Upper Clear Creek Watershed Plan Update

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Upper Clear Creek Watershed Association
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E.0 Executive Summary

This Upper Clear Creek Watershed Plan enhances and updates the original 2006 Plan that provided a framework for the development of nonpoint source controls for key trace metals (UCCWA, 2006). This updated Plan expands the water quality variables beyond trace metals to provide a more comprehensive evaluation of water quality conditions in the watershed. This report uses new studies and reports since 2006 to define priority areas and potential projects that will result in overall water quality improvements in Clear Creek. This Watershed Plan update:

1) Summarizes Upper Clear Creek trace metal conditions since the previous 2006 plan
2) Expands the water quality constituent assessment to include sediment and nutrients
3) Summarizes recent studies and water quality planning documents
4) Details the current status of water quality in Clear Creek
5) Develops maps of priority areas and lists potential water quality improvement projects
6) Provides an updated Emergency Notification System list (ENS or "call down list")

Background

Upper Clear Creek is a 394 square-mile (mi^2) drainage basin from the headwaters on the Continental Divide to the canyon mouth at the City of Golden. The Clear Creek watershed is characterized by beautiful mountain scenery and extensive outdoor recreation. Clear Creek is valued for its fishery and recreation, and is utilized extensively for wading, fishing, kayaking, rafting, swimming, and small-scale recreational placer mining. Most importantly, however, is the use of Clear Creek as a water supply. These uses are all heavily dependent upon acceptable water quality.

Development in the watershed began with the discovery of placer gold at the confluence of Chicago Creek and Clear Creek in Idaho Springs. This central part of the Clear Creek watershed lies at the heart of Colorado's mineral belt and has experienced widespread development of hardrock mines. The Clear Creek corridor has been extensively developed for transportation including railroads, U.S Highways 6 & 40, and Interstate 70. The majority of development has occurred along the Clear Creek waterway and its tributaries, resulting in impacts to water quality, aquatic life, and riparian vegetation.

Clear Creek and its tributaries serve as the primary drinking water supply source for the seven upper watershed towns of Silver Plume, Georgetown, Empire, Idaho Springs, Black Hawk, Central City, and the City of Golden. The cities of Northglenn, Thornton, and Westminster obtain their water supply from Standley Lake Reservoir which derives most of its water from Clear Creek. Clear Creek also provides a source supply for industries including Loveland Ski Area, Henderson Mine, Molson-Coors Brewing Company, and Xcel Energy.

Contamination from past mining and milling operations is a significant issue in Upper Clear Creek. Certain ambient (non-storm event) metal concentrations exceed standards established to protect aquatic life. Some stream segments in Clear Creek are not achieving water quality standards for trace metals and are listed as impaired.

A Clear Creek Watershed Management Agreement was developed to address water quality issues and concerns within the Clear Creek Basin, focusing on nutrients that could affect water quality in Standley Lake. An ambient (non-storm event) nutrient monitoring program is conducted in Clear Creek. There are currently no numeric sediment or nutrient standards for Clear Creek. While Clear Creek meets the total phosphorus interim standard value under ambient conditions, the standard is often exceeded under storm event conditions.

Hydrology and Water Quality

Hydrology of Clear Creek is dominated by the annual snowmelt cycle. Snow accumulates during the winter season followed by spring melt-off. On average, about 55 percent of the annual Clear Creek flow volume occurs over the 2-month period from May 15 to July 15. October through March are typically low-flow months. Trans-mountain diversions from the west slope watersheds into the Clear Creek basin increase stream flow each year.

Extensive water quality data is available for Clear Creek including trace metal and nutrient concentration data. The trace-metals database is updated annually, and data is evaluated in the Upper Clear Creek Watershed Trace-metals Data Assessment report. A nutrient-based water quality model for Upper Clear Creek is available to assess nutrient loading to Standley Lake.

The 2006 Watershed Plan provides substantial detailed analysis and reference on the status of trace metal conditions in the Clear Creek watershed. Remedial actions have achieved metal load reductions, and stream-standard exceedences continue to be notable, but relatively infrequent. The 2006 Watershed Plan indicated that trace metal reductions should be focused on segments of the main stem of Clear Creek from Georgetown to Idaho Springs and the Silver Plume area, along with the tributaries of Trail Creek, Virginia Canyon, and North Clear Creek.

Monitoring results have shown that high sediment concentrations result in higher nutrient and total trace-metal concentrations in Clear Creek. Sediment is the primary source of nutrient loading for total phosphorus and nitrogen in Clear Creek, causing exceedences of the proposed standard. Seasonal nutrient loads generated by sediment are two to three times greater than ambient (non-storm event) loads each year. The primary sources of sediment include roads and unconsolidated mine waste residuals.

Recent Studies

Recent studies, assessments, or plans in the Upper Clear Creek Watershed included in this update are:

- **Trail Creek and Gilson Gulch Studies**
- **Forested Event Mean Concentration Study**
- **Silver Plume Groundwater Evaluation**
- **Big 5 Tunnel Drainage and Virginia Canyon Groundwater Treatment**
- **OU4 North Fork Final Remedy**
- **Upper Clear Creek Watershed Trace-metals Data Assessment - 2013 Addendum**
- **Standley Lake and Clear Creek Source Water Protection Plan**
- **Georgetown Watershed Protection Ordinance**
- **Clear/Bear Creek Wildfire Watershed Assessment**
- **High Peaks to Headwaters Environmental Assessment**
- **CDOT Highway-Related Water Quality Studies in Upper Clear Creek Watershed**

Water Quality Status Summary

Significant progress has been made in the control of point source pollution. Ambient (non-storm event) water quality conditions in Clear Creek are likely better than they have been in more than a century. However, many challenges remain to correct legacy impacts from mining and road development. Future water quality will depend upon point source control and non-point source pollution through effective source control BMPs.

A stakeholder meeting was held in August 2013 to gather input from watershed stakeholders on ideas, concepts, and projects to improve water quality in Clear Creek. Maps were developed showing the location in the watershed where there are water quality concerns, projects or issues. Stakeholder comments included implementation of institutional or programmatic controls, existing plans, and recommended studies or assessments.

Seven primary sources were identified that are known or have the potential to impact water quality in Clear Creek:

- Spills from highways or publically-owned treatment works
- Post-wildfire impacts
- Highway sediment/salt loading
- County road sediment loading
- Metal and aggregate mining
- Point source nutrient loading
- Erosion from hydrologic modification

The size and complexity of the Upper Clear Creek watershed prompted the need to evaluate the watershed in smaller management units for planning purposes. Thirteen watershed sub-basins or Hydrologic Unit Codes were used to develop an overall ranking analysis and provide an indication of which areas of the watershed have the greatest need for water quality mitigation. The high and moderately-high areas are those in which many future water quality improvements projects should be focused.

Maps and tables were developed for this study with sub-basin priority ranking where new projects, studies, or plan implementation may need to be prioritized within the watershed. Two of these, Idaho Springs and North Fork, were identified as high priority, as also defined in the 2006 Watershed Plan. Two others, West Clear Creek and Soda Creek, emerged as moderately-high priority by factoring all major sources that can impact water quality.

The sub-basin source ranking analysis indicates the Idaho Springs area has the highest ranking for water quality impacts to Upper Clear Creek. Moderate-high priority areas include Clear Creek Headwaters, West Clear Creek, and North Clear Creek. These results are generally consistent with the 2006 Watershed Plan for trace metals, which recommended further remedial investigations in Trail Creek, Virginia Canyon, and North Fork. This plan establishes a priority framework for future projects aimed at addressing the most problematic water quality impacts facing the Clear Creek Watershed.

1.0 Introduction and Background

An Upper Clear Creek Watershed Plan was developed and approved in February 2006. The goal as stated in the 2006 Plan was to provide a basic framework for the development of nonpoint source controls such that currently applicable or ultimate (underlying) standards for key trace metals of concern can be met. The plan included a compilation and assessment of trace metal data to quantify non-attainment of stream standards for several Clear Creek stream segments of concern.

The approved initial (Phase 1) 2006 Plan addressed five of the nine EPA elements for 319-funded plans. These included:

1. Source Identification √;
2. Estimated trace metal load reductions √;
3. Nonpoint source management measures √;
4. Sources of technical and financial assistance √;
5. Information/education component √;
6. Schedule for implementation;
7. Interim and measurable milestones;
8. Criteria for achieving milestones; and
9. Monitoring component.

This updated plan does not attempt to re-trace each of these elements, but rather expand the water quality variables beyond trace metals to provide a more comprehensive evaluation of water quality conditions in the watershed. New studies and reports are available that can be integrated to identify priority areas and potential projects that will result in overall water quality improvements in Clear Creek.

The purpose of this watershed plan update is to:

1) Summarize Upper Clear Creek trace metal conditions since the previous 2006 Plan
2) Expand water quality constituent assessment to include sediment and nutrients
3) Review and summarize recent studies and water quality planning documents
4) Prepare a Watershed Plan detailing current status
5) Develop GIS maps of priority areas and list of future potential water quality improvement projects
6) Provide updated Emergency Notification System list (ENS or "call down list")

The results of existing studies, data analysis and reports have been summarized by reference to the extent possible rather than re-analyzing data. Updated results are summarized in tables and graphs, along with GIS-based maps.

2.0 Watershed Description

Clear Creek is located in the north-central front range of Colorado within the South Platte River Basin. It flows from west to east extending from the Continental Divide on the western edge to the confluence with the South Platte River in Denver. This watershed plan covers the upper mountainous portion of Clear Creek from the headwaters to the City of Golden (Figure 2-1). Clear Creek transitions from a cold water mountain stream to a warm water plains stream downstream of Golden.

