Publication 254
May 2008

West Branch Susquehanna Subbasin AMD Remediation Strategy:

Background, Data Assessment and Method Development

West Branch Susquehanna River Task Force

Despite the enormous legacy of pollution from abandoned mine drainage (AMD) in the West Branch Susquehanna Subbasin, there has been mounting support and enthusiasm for a fully restored watershed. Under the leadership of Governor Edward G. Rendell and with support from Trout Unlimited, Pennsylvania Department of Environmental Protection Secretary Kathleen McGinty established the West Branch Susquehanna River Task Force (Task Force) in 2004.

The goal of the Task Force is to assist and advise the department and its partners as they work toward the long-term goal to remediate the region's AMD.

The Task Force is comprised of state, federal, and regional agencies, Trout Unlimited, and other conservation and watershed organizations (members are identified by their logos on the back page). It first convened on September 10, 2004, and among its early actions, the Task Force recognized the need for a comprehensive AMD remediation strategy for the West Branch Susquehanna Subbasin.

A Report Produced by the Susquehanna River Basin Commission in Partnership with the West Branch Susquehanna River Task Force.

**For More Information, Contact:
Thomas Clark, AMD Project Coordinator
(717) 238-0423 ext. 114
tclark@srbc.net**

INTRODUCTION

The West Branch Susquehanna Subbasin, draining a 6,978-square-mile area in northcentral Pennsylvania, is the largest of the six major subbasins in the Susquehanna River Basin (Figure 1).

The West Branch Susquehanna Subbasin is one of extreme contrasts. While it has some of the Commonwealth's most pristine and treasured waterways, including 1,249 miles of Exceptional Value streams and scenic forestlands and mountains, it also unfortunately bears the legacy of past unregulated mining. With 1,205 miles of waterways impaired by AMD, it is the most AMD-impaired region of the entire Susquehanna River Basin (Figure 2).

Pristine setting along the West Branch Susquehanna River.

M. Smith

Abandoned mine lands in Clearfield County.

A. Gavin

At its most degraded sites, the West Branch Susquehanna River contains acidity concentrations of nearly 200 milligrams per liter (mg/l), and iron and aluminum concentrations of more than 17 and nearly 27 mg/l, respectively. Instream loadings of iron and aluminum downstream of Moshannon Creek – the most AMD-impacted West Branch Susquehanna Subbasin tributary – are more than 7,000 tons/year and nearly 5,000 tons/year, respectively.

Products and Tools of the West Branch Susquehanna Subbasin AMD Remediation Strategy

All the water quality data collected for this project are organized in a geodatabase that allows the user to view the data geographically with a combination of layers, including abandoned mine land features, impaired stream segments, regional geology, regional land use, political and watershed boundaries, and others.

This geodatabase, in combination with spreadsheet tools, can be manipulated by the user to simulate treatment for single or clusters of AMD discharges. This process can be used to calculate instream concentration and loading projections for post-discharge treatment. This technique allows the user to predict potential improvements after restoration strategies are completed, which can be helpful when prioritizing projects.

This report contains demonstrations on the use of these tools to determine potential remediation strategies for the West Branch Susquehanna Subbasin.

West Branch Susquehanna Restoration Initiative and Trout Unlimited

In 1998, Trout Unlimited (TU), an organization committed to the conservation, protection, and restoration of North America's coldwater fisheries, embraced the significance of AMD problems in the Kettle Creek Watershed in Clinton County as a component of its nationally renowned Home Rivers Initiative. Since then, TU has been the lead catalyst, working in close partnership with the local Kettle Creek Watershed Association to address severe AMD problems that plague the lower Kettle Creek Watershed. TU and its partners have conducted numerous assessments and developed restoration plans, completed construction of multiple reclamation and remediation projects, and are currently in the planning phases for several more treatment projects and land reclamation projects through remining.

While still actively involved with AMD cleanup in the Kettle Creek Watershed, TU took its AMD remediation work to the next level and established the West Branch Susquehanna Restoration Initiative in 2004, which is aimed at the restoration of coldwater streams and the ultimate recovery of the West Branch Susquehanna River. As the lead non-profit organization for this initiative, TU is working with numerous local, state, and federal government and non-government organizations on a coordinated, strategic, and cost-effective AMD cleanup approach for the entire river basin. TU is also providing organizational support to the West Branch Susquehanna Restoration Coalition, a group that represents the collective efforts of watershed groups, TU chapters, county conservation districts, businesses, and others that are working to address AMD problems throughout the West Branch Susquehanna Subbasin.

