

Managing tailings influenced ground water at the Butte Superfund site

by R.D. Williams

In a very real sense, Butte, MT is where the copper came from that won two world wars. The price for that unrestricted mining and smelting of copper came due in 1983 when Butte was declared a Superfund site.

One of the most complex remnants of this mining history is the Parrot Tailings site. The Parrot smelter operated from 1881 to 1910, moving Upper Silver Bow Creek to the south and depositing approximately 283,000 m³ (370,000 cu yd) of waste material adjacent to Upper Silver Bow Creek. Additional mixed waste from other processing sites deposited below the Parrot tailings at the Northside

Figure 1

1903 U.S.G.S. Topo graphic map showing impoundments along Silver-bow Creek and the location of the Parrot smelter.



Tailings, Diggings East and Blacktail Creek Berm total approximately 171,000 m³ (224,000 cu yd) of contaminated material. As part of the Superfund remedy, the U.S. Environmental Protection Agency (EPA) proposed leaving all these wastes in place. This proposal prompted a detailed criticism by several geoscientists familiar with the site. The EPA's 2006 Record of Decision (ROD) did in fact leave these wastes in place, which set the stage for a series

of studies that continue to refine how best to protect extensive completed Superfund Remediation downstream of Upper Silver Bow Creek.

R.D. Williams, member SME, is geologist, U.S. Bureau of Land Management, Butte, MT, email drwillia@blm.gov.

History of the Parrott Mine and tailings

Placer gold was discovered in Silver Bow Creek, the headwaters of the Clark Fork River only a few miles from the Continental Divide in 1864. This discovery led to a stampede of placer and lode claims. One of the first lode claims located was the Parrot lode, located in the fall of 1864. Progress for developing a mine at the Parrott was slow, and it was not until 1876 that one of the original locators encountered a rich vein of chalcocite. Butte had its first copper mine.

The Parrott Mine was patented in 1879 and by 1881 the Parrot, having lost a "t", concentrator and smelter were built. The smelter and concentrator were an immediate success with a considerable market for processing the district's rich copper ore. In 1885, the employees of the Parrot smelter bought the Butte Reduction Works, another smelter. In 1885, dams were built on Silver Bow Creek to contain various tailings and related processing byproducts (Fig. 1).

By 1890, the various smelters in Butte rendered Butte's air quality as suffocating (Fig. 2). An 1889 funeral procession was rumored to have gotten lost in the thick smelter smoke and somehow ended up at the Centennial Brewery. A city ordinance was passed late in 1890 in an attempt to control smoke. The Parrot smelter employed approximately 500 men by 1890. Through the 1890s, the tailings produced grew from approximately 91 t/d (100 stpd) to more than 181 t/d (200 stpd). Copper values in the tailings were initially as high as 4 percent, but as the processing improved that was reduced to 1.5 percent.

In 1899, Judge Lindsay ordered smelters to take additional steps to prevent smelter smoke from "deluging the said city of Butte and smothering the inhabitants thereof."

In May, 1899, the Parrot smelter closed and ore was processed at the Colorado smelter and Anaconda works. Later that year a fire destroyed the surface buildings.

20th century

For much of the 20th century the tailings did not look much different than shown in Figs. 3 and 4.

From the early 1900s through the Second World War there were various minor attempts to recover copper from the tailings. None of these projects significantly affected the volume or the contamination from the tailings.

In 1957, as the Anaconda Mining Co. began work on the Berkeley Pit, one of the first large

openpit metal mines, overburden was placed on top of the Parrot Tailings.

In 1977, Arco (Atlantic Richfield) acquired the Anaconda Copper Mining Co..

In 1978, Butte-Silver Bow built its county shops on top of the south side of the Parrot Tailings.

The bill comes due

On Sept. 18, 1983, Butte was listed as a Superfund site. The bill had come due. The Superfund project eventually expanded to include the Anaconda area and the Clark Fork River all the way to Milltown Dam, just upstream of Missoula, 193 km (120 miles) downstream from Butte (Fig. 5).

Following its designation as a Superfund site, the EPA initiated Remedial Investigation/ Feasibility Studies (RI/FS) to evaluate sources of contaminants and possible cleanup alternatives (US EPA, 2004).