Nearly two-thirds of the nearly 400-square mile upper Clear Creek watershed lies within the boundaries of the Arapaho and Roosevelt National Forest. As such, a large portion of the watershed is relatively undisturbed by human development. However, the steep rugged topography in the watershed has dictated that most human development occur along stream corridors. This development started in 1859 with the discovery of placer gold at the confluence of Chicago Creek and Clear Creek in Idaho Springs. This part of the Clear Creek watershed lies at the heart of Colorado's mineral belt and has experienced widespread development of hardrock mines.

Beginning with railroads, the Clear Creek corridor has been extensively developed for transportation including U.S Highways 6 and 40 with Interstate Highway 70 constructed along Clear Creek in the 1960's. Communities and towns were developed along Clear Creek originally to serve the mining industry. Today, the upper watershed is home to approximately 10,000 permanent residents (2010 data). The majority of human development has occurred along Clear Creek and its tributaries, resulting in impacts to water quality, aquatic life, and riparian habitat. The current water quality status from the headwaters to Golden is described in this document and summarized in Section 6.0.

2.1 Hydrology

Clear Creek has relatively abundant stream flow data as shown in Table 2-1. Eight stream flow gages currently operate in the upper Clear Creek study area, as shown on Figure 2-1. The hydrology of Clear Creek is dominated by the annual snowmelt cycle (Figure 2-2). Snow accumulates during the winter season (November-April) followed by spring melt-off (May-June). Maximum daily snowmelt flows are typically 680 cfs in Lawson and 800 cfs in Golden during the snowmelt period. On average, about 55 percent of the annual Clear Creek flow volume occurs over the 2-month period from May 15 to July 15. Summer rainfall can also increase stream flow from July to September. October through March are typically low-flow months with flows of less than 100 cfs in Clear Creek.

Most of the watershed is composed of variably fractured crystalline rocks and thin soils. This geology leads to fracture-flow groundwater systems. The remaining groundwater is present in alluvial gravel deposits associated with Clear Creek and its tributaries.

Clear Creek is generally a gaining stream, with flows increasing with distance downstream in proportion to drainage area. Lower elevation portions of the watershed have lower precipitation amounts, and therefore a lower watershed yield. For example, the North Fork Clear Creek comprises 15 percent of the total Clear Creek drainage area (at Golden), but produces only 7 percent of the total flow (USGS, 1995-2012).

Table 2-1: Stream Flow Gages in the Upper Clear Creek Watershed in 2013

Site No.	Site Name	Period of Record		
		Begin Date	End Date	Years of Record
	*ACTIVE SITES**			
6714800	LEAVENWORTH CREEK @ MOUTH NR GEORGETOWN, CO	7/12/1995	Current	18
6715000	CLEAR CREEK ABV WEST FORK CLEAR CREEK NR EMPIRE CO	6/17/1995	Current	18
6716100	WEST FORK CLEAR CREEK ABV MOUTH NR EMPIRE, CO	10/1/1994	Current	19
6716500	CLEAR CREEK NEAR LAWSON, CO.	6/12/1946	Current	67
6717400	CHICAGO CREEK BLW DEVILS CANYON NR IDAHO SPRGS CO	6/19/1995	Current	18
6718300	CLEAR CREEK ABV JOHNSON GULCH NR IDAHO SPRINGS, CO	6/21/1995	Current	18
6718550	NORTH CLEAR CREEK ABOVE MOUTH NR BLACKHAWK, CO	6/2/1995	Current	18
6719505	CLEAR CREEK AT GOLDEN, CO.	7/9/1975	Current	38

**Active Gage per USGS National Hydrography Dataset, April 2006.*

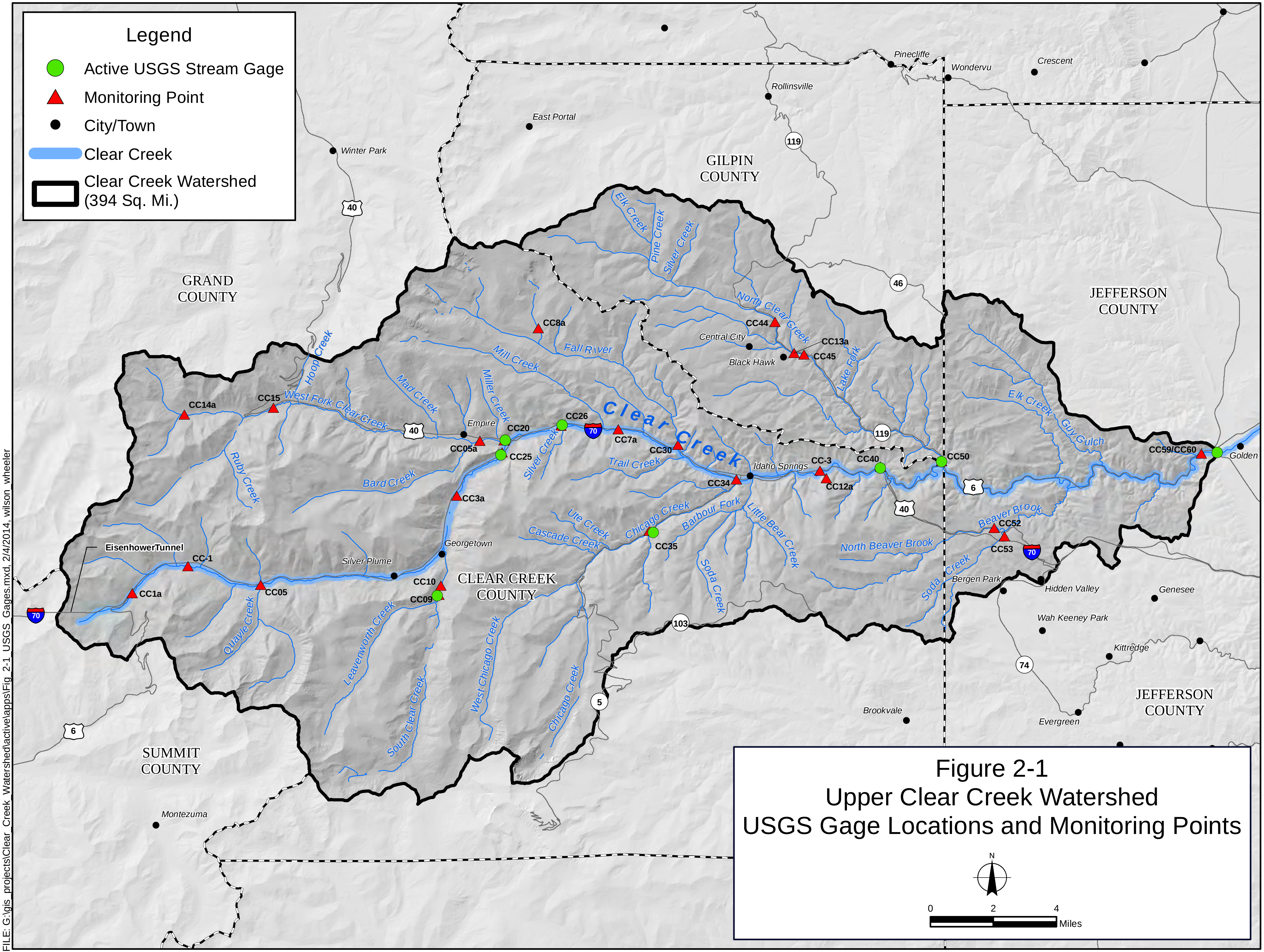
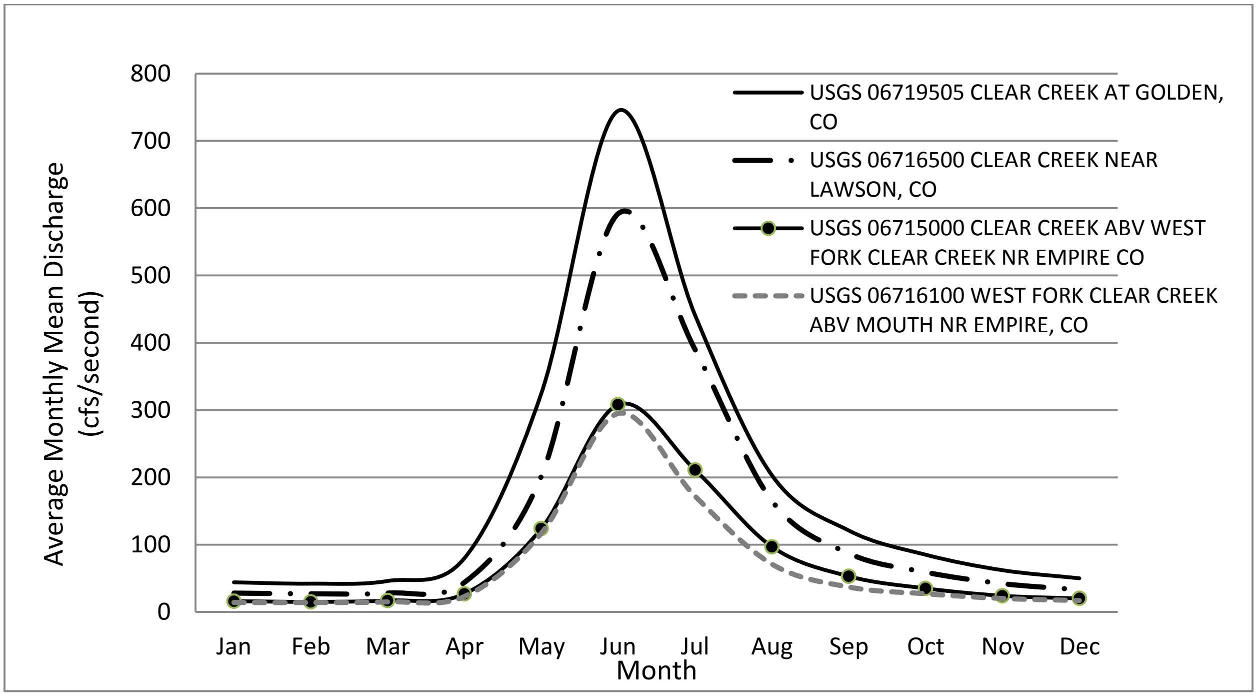


Figure 2-1
Upper Clear Creek Watershed
USGS Gage Locations and Monitoring Points

FILE: G:\gis_projects\Clear_Creek_Watershed\active\apps\Fig_2-1_USGS_Gages.mxd, 2/4/2014, wilson_wheeler

Figure 2-2: Avg. Monthly Discharge for USGS Gaging Stations on Clear Creek, CO



Low flows are particularly important for quantifying water quality impacts. During the low flow months, flow along Clear Creek is much less varied from the upstream reaches near Georgetown to the downstream reaches near Golden. As seen in Figure 2-2 above, average monthly low flows occur between the months of October and April. Near Empire, low flow varies from about 15 cfs to 35 cfs. Near Lawson, the average monthly low flows vary from approximately 30 cfs to 60 cfs. When Clear Creek reaches Golden, low flows vary from approximately 40 cfs to 80 cfs.

