Upper Slate River Watershed Plan Executive Summary

Prepared For:

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In 2011, the Coal Creek Watershed Coalition (CCWC) recruited local stakeholders to begin the watershed planning process in the Upper Slate River Watershed (Watershed). Watershed plans combine existing information and input of local stakeholders to create a comprehensive plan to address water quality impairments. During the watershed planning process stakeholders and partners identified the following desired outcomes for the Watershed:

1. To minimize water quality impairments attributed to historic abandoned mines.
2. To support healthy and diverse aquatic life.
3. To maintain or improve the overall channel function of the Slate River and its tributaries.

This Plan provides the pathway to implement the projects and activities necessary to achieve the desired outcomes.

CHARACTERISTICS OF THE UPPER SLATE RIVER WATERSHED

The Watershed is located near Crested Butte in Gunnison County, Colorado. The Watershed drains approximately 34 square miles on the east side of the Ruby Mountain Range. There are about 71 miles of streams and rivers in the Watershed. The headwaters of the Slate River lie below Purple Mountain and Yule Pass at nearly 13,000 feet. The first named tributary, Poverty Gulch, enters the Slate River from the west about five miles downstream of the headwaters. Oh-Be-Joyful Creek is a significant tributary that meets the Slate River about nine miles below the headwaters. Redwell Creek, which drains Redwell Basin, is tributary to Oh-Be-Joyful Creek. Beyond the confluence with Oh-Be-Joyful Creek, the Slate River flows on a sinuous trajectory through a large, broad valley to the Watershed outlet. The recreation path bridge, near Rainbow Park in Crested Butte, was designated as the Watershed outlet. The Watershed does not include drainage from the Coal Creek Watershed (Coal Creek Watershed is addressed in an existing Watershed Plan) or drainage from Washington Gulch, which flows into the Slate River downstream of the Watershed.

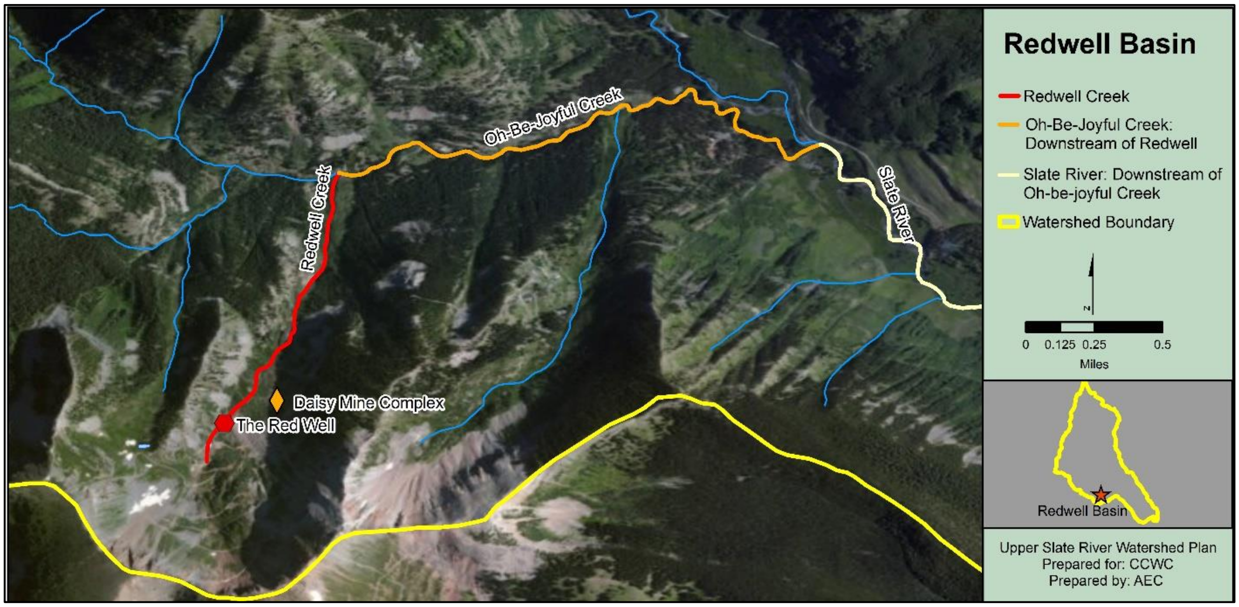
The majority of the Watershed is public land, managed by the United States Forest Service (USFS). The USFS manages 77 percent of the Watershed, 42 percent of which is designated as wilderness. The Bureau of Land Management (BLM) manages three percent of the Watershed. The remaining 20 percent of the Watershed is privately held. A large portion of the private land is owned by, or under conservation easements held by the Crested Butte Land Trust or the Town of Crested Butte. There are a handful of water rights that support irrigated pastures and ponds in the lower Watershed and near the Pittsburg town site. There are instream flow rights for the Slate River and Oh-Be-Joyful Creek and minimum lake level rights for five lakes. The Slate River does not currently serve as a municipal water supply. However, several wells that are hydrologically connected to the Slate River are used as domestic water supplies and the river is tributary to other drinking water supplies.

