sampling locations. The results of fish surveys at the locations downstream from the Argo Tunnel discharge indicate reduced brown trout populations compared to stations upstream. Brown trout populations at the stations downstream from the Argo Tunnel discharge indicate the fewest numbers of fish in the Clear Creek SWEEP study sections, with population estimates ranging from approximately 10 fish-per-acre during spring 1996 to approximately 70 fish-per-acre in spring 1998. Brown trout populations at the lower location were estimated to range from less than 10 fish-per-acre during 1995 and 1996 to approximately 200 fish-per-acre in fall 1997. Estimated population number were approximately 50 fish-per-acre in the spring of 1998. Copper concentrations detected by CDOW are likely high enough to result in periodic acute toxicity and the combination of copper and zinc concentrations is high enough that brown trout eggs may not hatch and brown trout growth may be negatively affected.

CDOW has stocked Snake River cutthroat trout upstream of this SS. As a result, these fish have most likely become distributed throughout this SS. According to CDOW, the Snake River cutthroat trout do not reproduce in Clear Creek, but populations have historically been maintained by stocking. Stocking was curtailed in 1995 (CDOW, 1998).

Water-based recreational opportunities in SS 8 include fishing, rafting and kayaking.

10.2 Issues

10.2.1 Historical Mining (Mineral) Influences

Mineral (mining) influences may be an issue within this SS. Past mining and geologic cuts associated with highway construction upstream affect water quality within this SS of Clear Creek.

10.2.2 Adjacent Land Use

Discharge from the Idaho Springs WWTP may contribute organic and inorganic pollutant loading to Clear Creek. Commercial development upstream from the twin tunnels and near Hidden Valley and Floyd Hill areas may influence Clear Creek water quality and riparian ecology in this SS through disruption of vegetation and soils.

10.2.3 Highway-related Construction, Operation and Maintenance Activities

Accidents involving the transportation of hazardous materials on I-70 impact Clear Creek. Because I-70 is a designated hazardous materials transportation route, the potential exists for such incidences to occur within this SS. Accidents are common throughout this SS, particularly along the "S" curves between the Twin Tunnels and Hidden Valley and on the bridge at the base of Floyd Hill.

Based on a review of current aerial photographs and wetland maps, construction of I-70 has eliminated or encroached upon approximately 3 acres of wetlands adjacent to Clear Creek.

Highway runoff containing chemical deicers used for winter maintenance on I-70 may be entering Clear Creek. Current water quality monitoring by CDOT in SS 8 is designed to assess the concentrations of constituents (contained in the chemical deicers) in the creek during intense storm events, which is when it is believed these constituents are transported to the stream.

10.2.4 Sedimentation

Sand and salt from CDOT winter maintenance and highway cut/fills on US 6 and I-70 may contribute to the sediment load in Clear Creek. The steeper gradient in this SS increases the transport of these particles downstream.

10.2.5 Channelization/Downcutting

Because of the confined valley associated with Clear Creek in this SS, the stream has been extensively channelized or encroached by I-70 and U.S. 6 construction (Figure 10-2). Of the 2.5 miles of Clear Creek in this SS, approximately 2.2 miles (88 percent) has been channelized by highway construction. With the exception of the segment associated with the Twin Tunnels, highway construction has resulted in the elimination of any previous natural meandering and sinuosity. The natural morphology of this reach of Clear Creek is described as a B2/B3/C3 high gradient narrow (small floodplain and entrenched) mountain stream with coarse substrate and sinuosity typically greater than 1.2 (Rosgen, 1996). The historic sinuosity estimated for this SS is 1.26. This relatively high sinuosity is reflected in the large bend associated with the Twin Tunnels rock formation. The current sinuosity for is also estimated at 1.26, indicating that the extensive channelization has not impacted the overall sinuosity.

10.2.6 Habitat Reduction and Fragmentation

SS 8 has undergone considerable development associated with highway construction and commercialization. As mentioned previously, construction of I-70 has eliminated or encroached upon approximately 3 acres of wetlands adjacent to Clear Creek.

10.2.7 Water-based Recreation

Channelization associated with the development of I-70 has enhanced the conditions for rafting and kayaking in Clear Creek by increasing the depth and velocity of stream flow.

11.0 REFERENCES

Balloffet and Associates, Inc. 2000. Georgetown Comprehensive Plan, May 23, 2000.

City of Idaho Springs. 2001. 1994 Idaho Springs Comprehensive Plan, Revised 2001.

Clear Creek County. 2001. Personal communications with Ms. Kim Yordt. Road and Bridge Department. September 28, 2001.

Colorado Department of Public Health and Environment (CDPHE). 2000. Status of Water Quality in Colorado – 2000. Water Quality Control Division. Colorado Department of Public Health and Environment.