USGS annual peak streamflow data show annual peak flows in Figure 2-3 at three locations along Clear Creek. Table 2-2 summarizes the maximum annual peak streamflow data. Peak flows in 1983 and 1995 exceeded 2,300 cfs in Golden. For the 59 year period of record, the USGS gage near Lawson, CO indicates one major peak on Clear Creek in June 1956 with a flow rate of 6,130 cfs. Other gages on Clear Creek do not indicate any other major peak streamflow trends in their more recent and shorter periods of record. Using the Lawson gage as an indicator, there have not been any significant floods on Upper Clear Creek in recent years.

Flows in Clear Creek can be impacted by droughts due to low winter snow accumulation. The two lowest peak stream flows on record at the Lawson gage, 252 and 302 cfs, occurred during the 2002 and 2012 droughts, respectively; the peak streamflow during the 1977 drought was 610 cfs. The graphs of annual peak streamflow in Figure 2-3 illustrate the highly variable flow conditions experienced in Clear Creek from year to year with 2011 flows 4 to 5 times greater than 2012 as measured at the Golden gage 06719505.

Table 2-2: Maximum Annual Peak Streamflow at Selected USGS Gage Sites

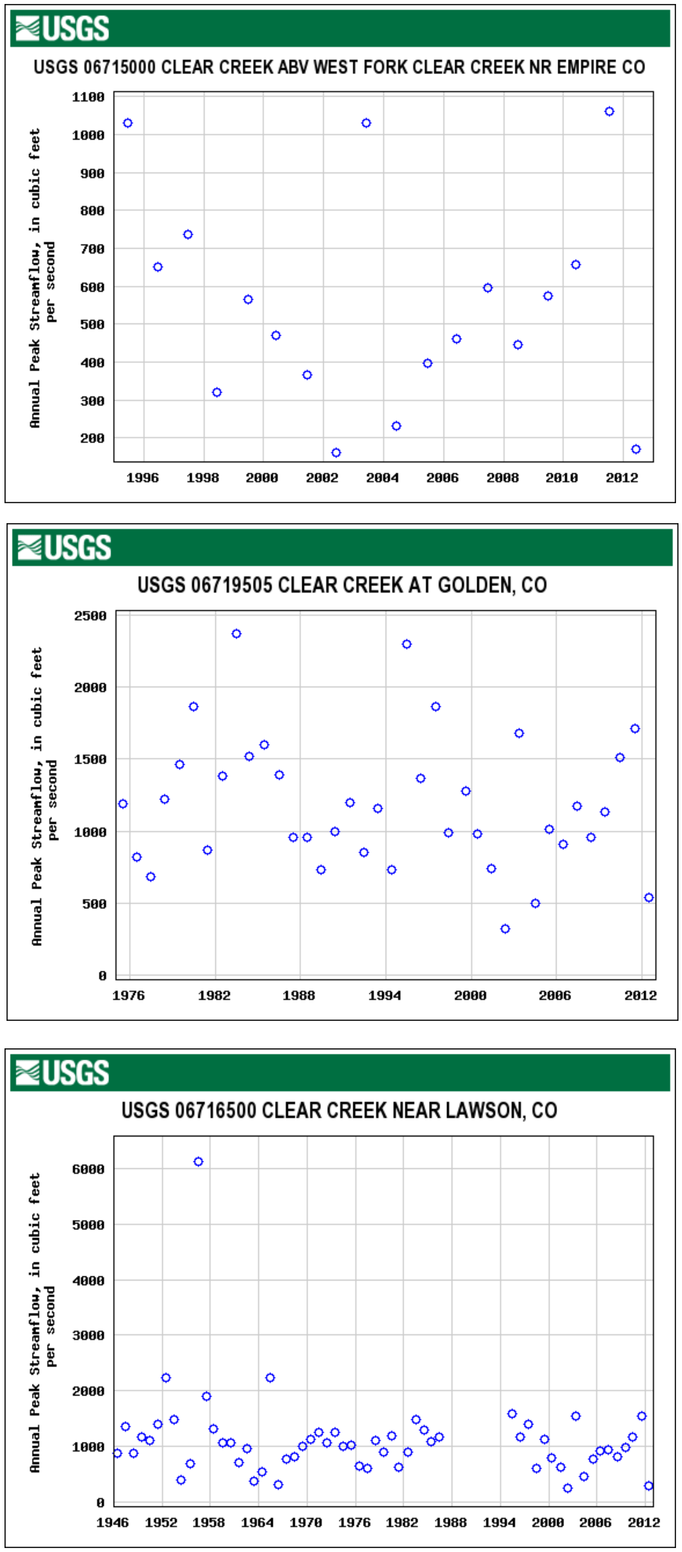
USGS Gage No.	Location	Period of Record	Drainage Area (sq. mi)	Annual Peak Streamflow (cfs)	Date of Peak Streamflow
06716100	West Fork Clear Creek near Empire, CO	1995-2013	57.4	855	May 31, 2003
06715000	Clear Creek above West Fork near Empire	1995-2013	86.3	1,060	July 8, 2011
06716500	Clear Creek near Lawson, CO	1946-2013	147	6,130	June 4, 1956
06719505	Golden, CO	1975-2013	394	2,370	July 10, 1983

Exceptions to the normal streamflow conditions described above can take place in stream reaches with water diversions. For example, the entire flow of upper Clear Creek can be diverted for snowmaking purposes at Loveland Ski Area, resulting in a dry stream channel. In lower Clear Creek, flow at the Johnson Gulch gage (267 sq-mi) can be higher than the flow at the Golden gage (400 sq-mi) due to stream flow diversions. At times, up to 40 percent of Clear Creek flow is diverted into the Church Ditch before reaching Golden (CCC, 2013a).

Trans-mountain diversions from the western slope into the Clear Creek basin can increase stream flow each year. The Straight Creek diversion (Eisenhower Tunnel), Vidler Tunnel, Jones Pass Tunnel, and Berthoud Pass Ditch each import water through the Continental Divide and into Clear Creek from the western slope of Colorado.

The above factors result in highly variable stream flow conditions in Clear Creek. Parameters affected by flow include water quality constituent concentrations, channel erosion, sediment deposition, aquatic biota, fisheries, recreation, water supply, riparian vegetation, wetlands, and aesthetics.

Figure 2-3: Clear Creek Streamflow at USGS Gages - Annual Peak Streamflow



2.2 Water Quality Data

There is an abundance of water quality data available for Clear Creek. A 17-year period of record (1995-2012) is available for ambient (non-storm event) trace metal and nutrient concentration data from Upper Clear Creek Watershed Association (UCCWA), City of Golden, and the Standley Lake Cities of Northglenn, Thornton, and Westminster. The Clear Creek Watershed Foundation (CCWF) has collected water quality data and supported analysis for numerous mine remediation projects. The Colorado Department of Transportation (CDOT) has collected storm water quality data to assess impacts associated with the operation and maintenance of US Highway 40 and Interstate Highway 70. Colorado Parks and Wildlife (CPW) has been collecting water quality and aquatic biology data for several Clear Creek sites. Other municipalities and sanitation districts in upper Clear Creek also conduct water quality sampling and analysis.

The trace-metals database is updated annually and data is evaluated in the Upper Clear Creek Watershed Trace-metals Data Assessment report supported by the CCWF (TDS, 2012). Sediment and nutrient data are managed by other watershed stakeholders involved in data collection. The City of Golden supports an annual data update analysis and PowerPoint presentation of sediment and nutrient data for the lower segment of Clear Creek. The Standley Lake Cities support the development and maintenance of a nutrient-based water quality model for upper Clear Creek to assess nutrient loading to Standley Lake (Standley Lake Watershed WARMF Model, 2007).

2.3 Water Use and Water Quality Impairments

As required by Section 305(b) of the Clean Water Act, the Water Quality Control Division (WQCD) has assessed the state's water bodies every two years to determine whether beneficial uses are supported. Stream segments have been designated in Clear Creek according to areas that are not achieving water quality standards (see Figure 2-1). Segments that are not supporting beneficial uses are considered to be impaired and are listed on the Section 303(d) list. For Clear Creek, the WQCD files involve primarily UCCWA and CPW data. The impaired stream segment list for upper Clear Creek for year 2012 is shown in Table 2-3 at the end of Section 2.

Contamination from past mining and milling operations and natural mineralization is a significant issue in upper Clear Creek. A total of ten segments are impaired by one or more of the following trace metals: cadmium, copper, lead, and zinc. In all cases, the concentrations exceed the standards established to protect aquatic life. No other beneficial uses are at risk according to current state regulations.

2.3.1 Aquatic Life

CPW has an interest in nurturing and extending the existing brown trout population in upper Clear Creek, which is sensitive to high zinc concentrations. A key segment of concern is 2b, which extends in Clear Creek from the confluence with West Fork downstream to the confluence with Mill Creek. This segment is immediately downstream of 2a, which is between Georgetown Reservoir and West Fork has a robust brown trout population. Segment 2b is listed as impaired for cadmium and zinc. Segment 2c and between Mill Creek and Argo Tunnel and Segment 11 from Argo Tunnel to Golden are both listed as impaired for cadmium. Several tributaries to Clear Creek are also listed as impaired by trace metals (Table 2-3).

