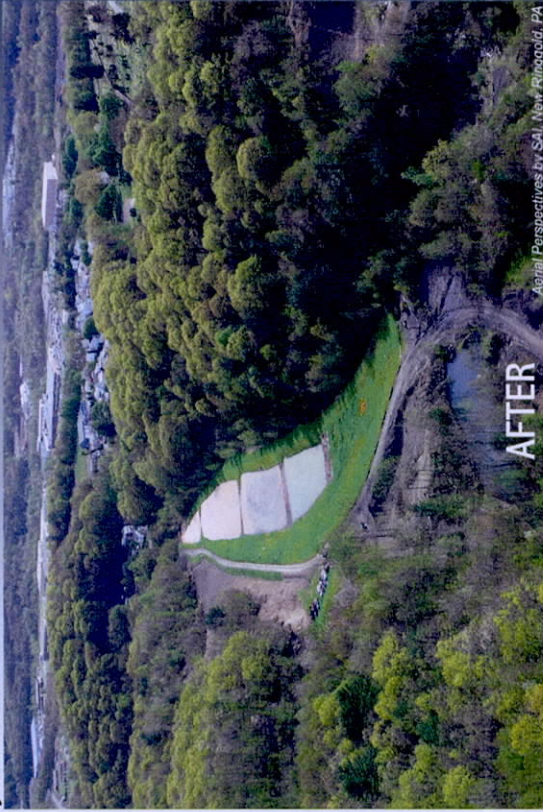


Pine Forest Mine Discharge Project

The Pine Forest Mine Discharge Project was constructed to treat the abandoned mine drainage (AMD) flowing from the abandoned underground mine workings of the Pine Forest Mine pump shaft. The treatment system consists of a flushable, anoxic limestone drain (ALD) followed by an aerobic wetland basin to neutralize acidity and reduce metals loadings from the discharge. Underdrain networks and outflow pipes within the ALD enable flushing of accumulated metals from the limestone bed to the wetland where final oxidation, precipitation, and settling of metallic-rich particles occurs. This treatment system raises the pH and alkalinity of the water and promotes the precipitation of dissolved iron and other metals. The project has reduced AMD pollution loadings from the Pine Forest Mine Discharge to Mill Creek and the Schuylkill River.



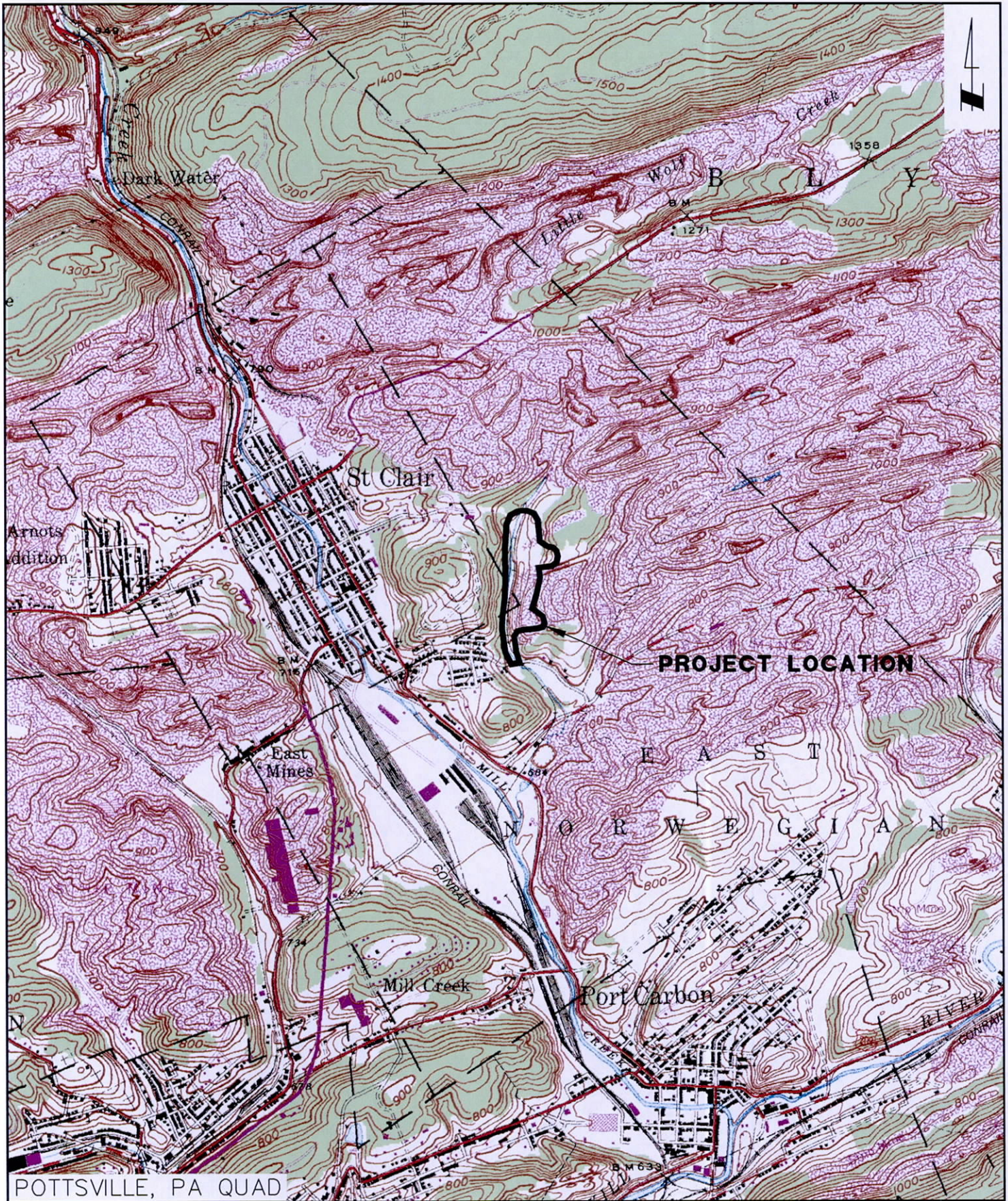
Aerial Perspectives by SAJ, New Ringgold, PA

