



Upper Uncompahgre Mine Remediation Projects

Progress to Date

October 2, 2015

WHY THE PROJECTS?

In recent years, the Colorado Department of Public Health and Environment has prioritized addressing non-point source pollution from heavy metals in Colorado's rivers. UWP's remediation projects at three legacy mine sites in the Upper Uncompahgre Watershed address metals loading and acidic mine drainage to streams that do not meet beneficial uses for aquatic life, recreation, water supply and/or agriculture. Consequently they are on EPA's Clean Water Act's 303(d) list of impaired waters. Loading from abandoned mines and natural processes results in overall poor water quality in the Upper Uncompahgre Watershed (headwaters to Ridgway Reservoir).

Michael Breen Mine: Drainage from a collapsed mine adit discharged across a waste rock pile leaching metals which were a non-point source pollutant to the Uncompahgre River flowing just below the abandoned mine site and Engineer Pass Road. This portion of the Upper Uncompahgre River is listed on the Clean Water Act's 303(d) list of impaired waters for cadmium, copper, zinc and manganese and on Colorado's Monitoring and Evaluation list for lead. This portion of the Uncompahgre does not support aquatic life.

Vernon Mine: This site contains two draining mine adits that discharge through waste rock piles before flowing into Gray Copper Gulch. The waste rock is in the gulch and as a result leaches significant amounts of copper into the stream. Gray Copper Gulch is on the 303(d) list for copper and on Colorado's Monitoring and Evaluation list for iron and low pH. The poor water quality does not support aquatic life.

Atlas Mill: The abandoned mill is off Camp Bird road and above Sneffels Creek. Mine tailings from legacy operations had been deposited in the Sneffels Creek floodplain. Erosion of the tailings and runoff during spring snowmelt contribute heavy metals to the stream which is on the 303(d) list for cadmium and zinc and does not support aquatic life.

MONITORING

In July and October 2014, we collected surface water samples from the Upper Uncompahgre River (Michael Breen Mine site), Gray Copper Gulch (Vernon Mine site) and Sneffels Creek (Atlas Mill site). In fall 2014, we also collected macro invertebrates (stream bugs). These data will be compared to data from samples we will collect after projects' completion to determine the effect of our remediation efforts.

MICHAEL BREEN MINE REMEDIATION

This project was completed in close collaboration with Jeff Litteral, Project Manager for Colorado's Division of Reclamation, Mining and Safety (DRMS). In October 2014, we constructed a diversion ditch to route the adit discharge around the waste rock pile in order to reduce leaching of metals from the waste rock and into the Uncompahgre River. This also re-routed water that was pooling under the load-out structure and destabilizing it. We also

worked with an archaeological consultant to guide stabilization of the historic ore load-out structure. *See more information and pictures in the [Nov. 12, 2014 e-newsletter](#) and [webpost](#).*

In August 2015, we re-vegetated areas adjacent to the diversion ditch and waste rock pile. Total area treated was approximately 1 acre. Biochar amendment was distributed first, followed by a mix of native seeds and sterile Triticale hybrid, and finally aspen mulch. The native seed mix included tufted hair grass, alpine bluegrass, mountain brome and yarrow. We applied the sterile Triticale hybrid (QuickGuard) as it is a fast germinating species that helps to initially stabilize soils by quickly developing a dense fibrous root system while allowing perennial species to establish. The Triticale hybrid has already germinated and growing this fall, thus it should also provide desirable organic matter for perennials next growing season. Chris Peltz of Research Services, LLC assisted with design of re-vegetation prescriptions and installation.

We also established several photo points and 1 m² cover plots to monitor re-vegetation outcomes one to two years after application of seeding treatments.



Applying biochar and aspen mulch on waste rock pile (1 & 2)



Broadcasting seed along diversion ditch

VERNON MINE REMEDIATION

This project was also completed in close collaboration with Jeff Litteral, Project Manager for Colorado's Division of Reclamation, Mining and Safety (DRMS) and permission granted by site's private landowner. In September 2015, construction crews removed approximately 1,000 cubic yards of waste rock from the Gray Copper Gulch valley floor. The material was hauled uphill to a repository in a flat area away from hillslope runoff or drainage areas. In a concurrent project, DRMS also oversaw installation of two adit closures and construction of a small diversion ditch for one of the draining adits around the waste rock remediation area.

Revegetation of the waste rock removal area, haul access road, and constructed repository followed. Prescription included application of 1) a native seed mix (Western yarrow, Rocky Mountain penstemon, Lewis flax, slender wheatgrass, fringed brome, Rocky Mountain fescue, tufted hairgrass, columbine, American vetch, blue wildrye, chick starter, Aspen daisy) 2) spreading of woody compost, 3) cover with aspen mulch blankets and bales, 4) cover with straw off slightly impacted areas, and 4) stabilization with straw bales at channel's edge and repository toe-slope.

We also established several photo points and 1 m² cover plots to monitor re-vegetation outcomes one to two years after application of seeding treatments.



Main waste rock pile before removal, July 2014



Main waste rock pile during removal, Sept. 2015



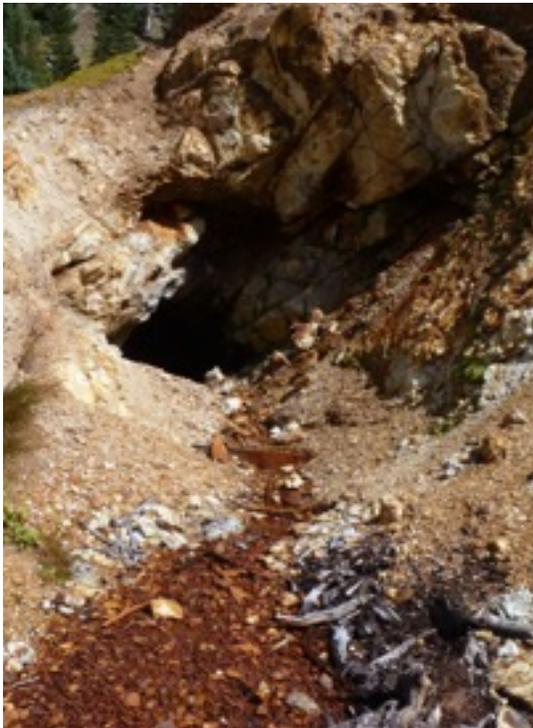
Main waste rock after removal and re-vegetation, September 2015



Repository before seeding & amendments, Sept. 2015



Repository after seeding & amendments, Sept. 2015



Draining adit 1 before closure, July 2014



Draining adit 1 after closure, September 2015

ATLAS MILL TAILINGS STABILIZATION

We have been collaborating with operators of Ouray Silver Mine, Inc. (property owner of areas selected for the project) and consulting with Western Stream Works, LLC on project design which would minimize erosion of tailings in the Sneffels Creek floodplain. The proposed design includes routing Sneffels Creek away from the tailings, stabilizing the channel with vane arms (boulders and possibly logs), and vegetating the affected areas to further enhance stabilization and riparian cover. Implementation is planned for summer 2016.



Sneffels Creek eroding tailings from abandoned Atlas Mill, August 2013