Amy Wolfe, Abandoned Mine Programs Director, Trout Unlimited

These pollutants degrade the environment and limit the use of the river as a resource. These losses are not just limited to biology, habitat, and recreation, but affect human health and the region's socioeconomics as well.

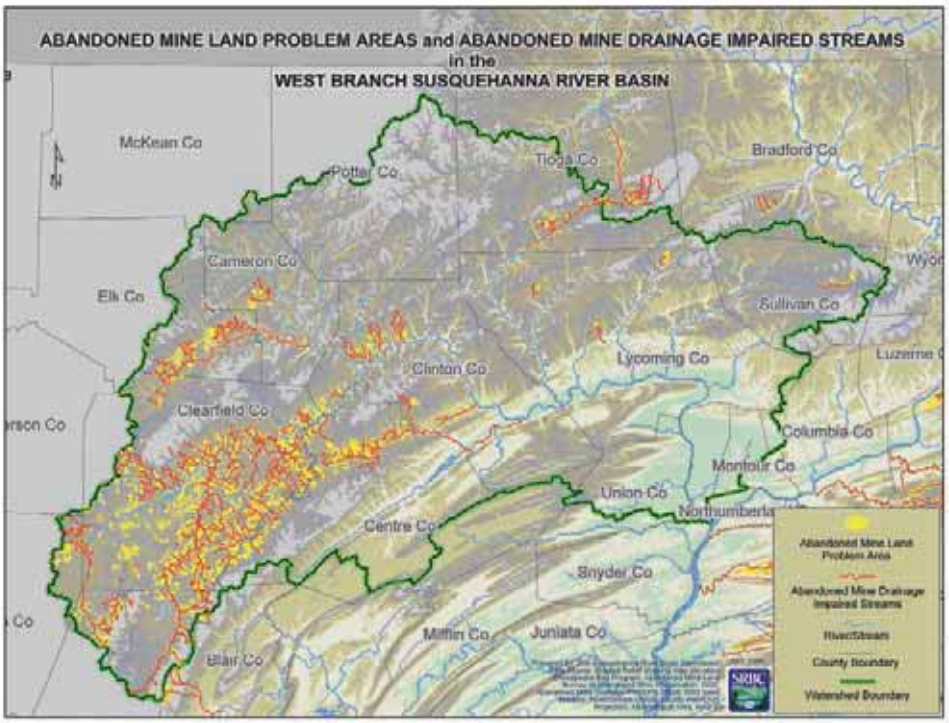
A long-term goal of fully restoring the West Branch Susquehanna Subbasin is extremely challenging and ambitious, especially in light of funding limitations. Members of the Task Force determined that a coordinated effort will be critical, starting with a remediation strategy for the AMD-affected areas.

The Susquehanna River Basin Commission (SRBC) was asked to develop an approach to review remediation alternatives and their impact on improving water quality in the West Branch Susquehanna Subbasin. Funding was provided by TU and Pennsylvania's Department of Environmental Protection (PADEP) and Department of Conservation and Natural Resources (PADCNR).

PADEP Bureau of Abandoned Mine Reclamation (BAMR) has estimated that the capital cost to treat all sources of AMD impacting the West Branch Susquehanna Subbasin could range from $279 million to $464 million, not including annual operation and maintenance associated with the necessary treatment systems (West Branch Susquehanna River Task Force, 2005). At the funding levels currently available for AMD restoration projects, it would take decades to address all of the West Branch

J. Zimmerman

Figure 1. *The Six Subbasins of the Susquehanna River Basin.*



J. Zimmerman

Figure 2. *Abandoned Mine Land Problem Areas and Abandoned Mine Drainage Impaired Streams in the West Branch Susquehanna Subbasin.*

Susquehanna Subbasin's AMD problems. Accordingly, SRBC took those factors into account and developed the remediation strategy as a guide to help resource agencies and organizations achieve comprehensive, region-wide environmental results over the long term.

