywood Products, Inc., received approval under the Land Recycling and Environmental Remediation Standards Act (Act 2) after submitting to DEP an Underground Storage Tank Closure report detailing the removal of seven underground storage tanks containing diesel, unleaded gasoline, new motor oil and heating oil and the removal of associated contaminated soils. No groundwater was encountered during the removal of the tanks and soils.

Water quality impairments of Coon Run were originally thought to be associated with activities at the Spartansburg Forest Products Facility. Formerly, the Spartansburg Forest Products Facility disposed of yard scrapings and other fill material on an area of land immediately adjacent to the stream bank where the spring seep is located. The fill contained construction demolition waste, refuse from the facility including paper and old furniture, and yard scrapings. The area also contained sawdust piles. In March of 1999, DEP staff conducted an inspection of this disposal area and found a smoldering fire within the fill pile. It was thought at the time that the spring seep was being contaminated by the fill and sawdust piles. The facility agreed to properly dispose of the material in the fill piles and remove the sawdust piles. In August of 1999, a follow-up inspection by DEP staff revealed that the sawdust piles and the fill piles had been completely removed. A malfunctioning septic system problem had also been corrected. In DEP reports it was noted that over time the water quality conditions of Coon Run should improve, resulting in a reduction in iron and manganese levels as the elevated metals were attributed to the fill and sawdust piles.

A biological survey of the stream was completed in October 2004 to determine if the correction of the above problems had allowed water quality to improve in Coon Run. Many previous violations of water quality including levels of aluminum, copper and zinc were found to be below detectable limits. Levels of ammonia, Biological Oxygen Demand (BOD), nutrients, phosphorus, total suspended solids and fecal coliforms decreased dramatically. Despite this, levels of iron and manganese were still elevated above the allowable limits. A survey of the macroinvertebrate community revealed that the stream was still impaired. The cause of the elevated iron and manganese in Coon Run is unknown. Currently there are no visible fill areas or sawdust piles located near the spring seep where elevated levels of metals are still found.

**Metals Reduction Methodology**

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

The statistical analysis described below can be applied to situations where all of the pollutant loading is from non-point sources as well as those where there are both point and non-point sources. The following defines what are considered point sources and non-point sources for the purposes of our evaluation; point sources are defined as permitted discharges, non-point sources are then any pollution sources that are not point sources. For situations where all of the impact is due to non-point sources, the equations shown below are applied using data for a point in the stream. The load allocation made at that point will be for all of the watershed area that is above that point. For situations where there are point-source impacts alone, or in combination with non-point sources, the evaluation will use the point-source data and perform a mass balance with the receiving water to determine the impact of the point source.

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

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

*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 represent a true reflection of acidity. This method assures that Pennsylvania's standard for pH is met when the acid concentration reduction is met.

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

**TMDL Endpoints**

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

Because all of the pollution sources in the watershed appear to be nonpoint sources, the TMDL is expressed as Load Allocations (LAs). All allocations will be specified as long-term average daily concentrations. These long-term average concentrations are expected to meet water-quality criteria 99% of the time as required in PA Title 25 Chapter 96.3(c). The following table shows the applicable water-quality criteria for the selected parameters.

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**Table 2. Applicable Water Quality Criteria**

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

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

**TMDL Elements (WLA, LA, MOS)**

$$TMDL = WLA + LA + MOS$$

A TMDL equation consists of a wasteload allocation, load allocation and a margin of safety. The wasteload allocation is the portion of the load assigned to point sources. The load allocation is the portion of the load assigned to non-point sources. The margin of safety is applied to account for uncertainties in the computational process. The margin of safety may be expressed implicitly (documenting conservative processes in the computations) or explicitly (setting aside a portion of the allowable load). The TMDL allocations in this report are based on available data. Other allocation schemes could also meet the TMDL. Table 3 contains the TMDL component summary for each point evaluated in the watershed. Refer to the maps in Attachment A.

**Allocation Summary**

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

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

Each permitted discharge in a segment is assigned a waste load allocation and the total waste load allocation for each segment is included in this table. There currently are no permitted discharges in the Coon Run Watershed. The difference between the TMDL and the WLA is the load allocation (LA) at the point. The LA at each point includes all loads entering the segment, including those from upstream allocation points. The percent reduction is calculated to show the amount of load that needs to be reduced to the area upstream of the point in order for water quality standards to be met at the point.

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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 3. Coon Run Watershed Summary Table**

| Parameter | Existing Load (lbs/day) | TMDL Allowable Load (lbs/day) | WLA (lbs/day) | LA (lbs/day) | Load Reduction (lbs/day) | % Reduction |
|---|---|---|---|---|---|---|
| CRSP- Site downstream of metals Seep | | | | | | |
| Aluminum (lbs/day) | ND | NA | 0 | NA | NA | NA |
| Iron (lbs/day) | 2.57 | 0.21 | 0 | 0.21 | 2.36 | 92% |
| Manganese(lbs/day) | 1.60 | 0.20 | 0 | 0.20 | 1.40 | 88% |
| Acidity (lbs/day) | ND | NA | 0 | NA | NA | NA |
| CR4 – Coon Run upstream of confluence with UNT 54553 | | | | | | |
| Aluminum (lbs/day) | 0.00 | 0.00 | 0 | NA | NA | NA |
| Iron (lbs/day) | 0.65 | 0.49 | 0 | 0.49 | 0.00 | 0%* |
| Manganese(lbs/day) | 0.46 | 0.46 | 0 | NA | NA | NA |
| Acidity (lbs/day) | ND | NA | 0 | NA | NA | NA |
| CR6 – Unnamed Tributary 54553 to Coon Run | | | | | | |
| Aluminum (lbs/day) | ND | NA | 0 | NA | NA | NA |
| Iron (lbs/day) | ND | NA | 0 | NA | NA | NA |
| Manganese(lbs/day) | ND | NA | 0 | NA | NA | NA |
| Acidity (lbs/day) | ND | NA | 0 | NA | NA | NA |
| CR2 – Coon Run downstream of seep | | | | | | |
| Aluminum (lbs/day) | ND | NA | 0 | NA | NA | NA |
| Iron (lbs/day) | 5.17 | 4.04 | 0 | 4.04 | 0.97 | 19% |
| Manganese(lbs/day) | 0.73 | 0.73 | 0 | NA | NA | NA |
| Acidity (lbs/day) | ND | NA | 0 | NA | NA | NA |
| CR3 – Unnamed Tributary 54552 to Coon Run | | | | | | |
| Aluminum (lbs/day) | ND | NA | 0 | NA | NA | NA |
| Iron (lbs/day) | 0.42 | 0.24 | 0 | 0.24 | 0.18 | 43% |
| Manganese(lbs/day) | 0.60 | 0.08 | 0 | 0.08 | 0.52 | 87% |
| Acidity (lbs/day) | ND | NA | 0 | NA | NA | NA |
| CR1 – Mouth of Coon Run | | | | | | |
| Aluminum (lbs/day) | ND | NA | 0 | NA | NA | NA |
| Iron (lbs/day) | ND | NA | 0 | NA | NA | NA |
| Manganese(lbs/day) | ND | NA | 0 | NA | NA | NA |
| Acidity (lbs/day) | ND | NA | 0 | NA | NA | NA |