The trace metals database maintained by UCCWA and CCWF was used to compute 85th percentile concentration values for the 6-year period prior to the previous watershed plan (2001-2006) and subsequent period for this update (2007-2012). The two data analysis periods are six years in duration and incorporate both high and low stream flow years. These trace metal results are compared to the current table value standards (TVS) for each stream segment listed on 303(d) as impaired (Table 2-2). Where detection limits were significantly higher (2001-2006), a value of ½ the reported detection limit was used. Average hardness values for each period were used to compute the TVS. Results of this analysis are summarized below:

- Clear Creek segments 2a, 2b, and 2c exceed the TVS for cadmium. However, Segment 2b is very close to meeting the standard, based on the last six years of data.
- According to the available data, Leavenworth Creek and South Clear Creek copper concentrations were below the TVS.
- Mad Creek and Hoop Creek zinc concentrations were below the TVS.
- Fall River zinc concentrations were below the TVS for 2001-2006 and 2007-2012.
- Trail Creek cadmium concentrations exceeded the TVS by one order of magnitude.
- North Clear Creek Segment 13B cadmium concentrations exceeded the TVS.
- Clear Creek segment 11 cadmium concentrations exceeded the TVS.

These results suggest that cadmium reductions should be focused on Trail Creek and North Clear Creek in an effort to meet the TVS in those tributaries. This approach should result in lower cadmium concentrations in Clear Creek segment 11. This conclusion is consistent with the Updated Dissolved-Cadmium Assessment (TDS, 2013).

2.3.2 Recreation

Clear Creek is used extensively for wading, fishing, kayaking, rafting, swimming, and small-scale recreational placer mining. These are primary contact recreational activities. With the exception of wading and fishing, which are common from the headwaters to Golden, other contact recreation takes place primarily downstream of the West Fork between Lawson and Golden. Swimming in Clear Creek is very popular in Golden. From its headwaters to Golden, Clear Creek and all of its tributaries are classified for existing Class 1 Recreation and meeting the standards that have been established to protect that use.

2.3.3 Water Supply and Agriculture

Clear Creek and its tributaries serve as the primary drinking water supply source for the seven upper watershed towns of Silver Plume, Georgetown, Empire, Idaho Springs, Black Hawk, Central City, and the City of Golden. Most of these towns operate water supply diversions on tributaries. Silver Plume, Black Hawk, and Golden withdraw water directly from Clear Creek for their primary drinking water supply.

The cities of Northglenn, Thornton, and Westminster obtain their water supply from Standley Lake Reservoir which derives most of its water from Clear Creek. Standley Lake is a 43,000 acre-foot facility that provides potable water to more than 350,000 municipal residents.

Clear Creek also provides a source supply for industries including Loveland Ski Area, Henderson Mine, Molson-Coors Brewing Company, and Xcel Energy. It is also the principle surface water source for numerous lower watershed ditch companies and water supply providers for many users in the lower part of the watershed downstream of Golden. Agriculture in the upper Clear Creek watershed is largely related to livestock production and ranching.

The standards established to protect water supply and agricultural uses are met in all cases.

Table 2-3: Clear Creek Tributary Impairments for Trace Metals

WBID	Segment Description	Portion	Monitoring & Evaluation Parameter	CWA 303(d) Impairment	303(d) Priority (Low, Medium, High)	Table Value Standard*	85th Percent Concentration 2001-2006	85th Percent Concentration 2007-2012
COSPCL01	Mainstem of Clear Creek, including all tributaries and wetlands, from the source to the I-70 bridge above Silver Plume.	Kearney Gulch, Grizzly Gulch	Aquatic Life					
COSPCL02a	Mainstem of Clear Creek from Silver Plume to West Fork CC (CC-25)	All		Cd	H	0.31	0.50**	0.42
COSPCL02b	Mainstem of Clear Creek from West Fork Clear to Mill Creek (CC-26)	All		Cd Zn	H	0.35 99	0.50** 132	0.37 144
COSPCL02c	Mainstem of Clear Creek from Mill Creek to Argo Tunnel (CC-34)	All		Cd	H	0.33	NA	0.62
COSPCL03a	Mainstem of South Clear Creek (CC-10)	All		Cu	H	4.7	2.9	NA
COSPCL03b	Leavenworth Creek (CC-09)	All		Cu	M	4.6	4.5	NA
COSPCL06	West Clear Creek tributaries	Mad Creek	pH	Zn	M	20	<10	<20
COSPCL06	All tributaries to West Clear Creek.	Hoop Creek	Cd, Pb, Zn			Zn 32	Zn <10	
COSPCL09a	Fall River & tributaries, source to Clear Creek (CC-30)	Fall River	Zn, D.O.			42	27	39
COSPCL09a	Fall River & tributaries, source to Clear Creek	Silver Creek		Cu, Pb	H	NA	NA	NA
COSPCL09b	Trail Creek & tributaries, source to Clear Creek (CC-31)	All		Cd, pH	H	0.40	NA	4.0
COSPCL11	Clear Creek, Argo Tunnel to Farmers Highline Canal (CC-40, CC-60)	All		Cd	H	0.34	1.10 (CC-40) 0.61 (CC-60)	0.86 (CC-40 0.68 (CC-60)
COSPCL13b	N. Clear Creek & tributaries, lowest water supply intake to Clear Creek (CC-50)	Mainstem of N. Clear Creek		Cd	M	0.6	3.4	3.3

*Underlying minimum default standard **1/2 reported detection limit

Source: CDPHE, WQCC 5 CCR 1002-93 Reg. 93, CO Sec. 303(D) List of Impaired Waters and Monitoring & Evaluation List, March 2012

3.0 Previous 2006 Watershed Plan for Trace Metals

An extensive compilation and assessment of stream flow and trace-metals data from several sources was completed in the 2006 Watershed Plan. Highlights of this plan are summarized below:

- High-priority areas identified in the watershed for remediation to achieve water quality stream standards were Trail Creek and Virginia Canyon.
- Moderate priority areas were the Georgetown to Idaho Springs area and the Silver Plume area.
- The more stringent (underlying TVS) stream standards would not be achieved assuming the currently planned remedial actions for reducing trace-metal loads.
- Recommendations included further water quality characterization of Trail Creek, characterization of waste rock piles in Virginia Canyon and North Clear Creek, and further monitoring and evaluation of trace-metal load reductions.

Areas identified for trace-metal load reductions that were thought to be achievable are listed in Table 3-1.

Table 3-1: Areas Identified for Trace-Metal Load Reductions

Area	Stream Segment	Priority	Parameters	Sources
Virginia Canyon	2c	High	Cd, Cu, Zn	Groundwater, surface runoff/waste rock piles
North Clear Creek	13b	High	Cd, Cu, Zn	Acid mine drainage
Silver Plume	2a	Moderate	Zn	Burleigh Tunnel drainage, groundwater
Idaho Springs	2c	Moderate	Cd	Trail Creek, Big 5 Tunnel drainage

Additional trace-metal source characterization studies were conducted in Trail Creek and Gilson Gulch by the CCWF to assess loading conditions. Groundwater is now being extracted from Virginia Canyon and Big 5 Tunnel for treatment at the Argo Tunnel treatment facility. Erosion control BMPs were implemented at several waste rock piles in the North Fork drainage pursuant to the OU4 ROD. Results of these studies and efforts are summarized in Section 4.

4.0 Recent Studies and Planning Documents

There have been several water quality studies and planning documents completed subsequent to the 2006 watershed plan. These reports are summarized in the following sections.

4.1 Trail Creek

A surface water monitoring program was conducted from 2006 to 2011 on Trail Creek to assess trace-metal concentrations and sediment loads related to historical mining and associated remediation efforts, and to evaluate potential impacts to Clear Creek water quality. This monitoring program was conducted on behalf of the CCWF (CCC, 2011a). A summary findings based on data collected from 2005 through 2010 are as follows.

- Trail Creek stream flow had typical peak snowmelt flows in May and June ranging from 4 to 6 cfs, and low flows less than 0.5 cfs. A large storm runoff event in Trail Creek measured on July 30, 2010 had an estimated peak flow of 125 cfs and turbidity greater than 4,000 NTU.
- New chronic water quality standards promulgated in 2009 were lower for Trail Creek, resulting in copper and zinc exceedences for all samples.
- The Lamartine Mine area contributed most of the zinc to Trail Creek.
- The Freeland Tailings area and Trail Run contributed most of the copper to Trail Creek, followed by the Phoenix Mine area.
- Metal loads in Trail Creek comprised less than 5 percent of the metal load in Clear Creek during ambient (non-storm event) conditions.
- Copper and zinc concentrations in Clear Creek were below water quality standards and did not change appreciably from upstream to downstream of Trail Creek, except during March and April.
- Dissolved copper, lead, and zinc concentrations in Trail Creek were much lower during storm runoff conditions indicating dilution.
- Total metal concentrations were correlated with high suspended sediment in Trail Creek runoff during storm runoff events including arsenic, lead, nickel, and silver.
- Metal loads in Trail Creek can constitute a large percentage of the total metal load in Clear Creek during storm runoff conditions.
- High total suspended solids concentrations were correlated with high phosphorus in Trail Creek and Clear Creek storm event samples, exceeding the phosphorus water quality interim standard value.
- Erosion of the county road is the primary source of sediment in Trail Creek.
- Trail Creek can produce as much or more total phosphorus load than carried by Clear Creek during storm events.