SRBC developed the strategy using pre-existing (historical) data and information compiled from a wide range of sources to characterize existing conditions in the West Branch Susquehanna Subbasin. From the outset, the purpose of this strategy was to avoid duplicating the efforts of other agencies and organizations in their problem-identification and problem-prioritization initiatives. Instead, the goal was to help identify overlapping goals and opportunities for remediation efforts. To maximize resources, SRBC coordinated strategy efforts while developing a Total Maximum Daily Load (TMDL) assessment for West Branch Susquehanna River AMD impairments.

Scope of the West Branch Susquehanna Subbasin AMD Remediation Strategy

The strategy focuses on water quality and targets opportunities for improving existing conditions. At the outset, SRBC divided the scope of work into the following three major categories to ensure an effective and efficient process:

Formulate Scope of Work -

SRBC was to develop the Scope of Work based on input from TU, PADEP, PADCNR, Task Force, and West Branch Susquehanna Restoration Coalition (Coalition). Information was gathered through meetings with agency and TU technical staff and citizen representatives and SRBC used the input to develop a database, model, and prioritization scheme. SRBC assisted with the coordination and planning process with respect to acquiring Task Force input, either as a group or with separate meetings of individual entities. At a minimum, SRBC met quarterly with Task Force members. In addition, SRBC promoted Task Force goals and encouraged additional partnerships with other relevant entities throughout the process of developing the West Branch Susquehanna Subbasin AMD Remediation Strategy.

Inventory and Analyze Water Quality Data -

SRBC was to compile pre-existing information related to water quality using both instream data and AMD discharge data. PADEP BAMR and District Mining Operations were the two primary sources of information; however, other relevant datasets were incorporated as certain data standards were met. SRBC designed and maintained the database, based on input received from Task Force members. The database contains other subbasin information important to the project, such as extent of active and abandoned mining areas, facility contact information, and information on the receiving waters. SRBC used all the information gathered for the project to formulate options when developing the model.

Develop a Database, Model, and Final Report -

SRBC was to develop an integrated database and model that applies the compiled information to determine existing water quality conditions. Depending on scale considerations, instream and discharge water quality conditions were to be characterized according to severity and extent of influence. The final model has the capability to simulate changes to water quality conditions given a select number of potential water quality improvement options. Input for those options was to be acquired from Task Force members. In addition, SRBC was responsible for developing a process to maintain and update the database and model as conditions change in the watershed.

SRBC participated in several meetings with stakeholders to gather the information used to develop the database and model. More than 20 organizations, representing government, industry, and citizen groups, contributed data for the strategy.

S. Buda

Winter in the West Branch.

■ DESCRIPTION OF THE WEST BRANCH SUSQUEHANNA SUBBASIN

The West Branch Susquehanna Subbasin drains 6,978 square miles of all or portions of 22 counties: Blair, Bradford, Cambria, Cameron, Centre, Clearfield, Clinton, Columbia, Elk, Indiana, Jefferson, Huntingdon, Lycoming, McKean, Montour, Northumberland, Potter, Snyder, Sullivan, Tioga, Union, and Wyoming Counties. The larger developed areas include Bellefonte, Clearfield, Lewisburg, Lock Haven, Montoursville, Renovo, State College, Wellsboro, and Williamsport.

The West Branch Susquehanna Subbasin contains 17 major watersheds. Listed in order from headwaters to the confluence with the Susquehanna River, they include Chest Creek, Anderson Creek, Clearfield Creek, Moshannon Creek, Mosquito Creek, Sinnemahoning Creek, Kettle Creek, Young Woman's Creek, Bald Eagle Creek, Pine Creek, Larry's Creek, Lycoming Creek, Loyalsock Creek, Muncy Creek, White Deer Hole Creek, Buffalo Creek, and Chillisquaque Creek.

The subbasin is dominated by forested land (about 83 percent or ~5,800 square miles) (Figure 3). Agriculture accounts for about 10 percent (~700 square miles) of the subbasin. The remaining seven percent (~500 square miles) of land use is developed and disturbed lands, where most of the abandoned mine land (AML) impacts exist. Land use is primarily rural, containing more than 1.4 million acres