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

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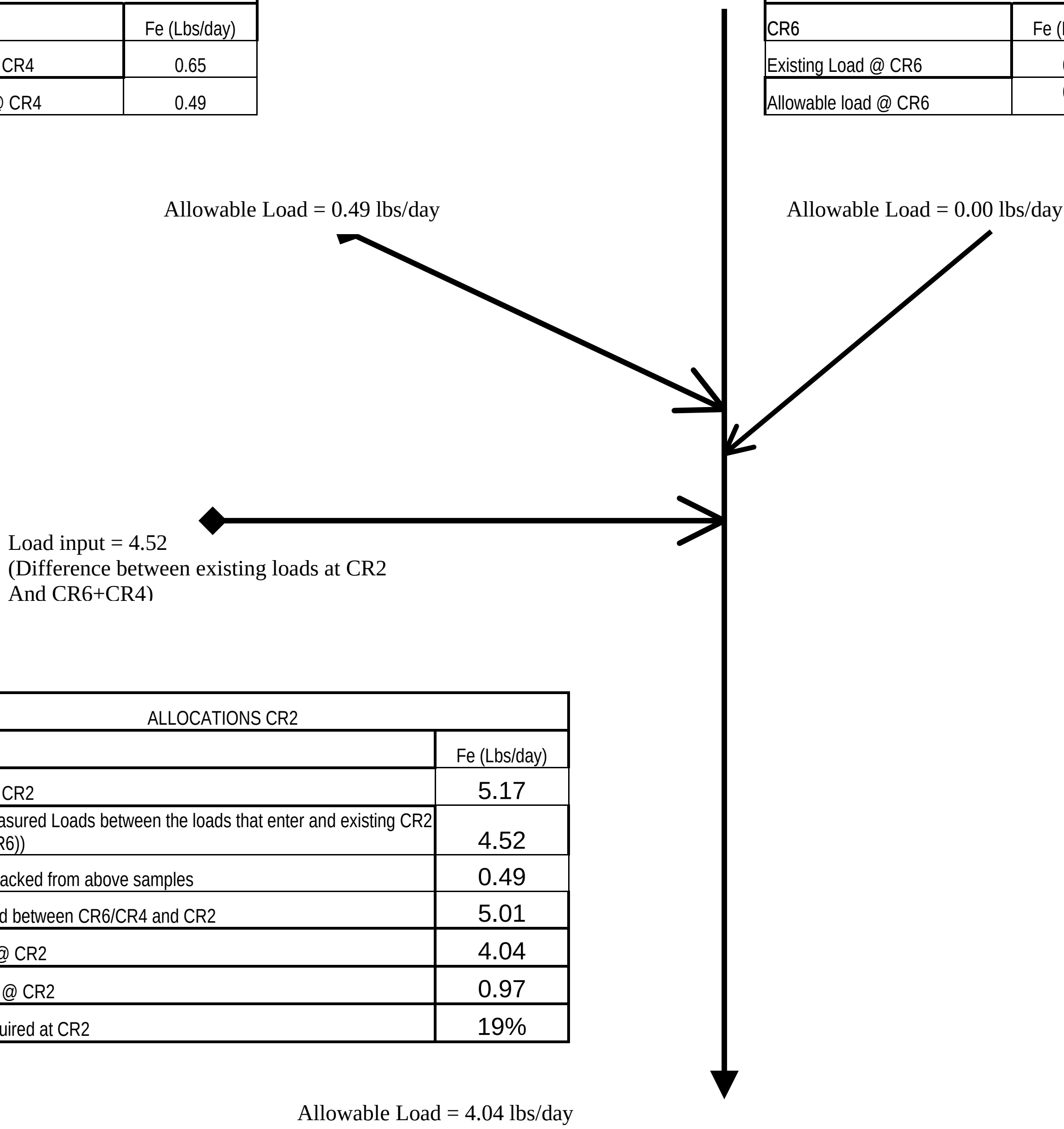
Following is an example of how the allocations, presented in Table 3, for a stream segment are calculated. For this example, iron allocations for CR2 of Coon Run are shown. As demonstrated in the example, all upstream contributing loads are accounted for at each point. Attachment C contains the TMDLs by segment analysis for each allocation point in a detailed discussion. These analyses follow the example. Attachment A contains maps of the sampling point locations for reference.

| ALLOCATIONS CR4 | |
|---|---|
| CR4 | Fe (Lbs/day) |
| Existing Load @ CR4 | 0.65 |
| Allowable load @ CR4 | 0.49 |

| ALLOCATIONS CR6 | |
|---|---|
| CR6 | Fe (Lbs/day) |
| Existing Load @ CR6 | 0.00 |
| Allowable load @ CR6 | 0.00 |




| ALLOCATIONS CR2 | |
|---|---|
| CR2 | Fe (Lbs/day) |
| Existing Load @ CR2 | 5.17 |
| Difference in measured Loads between the loads that enter and existing CR2 (CR2 – (CR4+CR6)) | 4.52 |
| Additional load tracked from above samples | 0.49 |
| Total load tracked between CR6/CR4 and CR2 | 5.01 |
| Allowable Load @ CR2 | 4.04 |
| Load Reduction @ CR2 | 0.97 |
| % Reduction required at CR2 | 19% |

The allowable load tracked from CR4/CR6 was 0.49 lbs/day. The existing load at CR4/CR6 was subtracted from the existing load at CR2 to show the actual measured increase of acidic load that has entered the stream between these two sample points (4.52 lbs/day). This increased value was then added to the allowable load at CR4/CR6 to calculate the total load that was tracked between

CR4/CR6 and CR2 (allowable load @ CR4/CR6 + the difference in existing load between CR4/CR6 and CR2). This total load tracked was then subtracted from the calculated allowable load at CR2 to determine the amount of load to be reduced at CR2. This total load value was found to be 5.01 lbs/day; it was 0.97 lbs/day greater then the CR2 allowable load of 4.04 lbs/day. Therefore, a 19% iron reduction at CR2 is necessary. From this point, the allowable load at CR2 will be tracked to the next downstream point, CR1.

