Section 319
NONPOINT SOURCE PROGRAM SUCCESS STORY
Virginia

Mined-Land Restoration Improves Middle Creek's Benthic Population

Waterbody Improved

Pollution from decades of coal mining resulted in reduced benthic populations in Virginia's Middle Creek. As a result, the Virginia Department of Environmental Quality (DEQ) added an 11-mile segment of Middle Creek to the Clean Water Act (CWA) section 303(d) list of impaired waters in 1998 because of violations of the General Standard (benthic). Between 2000 and 2005, the Virginia Department of Mines, Minerals and Energy's Department of Mined Lands and Reclamation (DMLR) implemented mined-land best management practices (BMPs). Post-BMP water quality monitoring indicated significant water quality improvements, prompting DEQ to remove Middle Creek from the list of impaired waters in 2006.

Problem

Middle Creek is an 11-mile-long tributary to the Clinch River with a drainage area of approximately 7,000 acres in southwest Virginia (Figure 1). The creek flows through the coalfields of Tazewell County, where layers of gently dipping sedimentary rocks are interspersed with coal seams. Over the past several decades, coal companies mined several hundred acres of Middle Creek watershed lands.

Portions of the Middle Creek watershed were mined prior to Surface Mining Control and Reclamation Act (SMCRA) of 1977. During this time, mining companies disposed refuse (coal mining waste) along Middle Creek and its tributaries without adequate environmental and engineering safeguards. Runoff from storm events washed suspended and dissolved solids from the mine sites into the creek.

Monitoring data showed that mining negatively affected the water quality. DMLR collected data in 1981 that showed that the average conductivity in Middle Creek was "relatively high" at 660 millimhos per centimeter (mmhos/cm). In May 1996 DEQ conducted biological monitoring in Middle Creek and collected only 28 organisms, significantly lower than the 100 organisms typically found at a healthy site. As a result, DEQ added Middle Creek to Virginia's CWA section 303(d) list of impaired waters in 1998 for violating the General Standard (benthic), which requires that all state waters be free of substances that harm aquatic life.

To identify the probable stressors on the benthic population in Middle Creek, DEQ selected an unimpaired watershed with similar size and characteristics to serve as a reference for comparative analysis.

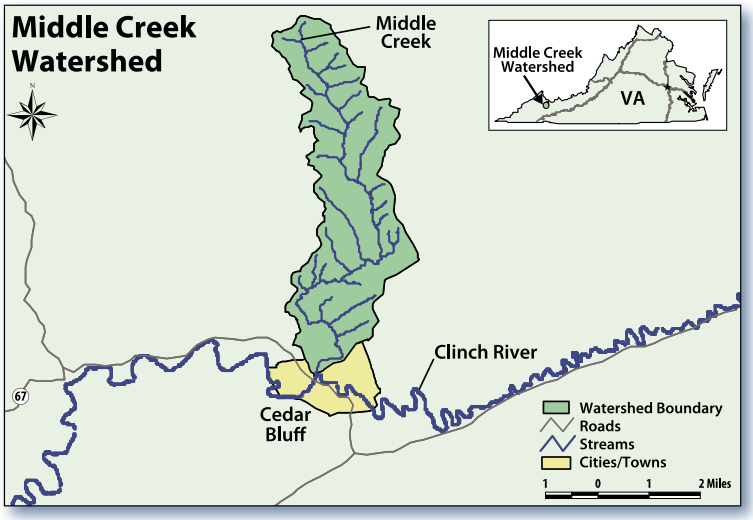

Figure 1. The Middle Creek watershed is in southwest Virginia.

The selected reference watershed, McClure River, is a fourth-order stream with a healthy benthic population in the same ecoregion as Middle Creek. Both watersheds contained mining-related land uses. DEQ considered a water quality parameter to be a possible stressor if values from Middle Creek samples exceeded the 90th percentile of data collected from McClure River more than 10 percent of the time. Between 1996 and 1999, conductivity data from Middle Creek showed several exceedances of the 90th percentile screening level (800 mmhos/cm). Therefore, DEQ listed conductivity (a measure of positively or negatively charged organic dissolved solids) as a possible stressor to biological health in Middle Creek. Other potential stressors noted included total dissolved solids (often correlated with conductivity), sulfate, pH, metals and sediment.

