

have been removed from numerous mines and the remaining mine materials piles have been graded, capped, and seeded throughout the Clear Creek drainage.

Other investigations into water-related issues of the I-70 Mountain Corridor have been initiated by CDOT and the Upper Clear Creek Watershed Association (UCCWA). CDOT has initiated a study investigating the control of sediment from traction sand and existing roadway cuts along Straight Creek and Black Gore Creek (west of the Continental Divide). UCCWA continues to monitor water quality conditions within Clear Creek from Bakerville downstream to its confluence with North Fork of Clear Creek as part of a phosphorous control agreement. CDOT has initiated a highway storm water quality monitoring program that assesses the water quality condition of Clear Creek immediately following snowmelt or storm runoff events. More recently, the Clear Creek Watershed Foundation has been established to strategize an approach for the state and local resources to continue cleanup activities within the watershed.

## 2.1 Water Resource-related Categories

Water resource-related categories define the general physical, chemical, and biological components of the water resource that may have been influenced or affected by past and present activities within the Mountain Corridor adjacent to Clear Creek. The following water resource-related categories are discussed in this document (Table 2-1 at the conclusion of Chapter 2 recaps these categories with the issues that follow in section 2.2):

- **Water Quality** – Prior to the settlement of the Clear Creek valley during the 1800s, water quality of Clear Creek was influenced by the naturally occurring Colorado Mineral Belt. Highly mineralized rock that extends northeast-southwest across the mountainous regions of Colorado, is comprised of mineral assemblages containing iron, manganese, zinc, aluminum, copper, cadmium, arsenic, gold, silver, lead, molybdenum and uranium. Water quality in Clear Creek and its tributaries was likely influenced by contact with these assemblages. During the more recent past and continuing into the present, Clear Creek experienced major water quality problems from point and nonpoint sources associated with historic mining, urban and industrial uses, paved and unpaved roadways (local and interstate) and land use practices. Historically, a majority of these problems have been attributable to the extensive mining of the Colorado Mineral Belt from Bakerville downstream to Floyd Hill and in tributaries to Clear Creek. The natural interaction of water with the mineral assemblages of the Mineral Belt along with the subsequent mining activities that worked both hard rock for metals as well as placer deposits formed from glacial and fluvial weathering of the primary rock deposits, have severely restricted aquatic life in these streams (CDPHE, 2000). Although most mining has ceased in the drainage, considerable mine-related materials (waste rock/mill tailings, etc.) remain. The construction of I-70 resulted in the relocation and containment (roadway fill) of some of these materials in several areas, thus reducing the potential for exposure of mine-related materials. In many places, mill tailings were used as a subbase for the

roadbed. In addition to metal loading influences, nutrient loading (particularly phosphorus) has increased within Clear Creek (EPA, 1997). Sources of nutrients are primarily sediment derived and municipal water treatment plants and possibly septic systems associated with homes adjacent to the stream. The decomposition of organic material within the forested areas can also contribute nutrients to the stream.

Clear Creek water quality is also affected by past alterations of wetlands, riparian vegetation and the natural floodplain. The reduction or removal of wetlands and riparian vegetation limited the natural removal of metals, sediment and nutrients from the system. Channelization and riprap placement during highway construction adjacent to the stream has resulted in the reduction in floodplain area by forcing the stream flow into a constricted channel and increasing the stream velocity thereby reducing the opportunity for interface with the natural floodplain.

Clear Creek is currently monitored by the Upper Clear Creek Watershed Association (UCCWA) under the Clear Creek Watershed Management Agreement (UCCWA, 2001). This agreement "seeks to address certain water quality issues and concerns within the Clear Creek Basin of Colorado, and specifically, such issues as they affect the water quality of Standley Reservoir, an agricultural and municipal water supply reservoir located in Jefferson County Colorado, which is supplied by water primarily from Clear Creek." UCCWA currently has four stream and four wastewater treatment plant (WWTP) monitoring sites on Clear Creek within the SWEEP study area. The U.S. Environmental Protection Agency and Colorado Department of Public Health and Environment (CDPHE) have also conducted stream monitoring on Clear Creek in association with the superfund mine cleanup program.