**Recommendations**

In the Coon Run watershed, there are at least two options to pursue in correcting water quality violations. One option would be to determine the source of the elevated metals that are entering Coon Run. If the source is not a natural occurrence, actions could be taken to remediate the source to reduce the levels of metals entering Coon Run. Another option to explore would be evaluating the use of a passive treatment system located near the spring seep to reduce the levels of metals entering Coon Run. However, any options considered would require coordination with the Spartansburg Forest Products Facility, as the headwaters and spring seep are located within the facility property.

**Public Participation**

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* and , to foster public comment on the allowable loads calculated. A public meeting will be held on at , to discuss the proposed TMDL.

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# Attachment A

## Coon Run Watershed Maps

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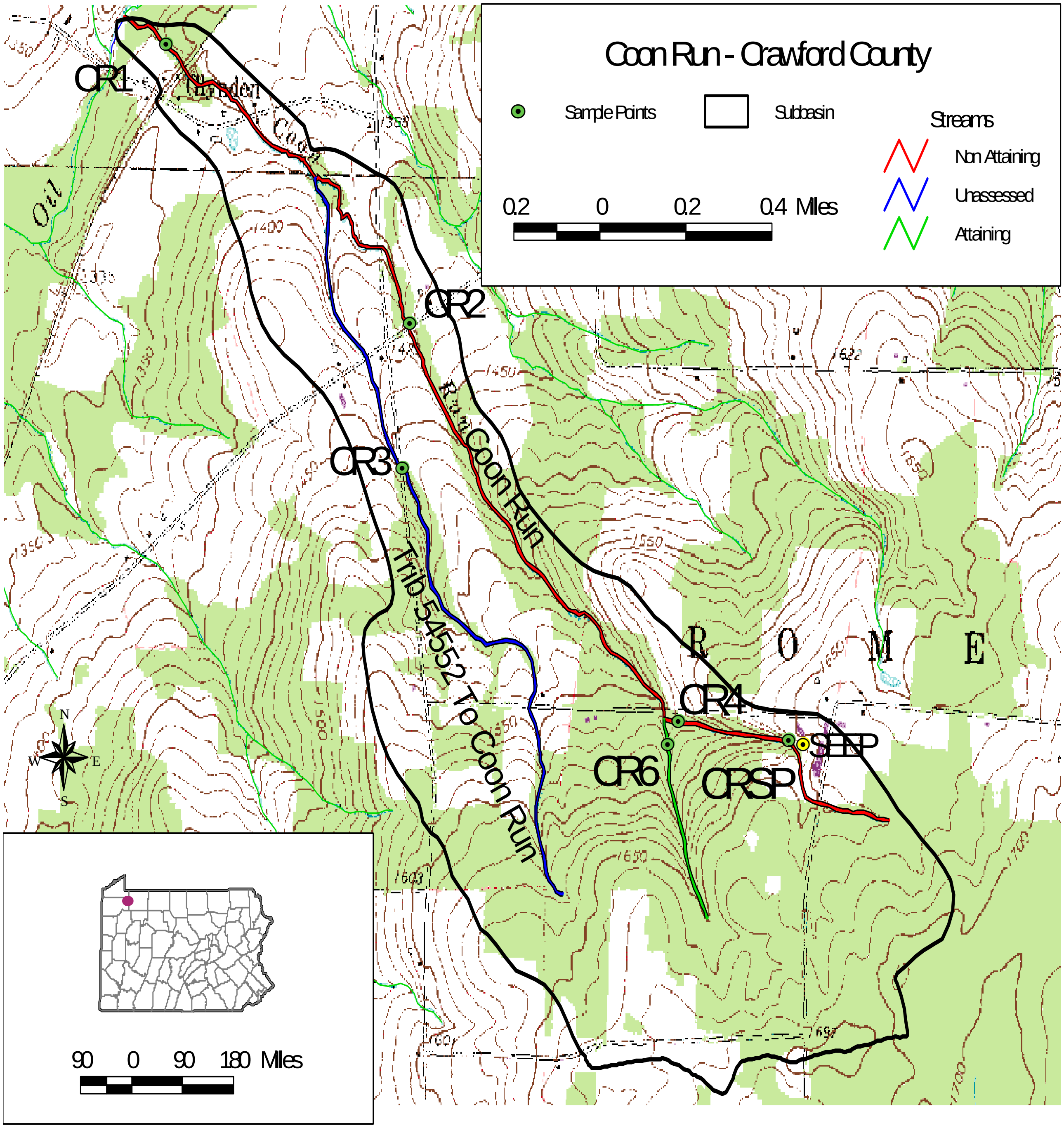
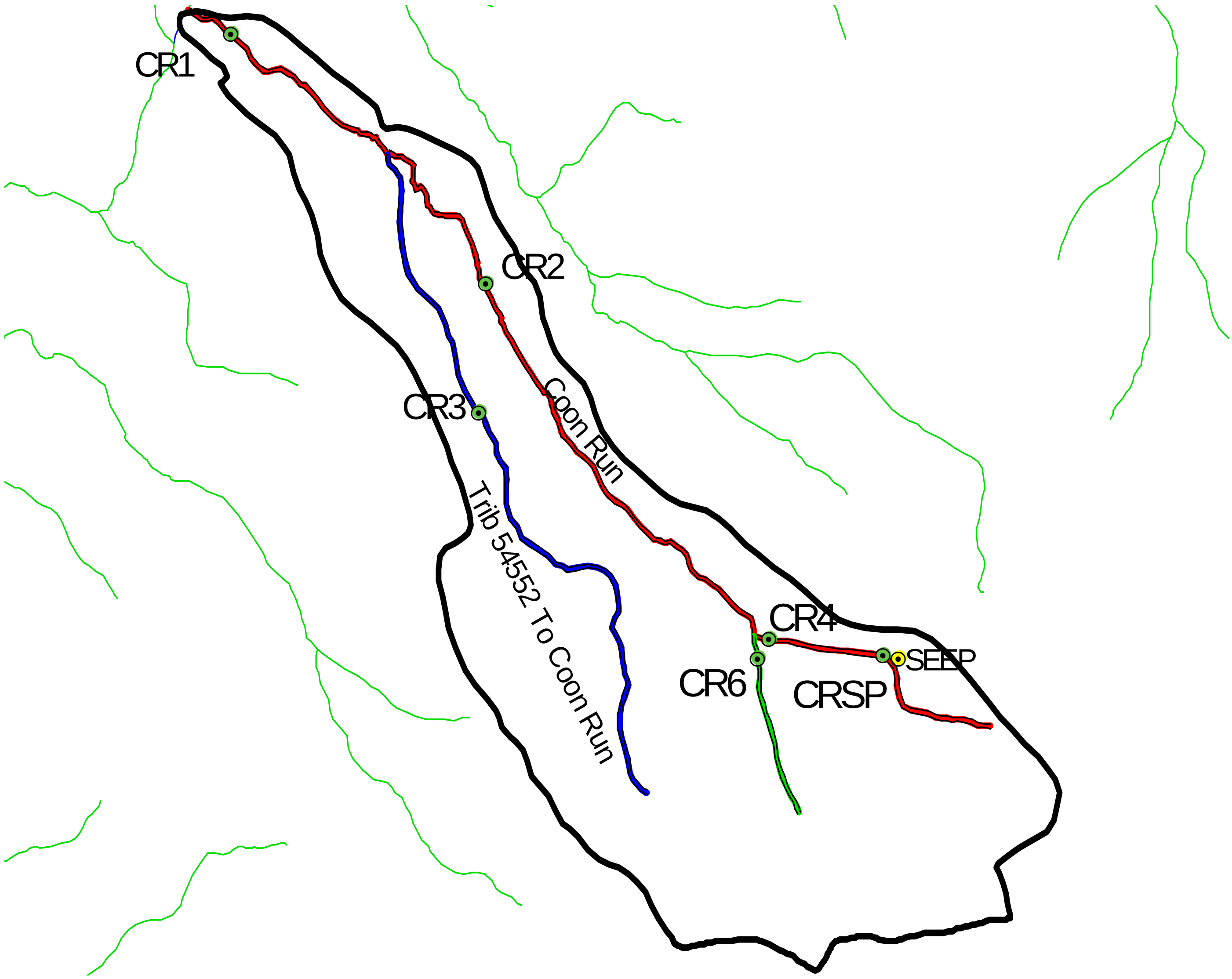