As part of the Superfund process the Silver Bow Creek Corridor was identified as the Butte Priority Soils Operable Unit (BPSOU).

21st century

From 2003-2004, a voluntary cleanup of Silver Bow Creek from Blacktail Creek to Texas Avenue was undertaken. A subdrain and effluent lines were installed and the drainage was essentially re-characterized as the Metro-Storm Drain (MSD).

At about the same time, the Montana Bureau of Mines and Geology (MBMG) was doing additional characterization work on the alluvial aquifer system below the Parrot Tailings and had identified a critical alluvial unit (Metesh and Madison, 2004).

In 2005, a group of professional scientists in the Butte area compiled a letter to the EPA regarding the Parrot tailings and the state of characterization work for the alluvial aquifer below the Parrot tailings. The group had considerable educational and practical experience in waste characterization including geochemistry, hydrogeology, hydrology and geology and several of the group had managed characterization work and abandoned mine lands cleanup projects. Several other professional scientists familiar with the Parrot tailings concurred with the group's conclusions as expressed in the letter but did not sign the letter for reasons regarding potential conflict of interest.

The concerns were expressed in bullet form as:

- The Parrott tailings have not been adequately characterized.
- The lateral and vertical extent of the contaminant plume in the MSD has not

Figure 2

View looking to the south from "Nanny Goat Hill" showing continued smoke in the Summit Valley. (Cindi Shaw.)

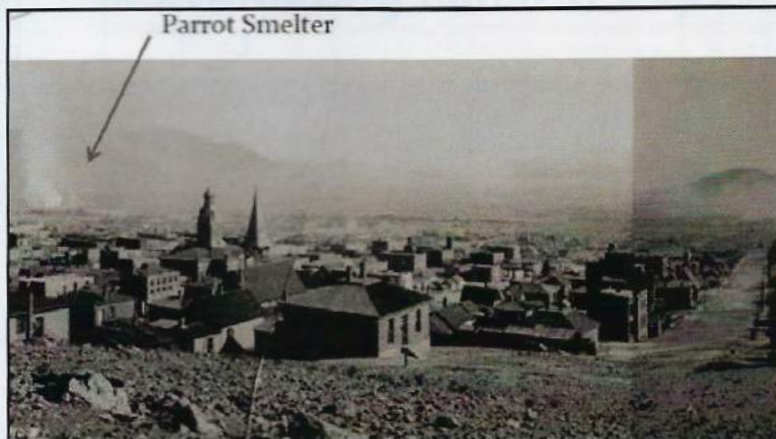


Figure 3

Photo of a person collecting a sample at the Parrot tailings. (National Archives.)



Figure 4

Silver Bow Creek in 1938. (Butte Silver Bow Public Archives.)

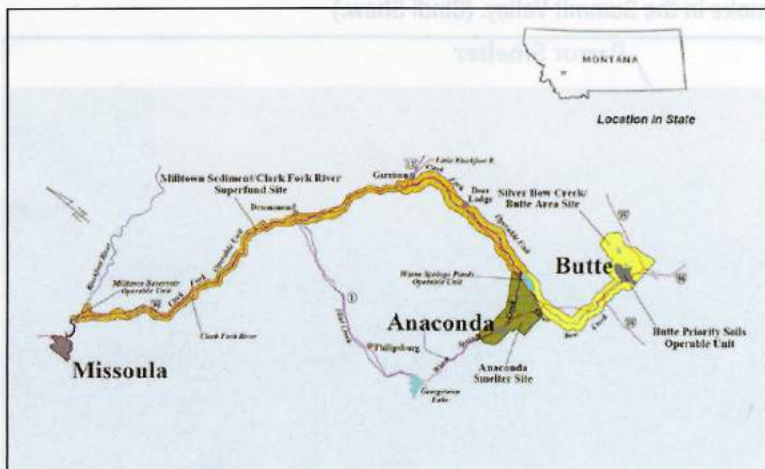


been delineated.

- Contamination from the Parrott tailings has migrated farther than expressed in the remedial investigation and the focused feasibility study.
- Operations and maintenance costs for both the lagoon treatment system and

Figure 5

A general view of the Butte Superfund complex.



general storm water management are likely to be underestimated because of the lack of characterization associated with portions of the operable unit.

