



# NONPOINT SOURCE SUCCESS STORY

## Virginia

### Reclaiming Acid Mine Drainage Areas and Implementing Control Measures Improve the Biological Health of Stone Creek

#### Waterbody Improved

Increased sediment and total dissolved solids from abandoned mine lands adversely affected the biological health of Stone Creek.

As a result, the Virginia Department of Environmental Quality (DEQ) added a 3.33-mile segment of Stone Creek (VAS-P20R\_STC01A96) to the state's 1996 Clean Water Act (CWA) section 303(d) list of impaired waters for violating the general standards for benthic impairment. Installing various acid mine drainage (AMD) treatment projects, ranging from simple limestone channels to complex multicell treatment systems, helped reduce sedimentation in the creek. As a result, DEQ removed the segment of Stone Creek from its list of impaired waters in 2014.

#### Problem

The 5,251-acre Stone Creek watershed is within the 17,670-acre Straight Creek watershed (hydrologic unit code 06010206) in southwest Virginia's Lee County. The Stone Creek watershed is northwest of Pennington Gap and drains an area along the Virginia-Kentucky border. The impaired segment (VAS-P20R\_STC01A96) includes Stone Creek from the confluence with Ely Creek to the Straight Creek confluence at the south-eastern part of the watershed (Figure 1). The Straight Creek watershed is primarily comprised of forest (81 percent), followed by mined areas (11 percent), and a combination of pasture/hayland, residential and commercial areas, and water (approximately 7 percent total).

DEQ used Modified Rapid Bioassessment Protocol (RBP) II surveys, applicable in 1990s, to evaluate aquatic life conditions of a waterbody. Four biological surveys conducted from May 1991 through November 1993 at a monitoring station at the confluence of Stone Creek and Straight Creek categorized Stone Creek as a "severely impaired" to "moderately impaired" waterbody. Subsequently, DEQ placed Stone Creek on Virginia's 1996 CWA section 303(d) list for not supporting the general standards (benthic) for aquatic life use.

The sources contributing to stressors include both nonpoint and point sources (permitted discharges and sedimentation basin outlets). Nonpoint sources in the watershed include sediment and AMD from abandoned mine lands, as well as disturbed and urban

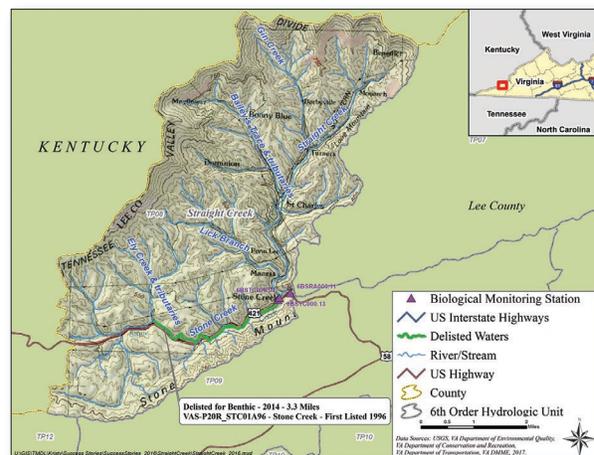


Figure 1. Location of delisted segment and biological monitoring stations in the Stone Creek watershed, Lee County, Virginia.

land areas within the watershed. The stressor analysis indicated sediment and total dissolved solids were the most probable causes of impairment.

DEQ and the Virginia Department of Mines, Minerals and Energy (DMME) jointly developed a benthic total maximum daily load (TMDL) in 2006 and an implementation plan in 2009 for Straight Creek and its tributaries, including Stone Creek. To assess aquatic life condition of a stream, the Commonwealth of Virginia now uses the Virginia Stream Condition Index (VASCI) based on biometrics analysis. A waterbody achieving a rating score 60 or above is considered to be supporting biological integrity and attaining the aquatic life designated use.

Photos courtesy of DBSWCD



Figure 2. Before and after reclaiming a hillside at the Gilbert site in the Stone Creek watershed.

## Story Highlights

DEQ assessed the AMD sources in watershed and identified the pollutant load reductions that would be necessary to meet TMDL goals. The results indicated that mitigation of AMD in the Stone Creek watershed was feasible by implementing best management practices (BMPs) in mining and reclamation areas, along with sediment control measures. These included BMPs within and adjacent to the disturbed mining area, singly or in combination with other reclamation measures and sediment control practices (Figure 2).

From 2002 through 2012, DMME partnered with the Daniel Boone Soil and Water Conservation District (DBSWCD) and other government agencies and watershed stakeholders to complete a variety of AMD treatment projects, including reclaiming more than 215 acres of mined land (primarily converting it to forest) in the Stone Creek watershed. These projects range from simple limestone channels for smaller discharges

to complex multicell passive treatment systems for larger, poorer-quality discharges. AMD treatment projects included constructing 1,087 linear feet of open limestone channels, five successive alkalinity producing cells, four aerobic wetlands, and nine water control structures. Additionally, 200 linear feet of slurry wall and 100 linear feet of stream bank protection were also completed. DMME routinely monitors all of the treatment systems to ensure proper function.

## Results

The sediment control measures and mining BMPs have helped improve water quality in Stone Creek. Biological monitoring conducted by DEQ personnel at two monitoring stations (6BSTC000.04 and 6BSTC000.13) showed that VASCI scores of biological samples collected from Stone Creek were above the minimum required threshold of 60 in the fall of 2009 and 2010 (earning scores of 64 and 65, respectively) and the spring of 2011 and 2013 (earning scores of 61 and 77, respectively). These VASCI scores indicate that biological conditions now fully support the aquatic life designated uses in Stone Creek. As a result, the 3.33-mile impaired segment of Stone Creek was removed from the list of impaired waters in the state's 2014 CWA 305(b)/303(d) Water Quality Assessment Integrated Report.

## Partners and Funding

The land reclamation projects sponsored by DMME largely resulted from partnerships with various state, federal and local agencies, including the U.S. Army Corps of Engineers, Natural Resources Conservation Service (NRCS), DEQ, Virginia Department of Conservation and Recreation, Tennessee Valley Authority, DBSWCD and Lee County. The DMME managed the projects and contracted with the DBSWCD to provide local administration for the construction phase of the projects. DEQ was involved in biological monitoring and assessing the impairment status of the creek. The DMME-administered projects were funded through \$3.73 million in federal assistance provided under the Watershed Protection and Flood Prevention Act of 1954. The projects were also supplemented by DMME funds (\$269,642), by NRCS through the Recovery and Reinvestment Fund (\$359,050), and by the U.S. Fish and Wildlife Service (\$44,000) through funding from the Upper Tennessee River Roundtable.



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