Coon Run - Crawford County
Sample Points
Subbasin
Streams
Non Attaining
Unassessed
Attaining
0.2 0 0.2 0.4 Miles
CR1
CR2
CR3
CR4
CR6
CRSP
SEEP
Coon Run
Trib 54552 To Coon Run
R O M E
N
S
E
W
90 0 90 180 Miles

# DRAFT



DRAFT

# Attachment B

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

DRAFT

# Method for Addressing Section 303(d) Listings for pH

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

The pH, a measurement of hydrogen ion acidity presented as a negative logarithm, is not conducive to standard statistics. Additionally, pH does not measure latent acidity. For this reason, and based on the above information, Pennsylvania is using the following approach to address the stream impairments noted on the Section 303(d) list due to pH. The concentration of acidity in a stream is at least partially chemically dependent upon metals. For this reason, it is extremely difficult to predict the exact pH values, which would result from treatment of abandoned mine drainage. Therefore, net alkalinity will be used to evaluate pH in these TMDL calculations. This methodology assures that the standard for pH will be met because net alkalinity is a measure of the reduction of acidity. When acidity in a stream is neutralized or is restored to natural levels, pH will be acceptable. Therefore, the measured instream alkalinity at the point of evaluation in the stream will serve as the goal for reducing total acidity at that point. The methodology that is applied for alkalinity (and therefore pH) is the same as that used for other parameters such as iron, aluminum, and manganese that have numeric water quality criteria.

Each sample point used in the analysis of pH by this method must have measurements for total alkalinity and total acidity. Net alkalinity is alkalinity minus acidity, both being in units of milligrams per liter (mg/l) $CaCO_3$. The same statistical procedures that have been described for use in the evaluation of the metals is applied, using the average value for total alkalinity at that point as the target to specify a reduction in the acid concentration. By maintaining a net alkaline stream, the pH value will be in the range between six and eight. This method negates the need to specifically compute the pH value, which for mine waters is not a true reflection of acidity. This method assures that Pennsylvania's standard for pH is met when the acid concentration reduction is met.

There are several documented cases of streams in Pennsylvania having a natural background pH below six. If the natural pH of a stream on the Section 303(d) list can be established from its upper unaffected regions, then the pH standard will be expanded to include this natural range. The acceptable net alkalinity of the stream after treatment/abatement in its polluted segment will be the average net alkalinity established from the stream's upper, pristine reaches added to the acidity of the polluted portion in question. Summarized, if the pH in an unaffected portion of a stream is found to be naturally occurring below six, then the average net alkalinity for that portion (added to the acidity of the polluted portion) of the stream will become the criterion for the polluted portion. This "natural net alkalinity level" will be the criterion to which a 99 percent confidence level will be applied. The pH range will be varied only for streams in which a natural unaffected net alkalinity level can be established. This can only be done for streams that have upper segments that are not impacted by mining activity. All other streams will be required to reduce the acid load so the net alkalinity is greater than zero 99% of time.

