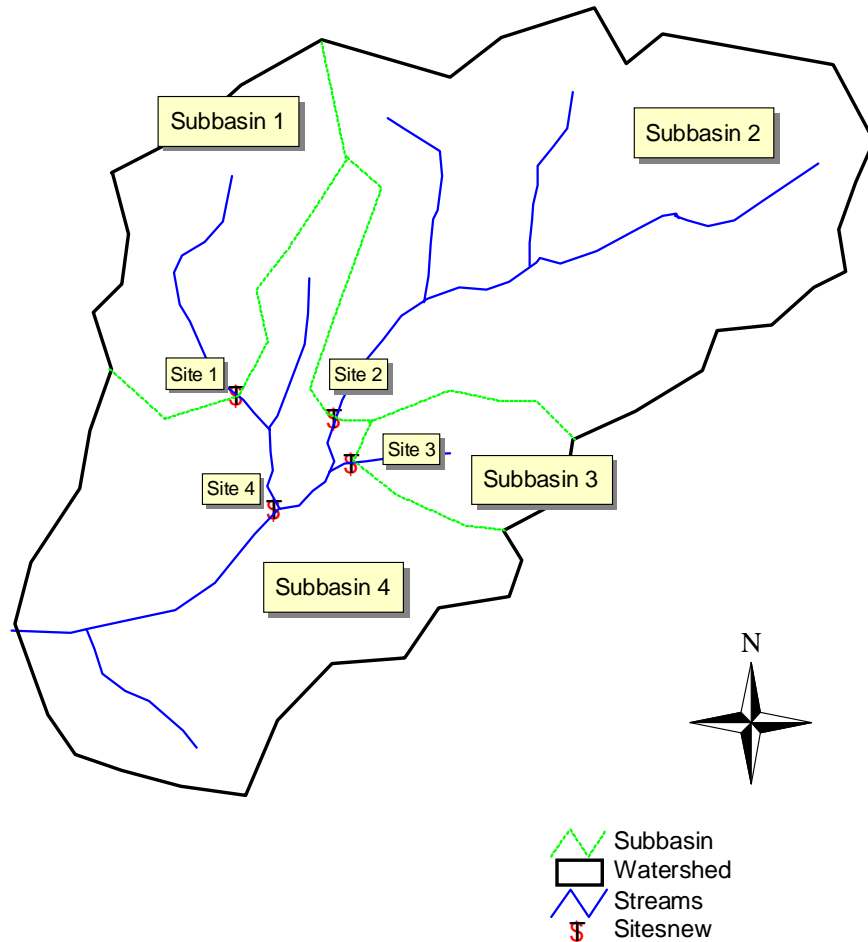


Wildcat Branch of Cumberland River

Total Maximum Daily Load (TMDL) Fact Sheet

Project Name:	Wildcat Branch of Cumberland River
Location:	Pulaski County, Kentucky
Scope/Size:	Wildcat Branch Watershed 1,234 acres (1.928 mi ²) Stream Segment: river mile 0.0 to 2.1
Land Type:	forest, agricultural, barren/spoil
Type of Activity:	acid mine drainage (AMD) caused by abandoned mines
Pollutant(s):	H ⁺ ion mass, sulfuric acid
TMDL Issues:	nonpoint sources
Water Quality Standard/Target:	The pH shall not be less than six (6.0) or more than nine (9.0) and shall not fluctuate more than one and zero tenths (1.0) pH unit over a 24-hour period. This standard is found within regulation 401 KAR 5:031.
Data Sources:	Kentucky Pollutant Discharge Elimination System Permit Historical Sampling Data, Kentucky Division of Water (KDOW) Data Collection
Control Measures:	Kentucky nonpoint source TMDL implementation plan, Kentucky Watershed Framework
Summary:	Wildcat Branch was determined as not supporting the designated uses of primary and secondary contact recreation (swimming and wading) and warm water aquatic habitat (aquatic life). Therefore, the creek was placed on the 1996 and subsequent 303(d) lists for TMDL development. The creek segment is characterized by a depressed pH, the result of AMD from abandoned mining sites. In developing the TMDL for Wildcat Branch, pH readings and corresponding streamflow measurements were made at four different locations within the watershed (see accompanying figure). The most recent sampling indicates that the entire watershed has unacceptable pH levels.



Wildcat Branch Subbasins

TMDL Development:

TMDLs in grams H^+ ions per day were computed based on the allowable minimum pH value (6.0) for streams to meet primary and secondary contact recreation and aquatic life uses. The TMDL was done for grams of ions (subsequently converted to lbs/day) because the units for pH do not allow for the computation of a quantitatively useful load or reduction amount.