The Watershed is primarily composed of thin alternating layers of shale, siltstone, sandstone, and other sedimentary rocks. Magma intruded through the sedimentary rocks during a period of mountain building. The magma cooled to form granodiorite and quartz-monzonite intrusive rocks. Fluids along with intense heat and pressure mineralized the intrusion and adjacent rocks. Mineralization creates ores that are enriched with metals. Erosion has exposed the intruded and mineralized rocks in high elevation areas of the Watershed. Waters that interact with mineralized rocks can become acidic and enriched with metals. Prospecting and mining typically occurred in mineralized rocks. By increasing the surface area of mineralized rock exposed to atmospheric conditions, mining or excavation activities increase the likelihood for water contamination.

SURFACE WATER QUALITY

Eighty percent of the water quality data collected from 1995 to 2010 in the Watershed met water quality criteria. Twenty percent of the water quality data from the Watershed exceeded water quality criteria (i.e., failed to meet). Metals are the most problematic pollutants in the Watershed. The most problematic metals are zinc, cadmium, copper, lead, and manganese. Metals that originate from historic abandoned mines are the most common pollutant in the Watershed. This finding is consistent with historic and current land uses in the Watershed.

The water quality standards assessment painted a clear picture. Metals that originate from historic abandoned mines and natural features impair water quality in Redwell Creek. Redwell Creek and the adjacent features accounted for seventy-five percent of the water quality exceedances. Redwell Creek delivers metals to Oh-Be-Joyful Creek and Oh-Be-Joyful Creek below Redwell Creek accounted for ten percent of the exceedances. The water in Oh-Be-Joyful Creek above Redwell Creek generally met all water quality criteria and accounted for less than one percent of the exceedances. Conservatively, Redwell Basin was the origin of eighty-five percent of the pollution in the Watershed. Although Oh-Be-Joyful Creek provides dilution, it is evident that metals that originate in Redwell Creek reach the Slate River. The Slate River below Oh-Be-Joyful Creek accounted for ten percent of the exceedances. The Slate River above Oh-Be-Joyful Creek typically met water quality criteria; only two percent of the evaluations exceeded applicable standards. Water quality exceedances in tributaries to the Slate River, including poverty Gulch, accounted for just over one percent of the exceedances.



Metals that originate from historic abandoned mines and natural features pollute Redwell Creek. Redwell Creek, which has elevated concentrations of several metals, flows into Oh-B-Joyful Creek which is tributary to the Slate River. The effect of metals from Redwell Basin is apparent is Redwell Creek, Oh-Be-Joyful Creek and the Slate River.

CAUSES OF WATER QUALITY IMPAIRMENT

Three features, all of which are located in Redwell Basin, are major sources of metals that impair water quality. Two features, the Drill Hole and the Daisy Mine, are man-made and the Red Well is natural.

DRILL HOLE

In the early 1970s, many holes were drilled to characterize the molybdenum deposit beneath Mount Emmons. In Redwell Basin a drill hole, located in the upper portion of the basin, was improperly abandoned. The Drill Hole penetrates the molybdenum deposit and allows water to flow under pressure to the surface. It delivers poor-quality groundwater to Redwell Creek. At the Drill Hole, metal concentrations increased dramatically over upstream locations in Redwell Creek.

A view of Redwell Basin. The orange slopes on the upper right of the photo are a part of the Daisy Mine, the drainage tunnel is located in the lower portion of the mine waste. In the lower right of the photo, flow from the Drill Hole enters Redwell Creek. The Redwell is in the lower left of the photo. Photo Credit: Nicki DeVanni (2011).

DAISY MINE

The Daisy Mine once produced silver, copper, and zinc. Exploration began in the late 1800s and the operated sporadically until the 1970s. The mine was abandoned prior to the passage of modern reclamation laws. The Daisy Mine is on the east side of Redwell Basin. The mine has multiple levels of underground tunnels with several portals on the slopes above. Gunsight Pass Road traverses between the upper mine portals and the collapsed drainage tunnel. Ore was transported to the Gunsight Processing Area. Much of the mine waste is located near the collapsed tunnel and Gunsight Pass Road.