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

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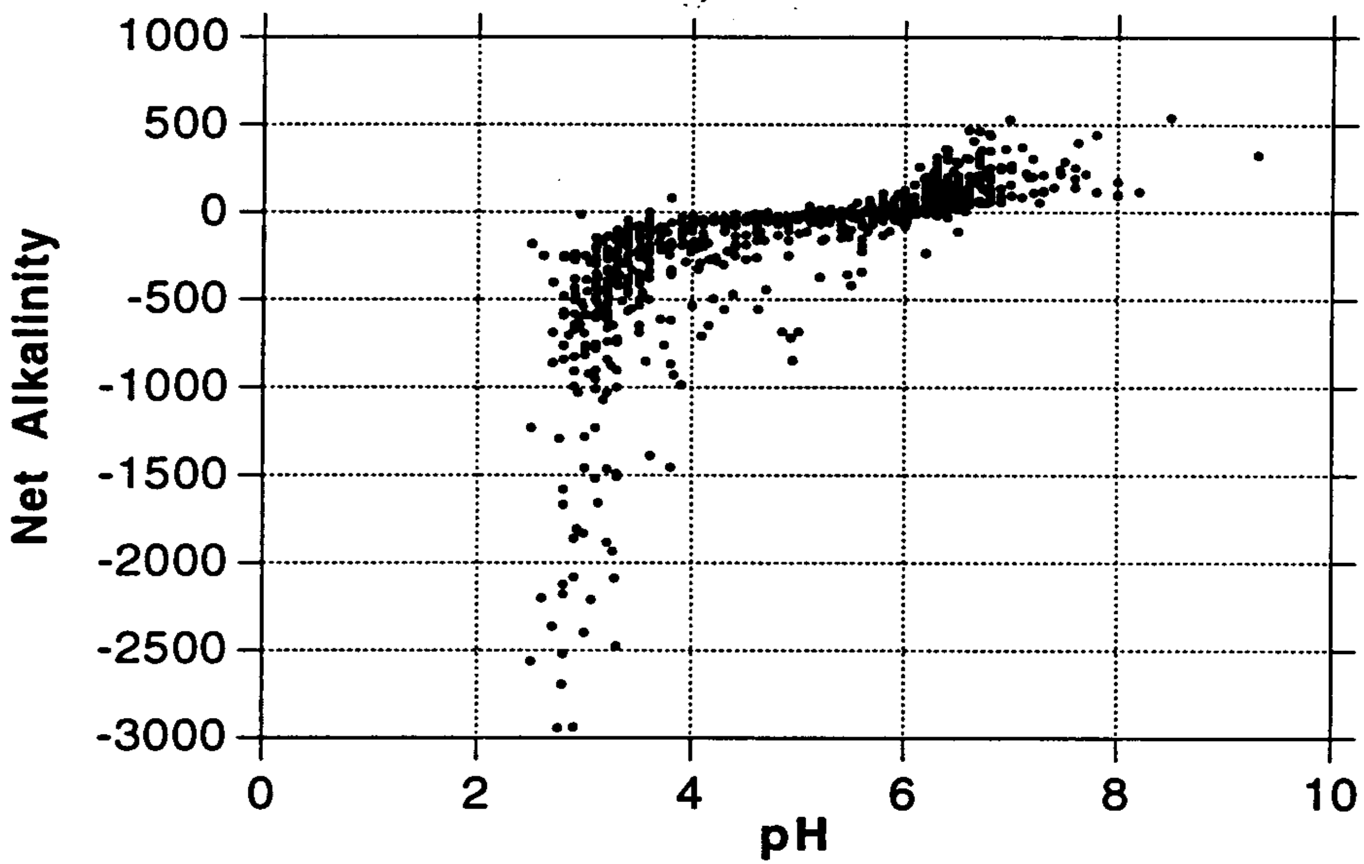


**Figure 1**. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

# Attachment C
## TMDLs By Segment

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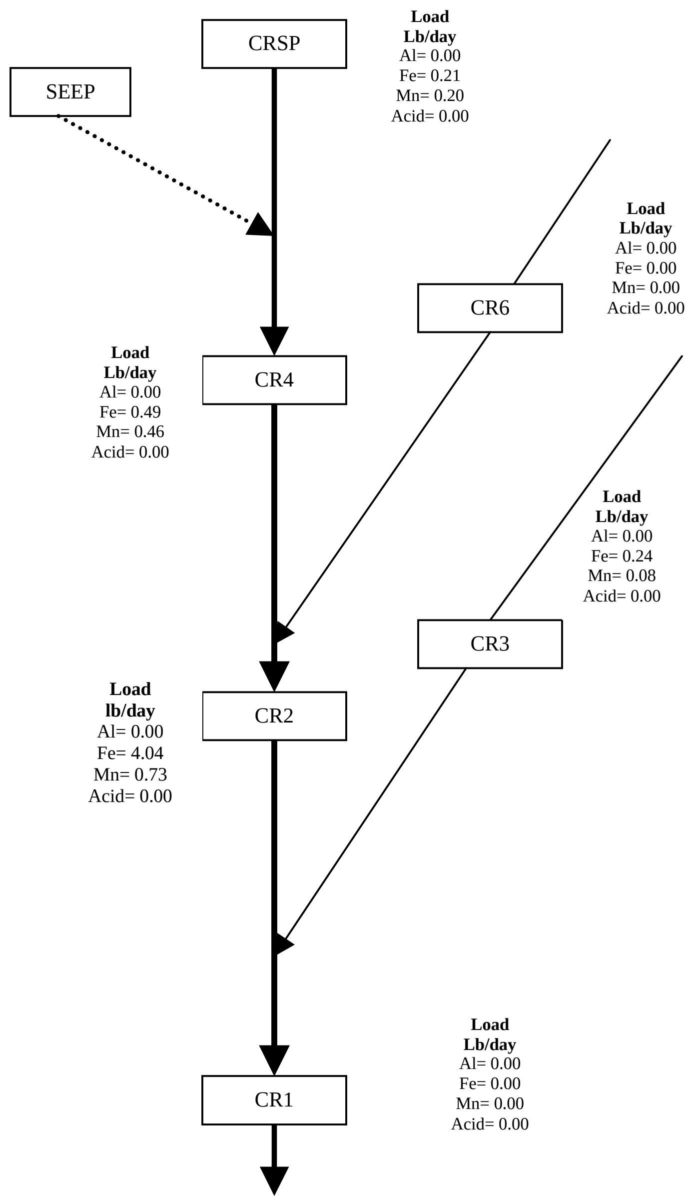
**Coon Run**

The TMDL for Coon Run consists of load allocations to four sampling sites along Coon Run (CRSP, CR4, CR2 and CR1) and two sampling sites on unnamed tributaries of Coon Run (CR6 and CR3) A headwaters segment was also sampled, but was dry on most sampling dates, therefore the data isn't included in this TMDL. Sample data sets were collected during 2006. All sample points are shown on the maps included in Attachment A as well as on the loading schematic presented on the following page.

