



## Section 319

# NONPOINT SOURCE PROGRAM SUCCESS STORY

# Pennsylvania

## Reclaiming Abandoned Mine Lands Improves the Lehigh River

### Waterbody Improved

Metals and acidity in runoff from abandoned surface mines and discharges from abandoned deep mines impaired

Pennsylvania's Lehigh River and some of its tributaries, prompting the Pennsylvania Department of Environmental Protection (PADEP) to add 25.1 miles of watershed streams to the state's Clean Water Act (CWA) section 303(d) list of impaired waters in 2002. Project partners reclaimed and treated 297.9 acres of abandoned mine lands to address pollutant loadings. Water quality improved downstream of the reclamation sites, allowing PADEP to remove a 14.7-mile-long segment of the Lehigh River from the list of impaired waters in 2012.

### Problem

The headwaters of the Lehigh River flow from the Lehigh Marshes just north of Gouldsboro, Pennsylvania. The river then meanders 103 miles through eastern Pennsylvania, draining an area of approximately 1,363 square miles before flowing into the Delaware River near Easton, Pennsylvania (Figure 1). The Lehigh River is the second largest tributary to the Delaware River—its watershed comprises 11 percent of the Delaware River drainage basin. The upper and middle portions of the Lehigh River watershed, including portions of Carbon, Luzerne, Monroe, Schuylkill, Lackawanna, and Wayne counties, support high-quality trout fisheries. A 32-mile stretch of the Lehigh River (from the Francis E. Walter Dam to the borough of Jim Thorpe) is designated as a Pennsylvania Scenic River. This section of the river flows through Lehigh Gorge State Park and Pennsylvania State Game Lands, and it is a popular Class II and III whitewater recreational resource.

Coal mining first began in the Lehigh River watershed in 1792, and it continues today. Deep coal mining, which involves the extraction of coal from deep deposits hundreds to thousands of feet below the surface, was prevalent until the 1940s, at which time surface mining became the primary mining method. A number of abandoned coal mining sites (of both types) in the watershed, dating back to the 1800s, have contributed nonpoint source pollution to nearby waterbodies.

As rainwater and snowmelt flow through surface mines and spoil piles (excavated soils that were removed during mining), they become laden with metals and acidity. Most of this water percolates down through the depressions left by the aban-

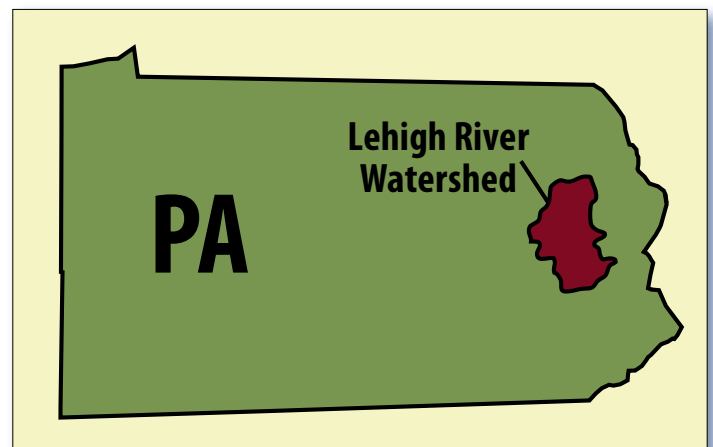


Figure 1. The Lehigh River watershed (red) is in a portion of eastern Pennsylvania underlain by coal fields.

andoned surface mines and then flows down into subterranean deep mine pools, where ground water has accumulated after mining operations ended. The runoff leaches additional acidity and metals as it passes through underlying sulfur-rich strata and into deep mine pools, thereby significantly compounding the toxicity and volume of the abandoned mine drainage (AMD) discharges associated with the legacy deep mine pools.

Over the years, polluted runoff from a number of abandoned surface coal mines and AMD from deep mines in the watershed delivered high loads of metals and acidity to the Lehigh River and its tributaries. A stream survey conducted by PADEP in 1998 showed that the Index of Biotic Integrity (IBI) scores for the Lehigh River fell below the state's numeric water quality criterion, a minimum IBI score of 63. The IBI is a multimetric index that measures different aspects of the biological communities

present to distinguish between reference conditions and stressed aquatic ecosystem conditions. The 1998 stream survey also found high levels of metals and acidity (indicated by low pH values) in the Lehigh River, which the state attributed to AMD. On the basis of these data, in 2002 PADEP included 25.1 stream miles of the mainstem of the Lehigh River on the state's CWA section 303(d) list of impaired waters for not meeting the aquatic life designated use because of metals and acidity from AMD. The 25.1 stream miles added to the list were later broken into two segments—a 14.7-mile segment and a 10.4-mile segment.

In 2009 PADEP developed a total maximum daily load (TMDL) for the impaired segments of the Lehigh River in the upper and middle portions of the watershed. The TMDL set limits for the metals (aluminum, iron, and manganese) and acidity loads at stations on the Lehigh River. These limits, which vary from station to station depending on the site-specific existing pollutant loads, serve as remediation goals. The limits are intended to allow each site to meet water quality criteria 99 percent of the time.

## Project Highlights

The federal Office of Surface Mining and the PADEP Bureau of Abandoned Mine Reclamation partnered to address the water quality problems identified in the TMDL. The partners designed and implemented 11 abandoned mine reclamation projects, which restored 297.9 acres of abandoned mine lands in the Lehigh River watershed through grading and revegetation. The projects aimed to reduce metals and acidity in surface and ground water while improving aquatic habitat.

## Results

PADEP conducted aquatic habitat assessments in the Lehigh Gorge in 2008 and 2011 to quantify the recolonization of aquatic life in the waterway. The data showed IBI values of 87.4 and 88.8, respectively. Both values exceeded the minimum IBI score of 63, indicating that the aquatic ecosystem is healthy and unimpaired. On the basis of these data, PADEP removed a 14.7-mile-long segment (Assessment ID 16581) of the middle mainstem of the Lehigh River (from Buck Mountain Creek downstream to the confluence with Nesquehoning Creek) from the list of impaired waters in 2012 (Figure 2). Project partners attribute the delisting of this segment to the aban-



Figure 2. A 14.7-mile segment of the Lehigh River mainstem was removed from the impaired waters list in 2012 after restoration projects improved water quality and aquatic habitat.

doned mine land reclamation projects upstream in the watershed. The remaining 10.4 miles of the mainstem remain listed as impaired.

## Partners and Funding

The Lehigh River Watershed is large and contains numerous impaired segments both upstream and downstream of the restored segment. As such, restoration efforts have occurred both upstream and downstream of the restored segment. Partners such as Eastern Pennsylvania Coalition for Abandoned Mine Reclamation have received 319 funds to analyze the legacy mining issues within the watershed which has helped guide watershed restoration efforts. PADEP's TMDL section has also received 319 funds, which were partly used to collect and analyze water quality data for development of the model used for the Lehigh River TMDL, which in turn was used to help steer restoration efforts. The federal Office of Surface Mining (OSM) and PADEP's Bureau of Abandoned Mine Reclamation had direct roles in restoring this segment as outlined within the success story. Restoration work completed downstream will contribute to further restoration of the greater watershed but did not contribute to restoring this segment. Additionally, with funds from an EPA CWA section 104(b)(3) grant, the Wildlands Conservancy conducted a comprehensive assessment of the Lehigh River in 1998 to prioritize the watershed areas affected by mining. Finally, PADEP used \$3,121,000 from the OSM from 1986 to 2006 to reclaim 297.9 acres of abandoned mine lands.



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