Section 319
NONPOINT SOURCE PROGRAM SUCCESS STORY
Maryland

Treating Acid Mine Drainage Improves Cherry Creek

Waterbody Improved

Abandoned coal mines contributed high levels of acidity and metals to Maryland's Cherry Creek, which flows into Deep Creek Lake. As a result, the Maryland Department of the Environment (MDE) added the Deep Creek Lake watershed, including Cherry Creek, to the state's 1996 Clean Water Act (CWA) section 303(d) list of impaired waters for pH. Acid mine drainage (AMD) mitigation projects were implemented in Cherry Creek, which now consistently meets the total maximum daily load (TMDL) goal for pH. In addition, acidity, iron and aluminum levels have declined.

Problem

Western Maryland's Cherry Creek begins near Savage River State Forest, flows about eight miles through a 7900-acre watershed, and empties into Deep Creek Lake (Figure 1). Outflow from the lake enters the Youghiogheny River, which is in the Ohio River Basin. The Cherry Creek watershed is composed of 69 percent woodlands and 12 percent wetlands; the remainder is mixed agriculture and developed lands. Deep Creek Lake is a manmade recreational impoundment that is popular for fishing and boating.

The name Cherry Creek can be traced to the waterbody's deep reddish color, which was historically caused by bog tannins from sphagnum wetlands. These wetland complexes include coniferous forest and marshes, and they contribute natural organic acidity to the stream.

In the 1920s Cherry Creek was a natural trout stream and the site of a trout-rearing station. During the next several decades, AMD associated with coal mining increased. In 1957 a large fish kill caused by low pH brought an end to trout stocking in Cherry Creek. A 1973 study reported that almost the entire main stem of Cherry Creek was severely or moderately polluted by AMD. That study also estimated that one-fourth of the acid load in the stream is derived from mines; the rest is from natural sources. In the 1980s it was estimated that Cherry Creek was the source of half the acidity entering Deep Creek Lake.

Before project implementation, AMD generally caused the in-stream pH to fall to between 4.0 and 4.3,with a pH as low as 3.2 during periods of low flow. To address this impairment, the TMDL approved for Cherry Creek calls for a pH of 4.6 or higher. That level takes into account the naturally low pH arising from the sphagnum wetlands that characterize Cherry Creek.

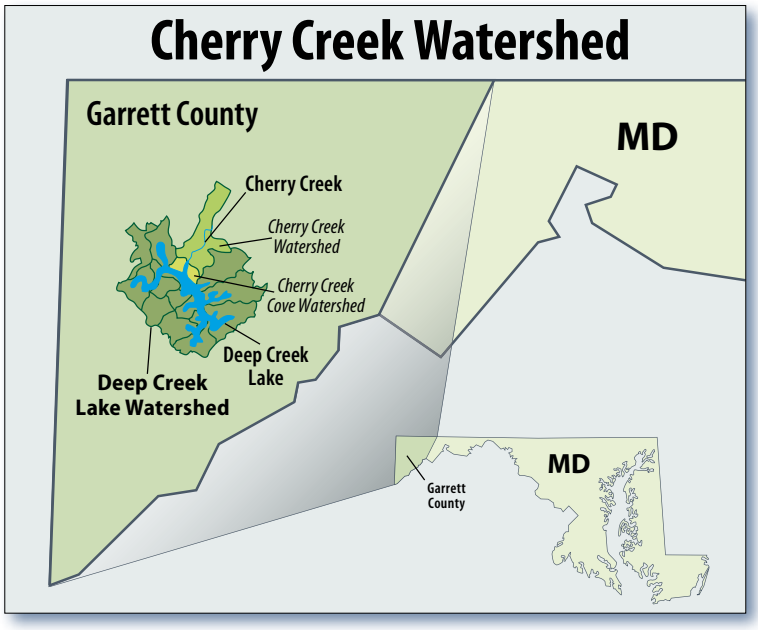

Figure 1. The Cherry Creek watershed is in western Maryland.