Coon Run is listed on the 1996 PA Section 303(d) list for metals as being the cause of the degradation to this stream. This TMDL will focus primarily on metals analysis to the Coon Run watershed.

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

# DRAFT




*TMDL calculations- CRSP-Site downstream of metals Seep*

The TMDL for sample point CRSP consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this most headwaters segment of Coon Run was computed using water-quality sample data collected at point CRSP. The average flow, measured at the sampling point CRSP (0.04 MGD), is used for these computations. This is the most upstream point of this segment and the allowable load allocations calculated at CRSP will directly affect the downstream point CR4.

Sample data at point CRSP shows that this headwaters section of Coon Run has a pH ranging between 7.3 and 7.9. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

# DRAFT

A TMDL for iron and manganese has been calculated. The measured sample data for aluminum was below detection limits. No acidity was measured at CRSP. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. The existing and allowable loads for all aluminum and acidity values at CRSP in Table C1 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C1 shows the measured and allowable concentrations and loads at CRSP.  Table C2 shows the reductions necessary for iron and manganese at CRSP.

| Table C1 | | Measured | | Allowable | |
|---|---|---|---|---|---|
| Flow (gpm)= | 29.74 | Concentration | Load | Concentration | Load |
| | | mg/L | lbs/day | mg/L | lbs/day |
| | Aluminum | ND | NA | ND | NA |
| | Iron | 7.20 | 2.57 | 0.58 | 0.21 |
| ND = non detection | Manganese | 4.47 | 1.60 | 0.55 | 0.20 |
| NA = not applicable | Acidity | ND | NA | ND | NA |
| | Alkalinity | 58.52 | 20.90 | | |

| Table C2. Allocations CRSP | | |
|---|---|---|
| CRSP | Fe (Lbs/day) | Mn (Lbs/day) |
| Existing Load @ CRSP | 2.57 | 1.60 |
| Allowable Load @ CRSP | 0.21 | 0.20 |
| Load Reduction @ CRSP | 2.36 | 1.40 |
| % Reduction required @ CRSP | 92% | 88% |

*TMDL calculations- CR4 - Coon Run before confluence with unnamed tributary*

The TMDL for sampling point CR4 consists of a load allocation to all of the area at and above this point shown in Attachment A.  The load allocation for this segment was computed using water-quality sample data collected at point CR4.  The average flow, measured at the sampling point CR4 (0.17 MGD), is used for these computations. The allowable loads calculated at CR4 will directly affect the downstream point CR2.

Sample data at point CR4 shows pH ranging between 7.2 and 8.1; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point CR4 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point.  This was based on the sample data for the point and did not account for any loads already specified from upstream sources.  The additional load from points CRSP shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points CRSP and CR4 to determine a total load tracked for the segment of stream between CR4 and CRSP. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at CR4.

A TMDL for iron and manganese at CR4 has been calculated. The measured sample data for aluminum were less than detection limits. No acidity was measured at this sample point. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated.

Table C3 shows the measured and allowable concentrations and loads at CR4. Table C4 shows the percent reduction for acidity needed at CR4.

| Table C3 | | Measured | | Allowable | |
|---|---|---|---|---|---|
| Flow (gpm)= | 120.68 | Concentration | Load | Concentration | Load |
| | | mg/L | lbs/day | mg/L | lbs/day |
| | Aluminum | ND | NA | ND | NA |
| | Iron | 0.45 | 0.65 | 0.34 | 0.49 |
| ND = non detection | Manganese | 0.32 | 0.46 | 0.32 | 0.46 |
| NA = not applicable | Acidity | ND | NA | ND | NA |
| | Alkalinity | 115.00 | 166.67 | | |

| Table C4. Allocations CR4 | | |
|---|---|---|
| CR4 | Fe (Lbs/day) | Mn (Lbs/day) |
| Existing Load @ CR4 | 0.65 | 0.46 |
| Difference in measured Loads between the loads that enter and existing CR4 | -1.92 | -1.14 |
| Percent loss due calculated at CR4 | 74.7% | 71.3% |
| Additional load tracked from above samples | 0.21 | 0.20 |
| Percentage of upstream loads that reach the CR4 | 25.3% | 28.8% |
| Total load tracked between CRSP and CR4 | 0.05 | 0.06 |
| Allowable Load @ CR4 | 0.49 | 0.46 |
| Load Reduction @ CR4 | -0.44 | -0.40 |
| % Reduction required @ CR4 | 0% | 0% |

There is a 1.92 lbs/day decrease of iron at this sample point compared to the sum of measured loads from upstream segments. This loss of iron occurred in this segment of stream between CRSP and CR4. The total iron load measured was 0.44 lbs/day less than the calculated allowable iron load of 0.49 lbs/day, resulting in no required iron reduction. There was no manganese load reduction required at CR4.

<u>*TMDL calculations- CR6-Unimpaired UNT 54553 of Coon Run*</u>

The TMDL for sampling point CR6 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point CR6. The average flow, measured at the sampling point CR6 (0.17 MGD), is used for these computations. The allowable loads calculated at CR6 will directly affect the downstream point CR2.

Sample data at point CR6 shows pH ranging between 6.6 and 7.6; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured sample data for aluminum, iron, manganese and acidity showed that all parameters were below detection limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. The existing and allowable loads for all parameter values at CR6 in Table C5 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C5 shows the measured and allowable concentrations and loads at CR6.

| Table C5 | | Measured | | Allowable | |
|---|---|---|---|---|---|
| Flow (gpm)= | 115.74 | Concentration | Load | Concentration | Load |
| | | mg/L | lbs/day | mg/L | lbs/day |
| | Aluminum | ND | NA | ND | NA |
| | Iron | ND | NA | ND | NA |
| ND = non detection | Manganese | ND | NA | ND | NA |
| NA = not applicable | Acidity | ND | NA | ND | NA |
| | Alkalinity | 45.00 | 62.6 | | |

*TMDL calculations- CR2-Coon Run downstream of Seep Impairments*

The TMDL for sampling point CR2 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point CR2. The average flow, measured at the sampling point CR2 (0.74 MGD), is used for these computations. The allowable loads calculated at CR2 will directly affect the downstream point CR1.