Water collected from the Daisy Mine exceeded acute criteria by two to four orders of magnitude for zinc, cadmium, copper and iron. The Daisy Mine is the single largest source of zinc in the basin. Because of the poor water quality, the Daisy Mine was recognized as a "high priority abandoned hard rock mine" by the Colorado Nonpoint Source Program (NPS Program) in 2012.

THE RED WELL

The Redwell is the naturally-occurring namesake of Redwell Basin. The Red Well is approximately 2,800 years old. The age was established by analyzing an iron oxide, called ferricrete, collected from the edge of the Red Well. The age indicates the feature is natural, not man-made. Metal concentrations measured at the Red Well are elevated, and occur in ratios similar to those found at the Drill Hole, but in lower concentrations. This suggests the two features share source waters, groundwater associated with the molybdenum deposit and the adjacent mineralized fracture network, but additional dilution occurs at the Red Well. Small seeps and wetland vegetation up-gradient of the Red Well indicate the area is saturated regularly. Given the hydrology of wetlands, some dilution with surface or groundwater is likely at the Red Well.

PROJECTS TO IMPROVE WATER QUALITY

This plan outlines three major projects to improve water quality and environmental health in the Watershed. Additional watershed improvement projects are also proposed in the Plan.

DRILL HOLE CLOSURE PROJECT

The Colorado Division of Mining, Reclamation and Safety (DRMS) closed the Drill Hole in fall 2013. The Drill Hole was closed by injecting cement; a standard procedure for well closures. Water from the Drill Hole no longer reaches the surface. The flow is dispersed to the subsurface, where it flowed as groundwater prior to the existence of the Drill Hole. The closure project eliminated the metal load from the Drill Hole. The metal load reductions associated with the project are important. However, the closure also eliminated an enormous source of acidity. Acidic waters from the Drill Hole increased metal solubility in Redwell Creek. The Drill Hole caused pH in Redwell Creek to fall from approximately 6.7 to 3.7; which is a thousand times more acidic. Decreased acidity should decrease metal solubility in Redwell Creek. This should translate to lower metal concentrations and increased pH in Redwell Creek downstream of the Drill Hole. In the next several years, water quality monitoring will be used to quantify these changes. Monitoring sites are located in Redwell Creek, Oh-Be-Joyful Creek, and the Slate River. Two monitoring events occurred in the summer of 2014; monitoring will also occur in 2015.

DAISY MINE RECLAMATION DESIGN AND IMPLEMENTATION

An effective reclamation project at the Daisy Mine will reduce metal loads that originate from the mine site. An effective design will balance practical considerations with water quality improvement goals. Potential reclamation strategies include: source water control, a waste repository, and passive water treatment. Additional information about site conditions is required to further plan for reclamation. A preliminary reclamation design will be drafted after the characterization work is complete. Once a preliminary design has been created, it will be possible to establish a budget and begin to solicit funds for final design and project implementation.

GUNSIGHT PROCESSING AREA RECLAMATION DESIGN AND IMPLEMENTATION

The Gunsight Processing Area is near the confluence of Oh-Be-Joyful Creek and the Slate River about 3.6 miles northwest of Crested Butte. Gunsight Pass Road is immediately adjacent to the Processing Area and the GB Trail, a popular hiking and biking trail, passes through the site. The site history is somewhat unclear, but it appears that ore from the Daisy, Augusta, and potentially other mines was transported to the Gunsight Processing Area. The mine waste on site suggests some crushing and possibly milling occurred on site. Mining did not occur on site; although there are very small prospect holes in the vicinity. The site consists of four prominent benches made from mine wastes.

The trail and site attract the attention of recreational users in this portion of the Watershed. The waste materials contain elevated concentrations of several metals, especially lead and zinc. Because of recreational traffic on mine waste, the site is a human health risk. The BLM, the landowner, placed signs on site to alert the public about the risk.

A water sample collected from a seep near the Gunsight Processing Area had metal concentrations that exceeded water quality standards for several metals. This and other data will complied into a report to document the need for reclamation. BLM and DRMS will lead the reclamation design effort. After the design is complete, an engineer will be hired to finalize the design. BLM has secured the funds needed for design and a portion of the implementation. Additional funding is needed to completed implementation.