In recognition of the inherent difficulties associated with imposition of a “no-exceedance” pH criteria on potentially intermittent streams, the KDOW has decided to use the lowest one year average discharge of the most recent 10-year flow record as the flow basis for setting the appropriate TMDL and associated loading reduction. Previous pH TMDLs have used a 3-year recurrence interval of the average flow as the critical flow. However, this flow resulted in a target discharge that frequently was significantly greater than any of the observed flows for the sites as collected over several years. Thus use of a 3-year flow would require an extrapolation of the observed ion vs. flow model, well beyond the upper limit of the observed data. The selection of the 10-year frequency was based on a consideration of water quality standards (WQSs) (i.e. 7Q10). However, since many of these streams have a 7Q10 of zero, a greater duration was needed. The consensus of the KDOW was to use the 1-year duration. The use of an average annual flow as the basis for determining the TMDL provides a more appropriate mechanism for determining (1) the total annual load, (2) the total annual reduction that would be derived from an annual summation of the daily TMDLs, and (3) the associated daily load reductions for the critical year using historical daily flows.

**TMDL for Wildcat
Branch:**

In developing a TMDL for Wildcat Branch, there are two possible strategies. Either a cumulative TMDL may be obtained for the downstream extent of the impaired portion of the watershed, or separate TMDLs and associated load reductions may be developed for each individual subbasin. As a result of the availability of sampling data at multiple sampling points, individual TMDLs were developed for Subbasins 1, 2, 3, and 4. The low pH condition extends to Site 4, which is the upstream extent of Subbasin 4. The TMDLs and associated load reductions for Subbasins 1, 2, 3, and 4 are shown below.

Summary of Flow Rate and TMDL for Each Subbasin In the Wildcat Branch Watershed

Subbasin	Upstream contributing area (mi ²)	Incremental critical flow (cfs)	Incremental TMDL for a pH of 6.0 (lbs/day)	Predicted incremental load (lbs/day)	Load Reduction needed (lbs/day)
1	0.2705	0.3287	0.0018	0.6496	0.6478
2	0.8456	1.0277	0.0055	7.4787	7.4732
3	0.1131	0.1375	0.0007	2.8267	2.8260
4	0.6988	0.8493	0.0046	39.9741	39.9695
Total Watershed	1.928	2.3433	0.0126	50.9291	50.9165

Permitting in the Wildcat Branch Watershed:

All of the streams in the watershed are considered to be impaired for low pH based on the available data.

New Permits:

New permits (except for new remining permits) for discharges to streams in the Wildcat Branch Watershed could be allowed anywhere in Subbasins 1, 2, 3, and 4 contingent upon end-of-pipe pH permit limits in the range of 6.35 to 9.0 standard units. WQSs state that for meeting the designated uses of aquatic life and swimming, the pH value should not be less than 6.0, nor greater than 9.0. This range of 6.0 to 9.0 for pH is generally assigned as end-of-pipe effluent limits. However, because a stream impairment exists (low pH), new discharges should not cause or contribute to an existing impairment. Application of agricultural limestone on mine sites results in highly buffered water leaving the site. A buffered solution with nearly equal bicarbonate and carbonic acid components will have a pH of 6.35 (Carew, personal communication, 2004). Discharge of this buffered solution will use up free hydrogen ions in the receiving stream, thus it should not cause or contribute to an existing low pH impairment. New permits having an effluent limit pH of 6.35 to 9.0 will not be assigned a hydrogen ion load as part of a Waste Load Allocation (WLA).

Remining Permits:

Remining permits may be approved on a case-by-case basis where streams are impaired because of low pH from abandoned mines. Permit approval is contingent on reclamation of the site after mining activities are completed. Existing water quality conditions must be

maintained or improved during the course of remining. The permittee is required to monitor in-stream conditions during remining to make sure that current water quality conditions are maintained or improved. Reclamation of the site is the ultimate goal, but WQSs (pH of 6.0 to 9.0 standard units) may not necessarily be met in the interim if the Commonwealth issues a variance to the discharger. In instances where the Commonwealth issues a variance for a remining activity consistent with this regulation, hydrogen ion loads from this remining activity are allowed to exceed the waste load allocation (WLA). The variance allows an exception to the applicable WQS as well as the TMDL. Remining therefore constitutes a means whereby a previously disturbed and unreclaimed area can be reclaimed. The authority for remining is defined in Section 301(p) of the Federal Clean Water Act; Chapter 33, Section 1331(p) of the U.S. Code – Annotated (the Rahall Amendment to the Federal Clean Water Act); and the Kentucky Administrative Regulations (401 KAR 5:029 and 5:040).

The remediation of the remining site will result in a reduction of the nonpoint source ion load of the subbasin where the remining is done. When remining is completed, the remediation should result in a reduction in the load allocation. Follow-up, in-stream monitoring will need to be done at the subbasin outfall to determine the effect of reclamation activities following remining on the overall ion load coming from the subbasin. There are currently no active remining permits in the Wildcat Branch watershed.

**General KPDES Permit
for Coal Mine Discharges:**

This permit covers all new and existing discharges associated with coal mine runoff. This permit does not authorize discharges that (1) are subject to an existing individual KPDES permit or application, (2) are subject to a promulgated storm water effluent guidelines or standard, (3) the Director has determined to be or may reasonably be expected to be contributed to a violation of a water of a WQS or to the impairment of a 303(d) listed water, or (4) are into a surface water that has been classified as an Exceptional or Outstanding or National Resource Water. A signed copy of a Notice of Intent (NOI) form must be submitted to the Kentucky Division of Water (KPDES Branch) when the initial application is filed with the Division of Mine Permits. However, coverage under this

general permit may be denied and submittal of an application for an individual KPDES permit may be required based on a review of the NOI and/or other information.

