



NONPOINT SOURCE SUCCESS STORY

Pennsylvania

Passive Treatment Systems Improve the Upper Tioga River

Waterbody Improved

The Pennsylvania Department of Environmental Protection (PA DEP) added the Tioga River to the state's 2002 Clean Water Act (CWA) section 303(d) list of impaired waters for aquatic life. Acid mine drainage (AMD) caused high levels of metals and low pH in the mainstem of the Tioga River. AMD degradation is caused primarily by abandoned deep mines in the Morris Run, Fall Brook, Bear Creek, Coal Creek, and Johnson Creek subwatersheds. The Susquehanna River Basin Commission (SRBC) developed a comprehensive remediation strategy to address AMD in the Tioga River, and a total maximum daily load was approved in 2005. Multiple partners collaborated to install two passive treatment systems on Fall Brook. Approximately 3 miles of Tioga River improved to meet water quality standards and was delisted for pH and metals in 2022.

Problem

The 67.5-square mile Tioga River watershed is in Tioga and Bradford counties north of Williamsport (Figure 1). The river originates in Armenia Township, Bradford County, and travels southwest towards Blossburg, flowing through the Northcentral Bituminous Coalfield. The watershed is approximately 93% forested.

The Upper Tioga River watershed has a long history of coal mining, with the first mine opening in the early 1800s. Coal mining in the area is characterized by strip and drift mining of coal seams horizontal in orientation. This often resulted in fairly level underground tunnels running for miles, as coal was mined along the seams. After the mine workings were abandoned, the tunnels often collapsed, filling with water that discharged to the surface. There are five large deep mine discharges near Blossburg. Fall Brook is the first major source of AMD to the mainstem of the Tioga River and contributes acidity and heavy metals from both AMD and non-AMD sources to impair the mainstem of the Tioga River.

Story Highlights

In 2014, the Tioga County Concerned Citizens Committee (TCCCC) worked with the Southwestern Energy Company (SWN) through their Energy Conserving Water initiative to address AMD pollution in Fall Brook. They constructed two separate passive AMD treatment systems on Pennsylvania Department

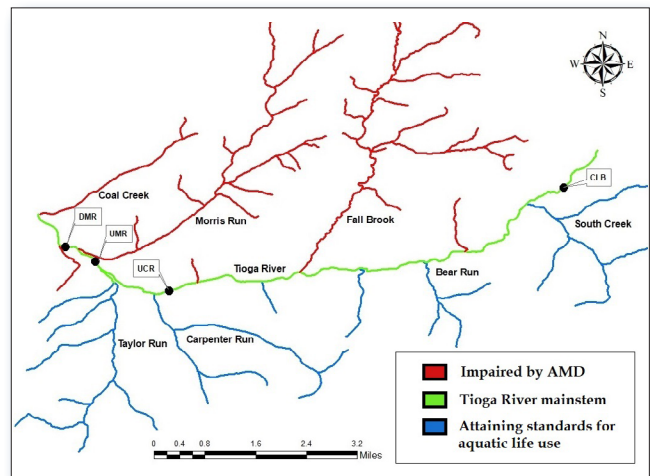


Figure 1. Tioga River watershed and monitoring station locations.

of Conservation and Natural Resources (PA DCNR) Bureau of Forestry property. The treatment systems consist of drainable limestone beds and polishing ponds (Figure 2). An underground pipe network connects the AMD discharges to the limestone beds and ponds, and a solar-powered automatic flushing system cleans the limestone beds. The AMD treatment systems went online in November 2015. SWN funded and oversaw the systems' construction and funded the Operation and Maintenance (O&M) Trust covering the cost of 20 years of O&M expenses. The Tioga County Conservation District oversees the Trust, and the Blossburg Municipal Authority has been contracted to perform the O&M work.



Figure 2. Fall Brook AMD passive treatment system.

Results

Two continuous instream monitoring (CIM) stations were established at sites UCR and UMR (see Figure 1) in February 2016 to continuously monitor water quality. The pH data collected from both Tioga River CIM locations was below the criteria maximum (9.0 standard units) and above the criteria minimum (6.0 standard units) at least 99% of the time. The median pH was near neutral (7.0) at UMR but declined to 5.2 at DMR.

The two samples collected in the Tioga River at UCR and UMR, before the Fall Brook treatment system was constructed, had the highest concentrations of aluminum, iron, and manganese than any samples collected post-treatment. In addition, aluminum hydroxide deposition on stream substrate observed in September 2015 was not observed after system construction.

Benthic macroinvertebrate samples and habitat assessments were collected at each station in the fall and spring from December 2015 to April 2018. The index of biological integrity (IBI) macroinvertebrate scores calculated for each station were used to assess whether the river met criteria for attaining the designated use for aquatic life using the small streams IBI criteria. The attaining aquatic life use freestone IBI assessment criteria > 50 in both pre- and

post-treatment samples. The mean IBI score of the samples collected at UCR from April 2016 to November 2017 was 89 (n=4), and the mean IBI score of samples collected at UCR (2) in 2019 and 2020 was 94 (n=2). The IBI score at UMR increased after the treatment system went online, from 75 to a mean of 92 samples collected post-treatment. While the Tioga River from Fall Brook to Morris Run met IBI attainment thresholds before the treatment system went online, there were noticeable declines in metals loading and marked improvements in IBI scores occurred after the treatment system was installed. Based upon the improved IBI scores, it is clear that the Fall Brook treatment systems have improved the biological conditions in the Tioga River (downstream to Morris Run for approximately 3 miles) and is attaining the designated uses for aquatic life.

The systems have not fully restored Fall Brook but have improved the tributary enough to where Fall Brook is easily assimilated by the Tioga River. Consequently, the Tioga River is vastly improved between Fall Brook and Morris Run. Water quality monitoring over time indicated that the South River Road system, which treats the largest discharge to Fall Brook (known as DFB099), was underperforming. Flushing and cleaning the beds and the replenishment of additional limestone provided a temporary improvement. The future plans include the design and construction of an AMD active treatment plant to further improve the quality of the Tioga River.

When complete, treatment of the discharges will not only restore the mainstem of the Tioga River, but will also restore parts of Morris Run, Fall Brook, and Tioga Lake. Downstream water quality improvements and benefits are expected to flow across state lines as the Tioga River runs from Pennsylvania north into New York state.

Partners and Funding

Multiple partners contributed time and/or funding to the project, including Blossburg Municipal Authority, North Central Conservancy (\$500,000), PA DEP North Central Regional Office, PA DCNR's Bureau of Forestry, Tioga CCCC's Save the River Campaign (\$129,400), Tioga County Conservation District, SWN (\$2,500,000), SRBC (\$1,500,000), Trout Unlimited, and volunteers.



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