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Restoring for the Future through Cooperation: The Martin Mine Reclamation Project, Craters of the Moon National Monument

David L. Steensen and Vera A. Smith
National Park Service, Mining and Minerals Branch
Denver, Colorado 80225
and
Vicki Snitzler-Neeck
Craters of the Moon National Monument
Arco, Idaho 83213

Introduction

The Martin Mine is located in the Little Cottonwood Creek Watershed, the sole source of drinking water for Craters of the Moon National Monument. The Martin Mine (the Creek Lode mining claim) was a gold and silver mine that operated from 1922 through 1929. The property remained as an inholding within the Monument until 1967. At that time, the Craters of the Moon National History Association purchased the land and the mining claim was relinquished. In the early 1980's, four shafts were closed and two buildings removed.

Nonetheless, mine-waste dumps close to Little Cottonwood Creek remained exposed. Concern over potential contamination of surface and ground water prompted the park to initiate investigations into the water quality of the watershed. Results from a preliminary assessment suggested that mine waste has had a minimal impact on stream water quality. However, analysis of waste materials showed elevated metal concentrations above EPA guideline. Soil data, obtained from areas downslope of the waste piles, showed elevated metal concentrations relative to similar soils away from the waste. Thus, the potential for adverse effects was of concern.

To eliminate the potential for transport of waste products to the stream system, the park received funding to reclaim the Martin Mine in FY1994. On-the ground work was performed in September, 1994 and completed in five days.

Site Characteristics

The Martin Mine, at an average elevation of 6300 feet, occupies a total area of about 3 acres within the inner gorge and flood-prone area of Little Cottonwood Creek. The watershed area of the stream above the mine site is about one square mile. The creek is perennial; surface flow is maintained throughout the channel above the mine, but becomes discontinuous below during late summer low flow conditions. Approximately one-half mile below the mine, the valley widens and the stream infiltrates completely into the alluvial fill. Here, in combination with springs high in the watershed, two sixty-foot deep water wells serve as the Monument's water supply.

The ore rock is a complex of hydrothermal quartz veins (Kuntz *et al.* 1988). Mining related disturbances included four small waste-dumps, all within 150-feet of the active stream channel, composed primarily of hydrothermally-altered granite and limestone; several access roads; and the former mill foundation. All other structures were removed earlier and the openings closed.

Little vegetation had established on the waste piles despite the lack of additional disturbance over the last 60 years, suggesting some degree of metal toxicity and/or poor textural qualities. Analytical data from the waste showed that arsenic, zinc, lead, iron, and cadmium concentrations were considerably higher than unaffected soils nearby. Of these elements, arsenic had the highest con-

centrations ranging from 822 to 5943 mg/l. Sulfate salts, caused primarily by the oxidation of pyrite, formed a crust on the surface that reduced infiltration but increased runoff. The potential for acid production from oxidation processes was believed to be low due to the presence of calcite in the host rock (Drever 1982). Numerous rills showed that waste materials were likely being transported from the piles to surfaces below the piles and/or the stream. Soil samples from undisturbed ground located below each of the waste piles indicated that metal migration occurred, particularly zinc.

Analysis of the stream water quality showed that electrical conductivity increased below the mine in relation to the stream water above (Martin 1993). However, it is unclear whether this condition is caused by natural surface water interaction with hydrothermally altered rocks or with waste materials. No metals were detected above background levels in the stream water below the mine, nor were any metals detected in water well samples. Synoptic storm sampling did not take place, which may have shown a pulse of contaminants being flushed into the stream during runoff events.

Reclamation Prescriptions

Monument staff identified reclamation of the mine as a management priority because of the potential for continued transport of metals and sulfate salts by surface runoff and subsequent contamination of nearby water. The Resource Management Plan outlined the work tasks: the water and soil investigation phase (described above), the design, implementation, and monitoring phases.

The selected reclamation alternative included treating the waste-rock piles on-site by: (1) storing the waste material in areas less susceptible to local rainfall, snowmelt, and ground water inputs. The goal of this work was to reduce exposure of the

waste-rock to oxygen, thus diminishing chemical reactions, and minimizing the potential for runoff events to transport material from the piles to surface waters; (2) recontouring the piles to stable configurations and eliminating visual impacts associated with the mine workings; and (3) placing a minimum 18-inch, and up to 36-inch, cover of topsoil on the recontoured waste piles. The soil was salvaged from adjacent sidecast road fills to encourage revegetation. The revegetation treatment included placing straw mulch and seeding with Indian ricegrass (*Oryzopsis hymenoides*) and Basin wildrye (*Elymus cinerius*), early successional species native to the area.

Project Implementation

Heavy equipment was used to excavate and bury the waste rock piles, place a cover of "clean" topsoil over the waste rock piles, and reshape the sites to conform with the surrounding landforms. To access the sites, the abandoned mine roads required opening, including brushing vegetation and rebuilding portions of eroded road fills, and the construction of a temporary stream-crossing.

The work was completed in September 1994 with funding from the US National Park Service (USNPS) Pacific Northwest Region and a cooperative agreement with the Shoshone District of the US Bureau of Land Management (USBLM). The Shoshone District provided a Caterpillar D7 bulldozer and operator. A Hitachi 150 hydraulic excavator and operator was procured through a construction contract. A local Boy Scout troop assisted Monument staff with seeding and mulching.

Water quality monitoring will continue through a contract with Idaho State University. Vegetation recovery monitoring will be performed by monument staff; the first growing season will be Spring 1995.

Conclusion

This project addressed erosion and chemical problems associated with historic mining within a sensitive watershed area. The area was returned to near pristine conditions, thus meeting goals for managing the area as backcountry. Project evaluation, design, and implementation were completed in about four months, a short time interval for a project of this type. Heavy equipment work went smoothly due to the experience and capabilities of the contractors.

Additionally, this project highlights the effectiveness of cooperation between groups within the USNPS to accomplish important resource management objectives. For example, Monument staff accomplished the following tasks:

- project initiation by the inclusion of a work statement in the Resource Management Plan,
- solicited and obtained funding from the USNPS Pacific Northwest Region,
- coordinated the following work phases: (1) a USNPS Water Resources Division preliminary assessment, (2) a water quality study through Idaho State University, (3) the reclamation design phase

and specifications by the USNPS Mining and Minerals Branch, (4) wrote the agreement to use the USBLM dozer, and (5) worked with the Pacific Northwest Region on contracting details

- performed all necessary consultations, acquired all necessary permits, and completed all necessary compliance (e.g., SHPO). The Monument wrote the Environmental Assessment. Monument staff designed the revegetation treatment and purchased seed and straw mulch.

The following complimentary tasks were performed by reclamation staff of the USNPS Mining and Minerals Branch, who provided:

- technical assistance in the form of geomorphic evaluations, tailings sampling, surveying for reclamation design, interpretation of sample results, reclamation design, preparation of contract specifications, and estimation of equipment time.
- on-site supervision of heavy equipment work that allowed minor modifications in reclamation design to adapt to unseen conditions at depth, thus maximizing cost-effectiveness.

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