Antidegradation Policy: Kentucky’s Antidegradation Policy was approved by EPA on April 12, 2005. For impaired waters, general permit coverage will not be allowed for one or more of the pollutants commonly associated with coal mining (i.e., sedimentation, solids, pH, metals, alkalinity of acidity). The individual permit process remains the same except new conditions may apply if a Total Maximum Daily Load (TMDL) has been developed and approved.

Distribution of Load: Because there were no point source discharges active during the 2000-2002 monitoring period, the existing hydrogen ion load for the watershed was defined entirely as a nonpoint source load. Because new permits (pH 6.35 to 9.0) should not cause or contribute to the existing impairment and remaining permits would be exempt from the TMDL requirements, no load has been provided for the WLA category.

Wasteload and Load Allocation for Each Subbasin in the Wildcat Branch Watershed

	Incremental Critical Flow Rate (cfs)	TMDL for pH = 6.0 (lbs/day)	Wasteload Allocation* (lbs/day)	Load Allocation (lbs/day)
Subbasin 1	0.3287	0.0018	0.00	0.0018
Subbasin 2	1.0277	0.0055	0.00	0.0055
Subbasin 3	0.1375	0.0007	0.00	0.0007
Subbasin 4	0.8493	0.0046	0.00	0.0046

*pH limits for new discharges must be between 6.35 and 9.0

Implementation/ Remediation Strategy: Remediation of pH-impaired streams, as a result of current mining operations is the responsibility of the mine operator. The Kentucky Division of Field Services of the Kentucky Department of Surface Mining Reclamation and Enforcement (DSMRE) is responsible for enforcing the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The Kentucky Division of Abandoned Mine Lands (DAML), also a part of DSMRE, is charged with performing reclamation to address the impacts from pre-law and bond forfeiture mine sites in accordance with

priorities established in SMCRA. SMCRA sets environmental problems as third in priority in the list of Abandoned Mine Lands (AML) problem types.

The Mt. Victory area of Pulaski County, Kentucky, which lies within the Wildcat Branch watershed, has a long history of coal mining with operations dating back to the Civil War. In the mid 1950's through the 1980's, this area was extensively mined using strip, deep, and auger mining techniques. The mines were operated at various times by Stokes, Mt. Victory, and Wash Ridge coal companies. Many of these mines were abandoned before they were successfully reclaimed. There are only a few areas where reclamation continues by bonded mining companies. Wildcat Branch, which is a tributary to Lake Cumberland, drains the Mt. Victory area. More than 100 years after coal mining began in this watershed, Wildcat Branch is still a heavily impaired stream.

Three separate reclamation projects have been implemented in the Wildcat Branch watershed during the last 10 years. A brief summary of each project is provided in the following sections.

Project #1

This project area is located in Subbasin 3 of the Wildcat Branch watershed. In 1992, the Forest Service acquired land in the Wildcat Branch watershed with hopes of reclaiming the area and improving water quality. The Forest Service took a watershed approach to solving the water quality in this stream by designing staged projects that would solve problems in the entire watershed. Through a series of anoxic limestone trenches, shallow wetland cells, and revegetation of bare areas, the water quality has been significantly improved. Recent water samples indicate water pH of 6-7 and metal concentration to be within state standards or acceptable limits. The project was completed in 1995 and cost approximately \$77,000.

Project #2

This project area is located in Subbasin 2 of the Wildcat Branch watershed. This project routes water from a very acidic seep and through a series of underground limestone trenches and a wetland that is filled with limestone. By not allowing the limestone to come into contact with oxygen, bicarbonate alkalinity is produced without precipitating metal oxides that often armor limestone. Once the limestone is armored it is no longer effective in reducing AMD.

The initial results of this restoration effort are promising. Before treatment, the water from the seep had a pH value below 4. After flowing through the limestone trench and wetland, the pH was raised to a value of approximately 5. Heavy metals are also being dropped out of solution in the treatment system. Even though the water still does not meet Kentucky WQSs, the improvements are significant. In future years the water will be routed through additional treatment systems.

Project #3

This project area is also located in Subbasin 2 of the Wildcat Branch watershed. This is the most recent of the remediation projects completed in this watershed. The project was completed with assistance from the Kentucky Office of Surface Mining, and consists of the construction of three (3) ponds (lagoons) to treat AMD drainage. The project, known as “Wildcat Branch Mine Reclamation Project #4”, was completed in July 1999. The Office of Surface Mining and Reclamation contributed \$100,000 for this project. The project consists of a source of clean water flowing into a middle pond diluting some of the acid water, which flows through a limestone field into the third pond. The third pond is seeded with aquatic vegetation to create an acid treatment wetland, which should improve the water quality prior to its release into Wildcat Branch.