The Colorado Department of Public Health and Environment Water Quality Control Commission promulgates regulations that establish classification and numeric water quality standards for streams in Colorado, including Clear Creek. Clear Creek within the SWEEP study area has three different classifications.

The classification for upper Clear Creek (from its source to the I-70 bridge above Silver Plume) is class 1 cold-water aquatic life, class 2 recreation, water supply, and agriculture. The class 1, cold-water aquatic life classification indicates that these waters are currently capable of sustaining a wide variety of cold-water biota or could sustain such biota if water quality conditions were corrected. Class 2 recreation (or secondary contact recreation) indicates that these waters are not suitable or intended to become suitable for primary contact recreation uses (when the ingestion of small quantities of water is likely to occur) but are suitable for recreational uses on or about the water including but not limited to wading, fishing, and other streamside recreation. The water supply classification indicates that these waters are suitable or intended to become suitable for potable water supplies. After receiving standard treatment, these waters will meet the Colorado drinking water regulations. The agricultural classification indicates that these waters are suitable or intended to become suitable for irrigation of crops commonly grown in Colorado and are not hazardous as drinking water for livestock (CDPHE, 1999).

The classification for Clear Creek from the I-70 bridge above Silver Plume to the Argo Tunnel discharge is class 1 coldwater aquatic life, class 1 recreation and agricultural. This classification is the same as upper Clear Creek with the exception of the class 1 recreation which indicates that these waters are suitable or intended to become suitable for recreational activities in or on the water when the ingestion of small quantities of water is likely to occur (activities such as swimming, rafting, kayaking, and waterskiing).

The classification for Clear Creek from the discharge of the Argo Tunnel to Golden is class 1 coldwater aquatic life, class 1 recreation, water supply and agricultural.

- **Hydrology/Hydraulics/Stream Morphology/Floodplains** – With the exception of the upper reaches of Clear Creek, the stream morphology has been altered as a result of historic placer mining activities that removed substrate and relocated the stream channel. Channelization has also resulted from the construction of U.S 6, U.S. 40 and I-70 and urban development. The bulk of Clear Creek channelization began in the 1940s with the construction of U.S. 6 and U.S. 40. Today, of the approximate 30 miles of Clear Creek within this study area, over 50% (16 miles) has been channelized as a result of highway development. Approximately 13% (4 miles) of the stream has been channelized as a result of ski area and urban development and 5% (1.5 miles) has been channelized as a result of mining. Channelization has reduced the overall meandering or sinuosity of the stream which is an essential element in providing aquatic habitat and dissipating the streams energy. Minor attempts to mitigate the effects of channelization have occurred over time by the addition of boulders and drop structures in the stream channel. The channelization of Clear Creek, however, has eliminated the floodplain and, as a result, contributes to the area of flooding in various municipalities such as Silver Plume, Georgetown and Idaho Springs. Channelization also altered the groundwater conditions adjacent to the stream by limiting seasonal flooding and potentially affecting groundwater recharge.

Prior to the construction of I-70, the Clear Creek floodplain generally reached beyond its banks when the canyon segments did not constrict the stream channel. With the construction of I-70 during the 1960s and the construction of Georgetown Lake Dam during the early 1970s, the Clear Creek floodplain has become generally more confined and restricted to the stream channel.

- **Wetland and Riparian Ecosystems** – Although functionally valuable when present, wetlands are currently not a major resource in various segments of Clear Creek. The topography (constricted valleys) of the Clear Creek drainage naturally limits the establishment of wetlands. When present, the wetlands and riparian ecosystems adjacent to Clear Creek have experienced direct loss due to fill or dredge and hydrologic changes since the construction of railroads and mining of the mineralized ore deposits began in the late-1850s. In particular, placer mining disturbed wetlands and riparian areas as a result of dredging stream substrate and relocating the stream