4.2 Gilson Gulch

A surface water monitoring program was conducted in Gilson Gulch by the CCWF from 2009 to 2011 and TDS Consulting in 2005. Gilson Gulch is a north tributary to Clear Creek near Idaho Springs, Colorado. The purpose was to monitor water quality conditions during various remedial activities being undertaken in Gilson Gulch by the CCWF under the Nonpoint Source Program of the Colorado Water Quality Control Division. Resulting data was used to characterize trace-metal concentrations related to historical mining and changes during remediation (CCC, 2011b). A summary of findings are as follows.

- Stream flows in Gilson Gulch surface waters were low (<20 gallons per minute) during the sampling events, with the exception of June 15, 2010 when flow was 120 gpm.
- Concentrations of cadmium, lead, and zinc were highest in the Silver Cycle Mine adit drainage, the primary metal source in Gilson Gulch. Dissolved copper concentrations were less than 0.1 mg/L in mine adit samples, suggesting that copper in Gilson Gulch is derived from surface mine waste residuals.
- Water quality remained fairly consistent at each sampling station throughout the monitoring seasons. Based on flow results, metal concentrations in Gilson Gulch did not show any significant seasonal variance at the flow rates encountered during the monitoring period. The highest flow sampled (June 2010) had the lowest concentration, suggesting metal concentrations were diluted in Gilson Gulch.
- Gilson Gulch zinc loads ranged from 1 to 18 percent of the Clear Creek load with the highest percentages measured during low Clear Creek flows. The average zinc load contribution was less than five percent.

4.3 Forested Event Mean Concentration Study

The UCCWA supported an event-based water quality monitoring in the upper Clear Creek watershed from 2000 to 2004 in an effort to characterize chemical constituent Event Mean Concentrations (EMC) in stream storm water runoff. The EMC study involved collection and analysis of stream water samples during summer rainfall-runoff events. The objective was to gather runoff event data that can be used to evaluate relative contributions of chemical constituent concentrations by various land use and cover types.

Study Phases I and II were completed in 2000 and 2001, with EMC samples collected from foothills urban areas (lower Tucker Gulch near Golden), lightly developed mountain areas (upper Tucker Gulch), and forested mountain areas (Chicago Creek and Mad Creek) (LRCWE, 2002). Phases III through V (2002-2004) focused exclusively on forested watershed types in the middle portion of Clear Creek County (Mad Creek and Devils Canyon) (CCC, 2005). All of the EMC study streams were located within the Clear Creek watershed in either Clear Creek or Jefferson County.

An EMC is the mean concentration of a pollutant parameter during a storm water runoff event, typically resulting from rainfall runoff. EMC values are developed for various land use types to estimate pollutant loading on a watershed scale, where multiple land uses are common. The Standley Lake Cities have used EMC values published for the EPA Nationwide Urban Runoff Program (NURP) in a Watershed Management Model to estimate nutrient loading into Standley Lake. The purpose of the EMC study was to generate watershed-specific data that can be used for basin-wide water quality planning and management. Nutrients were the focus of this effort because they play an important role in stream and lake water quality. Results are summarized below:

- The Mad Creek and Devils Canyon watersheds represent mountain forested areas that are mostly undeveloped with a predominant vegetation cover of coniferous forest. With the exception of a small fire road or jeep trail, there is minimal disturbance from mining or other anthropogenic activities. Although Chicago Creek is classified as a mountain forested watershed, unlike Mad Creek and Devils Canyon, there is significant land disturbance in the form of reservoir and highway development in upper Chicago Creek. This is reflected in the EMC values which were generally higher in Chicago Creek.

- Mad Creek results had lower average total phosphorus concentrations (0.018 mg/L) when compared to Devils Canyon (0.021 mg/L). In general, Devils Canyon produced higher concentrations of total phosphorus and suspended solids than Mad Creek. However, phosphorus maximums in excess of 0.032 mg/L occur at both stations.
- Mad Creek had higher average total nitrogen concentrations (0.28 mg/L) when compared to Devils Canyon (0.24 mg/L). However, nitrogen maximums in excess of 0.30 mg/L occur at both stations.
- The available data suggests less variability in the Mountain Forested EMC values when compared to developed foothill areas (Tucker Gulch). This is consistent with the land use and cover type, which has minimal disturbance in mountain forested areas. The EMC values for most parameters were up to one order of magnitude less in the Mountain Forested watersheds when compared to the Foothills Urban areas.
- Results showed relatively low total phosphorus concentrations with an overall average of 0.018 mg/L and total nitrogen of 0.26 mg/L. These values were believed to be adequately representative of the undisturbed forested land use type in the Clear Creek watershed.

4.4 Silver Plume Groundwater

The Town of Silver Plume began improving its wastewater collection system to reduce Inflow and Infiltration (I&I) in 2010. Wastewater is treated at the Town of Georgetown wastewater treatment facility. The Preliminary Engineering Report (PER), which the Town commissioned in order to evaluate both its sewer lines and manholes, revealed a large amount of groundwater infiltration suggesting the need for extensive replacement and repair.

During the course of the preparation of the PER, samples of wastewater were collected at various manholes in the town that exhibited elevated zinc levels. At the west end of town a measurement sample of groundwater flowing into a manhole in the vicinity of the Burleigh Tunnel revealed quite elevated zinc levels, substantiating that the water from the Burleigh mine drainage tunnel is entering groundwater and eventually Clear Creek.

A significant amount of this subsurface flow has been intercepted by Silver Plume's sewer collection system and conveyed to Georgetown's wastewater treatment plant. Georgetown provides wastewater treatment service on behalf of Silver Plume and this intercepted load of zinc has caused persistent compliance concerns.

EPA's 2003 Burleigh Tunnel Remedial Investigation shows that during the years from 1989 to 2001 the Burleigh Drainage tunnel discharged a load of zinc averaging 24 pounds per day. This is an annual average load of 8906 lbs, or 4.5 tons of zinc. This loading is based on an average discharge rate of 0.07 cfs (31 gpm) and average zinc concentration of 55,380 µg/L established over a 12-year period (CCWF, 2010).

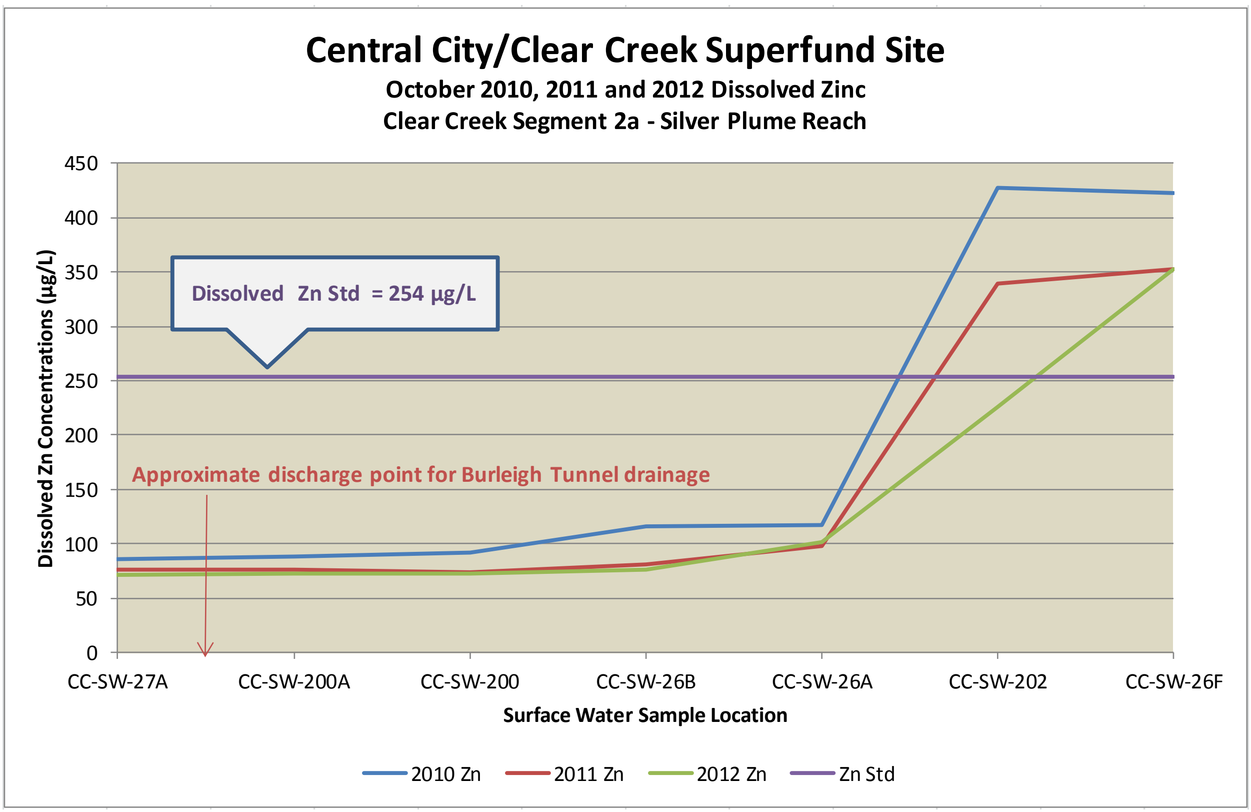
Drainage from the Silver Plume mining district is an important source of zinc loading into the headwaters of Clear Creek. EPA's Remedial Investigation shows that above the town of Silver Plume, Clear Creek has a zinc concentration of approximately 25µg/L. Less than a mile downstream of the Burleigh, near the eastern edge of Silver Plume, the in-stream concentration in Clear Creek has averaged over 400 µg/L.

More recent data (2010-2012) assessed by the Water Quality Control Division shows that zinc concentrations upstream of Silver Plume have averaged 80 µg/l, while downstream of Silver Plume to Georgetown (upper portion of segment 2a) zinc concentrations in Clear Creek have averaged over 250 µg/l. These results are illustrated in Figure 4-1, showing a large increase in Clear Creek zinc concentrations at location CC-SW-202 below Silver Plume. See CDPHE report for specific sampling locations.

