MINING

ASSESSMENT OF REMEDIATION OF FLUVIAL TAILINGS DEPOSITS IN THE UPPER ARKANSAS RIVER BASIN, LAKE COUNTY, COLORADO

Conducted by:	Lake County Conservation District
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Project Partners:	U.S. Geological Survey, Colorado Division of Wildlife, the Cities of Aurora and Pueblo, Colorado, Colorado Mountain College, CH2MHill, Resurrection/ASARCO
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Matching Funds:	$63,796

Water quality in the upper Arkansas River downstream from Leadville, Colorado, has been degraded by drainage related to historical mining activities associated with mineral deposits in the Leadville area. Nonpoint sources of mine drainage (water having low pH and high concentrations of some metals) to the upper Arkansas River include fluvial tailings deposits stored in the flood plain of the upper Arkansas River downstream from Leadville and California Gulch (map). Fluvial tailings deposits consist of mine waste and tailing materials that have been transported and deposited by natural fluvial processes some distance from their origin in a mining district.

Project study sites

In 1998, the U.S. Environmental Protection Agency (USEPA) began remediating selected fluvial tailings sites in the flood plain of the upper Arkansas River using a best management practice (BMP) that incorporated organic-rich material (biosolids and/or compost) and alkalinity-generating material (lime, limestone, and other amendments) into the surface layers of the soil. This nonpoint source project was initiated to continue monitoring subsurface-water quality at one site (site CO) where the U.S. Geological Survey began monitoring in 1998 (total monitoring period from 1998 to

2004), and to monitor subsurface-water quality at two additional sites (sites LN and NI) on the floodplain (total monitoring period from 2002 to 2004).

The goals of the monitoring program were to assess the water-quality effects of the BMP on the underlying unsaturated and saturated (ground water) zones. The primary project goal was accomplished by monitoring water quality in the unsaturated and saturated zones to determine (1) if there were water-quality improvements caused by treating the fluvial tailings, (2) if there were differences in water quality among the three sites that could be attributed to variations in the BMP at each site, and (3) if infiltration of moisture and dissolved constituents below the depth of BMP application (20–25 centimeters) was occurring at the sites. A secondary goal of the project was to assess the effect of the BMP on sediment toxicity characteristic leaching procedure results.

Monitoring at the three sites (sites CO, LN, and NI) showed that there have been water-quality improvements at some sites and some depths as indicated by increasing pH and alkalinity values through time, and decreasing zinc and copper concentrations during the spring flush. In addition, differences in nitrate concentrations among sites may be attributed to the different materials used in the BMP at the three sites.

Nitrate concentrations were greatest at site CO and least at site NI. This pattern is likely related to the different organic amendments used at each site: site CO received wet biosolids, site LN received a mixture of biosolids pellets and compost, and site NI received compost only. Evidently nitrate in the wet biosolids was more available and leachable than in the other two amendments.

The monitoring data showed that water and dissolved constituents infiltrated to depths below the depth of BMP application. This information is important because it indicates that the effects of surficial application of the BMP may have beneficial effects to water quality at depth.

Finally, results of toxicity characteristic leaching procedures (a test to help determine the mobility of metals in soil) of samples collected at two locations at site NI before and after the remediation indicate that one of the samples was classified as hazardous waste for lead concentrations before the remediation but not after the remediation, indicating that the BMP may help reduce metal mobility in soils.

This project involved cooperation between local, State, and Federal organizations. Lake County Conservation District administered most of the grant and matching funds and provided some of the required matching funds. U.S. Geological Survey was the technical lead for the project and conducted monitoring activities including sample collection and analysis, data interpretation, and report compilation, and supplied non-required matching funds. The Colorado Division of Wildlife provided some of the chemical analysis of samples as part of the project match. Students from Colorado Mountain College assisted with sample collection activities. Other partners (the cities of Aurora and Pueblo, Colorado and Resurrection/ASARCO and CH2MHill) provided matching funds.