Project Highlights

Between 1986 and 1989, MDE created a series of treatment wetlands to help reduce AMD impacts in the Cherry Creek watershed. The Department constructed additional AMD treatment systems between 1998 and 2001, including successive acid treatment systems and more treatment wetlands. Several commercial AMD treatment systems were also introduced, including an Aluminator® (a successive

Figure 2 . Partners installed a successive alkalinity-producing system at the Everhart project site.

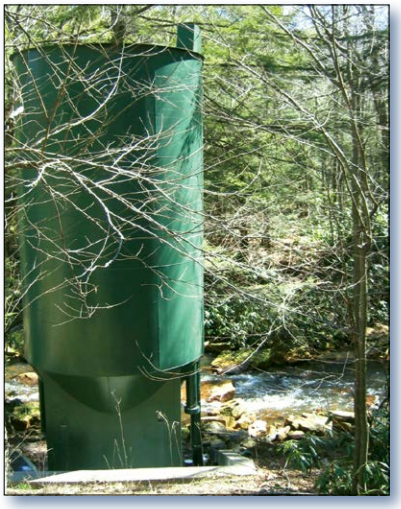

Figure 3 . Partners installed a limestone doser adjacent to Cherry Creek.

alkalinity-producing system that includes a treatment cell designed to precipitate aluminum while keeping iron in a soluble form), a Pyrolusite® cell (bioremediation using limestone and bacteria to remove metals), and a Boxholm® doser (a system that introduces lime to the water at a given rate). (See Figures 2 and 3.) The Cherry Creek mitigation effort used approximately 6,760 tons of limestone, not including the lime used for the doser.

Results

In-stream sampling conducted after AMD implementation (2003–present) shows that pH is generally greater than 6.0 and is always greater than 5.2, meeting the TMDL goal (a pH of 4.6 or greater). Data also show that individual AMD treatment sites have significantly reduced concentrations of pollutants while also increasing alkalinity (Table 1).

Fish surveys show that fish populations have increased. In 1971 only three species of lake fishes were found in Cherry Creek, and they were found only near the confluence of the creek with Deep Creek Lake. In 2004, after implementation of AMD mitigation, a survey found seven fish species in the stream. The survey report stated that rainbow trout, brown trout and smallmouth bass were common enough to support some recreational fishing and that the range of several fish species extended from the stream mouth upstream about 1.5 miles to the vicinity of the lime doser. According to the 2004 survey report, fish have not progressed farther upstream because of a complete blockage by an old mill dam and inflow from a small unnamed tributary, which might be contributing additional AMD. A 2012 analysis of all benthic macroinvertebrate data for Cherry Creek found that the Benthic Index of Biological Integrity might have improved, but the stream's condition continues to be classified as poor overall. The sources of this continuing biological impairment are believed to include AMD.

Partners and Funding

MDE's Abandoned Mine Lands Division was the primary implementer of the Cherry Creek AMD mitigation projects. The total capital cost for the restoration project was $496,000 over 15 years; funds were provided by the State of Maryland; the U.S. Department of the Interior, Office of Surface Mining; and the U.S. Environmental Protection Agency. In addition, the private Sprenger Lang Foundation paid for the purchase and construction of the lime doser, which is located on property owned by the Rock Creek Trust. Funds for operation and maintenance of the doser ($30,000 annually) come from the State of Maryland and the U.S. Department of the Interior. Other partners that help manage and monitor Cherry Creek include the Maryland Department of Natural Resources' Fisheries Service and the University of Maryland's Appalachian Lab.

Table 1. Monitoring Data for Cherry Creek Project Sites, Before and After Installation of AMD Treatment (Average)

Project Site	pH [a]		Acidity [b]		Alkalinty [b]		Iron [b]		Aluminum [b]	
	Before	After	Before	After	Before	After	Before	After	Before	After
Everhart site	3.5	6.1	300	21	0.0	23	65	1.5	4.9	0.1
Glotfelty site	5.3–5.9	6.9	372	0.0	N/A [c]	N/A [c]	111–147	0.83	1.5–3.5	0.1
Teets site	3.1	7.1	486	0.0	0.0	106	73	1.2	37	0.1

[a] In standard units. [b] In milligrams per liter (mg/L). [c] Not available.

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