The Burleigh is a major source of this pollution, but one or more additional sources are located on the eastern edge of town, as well. It is possible that the impaired status not only of segment 2a, but even the next two segments of Clear Creek (2b ending below Mill Creek in Dumont and 2c ending in Idaho Springs just above the Argo Tunnel) are impacted significantly by metals-contaminated groundwater in Silver Plume.

Passive remediation of mine drainages similar the Burleigh Tunnel indicate it may be possible to remove 85% to 95% of the zinc in shallow Silver Plume groundwater using newer proven treatment techniques that require fairly infrequent, low-level maintenance. The feasibility of such passive remediation should be re-evaluated for the groundwater contamination in the Silver Plume area. If such treatment looks promising, a new passive groundwater treatment system should be constructed to prevent this nonpoint source problem from worsening.

Figure 4-1: Dissolved Zinc in Clear Creek Silver Plume Reach



4.5 Treatment of Big 5 Tunnel Drainage and Virginia Canyon Groundwater

Collection and treatment of the Big 5 Mine tunnel drainage and Virginia Canyon groundwater in Idaho Springs started in 2006. These actions were initiated by EPA under Operable Unit #3 of the Central City/Clear Creek Superfund Site. Water from these sources is contaminated with heavy metals from past mining activities. Water is treated for metals removal at the Argo Tunnel water treatment facility in Idaho Springs, operated by CDPHE.

Flow data is recorded as water flows into the Argo facility from these two sources (CDPHE, 2013). Over the past 17 months (July 2012 to November 2013) Big 5 inflows ranged from 23 to 29 gallons per minute (gpm) with an average of 24 gpm. At concentrations measured by the facility, this translates into an average copper load of 0.1 pounds per day and an average zinc load of 2 pounds per day that is treated from the Big 5 tunnel.

Virginia Canyon groundwater inflows to the Argo treatment facility vary seasonally ranging from 2 to 63 gpm over the same 17 month period, with an average flow of 15 gpm. At concentrations measured by the facility, this translates into an average copper load of 1 pound per day and an average zinc load of 9 pounds per day that is treated from Virginia Canyon.

These sources, combined with water treated from the Argo Tunnel, result in metal load reductions and lower metal concentrations in Clear Creek in the Idaho Springs area.

4.6 OU4 Final Remedy

The Central City/Clear Creek Superfund Site (Site) was added to the National Priority List in 1983. Since that time, EPA and CDPHE have conducted numerous water quality investigations to identify and prioritize specific sources of metals contamination impacting water quality and have implemented remedial actions at a number of the priority impacted areas to address the sources. EPA and CDPHE divided the Site into four operable units (OU). Each OU was designed to address heavy metals contamination associated with historic mining activities in the Clear Creek drainage basin.

The OU4 remedial actions are intended to improve water quality in the North Fork of Clear Creek and its tributaries to enable the North Fork to support a non-reproducing brown trout population (EPA, 2004). Another intended result of implementing the OU4 remedial actions is to reduce the impact that the North Fork has on the water quality in the main stem of Clear Creek so that remedial action objectives are met for the mainstem of Clear Creek between its confluence with the North Fork and the City of Golden.

Components of the 2004 OU4 Record of Decision and its amendments include:

- Capping/removal and sediment control of priority waste rock piles/tailings in the North Fork of Clear Creek
- Collection, conveyance and treatment of Quartz Hill, Gregory Incline and National Tunnel discharges
- Collection, conveyance and treatment of Gregory Gulch drainage/groundwater
- Construction of sediment control and stream channel stabilization in the North Fork of Clear Creek and its tributaries
- Construction of a site-wide repository for the consolidation of mining and milling-related wastes.

The OU4 ROD was modified in September 2006 by the Amendment to the OU3 and OU4 ROD for the Addition of an On-Site Repository. The OU4 ROD was again amended in April 2010 by the Amendment to the OU4 ROD for the Active Treatment of National Tunnel, Gregory Incline and Gregory Gulch (EPA, 2010).

In 2006, the Site was reorganized to implement the remaining OU2 and OU3 projects, specifically the Quartz Hill mine waste pile and the Golden Gilpin mine waste site, under OU4. All of the OU2 and OU3 remedial actions have been completed. The following summarizes the portions of the OU4 remedial actions that have been completed.

- The project focused on reducing the erosion and transport of mine wastes from the high- and medium-ranked mine waste sources in Gregory, Russell, Willis and Nevada Gulches. This was achieved through mine waste removal and consolidation in an on-site repository, capping, construction of erosion controls such as run-on and run-off ditches, and construction of sedimentation dams.
- Twenty waste rock piles were removed or remediated.
- Two sediment retention basins were constructed: one in Nevada Gulch and one in Russell Gulch.
- Check dam structures were constructed in South Willis, Willis, Russell and Nevada Gulches in order to stabilize stream channels and reduce sediment transport.
- Hazardous mine openings associated with four waste rock piles were closed.
- Creation of the Church Placer and Site-wide repository.

Collection, conveyance, and active treatment of Quartz Hill, National Tunnel, and Gregory Incline discharges along with Gregory Gulch groundwater is scheduled for completion in 2015.

4.7 Upper Clear Creek Watershed Trace-Metals Data Assessment – 2013 Addendum

A summary of the most recent trace metals data assessment for upper Clear Creek was taken from the 2013 addendum (TDS Consulting, 2013a) as follows:

- Trace metal concentrations for the 2013 calendar year in general were quite low. This condition was judged to be a result of the beneficial impacts of mine-related remedial actions.
- For the 2000-2013 period, average trace metal concentrations at both upstream and downstream mainstem Clear Creek sites continued to remain lower than for the 1995-1999 period.
- Dissolved and total trace metal loads have decreased appreciably at all six key monitoring sites during the 19-year period of record (1995-2013) for which loads were estimated.

4.8 Standley Lake and Clear Creek Source Water Protection Plan

Standley Lake, a 43,000 acre-foot facility located on the western edge of Westminster, CO, is a primary water source for the cities of Westminster, Northglenn, and Thornton, CO. In 2008, these cities convened the Standley Lake/Clear Creek Watershed Steering Committee, a group of stakeholders concerned with the financial and public health risks associated with nutrient contamination of Standley Lake's source water, to develop the Standley Lake and Clear Creek

Source Water Protection Plan (SWPP). The SWPP identifies nutrient contamination sources and corresponding protection activities for Standley Lake. The Steering Committee issued the final SWPP in 2010 (SWPP, 2010).

The Source Water Assessment (SWA) area for Standley Lake comprises three sub-basins including the approximately 525 square miles of the Upper Clear Creek Watershed, the approximately 6.5 square miles tributary to the Standley Lake feeder canals, and the area immediately surrounding Standley Lake. The Upper Clear Creek Watershed represents over 95% of the Standley Lake SWA area. CDPHE provided Source Water Assessment reports for the cities, municipalities, and other systems within the Clear Creek Watershed.

Table 4-1 summarizes the priority and susceptibility results for contamination sources for Standley Lake. Pending any future analysis of contamination sources, the SWPP recommends implementing the following BMP's in the Standley Lake/Clear Creek SWP Area to prevent contamination:

- Call-Down System Enhancement (now the Emergency Notification System)
- Standley/Clear Creek Source Water Protection Plan - Work plan
- Wastewater Treatment Plant Optimization
- Participate in annual Clear Creek Watershed Festival, a festival to raise community awareness of natural resource management and source water protection
- Participate in annual Household Chemical / Hazardous Materials Clean-Up Day
- Conduct Watershed Assessments for Prioritizing Fire Risk
- Implement regular inspection and pumping program for Onsite Wastewater Systems
- Implement a community education/outreach campaign on the effects of nutrient enrichment
- Install runoff and sediment controls
- Reduce levels of Phosphorus in consumer and industrial products

Table 4-1: Source Water Protection Priority Strategy and Susceptibility Results (Source: SWPP, 2010)

SOURCE ID	CO0101170-003
Source Name	STANDLEY LAKE
Source Type	Surface Water
Total Susceptibility Rating	High
Physical Setting Vulnerability Rating	Moderately Low
MOST CONCERNING DISCRETE CONTAMINANT SOURCES	
EPA Superfund Sites	2
EPA Abandoned Contaminated Sites	6
EPA Hazardous Waste Generators	21
EPA Chemical Inventory/Storage Sites	13
EPA Toxic Release Inventory Sites	9
Permitted Wastewater Discharge Sites	9
Aboveground, Underground and Leaking Storage Tank Sites	99
Solid Waste Sites	4
Existing/Abandoned Mine Sites	353
Confined Animal Feeding Operations	0
Other Facilities	48
TOTAL	**564**

MOST PREVALENT DISPERSED CONTAMINANT SOURCES	
LAND USES	
Commercial/Industrial/Transportation	X
High Intensity Residential	X
Low Intensity Residential	X
Urban Recreational Grasses	X
Quarries/Strip Mines/Gravel Pits	X
Row Crops	X
Fallow	X
Small Grains	
Pasture/Hay	X
Orchards/Vineyards/Other	
Deciduous Forest	X
Evergreen Forest	X
Mixed Forest	X
OTHER TYPES	
Septic Systems	X
Oil/Gas Wells	X
Road Miles	X
TOTAL	**14**

(**italicized entries indicate nutrient-related contaminant sources*)

4.9 Georgetown Watershed Protection Ordinance

The Town of Georgetown developed a Watershed Protection District in 2000 for the purpose of protecting the sources, supply, quantity, quality, delivery, storage, treatment and distribution of water serving the Town, its citizens and water-using customers. An ordinance was developed to protect the Town's water resources from pollution and degradation within 5 miles upstream of the point of diversion. A permit is required for work within this 5 miles zone upstream of the intake on South Clear Creek and Leavenworth Creek. Restricted activities include Individual Sewage Disposal System (ISDS); earthwork; timber harvesting; drilling; work on the waterways; mining; use of fertilizers, herbicides, pesticides, toxic or hazardous substances, and explosive materials; altering the hydrology, or any other potential pollution activity.