Project Highlights

In the early 1980s (after passage of the SMCRA) the DMLR began regulating coal mining operations in the Middle Creek watershed. Most of the previously mined areas were incorporated into state-issued mining and reclamation permits. These permits contained requirements for drainage plans, materials handling, regrading, revegetation and pollution control. To receive a permit, operators had to provide a performance bond to ensure that the mine sites would be reclaimed to an acceptable post-mining land use.

Through the 1990s, the Covenant Coal Corporation (Covenant) operated mines on more than 200 permitted acres in the watershed. After Covenant closed its last operation in the Middle Creek watershed in 1999, the company did not complete reclamation of the mine sites and, as a result, DMLR initiated enforcement actions that led to the company's forfeiture of performance bonds in 2000. After Covenant's bond forfeiture, DMLR administered the reclamation of the sites through a settlement agreement with Claredon National Insurance Company.

From 2000 to 2005, DMLR implemented the following mined-land BMPs within the Middle Creek watershed: revegetation, regrading of the land to original contours, removing abandoned mining equipment and structures, and implementing post-mining land use requirements. All former mining sites in Middle Creek were ultimately reclaimed as unmanaged forestlands (Figure 2). Although the state began to develop a total maximum daily load (TMDL) for Middle Creek, water quality improvement was achieved before the TMDL was completed.

Results

In 2003, DEQ used the Rapid Bioassessment Protocol II (RBP II) to assess the health of the benthic macroinvertebrate community in Middle Creek. RBP II measures different aspects of the biological community's health using eight biometrics, such as taxa richness, the percent contribution of dominant family, and other metrics that provide information on the abundance of pollution-tolerant and pollution-intolerant organisms.

RBP II biological condition scores collected in Middle Creek were compared to reference scores from McClure River and assessed according to the bioassessment scoring matrix (Table 1). The biological condition score at Middle Creek sampling site #1 was 44 (95 percent of the McClure River reference score of 46), while the score at Middle Creek sampling site #2 was 40 (95 percent of the McClure River reference score of 42). Both scores indicate that Middle Creek is no longer impaired.

Table 1. Bioassessment Scoring Matrix

Percentage as Compared to Reference Score*	Biological Condition Category	Attributes
>83%	Non-Impaired	Displays optimum community structure (composition and dominance).
54 – 79%	Slightly Impaired	Supports lower species richness due to loss of some intolerant forms.
21 – 50%	Moderately Impaired	Supports fewer numbers of species due to loss of most of the intolerant forms.
<17%	Severely Impaired	Few species present. Dominated by one or two taxa of tolerant organisms.

* Percentage values falling in between the above ranges require subjective judgment to correctly place them.

Additionally, post-BMP monitoring data revealed substantial decreases in conductivity compared to levels recorded during the period of active mining prior to reclamation. Samples collected from Middle Creek in 2003 averaged 263 mmhos/cm, well below the 90th percentile conductivity screening level of 800 mmhos/cm. On the basis of these data, DEQ removed the 11-mile segment of Middle Creek from Virginia's list of impaired waters in 2006.

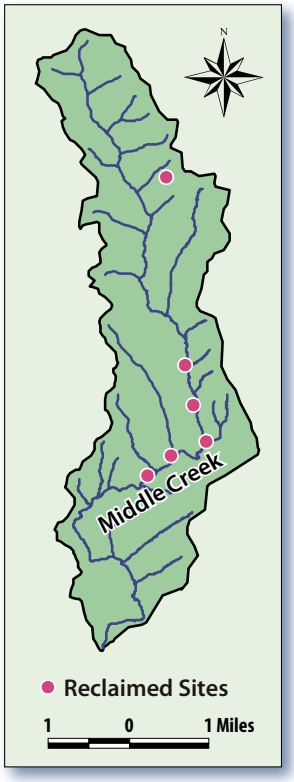

Figure 2. DMLR reclaimed former mining sites in the Middle Creek watershed using funds from a performance bond forfeiture.

Partners and Funding

DMLR administered the reclamation of the sites through a settlement agreement with Claredon National Insurance Company. The total bond forfeiture amount for Middle Creek was $1,190,100. DEQ assisted with water quality monitoring in Middle Creek, including post-project monitoring to assess water quality improvement.

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