



## Section 319

# NONPOINT SOURCE PROGRAM SUCCESS STORY

# Pennsylvania

## Installing Passive Treatment System Restores Trout Population

### Waterbodies Improved

Abandoned mine drainage (AMD) polluted central Pennsylvania's Sterling Run watershed. The Pennsylvania Department of Environmental Protection (PADEP) added Sterling Run and four of its tributaries to the state's 1996 Clean Water Act (CWA) section 303(d) list of impaired waters for siltation, metals and pH. PADEP's Bureau of Abandoned Mine Reclamation (BAMR) designed and contracted the construction of a treatment system that increased pH and significantly reduced metal levels in the stream. PADEP's Division of Water Quality Standards determined that segments in the Sterling Run watershed meet water quality standards and plans to remove the waters from the state's 2010 CWA section 303(d) list of impaired waters.

### Problem

Sterling Run is in a heavily forested part of central Pennsylvania, just east of the town of Pine Glen and northwest of State College in Centre County. Numerous tributaries, including Boake Run (Figure 1), flow into Sterling Run, which in turn flows into the West Branch of the Susquehanna River. Decades of strip mining during the mid-1900s left multiple abandoned coal mines. Coal mines that are not properly reclaimed after coal is removed often leach pollutants into nearby streams. A chemical reaction occurs when rain, stormwater runoff or groundwater contact the mineral pyrite, which is exposed during mining activities. The product of that chemical reaction is often toxic to receiving waters because of acidic pH and elevated levels of metals including aluminum, iron and manganese. Severely affected streams lose all aquatic life and become coated with white- or orange-colored sediment.

Water flowing from mines contributed acidic water, metals and sediment to Sterling Run and its tributaries. The impairments prevented the waters from attaining their aquatic life designations. PADEP added five segments of Sterling Run and its tributaries (12.33 total stream miles) to the state's 1996 CWA section 303(d) list of impaired waters for elevated metals, low pH and siltation. PADEP completed a total maximum daily load for Sterling Run and its tributaries in 2004.

The most significant source of AMD in the watershed is an abandoned strip mine along Boake Run. This tributary to Sterling Run suffers elevated levels of aluminum and magnesium and low pH. A 2008 report by BAMR documents that water in Boake

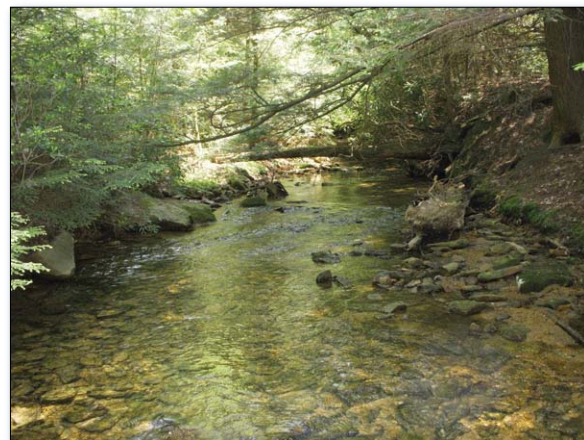


Photo courtesy of Kay Spyker, PADEP-BAMR

Figure 1. Boake Run, a tributary of Sterling Run.

Run had an average pH of 4.5, an average aluminum level of 5.47 milligrams per liter (mg/L) and an average manganese level of 6.17 mg/L. Pennsylvania water quality standards require that water quality metal concentrations not exceed 1.00 mg/L for manganese and 0.75 mg/L for aluminum. Additionally, the pH level must be between 6.0 and 9.0 to ensure attainment of designated uses.

### Project Highlights

BAMR designed and contracted the construction of a passive treatment system to address the AMD problem. The project diverts Boake Run and a smaller, unnamed tributary into the treatment system to improve water quality, and it then re-directs the treated effluent back to the stream channel below the site. Construction began in the summer of 2004 and took about a year to complete. The system,

which consists of collection channels, limestone treatment and settling ponds (Figures 2 and 3), raises pH levels and allows the metals to drop out of solution. The project also included planting 50,000 trees on Pennsylvania Game Commission watershed land in 2000, which emphasized including trees and shrubs that are desirable to local wildlife.

Photo courtesy of Richard Macklem,  
Pennsylvania State Game Commission



Figure 2. Vertical flow limestone treatment pond.

Photo courtesy of Kay Spyker,  
PADEP-BAMR



Figure 3. Settling pond with limestone baffles.

## Results

Data collected by BAMR in November 2006 through July 2008 show an average pH of 4.5 above the treatment system and an average downstream pH of 7.5. Data indicate that the passive treatment system captures 84 percent of aluminum and 86 percent of manganese present.

On the basis of a 2008 BAMR biologist's assessment of aquatic macroinvertebrates in the Sterling Run watershed, PADEP's Division of Water Quality Standards has determined that the Index of Biotic Integrity is sufficiently high to support removing

five segments (12.33 miles) of Sterling Run from the state's 2010 CWA section 303(d) list of impaired waters.

Studies by the Pennsylvania Fish and Boat Commission show that brook trout populations increased post-project. A May 2009 report notes that only one brook trout was present in 1985 below the point where Boake Run flows into Sterling Run. When sampled again in 2008, 31 brook trout were present. Also, the overall biomass at that location increased from 0.2 kilograms per hectare (kg/ha) to 5.9 kg/ha from 1985 to 2008. The number of brook trout and biomass present increased significantly after completing the treatment system. This reestablishment of naturally reproducing brook trout population indicates that waterbodies are attaining their aquatic life designated use.

## Partners and Funding

Sterling Run's heavily forested watershed drains mostly state-owned land that is managed by the Pennsylvania Game Commission. The rest of the watershed is privately held, except for a small portion that lies within the Sproul State Forest and is managed by the Pennsylvania Department of Conservation and Natural Resources. Primary partners in the project were BAMR and the Game Commission. Other partners include the Pennsylvania Fish and Boat Commission, which has sampled for fish species in the watershed as far back as 1985, and E.M. Brown Construction.

The Game Commission dedicated the Boake Run Mine Acid Abatement Project on September 29, 2005 (Figure 4). Final cost for the entire project was \$856,677, which was provided by the federal Office of Surface Mining through the Appalachian Clean Stream Initiative.

Photo courtesy of Richard Macklem,  
Pennsylvania State Game Commission



Figure 4. Partners from PADEP BAMR, Pennsylvania Game Commission and E.M. Brown Construction gathered to dedicate the Boake Run project.



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