The Town of Georgetown issued a letter on September 28, 2011 to the Office of Energy Projects, Division of Dam Safety and Inspections, to put them on notice of the release of muddy water from Georgetown Forebay Reservoir. The releases created sediment problems impacting the Town's water intake. A water quality comparative evaluation was conducted from water samples collected during the release (September 22, 2011) showing trace-metals concentrations were 2-to-3 orders of magnitude higher than ambient (non-event) data (TDS Consulting, 2011).

In a letter from Xcel Energy to the Federal Energy Regulatory Commission, Xcel Energy indicated that there was no long-term environmental impact from the dam inspection maintenance activity (Xcel, 2012). The Town requested that precautionary measures be taken to prevent further degradation of water quality, and recommended dredging the reservoir rather than flushing accumulated sediment downstream.

4.10 Clear/Bear Creek Wildfire Watershed Assessment

The Clear/Bear Creek Wildfire Watershed Assessment identified, prioritized, and recommended strategies to protect the Clear Creek watershed from post-wildfire effects (JWA, 2013). JW Associates, Inc. produced the report for a group of stakeholders concerned with wildfire effects on water supplies; stakeholders include CDOT, City and County of Denver, Molson-Coors Brewing Company, US Forest Service, and Xcel Energy.

This watershed assessment first evaluated the sixth-level watersheds in the Clear Creek Watershed (HUC 10190004) based on the following post-wildfire hazards to water supplies:

- Flood generation
- Debris flow
- Soil erodibility

The report discussed opportunities and constraints to mitigate effects of hazards on water supply features in the watershed.

Figure 4-2: Source: Clear/Bear Creek Wildfire/Watershed Assessment (JWA, 2013)

The three factors (1. wildfire hazard, 2. flooding and debris flow, and 3. soil erodibility) are used to create a composite hazard ranking for each sixth-level watershed. The study evaluated wildfire hazard based on spatial data including forest density, vegetation type, and mountain pine beetle-kill. Wildfire hazard is based on the output of flame length expected in each watershed.

Hazard potentials related to flooding and debris flow were evaluated on watershed slope and road density. Watersheds with steeper slopes tend to generate greater debris flows after a wildfire; and watersheds with greater road densities are more sensitive to higher peak flows following a wildfire.

Soil erodibility was determined as a combination of land slope in the watershed and inherent erodibility of the soils. Soils with greater erodibility on steeper slopes are determined as having “very severe” potential soil erodibility.

Priority watersheds were then determined as those with the highest composite hazard ranking and those with a water supply feature (such as an intake, diversion or storage reservoir). Five categories of ranking were used with 1 being lowest and 5 the highest priority. The highest priority sixth-level watersheds in Clear Creek were:

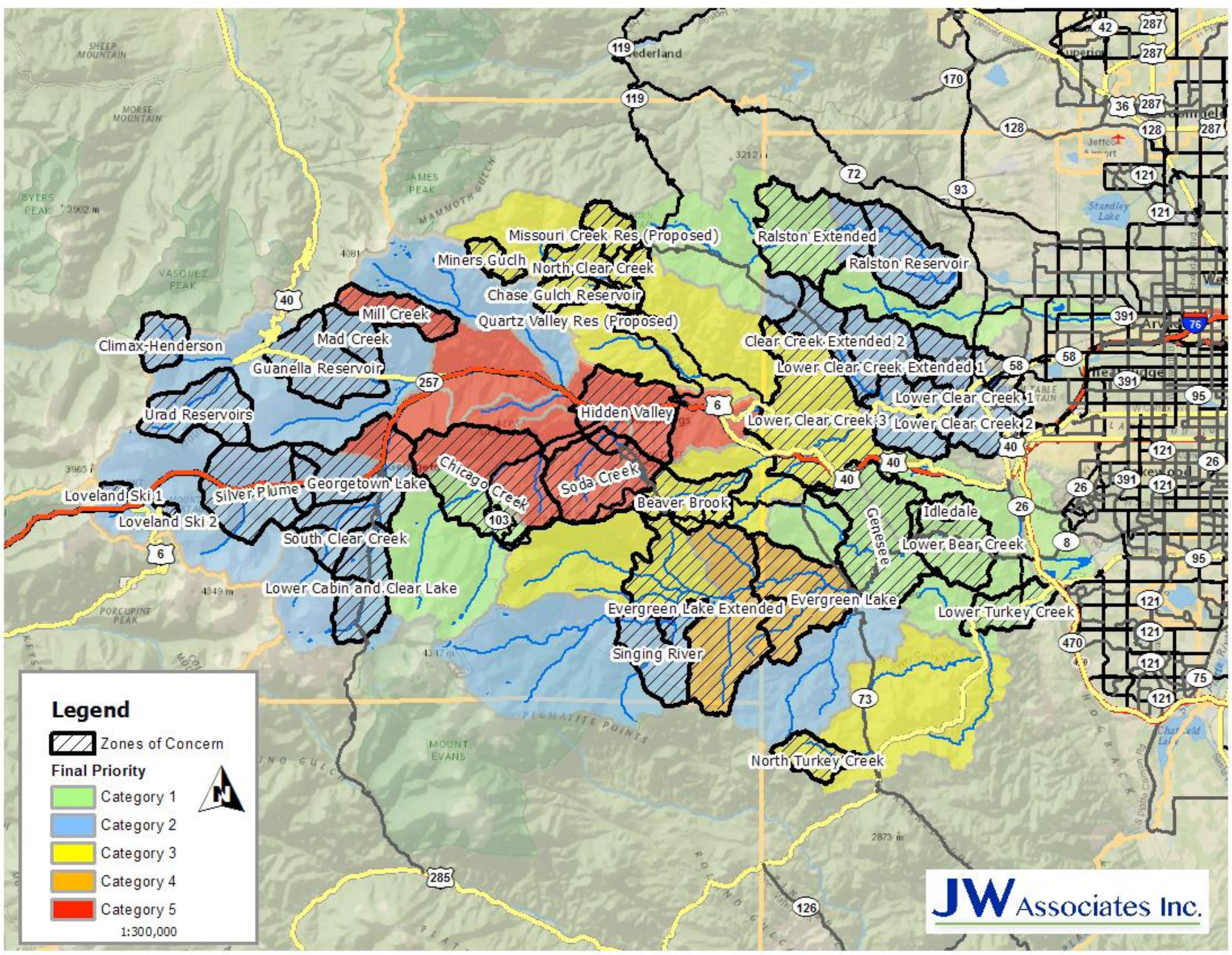
- Silver Gulch-Clear Creek
- Mill Creek-Clear Creek
- Soda Creek
- Outlet Chicago Creek
- City of Idaho Springs-Clear Creek

Zones of Concern (ZoC) are defined as areas upstream of water supply features that have a greater risk of conveying sediment and debris to that feature. ZoCs were defined for areas up to 11 miles upstream of each water supply feature in the watershed. The study then compared the ZoCs with sixth-level watershed hazard priority, the opportunities for hazard mitigation, and the constraints on various actions. Examples of opportunities for forest management and hazard mitigation include conifer removal, and developing tree age diversity and aspen stands. Constraints include private land ownership, land slope, and road access.

The priority assessment and ZoC discussion can be used by stakeholders to determine and prioritize the types of forest management activities necessary to protect water supply quality from wildfire hazards. The final priority watersheds with zones of concern developed from the study are shown in Figure 4-3.

Figure 4-3: Comparison of ZoC to Watershed Final Priority

(Source: Figure 13. Clear/Bear Creek Wildfire/Watershed Assessment, JWA, 2013)



4.11 High Peaks to Headwaters EA

Watershed restoration is a core management objective of the National Forests and Grasslands in accordance with the US Department of Agriculture Strategic Plan for FY 2010-2015. The Forest Service developed the Watershed Condition Framework (WCF) to assess watershed conditions; the results of the WCF show that within the Clear Creek Ranger District, "three sixth-level watersheds are impaired, nine are functioning at risk, and four are properly functioning". The High Peaks to Headwaters Watershed and Fisheries Restoration Environmental Assessment (USFS, 2013b) proposes restoration projects to improve and/or maintain watershed conditions within the Clear Creek Ranger District.

For this Environmental Assessment, the following four sixth-level watersheds were selected for watershed and aquatic habitat improvement:

- South Clear Creek (HUC 10190004-0101),
- Headwaters West Chicago Creek (HUC 10190004-0204),
- West Fork Clear Creek (HUC 10190004-0103), and
- Headwaters Clear Creek (HUC 10190004-0102).

The goal is to improve or maintain watershed conditions through restoration of aquatic and riparian areas. Objectives include improving in-stream aquatic habitat for streams with high fishery value, improving water quality and in-stream habitats by improving road/stream crossings, reducing impacts to water quality and aquatic habitats by decommissioning roads that negatively affect watershed conditions, and restoring and enhancing floodplains and off-channel wetland habitats.

To achieve the goals and objectives, proposed projects target several factors to improve watershed conditions. The primary factors related to water quality include erosion and sedimentation. Projects proposed to mitigate effects of erosion and sedimentation include stream restoration and bank stabilization, improved aquatic organism passage at stream crossings, road maintenance, and road decommissioning. Stream restoration and bank stabilization projects will also enhance fish habitat. Annual monitoring of project effectiveness will be conducted for three years.

