Problem

Lloydville Run (Figure 1) flows south near the boundary of Pennsylvania’s Cambria and Blair counties before emptying into Bells Gap Run, which flows into the Little Juniata River near Altoona. The headwaters flow through state-owned game lands that contain several abandoned strip and deep coal mines that contribute AMD to Lloydville Run. PADEP added the creek to the 2002 Clean Water Act (CWA) section 303(d) list of impaired waters for metals, pH and siltation. Water quality improved after PADEP’s Bureau of Abandoned Mine Reclamation (BAMR) installed a network of treatment systems designed to remove metals and neutralize the acidity of the inflowing water. As a result, PADEP expects to remove this 2.77-mile segment of Lloydville Run from the state’s 2010 CWA section 303(d) list of impaired waters.

In general, the goal is to get metals to drop out of solution by neutralizing the water’s pH. This is done by adding alkalinity to the source of AMD.

Project Highlights

PADEP BAMR designed three treatment systems and a land-reclamation site to clean up the discharges along Lloydville Run. The agency finished constructing the treatment systems in the fall of 2001. The project included 18 acres of bare earth revegetation above the treatment sites.
The network of treatment systems includes an anoxic limestone drain, a limestone vertical flow pond, sediment ponds, and aerobic and anaerobic wetlands. The treatment system series covers an area of approximately 7 acres. To address specific water chemistry issues, BAMR also implemented passive treatment features to address several acidic seeps from abandoned coal extraction areas. Improved water quality in Lloydville Run and Bells Gap Run benefits Bellwood Reservoir, a downstream water source for the Altoona Water Authority.

**Results**

Monitoring data collected at a sampling location on Lloydville Run downstream of the treatment systems and land reclamation show that the pH level increased from an average of 4.10 in 2000 to 6.92 in 2007 (Figure 2). Metal concentrations at the location also dropped significantly over the same period. Manganese dropped by 80 percent, aluminum by 67 percent and iron by 59 percent. Monitoring data collected between 2005 and 2007 show that metal concentrations meet water quality standards (Table 1).

In addition, PADEP biologists have documented healthy populations of macroinvertebrates. All sites sampled throughout the Bells Gap Run watershed in 2008 produced Index of Biologic Integrity (IBI) values ranging from 66.4 to 94.4. An IBI value of 63 or greater indicates good water quality and supports removing a stream from the CWA 303(d) list. PADEP expects to remove a 2.77-mile segment of Lloydville Run (UNT to Bells Gap Run) from that list for pH and metals in 2010.

**Partners and Funding**

Partners involved in restoring the watershed include Environmental Alliance for Senior Involvement (EASI), BAMR, and the Altoona Water Authority. EASI performed the original water quality monitoring. Although the organization disbanded locally, many of the same volunteers continue to monitor the watershed. The project’s total cost was $503,970. PADEP’s Growing Greener Program provided $337,515 and the U.S. Department of Interior Office of Surface Mining’s Clean Streams Initiative funded the remaining $166,455.

<table>
<thead>
<tr>
<th>Metal</th>
<th>2000 average measured concentration (mg/L)</th>
<th>2005–2007 average measured concentration (mg/L)</th>
<th>Water quality criteria maximum (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>2.7</td>
<td>0.64</td>
<td>0.75</td>
</tr>
<tr>
<td>Manganese</td>
<td>2.6</td>
<td>0.48</td>
<td>1.00</td>
</tr>
<tr>
<td>Iron</td>
<td>1.5</td>
<td>0.4</td>
<td>1.50</td>
</tr>
</tbody>
</table>

$^{1}$mg/L: milligrams per liter

Figure 2. Increase in pH in Lloydville Run from 2000 to 2007 as a result of land treatment.