- Lower Area One remains a persistent source of contamination and additional wastes could be removed and/or stabilized.
- Economic development and the future of Butte may be hindered by leaving waste in place.

Each of these bullet items was backed up by a detailed discussion and the letter ultimately ran to nine pages, excluding the list of signatories and references.

In 2006, EPA issued a Record of Decision for the BPSOU (US EPA, 2006), largely discounting the concerns of the Butte geoscientists.

The Butte Restoration Alliance was formed about this time and encouraged considerable additional characterization work by MBMG. This work detailed extensively the inadequacies of the previous RI/FS work (Tucci, 2010; Tucci and Icopini, 2010, 2012). This work detailed that EPA's initial estimates regarding hydraulic conductivity underestimated hydraulic conductivity by orders of magnitude. This work also demonstrated that the concern for continued impacts to Silver Bow Creek from the tailings remaining in place was valid. Without removal, contamination from the tailings would continue to impact reclamation and restoration efforts downstream throughout the Silver Bow and Clark Fork drainages.

Continued work on restoration plans by Montana's Natural Resource Damage Program and characterization by the MBMG (Tucci, 2010; Tucci and Icopini, 2010, 2012) ultimately led to a middle alluvial aquifer unit test confirming the Parrot tailings impacts.

Now

In 2014, a group of citizens in Butte got together and formed the Restore Our Creek Coalition which pressed for the removal of all the contaminated tailings left in place in the upper Silver Bow Creek corridor, including the Diggings East and North Side tailings located below the Parrot tailings. This ultimately led to a detailed representation of what a restored upper Silver Bow Creek could look like and furthered a consensus for removal of waste left in place.

This consensus, work done by the MBMG, and the NRDP were some of the factors that led Montana Gov. Steve Bullock, in 2015, to announce that the state would remove the Parrot tailings.

Early in 2018, Regional Administrator for the EPA, Doug Benevento, announced that the EPA had reached an agreement with Arco for the removal of much of the remaining waste in the upper Silver Bow Creek corridor.

On June 21, 2018, the state of Montana held a celebratory groundbreaking ceremony with the principal contractor as the removal of the Parrot tailings got underway.

Collectively, approximately 535,000 to 612,000 m³ (700,000 to 800,000 cu yds) of contaminated wastes will be hauled offsite, and upper Silver Bow Creek will be partially restored through Superfund. ■

References

- Metesh, J.J., and Madison, J.P., 2004, Summary of investigation, Upper Silver Bow Creek, Butte, Montana: Montana Bureau of Mines and Geology Open-File Report 507, 7 p.
- Tucci, N.J., 2010, The Parrot complex: A drilling investigation of historic mine waste left in place; tailings and overburden volumes, leachability and economic feasibility for recovery, and water quality along the upper metro storm drain in Butte, Montana (CD only): Montana Bureau of Mines and Geology Open-File Report 590, 127 p.
- Tucci, N.J., and Icopini, G.A., 2010, Aquifer test evaluation conducted on the middle gravel unit of the alluvial aquifer in the Upper Metro Storm Drain area, Butte, Montana: Montana Bureau of Mines and Geology Open-File Report 592, 47 p., 1 sheet.
- Tucci, N.J., and Icopini, G.A., 2012, Geochemical and Hydrogeologic Investigation of Groundwater Impacted by Wastes Left in Place in the Butte Priority Soils Operable Unit, Butte, MT: Montana Bureau of Mines and Geology Open-File Report 613, 198 p., 2 sheets.
- U.S. Environmental Protection Agency (EPA), 2004, Final focused feasibility study for the Metro Storm Drain, Butte Priority Soils Operable Unit.
- U.S. Environmental Protection Agency (EPA), 2006a, Record of Decision, Butte Priority Soils Operable Unit, Silver Bow Creek NPL Site, Butte, Montana. Lead Agency U.S. EPA Region VIII, September 2006.
- U.S. Environmental Protection Agency (EPA), 2006b, Final Technical Memorandum: technical impracticability evaluation for alluvial groundwater, Butte Priority Soils Operable Unit, Silver Bow Creek NPL Site, Butte, Montana. Lead Agency U.S. EPA Region VIII, February 2006.