

channel. Although mining activities subsided during the mid-1950s and populations decreased, wetlands and riparian ecosystems continue to be affected by the construction and operation of I-70 and other infrastructures associated with municipalities throughout the drainage. Channelization of Clear Creek has resulted in constricting or eliminating the natural floodplain and reducing flood-dependent wetlands and riparian areas. The construction of U.S. 6, U.S. 40 and I-70 has created localized pockets of wetlands immediately upgradient of the highway by intercepting and retaining groundwater and surface water flows. Additionally, various enhancement projects have improved certain areas of Clear Creek. CDOT has recently purchased property downstream from Georgetown Lake adjacent to Clear Creek with the intent of preserving and creating wetland habitat previously impacted by channelization and berming.

- **Aquatic-dependent Communities** - the aquatic-dependent communities include those that may have been or could be affected by the disruption of habitat resulting from past development including I-70, municipalities, mining, etc. The fisheries of Clear Creek consist primarily of the non-native brown trout. This resource has been affected by historic mining activity and continues to be impacted presumably by metals contamination, particularly downstream from the West Fork of Clear Creek (CDOW, 1998). Fisheries resources upstream from Chicago Creek to the Georgetown Lake Dam are considered highly productive with fish populations reaching nearly 800/acre immediately downstream from the West Fork of Clear Creek (CDOW, 1998). In addition to fisheries, aquatic dependent communities include boreal toad (candidate for federal listing) populations inhabiting areas near Herman Gulch in the upper reaches of the Clear Creek drainage and the tiger salamander (U.S. Forest Service listed sensitive).

The Greenback cutthroat trout (*Oncorhynchus clarki stomias*) is native the upper South Platte River basin, including Clear Creek. However, with the increased human activities, land and water exploitation, mining, agriculture, logging, unregulated fishing, and the introduction of non-native salmonids during the mid-1800s, this species' distribution rapidly decline. Today, no pure strain populations of this species are known to occur in the Clear Creek drainage. However, several attempts to reestablish pure strain populations within the Clear Creek drainage have been recently undertaken with little success. Attempts at reintroduction have occurred in Bard Creek near Empire and in Leavenworth Creek above the town of Georgetown. The attempts at reintroducing these populations were unsuccessful.

2.2 Major Issues Identified

This section presents major water-related issues identified by the SWEEP Team for Clear Creek along I-70. These issues may be applicable to more than one water resource-related category described in the previous section. The various elements potentially contributing to these issues have also been identified by the SWEEP team and are listed with each major issue in this section. These elements, similar to the issues, may also

contribute to more than one issue. The issues identified for each segment are presented in Figure 2-1 and summarized for Clear Creek at the end of this section (2.0). More detailed descriptions of existing conditions and issues for each individual segment are presented in Sections 3.0 through 10.0.

2.2.1 Historical Mining (Mineral) Influences

Natural ore bodies and mine waste associated with the Colorado Mineral Belt and its extraction, exist within the Clear Creek drainage system. Through natural processes, historic mining, mine drainage, and mining and highway rock cuts, surfaces of these elements have oxidized, releasing dissolved heavy metals to the streams within the Clear Creek drainage. Heavy metals are defined as a group of elements that can, under certain conditions, be toxic to plants, animals and/or humans and can pose a threat to water, air and land resources. These elements occur in nature and are essentially harmless at trace concentrations, but can be harmful at higher concentrations. Examples of heavy metals include cadmium, copper, chromium, manganese, lead, mercury and zinc.

Past mining developments are associated with the exploitation of the Colorado Mineral Belt, a zone of highly mineralized rock that trends northeast-southwest across the mountainous regions of Colorado, including the Clear Creek watershed. Metals of the mineral belt were extensively and profitably mined from the mid-1800's until the outbreak of World War II when mines not essential to the war effort were closed by Federal mandate. Along with the contributions of enormous wealth to our nations economy accompanied by expansion of settlement within former wilderness, the past mining activity continues to impact the quality of life with an environmental legacy. This includes concentrations of heavy metals in mine waste and mill-tailings as well as acid drainage from mine workings. Mines worked both hard rock for metals as well as placer deposits formed from glacial and fluvial weathering of the primary rock deposits.

Present day evidence within the I-70 Mountain Corridor of the Mineral Belt includes areas of former mining that are clustered near discovered concentrations of various metals. These are known by historic district names including the Central City-Idaho Springs District and the Breckenridge District. Metal concentrations within the Colorado Mineral Belt vary as can be seen by areas of little or no mining adjacent to these districts.

The Central City-Idaho Springs District, through which Clear Creek flows, was the first major mining district discovered in Colorado (January, 1859) and was highly productive of gold and silver. Copper, lead, zinc and uranium were also mined from this district. While hard rock was the primary source of metals, rich placer deposits were also worked along Clear Creek, its tributaries and gulches. Gold also was produced from rich quartz-sulfide veins. Lead, zinc, silver and copper were also produced from some veins.

Residual metals from these mining activities have impacted the wetlands, riparian areas, aquatic habitat and aquatic communities associated with Clear Creek. Placer mining destroyed aquatic habitat through the disruption of substrate materials and repeated

relocation of stream channels. The construction and operation of milling facilities to process the ores resulted in both direct and indirect impacts on the aquatic resources of Clear Creek. Inefficient milling operations and the deposition of mill wastes (tailings) and waste rock within the Clear Creek drainage resulted and continues to result in contributions of dissolved metals to Clear Creek. Acid mine drainage containing various dissolved heavy metals continues unabated from many mines. Elements contributing to this issue include:

- Abandoned (orphan) Mine sites
- Permitted Mine Sites
- Acid Mine Drainage
- Existing Mill Tailings and Mine Waste Piles
- Water Contamination from Heavy Metals

2.2.2 Adjacent Land Use

Land within the Clear Creek drainage has been developed in response to mining activities, highway (U.S.6, U.S 40, and I-70) induced access from urban development, and recreational resource development. These activities result in increased impermeable surfaces, nonpoint source pollution, and permitted point source discharges which all affect the water quality in Clear Creek.

Permitted point discharges are those facilities required to have a National Pollution Discharge Elimination System (NPDES) permit under the federal Clean Water Act. These may include, but are not limited to, certain industrial discharges, wastewater treatment plants, land disposal facilities, animal feeding operations, mine drainage, construction activities, and point discharges of storm water runoff in certain municipalities. Permits provide for allowable limits and/or the implementation of specific controls to reduce the amount of pollutants entering state waters. In Colorado, this program is administered by the Colorado Department of Public Health and Environment.

These discharges potentially increase concentrations of various chemical and biological constituents and nutrient loading within the Clear Creek drainage system. Conversely, the organic nature of many wastewater effluents tends to bind dissolved metals thus rendering these metals less bioavailable and reducing their toxicity to aquatic organisms. Elements contributing to this issue include:

- Ski Area Development
- Forest Land Development
- Local Community Growth and Development
- Permitted Point Discharges (e.g., WWTPs)
- Present-day Mining
- Road Construction