Funding for this project has been provided by the Pennsylvania Department of Environmental Protection's Section 319(h) Nonpoint Source Management Grant; the U.S. Dept. of the Interior's Office of Surface Mining Appalachian Clean Streams Initiative Watershed Cooperative Agreement Grant; and, the U.S. Environmental Protection Agency. Partial funding for this project has been provided by the U.S. Environmental Protection Agency through a Targeted Watershed Initiative Grant administered by the Philadelphia Water Department and the Partnership for the Delaware Estuary.

The information presented here does not necessarily reflect the opinion or position of EPA.



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SCHUYLKILL HEADWATERS ASSOCIATION, INC.
 ABANDONED MINE DRAINAGE REMEDIATION
 PINE FOREST DISCHARGE

ST. CLAIR BORO. & E. NORWEGIAN TWP. SCHUYLKILL CTY.

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DRAWN BY: CH
 DATE: 5/5/05
 SCALE: 1" = 2000'
 DWG. NO. 03-04234-001

**ABANDONED MINE DRAINAGE REMEDIATION PROJECT FOR THE
PINE FOREST MINE DISCHARGE, EAST NORWEGIAN TOWNSHIP & ST. CLAIR
BOROUGH, SCHUYLKILL COUNTY, PA**

Abandoned mine drainage (AMD) from the Pine Forest Mine pump shaft contributes aluminum, iron, manganese, and acidity to Mill Creek, a tributary to the Schuylkill River in Schuylkill County, PA. Hence, Mill Creek is designated "impaired because of metals" on the Pennsylvania Department of Environmental Protection's (PADEP) 303(d) List of Impaired Waterways. This project involved the construction of a passive treatment system consisting of a flushable, anoxic limestone drain (ALD) followed by an aerobic wetland basin to neutralize acidity and reduce metals loadings from the discharge. Underdrain networks and outflow pipes within the ALD enable flushing of accumulated metals from the limestone bed to the wetland where final oxidation, precipitation, and settling of metallic-rich particles occur. Because of the large flow rate and corresponding large size of the treatment system, cubitainer testing was conducted to evaluate the rate of limestone dissolution and any effects of the metal precipitate on limestone dissolution rates. Monitoring and evaluation of treatment efficiency continued to be conducted following completion of construction in September 2007. This project reduces AMD loadings from the Pine Forest Discharge to Mill Creek and the Schuylkill River, and it demonstrates the effectiveness of using an ALD for treatment of a large volume, near-neutral-pH, iron-contaminated discharge.

Recent flow and chemistry data collected since 1997 by the PADEP and the U.S. Geological Survey (USGS) indicated the flow rate at the Pine Forest discharge ranged from 1,180 to 1,580 gal/min and averaged about 1,360 gal/min. The discharge water has consistently been acidic (pH 5.5 to 5.9; net alkalinity -1.0 to -38.0 mg/L CaCO₃), anoxic to suboxic (0.2 to 2.2 mg/L O₂), and contaminated with dissolved metals (Fe = 16.3 to 23.7 mg/L; Mn = 5.3 to 8.2 mg/L; Al = <0.5 to 1.6 mg/L). Water having this chemical character, but less than one-tenth the flow rate, has successfully been treated with 15-hour detention times in ALDs. Recently constructed ALDs, such as that at the Buck Mountain Discharge in the Swatara Creek basin, have been effectively producing net alkaline effluent with an average 3-hour detention time and have incorporated perforated piping within the limestone bed to enable flushing and hence reduce the potential for clogging. Cubitainer tests for the Pine Forest Discharge indicated comparable alkalinity production rates and maximum alkalinities for uncoated limestone and limestone that was placed at the site to become coated with precipitates. Nevertheless, field studies were needed to evaluate the actual performance and benefits of such large-scale passive treatment systems.

The primary goal of the project was to eliminate AMD (acid and metals) loadings from the Pine Forest Discharge to Mill Creek and the Schuylkill River. The passive treatment system reduces nonpoint source pollution, improve water quality, and improve wildlife and fisheries habitats. A secondary goal was to evaluate the effectiveness of an anoxic limestone drain for treatment of a low-pH, moderately oxygenated and iron-contaminated, moderate-to-high-flow discharge. Ultimately, the knowledge gained from this evaluation will be useful for improving remedial designs for treatment of AMD.

The \$864,000 project was funded by grants from US EPA 319 Non-Point Source Pollution Program, U.S. Department of the Interior - Office of Surface Mining (OSM), USEPA Targeted Watershed Initiative Program (TWIG), and Reading Anthracite Company. Project partners included Schuylkill Headwaters Association, Inc., RETTEW Associates, Inc., Schuylkill County Conservation District, PADEP, USGS, OSM, and Reading Anthracite Company.