Colorado Department of Public Health and Environment (CDPHE). 1999. Regulation No. 38, Classification and numeric standards South Platte River Basin, Laramie River Basin, Republic River Basin, Smoky Hill River Basin: Colorado Department of Public Health and Environment, June, 30, 1999, 140p.

Colorado Department of Transportation (CDOT). 1999. Studies of Environmental Effects of Magnesium Chloride Deicer in Colorado. Report No. CDOT-DTD-R-99-3. November, 1999.

Colorado Department of Transportation (CDOT). 2001. Data Summary Report – 2000, I-70 PEIS Storm Water Quality Monitoring. CDOT, Region 1. May, 2001.

Colorado Division of Wildlife (CDOW). 1998. Clear Creek Monitoring Program. June 1998.

Colorado River Outfitters Association. 2000. Commercial River Use in the State of Colorado, 1988-2000.

Cuffin, S.M. and D.T. Chafin. 2000. Effects of Georgetown Lake on the Water Quality of Clear Creek, Georgetown, Colorado, 1997-98. U.S. Department of the Interior. Water Resources Investigation Report 00-4109.

Felsburg Holt & Ullevig. 2001. Draft Identification of Problematic Areas (Congestion, Traffic Safety, Maintenance Hazards). I-70 Mountain Corridor Programmatic Environmental Impact Statement. Unpublished.

Hurr, R.T., and D.B. Richards. 1974. Hydrologic Investigations, in, Engineering Geologic, Geophysical, Hydrologic, and Rock-Mechanics Investigations of the Straight Creek Tunnel Site and Pilot Bore, Colorado. United States Geological Survey Professional Paper 815. 79-92.

J.F. Sato and Associates (JFSA). 2001. Data Summary Report – 2000, I-70 PEIS Storm Water Quality Monitoring. May 2001.

Rosgen, R. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, Colorado.

Resource Consultants & Engineers, Inc. 1993. Draft Report, Straight Creek Sedimentation Investigation. Prepared for Summit Water Quality Committee.

Upper Clear Creek Watershed Advisory Group (UCCWAG). 2001. UCCWAG Technical Final Report. Board of Upper Clear Creek Watershed Advisory Group. 79pp.

Upper Clear Creek Watershed Association (UCCWA), et. al.. 2001. Clear Creek Watershed Management Agreement. Historic Annual Report 1994-1999. April, 2001.

U.S. Department of Housing and Urban Development. 11980. Flood Insurance Rate Map, Clear Creek, Colorado, Unincorporated Area. Community Plan Number 0800340100A. National Flood Insurance Program. Federal Insurance Administration. March 11,1980.

U.S. Department of Housing and Urban Development. 11980. Flood Insurance Rate Map, Clear Creek, Colorado, Unincorporated Area. Community Plan Number 0800340075A. National Flood Insurance Program. Federal Insurance Administration. March 11,1980.

U.S. Department of Housing and Urban Development. 11980. Flood Insurance Rate Map, Clear Creek, Colorado, Unincorporated Area. Community Plan Number 0800340050A. National Flood Insurance Program. Federal Insurance Administration. March 11,1980.

U.S. Environmental Protection Agency. 1997. State of the Watershed Report – 1997, Clear Creek, Colorado. U.S. Environmental Protection Agency and Colorado Department of Public Health and Environment.

U.S. Forest Service. 2000. Upper Clear Creek Watershed – Pebble Count Results. Unpublished Internal Report. March 13, 2000.

Wohl, E. E. 2001. Virtual Rivers, Lessons from the Mountain Rivers of the Colorado Front Range. Yale University Press. 210pp.

Yeh and Associates, Inc. 2001. Draft Methods for Soil (Mine Waste) Effects Assessment, Tier 1, Programmatic Environmental Impact Study, I-70 Mountain Corridor, Colorado. Project No. 99-004. December 12, 2001

LIST OF ACRONYMS AND ABBREVIATIONS

BMP	Best Management Practices
CDOT	Colorado Department of Transportation
CDOW	Colorado Division of Wildlife
Corridor	The I-70 Mountain Corridor (Denver to Glenwood Springs)
ISA	Initial Site Assessment (aka Modified Environmental Site Assessment)
JFSA	J.F. Sato and Associates
MP	Mile post
NaCl	Sodium Chloride
MgCl	Magnesium Chloride
PEIS	Programmatic Environmental Impact Statement
SS	Stream Section
SWEEP	Stream and Wetland Ecological Enhancement Program
U.S. 6	U.S. Highway 6
U.S. 40	U.S. Highway 40
USFS	U.S. Forest Service
USGS	U.S. Geological Survey