Sample data at point CR2 shows pH ranging between 6.7 and 7.9; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point CR2 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points CR6/CR4 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points CR6/CR4 and CR2 to determine a total load tracked for the segment of stream between CR2 and CR6/CR4. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at CR2.

# DRAFT

A TMDL for iron at CR2 has been calculated. All aluminum sample data was less than detection limits. The measured sample data for manganese were above detection limits but fell below applicable water quality criteria limits. No acidity was measured at CR2. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated.

Table C6 shows the measured and allowable concentrations and loads at CR2. Table C7 shows the percent reduction for iron needed at CR2.

| Table C6 | | Measured | | Allowable | |
|---|---|---|---|---|---|
| Flow (gpm)= | 516.98 | Concentration | Load | Concentration | Load |
| | | mg/L | lbs/day | mg/L | lbs/day |
| | Aluminum | ND | NA | ND | NA |
| | Iron | 0.83 | 5.17 | 0.65 | 4.04 |
| ND = non detection | Manganese | ND | NA | ND | NA |
| NA = not applicable | Acidity | ND | NA | ND | NA |
| | Alkalinity | 77.68 | 482.30 | | |

| Table C7. Allocations CR2 | |
|---|---|
| CR2 | Fe (Lbs/day) |
| Existing Load @ CR2 | 5.17 |
| Difference in measured Loads between the loads that enter and existing CR2 | 4.52 |
| Additional load tracked from above samples | 0.49 |
| Total load tracked between CR4/CR6 and CR2 | 5.01 |
| Allowable Load @ CR2 | 4.04 |
| Load Reduction @ CR2 | 0.97 |
| % Reduction required @ CR2 | 19% |

There is a 4.52 lbs/day increase of iron at this sample point compared to the sum of measured loads from upstream segments. This iron increase entered this segment of stream between CR6/CR4 and CR2. The total iron load measured was 0.97 lbs/day greater than the calculated allowable iron load of 4.04 lbs/day, resulting in a required 19% iron reduction.

*TMDL calculations-CR3- Unnamed Tributary 54552 to Coon Run*

The TMDL for sample point CR3 consists of a load allocation to this unnamed tributary as shown in Attachment A. The load allocation for this tributary was computed using water-quality sample data collected at point CR3. The average flow, measured at the sampling point CR3 (0.07 MGD), is used for these computations. The allowable loads calculated at CR3 will directly affect the downstream point CR1.

# DRAFT

Sample data at point CR3 shows a pH ranging between 6.8 and 7.5. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

The measured sample data for aluminum was less than detection limits. Iron and manganese were above detection limits but less than water quality standards. No acidity was measured at CR3. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. The existing and allowable loads for all parameter values at CR3 in Table C8 will be denoted as "NA". The concentrations will be denoted as "ND".

Table C8 shows the measured and allowable concentrations and loads at CR3.

| Table C8 | | Measured | | Allowable | |
|---|---|---|---|---|---|
| Flow (gpm)= | 48.53 | Concentration | Load | Concentration | Load |
| | | mg/L | lbs/day | mg/L | lbs/day |
| | Aluminum | ND | NA | ND | NA |
| | Iron | ND | NA | ND | NA |
| ND = non detection | Manganese | ND | NA | ND | NA |
| NA = not applicable | Acidity | ND | NA | ND | NA |
| | Alkalinity | 57.13 | 33.30 | | |

*TMDL calculations- CR1-Mouth of Coon Run*

The TMDL for sampling point CR1 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point CR1. The average flow, measured at the sampling point CR1 (0.55 MGD), is used for these computations.

Sample data at point CR1 shows pH ranging between 6.7 and 7.9; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point CR1 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points CR3/CR2 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points CR3/CR2 and CR1 to determine a total load tracked for the segment of stream between CR1 and CR3/CR2. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at CR1.

The measured sample data for aluminum, iron and manganese were measured below detection limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. Sample data showed there was no acidity measured at this sample site.

# DRAFT

Table C9 shows the measured and allowable concentrations and loads at CR1.

| Table C9 | | Measured | | Allowable | |
|---|---|---|---|---|---|
| Flow (gpm)= | 385.03 | Concentration | Load | Concentration | Load |
| | | mg/L | lbs/day | mg/L | lbs/day |
| | Aluminum | ND | NA | ND | NA |
| | Iron | ND | NA | ND | NA |
| ND = non detection | Manganese | ND | NA | ND | NA |
| NA = not applicable | Acidity | ND | NA | ND | NA |
| | Alkalinity | 72.88 | 337.0 | | |

Margin of Safety

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

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

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

Seasonal Variation

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

Critical Conditions

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

# Attachment D

## Excerpts Justifying Changes Between the 1996, 1998, 2002 and 2004 Section 303(d) Lists

# DRAFT

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

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

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

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

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

# Attachment E

## Water Quality Data Used In TMDL Calculations

# DRAFT

| DATE | SITE | ALK @ Ph | HOT ACIDITY mg/l | ALUMINUM T ug/l | IRON T ug/l | MANGANESE T ug/l | FLOW gpm | pH |
|---|---|---|---|---|---|---|---|---|
| 5/25/2006 | CRSP | 126.6 | -106.20 | <500.00 | 10980.00 | 2668.00 | 64.31 | 7.3 |
| 6/21/2006 | CRSP | 258.0 | -244.60 | <500.00 | 5450.00 | 4570.00 | 19.43 | 7.6 |
| 7/18/2006 | CRSP | 229.8 | -206.60 | <500.00 | 9034.00 | 5512.00 | 11.22 | 7.4 |
| 8/9/2006 | CRSP | 235.4 | -208.00 | <500.00 | 3340.00 | 5120.00 | 24.01 | 7.9 |
| | | | | | | | | |
| AVERAGE | | 212.5 | -191.4 | 0 | 7201.00 | 4467.50 | 29.74 | |
| ST DEV | | 58.51709 | 59.43026726 | 0 | 3445.48 | 1260.349555 | 23.65 | |

