Section 319
NONPOINT SOURCE PROGRAM SUCCESS STORY
West Virginia

Passive Treatment Systems Restore Water Quality

Waterbody Improved

Acid mine drainage from abandoned coal mines impaired West Virginia's Morris Creek, prompting the state to add the creek to its 1996 Clean Water Act section 303(d) list of impaired waters for metals and pH. To restore the stream, project partners installed various passive treatment systems [e.g., anaerobic and aerobic wetlands, open limestone channels (OLCs), polishing ponds] at four sites in the watershed. As a result, metal concentrations in Morris Creek have dropped significantly. West Virginia proposes to remove this waterbody from the section 303(d) list in 2010.

Problem

Morris Creek flows through Kanawha County, approximately 25 miles southeast of Charleston, West Virginia, and joins the Kanawha River in the town of Montgomery. West Virginia first placed Morris Creek on the section 303(d) list in 1996 for metals and then again in 1998, 2000, 2002 and 2004 for pH and metals. Stretches of the stream were devoid of aquatic life, and deposits of iron and aluminum existed at several points along the streambed, preventing the creek from supporting its warm-water fishery, drinking water and contact recreation designated uses (Figure 1).

West Virginia developed a total maximum daily load (TMDL) study in 2005 for the Upper Kanawha River system, which includes Morris Creek. The TMDL analysis suggested that for Morris Creek to achieve water quality standards, metal loads would need to be reduced—aluminum by 5,900 pounds per year (lbs/yr), iron by 8,007 lbs/yr and manganese by 4,444 lbs/yr.

Project Highlights

In 2002 the newly formed Morris Creek Watershed Association (MCWA) contacted the West Virginia Department of Environmental Protection's (DEP's) Abandoned Mine Lands (AML) program and the U.S. Office of Surface Mining to request assistance in treating the acid mine drainage polluting Morris Creek. In response, AML and MCWA conducted a watershed-wide monitoring sweep and identified four primary project sites.

By 2003 AML began planning for passive treatment systems at the four sites—Possum Hollow, Blacksnake Hollow, Lower Mainstem and Upper Mainstem Morris Creek. The Possum Hollow site treatment system consists of an aerobic wetland,

Figure 1. Acid mine drainage flows into Possum Hollow, a Morris Creek tributary.

40 by 350 feet, with 3 to 18 inches of limestone in a 60-mil liner, and a polishing pond with an area of 25 by 60 feet. The second site, Blacksnake Hollow, is in a small, very steep area with several acid mine drainage sources seeping out of the hillside from old mine voids. Although a low volume of water typically flows from Blacksnake Hollow (10.5 gallons per minute), the flow contributed highly acidic water (246 milligrams per liter) before the project. The steep terrain and lack of space required partners to select OLCs as the treatment system. Check dams in the OLC slow water flow and lengthen the treatment time. Although project partners expected the Blacksnake Hollow project to accomplish the least amount of water quality treatment of any of the projects, they believed that, when combined with the treatment success of upstream systems, it would help to fully restore Morris Creek.

The third and fourth sites are upstream from a residential section of Morris Creek, where the old Eureka #2 mine discharges highly acidic water from several seeps and collapsed portals adjacent

to the stream for several hundred feet. Two projects were designed to treat these sources: the Lower Mainstem and the Upper Mainstem sites. The Lower Mainstem passive treatment system consists of an anaerobic wetland with five 30 by 250-foot cells lined with 6 to 9 inches of limestone in a 60-mil liner, a 30 by 100-foot-wide polishing pond, and wetland plantings consisting of cattails, bull rushes and common rushes. The Upper Mainstem treatment system is the largest of the four projects. To treat the discharges adjacent to the creek, partners installed a 15 by 450-foot-wide drainage channel with five check dams lined with a 12-inch layer of limestone (Figure 2). The creek itself is routed through a 450-foot OLC to add alkalinity.

Results

Partners finished installing treatment systems in September 2006. Water quality improved immediately. Initial monitoring results showed that Morris Creek and its tributaries (Possum and Blacksnake hollows) met water quality standards for pH, aluminum, iron and manganese below the treatment sites. In fact, the treatment systems reduced metal loads far beyond that required by the TMDL (Table 1). In response, aquatic life is returning to the creek, including a surviving population of brown trout fingerlings (stocked by Trout Unlimited). DEP expects to remove Morris Creek from the 303(d) list of impaired waters in 2010 if conditions remain improved.

Some challenges remain. Flooding and sediment accumulation have caused some problems with the systems in the two years since construction. The efficiency of the Lower Mainstem treatment system has declined, allowing the iron levels to rise again in the creek below this site. However, pH and aluminum continue to meet water quality standards. The partners plan to secure an engineering review of the system to isolate the problem and fix it.

Table 1. Initial environmental results after installing acid mine drainage treatment systems in the Morris Creek watershed.

Project site	pH level: pre/post treatment	Metal reductions achieved		
		Aluminum (lbs/yr)	Iron (lbs/yr)	Manganese (lbs/yr)
Possum Hollow	3.5/6.7	390.55	47.45	102.2
Blacksnake Hollow	4.4/5.0	84.45	76.65	36.86
Lower Mainstem	4.0/6.3	1,759.3	9,249.1	1,098.65
Upper Mainstem	4.2/5.4	31,006.75	276,483.85	31,119.9
Total Reductions	--	**33,248**	**285,857**	**32,320**
TMDL Allocations	--	5,900	8,007	4,444

Figure 2. The Upper Mainstem Morris Creek treatment system includes a drainage channel lined with limestone.

Although the creek is not officially considered impaired for sediment, partners recognize that excess sediment is entering the creek. As part of the comprehensive effort to restore Morris Creek, the DEP Nonpoint Source Program applied to the U.S. Environmental Protection Agency for two grants to reduce sediment loads. The Phase I project, completed in September 2007, restored 1,500 feet of abandoned road, armored culvert outfalls and improved road drainage. The project should reduce sediment entering Morris Creek above the Upper Mainstem site by 213 tons/year. Another part of this project reduced erosion pressure from a large slip area known as the Jones Hollow Slip. This section of the project should reduce sediment by 370 tons/year. Phase II, which began in 2008, includes stabilizing stream banks along the residential section of Morris Creek.

Partners and Funding

The projects received a nonfederal match of $971,810: $312,683 from the Watershed Cooperative Agreement Program (state matching funds) and $659,127 from AML. The DEP Nonpoint Source Program contributed $690,167 in section 319 funds. Project costs totaled $1,661,977. The MCWA provided project assistance and initiated valuable partnerships, such as that with the DEP Nonpoint Source Program. The success of these projects is due in large part to the MCWA.

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