| DATE | SITE | ALK @ Ph 3.9 mg/l | HOT ACIDITY mg/l | ALUMINUM T ug/l | IRON T ug/l | MANGANESE T ug/l | FLOW gpm | pH w/ 3.9 Alk |
|---|---|---|---|---|---|---|---|---|
| 4/13/2006 | CR4 | 53.4 | -10.80 | 600.00 | 1110.00 | 227.00 | 440.90 | 7.2 |
| 5/25/2006 | CR4 | 101.0 | -93.40 | <500.00 | <300.00 | 233.00 | 78.76 | 8 |
| 6/21/2006 | CR4 | 141.2 | -127.80 | <500.00 | 404.00 | 284.00 | 39.31 | 7.7 |
| 7/18/2006 | CR4 | 137.0 | -125.80 | <500.00 | 334.00 | 293.00 | 29.40 | 7.6 |
| 8/9/2006 | CR4 | 142.4 | -117.20 | <500.00 | 398.00 | 542.00 | 15.03 | 8.1 |
| | | | | | | | | |
| AVERAGE | | 115.0 | -95.0 | 0 | 449.20 | 315.80 | 120.68 | |
| ST DEV | | 38.44399 | 49.01407961 | 0 | 405.0842 | 129.8449075 | 180.563 | |

| DATE | SITE | ALK @ Ph 3.9 mg/l | HOT ACIDITY mg/l | ALUMINUM T ug/l | IRON T ug/l | MANGANESE T ug/l | FLOW gpm | pH w/ 3.9 Alk |
|---|---|---|---|---|---|---|---|---|
| 4/13/2006 | CR6 | 30.8 | -17.40 | <500.00 | <300.00 | <50.00 | 202.813 | 6.6 |
| 5/25/2006 | CR6 | 41.4 | -32.60 | <500.00 | <300.00 | <50.00 | 145.007 | 7.4 |
| 6/21/2006 | CR6 | 48.8 | -39.20 | <500.00 | 328.00 | <50.00 | 109.507 | 6.9 |
| 7/18/2006 | CR6 | 49.8 | -40.20 | <500.00 | <300.00 | <50.00 | 18.1315 | 6.8 |
| 8/9/2006 | CR6 | 54.2 | -37.00 | <500.00 | <300.00 | <50.00 | 103.224 | 7.6 |
| | | | | | | | | |
| AVERAGE | | 45.0 | -33.3 | 0 | 0 | 0 | 115.737 | |
| ST DEV | | 9.174966 | 9.346229186 | 0 | 0 | 0 | 67.3816 | |

| DATE | SITE | ALK @ Ph 3.9 mg/l | HOT ACIDITY mg/l | ALUMINUM T ug/l | IRON T ug/l | MANGANESE T ug/l | FLOW gpm | pH w/ 3.9 Alk |
|---|---|---|---|---|---|---|---|---|
| 4/13/2006 | CR2 | 44.6 | -21.60 | <500.00 | 602.00 | 53.00 | 1048.89 | 6.7 |
| 5/25/2006 | CR2 | 65.2 | -52.00 | <500.00 | 617.00 | <50.00 | 827.77 | 7.9 |
| 6/21/2006 | CR2 | 93.4 | -79.00 | 710.00 | 1370.00 | 175.00 | 510.42 | 7.1 |
| 7/18/2006 | CR2 | 88.4 | -76.00 | <500.00 | 600.00 | 126.00 | 137.51 | 7.1 |
| 8/9/2006 | CR2 | 96.8 | -76.00 | <500.00 | 977.00 | 235.00 | 60.32 | 7.9 |
| | | | | | | | | |
| AVERAGE | | 77.68 | -60.92 | 0 | 833.20 | 117.80 | 516.98 | |
| ST DEV | | 22.23538 | 24.53226447 | 0 | 340.3714 | 93.74273305 | 427.81 | |

| DATE | SITE | ALK @ Ph 3.9 mg/l | HOT ACIDITY mg/l | ALUMINUM T ug/l | IRON T ug/l | MANGANESE T ug/l | FLOW gpm | pH w/ 3.9 Alk |
|---|---|---|---|---|---|---|---|---|
| 4/13/2006 | CR3 | | | | | | | |
| 5/25/2006 | CR3 | 42.8 | -32.40 | <500.00 | 637.00 | 86.00 | 1417.25 | 7.5 |
| 6/21/2006 | CR3 | 62.6 | -49.20 | <500.00 | 449.00 | 305.00 | 38.15 | 6.8 |
| 7/18/2006 | CR3 | 66.0 | -53.60 | <500.00 | 319.00 | 205.00 | 8.71 | 6.8 |
| 8/9/2006 | | | no flow - data shows unimpaired for metals | | | | | |
| | | | | | | | | |
| AVERAGE | | 57.13333 | -45.06666667 | 0 | 468.33 | 198.67 | 488.04 | |
| ST DEV | | 12.5289 | 11.1880889 | 0 | 159.8791 | 109.6372808 | 804.859 | |

# DRAFT

| DATE | SITE | ALK @ Ph 3.9 mg/l | HOT ACIDITY mg/l | ALUMINUM T ug/l | IRON T ug/l | MANGANESE T ug/l | FLOW gpm | pH w/ 3.9 Alk |
|---|---|---|---|---|---|---|---|---|
| 4/13/2006 | CR1 | 42.4 | -21.60 | 698.00 | 1190.00 | 87.00 | 1315.66 | 6.7 |
| 5/25/2006 | CR1 | 59.4 | -49.60 | <500.00 | <300.00 | <50.00 | 367.163 | 7.8 |
| 6/21/2006 | CR1 | 89.2 | -74.60 | <500.00 | <300.00 | <50.00 | 71.9875 | 7.2 |
| 7/18/2006 | CR1 | 81.8 | -68.60 | <500.00 | <300.00 | <50.00 | 125.664 | 7.2 |
| 8/9/2006 | CR1 | 91.6 | -71.80 | <500.00 | <300.00 | <50.00 | 44.6556 | 7.9 |
| AVERAGE | | 72.9 | -57.2 | 0 | 0 | 0 | 385.0 | |
| ST DEV | | 21.25493 | 22.19792783 | 0 | 0 | 0 | 535.609 | |

DRAFT

# Attachment F
## Comment and Response