The Acting District Ranger issued a Decision Notice and Finding of "No Significant Impact" in August 2013. Ultimately, the Decision Notice recommends projects from the Environmental Assessment including:

- Place boulders and/or log structures on approximately 24 miles of streams
- Restore, and otherwise stabilize, approximately 20 miles of streambanks in the Headwaters Clear Creek (10190004-0102)
- Install and/or replace up to 15 road/stream crossing structures with those designed to pass aquatic organisms
- Perform general road maintenance on roads having impacts to wetlands or aquatic habitats
- Decommission 6.9 miles of Nation Forest System roads

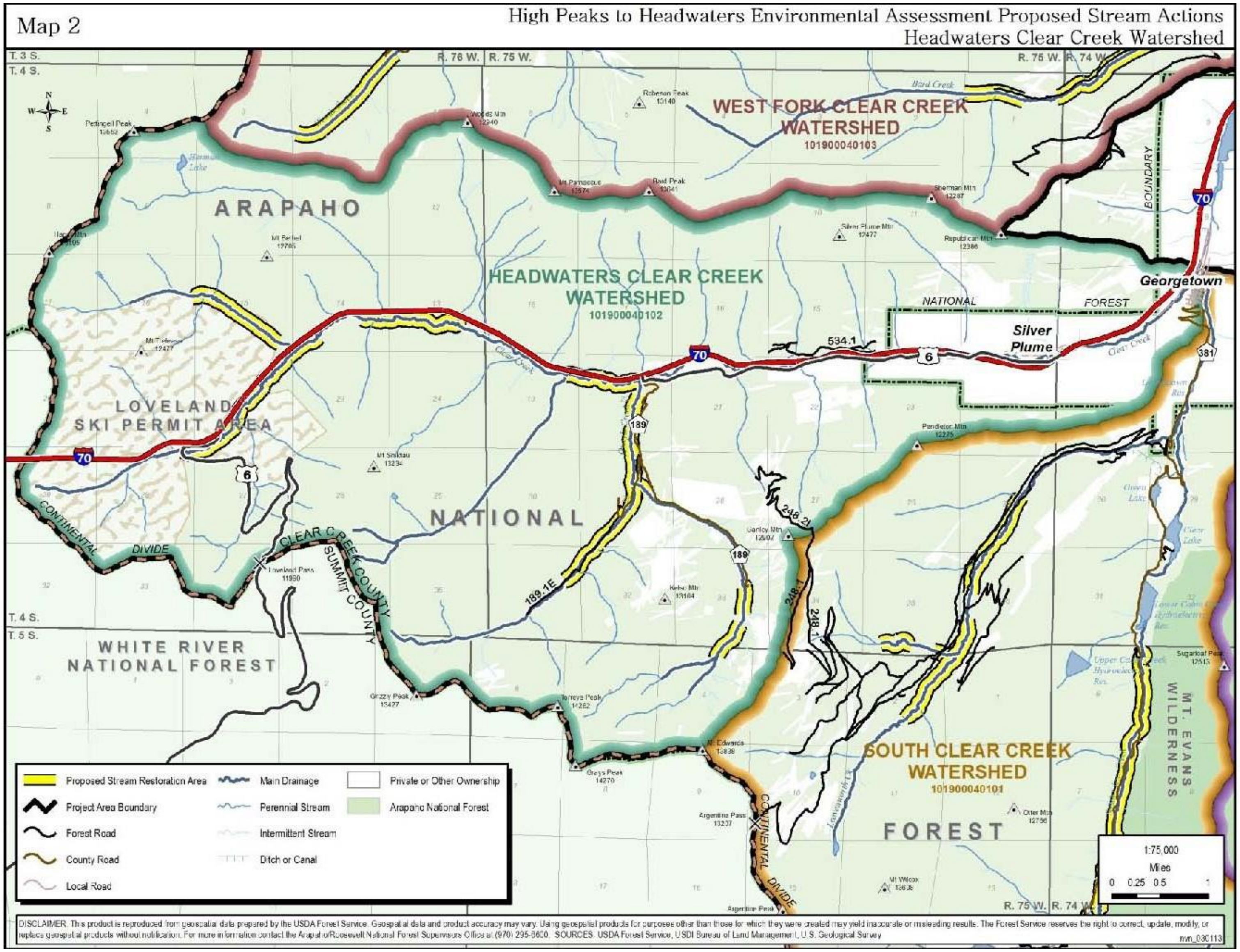


Figure 4-4: Headwaters Clear Creek Proposed Stream Improvement Projects
(Source: Map 2 High Peaks to Headwaters Fisheries and Watershed EA, USDA-FS, 2013)

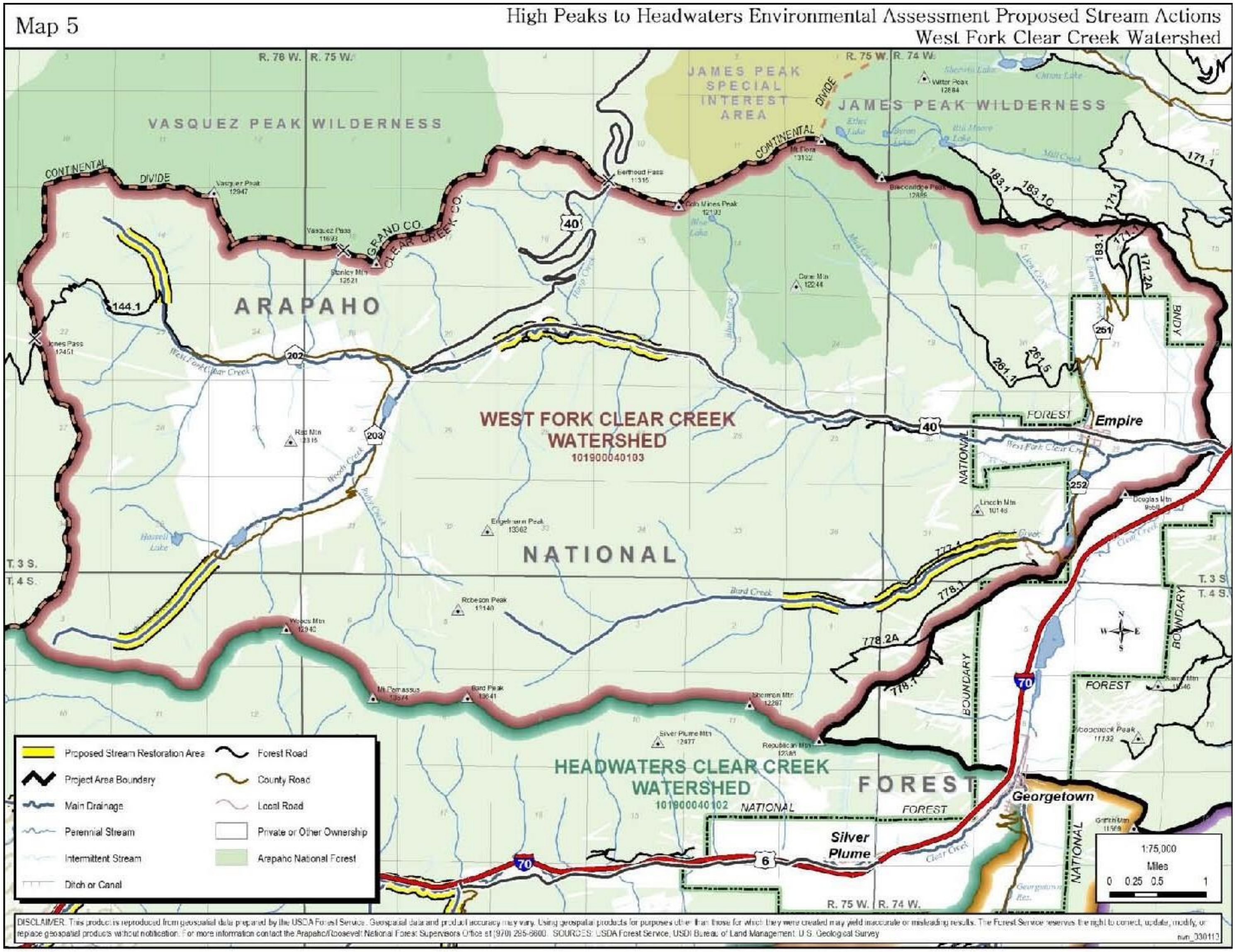


Figure 4-5: West Fork Clear Creek Watershed Proposed Stream Improvements
(Source: Map 5 High Peaks to Headwaters Fisheries and Watershed EA, USDA-FS, 2013)

4.12 CDOT Highway-related Water Quality Studies in Upper Clear Creek Watershed

4.12.1 U.S. Highway 40 Berthoud Pass East

The Colorado Department of Transportation (CDOT) has been operating and maintaining U.S. Highway 40 over Berthoud Pass since 1940. Berthoud Pass crosses the Continental Divide between the towns of Empire and Fraser, Colorado. Highway re-construction was started in 1999 to improve safety and mobility on the east approach between Berthoud Falls and the summit, in Clear Creek County. Phases 1 and 2 of the project were completed in 2002, while Phase 3 was completed in 2006.

An Environmental Assessment (EA) and Section 404 permit for the highway reconstruction project were completed in 1997 (D&M/JFSA, 1997). The EA identified excessive sedimentation of local streams and forested areas as a primary environmental concern caused by highway runoff on Berthoud Pass. The sedimentation is primarily caused by the transport and deposition of traction sand that is applied to the highway during winter to maintain mobility. Wetland areas were identified for monitoring of water quality impacts, including a unique wetland fen at Horseshoe Bend.

Hoop Creek, a tributary to West Clear Creek, drains the Berthoud Pass East area. Hoop Creek water quality was monitored and evaluated by CDOT from 1997 to 2009 pursuant to the requirements of the EA and Section 404 Permit for the Berthoud Pass East reconstruction project. Traction sand and salt from highway operations is transported in surface runoff into Hoop Creek and its tributaries, increasing contaminant loading and degrading aquatic habitat. The purpose of the monitoring was to assess the effects of U.S. Highway 40 winter maintenance operations and improvements associated with implementation of Best Management Practices (BMPs) on stream water quality along Berthoud Pass East. Monitoring data was evaluated and presented in annual reports (CDOT, 2010).

Permanent sediment control structures were installed as part of the new highway design. The effectiveness of these permanent BMPs was evaluated with respect to highway maintenance and stream sediment loading. A maintenance plan entitled "East Side Berthoud Pass US Highway 40 BMP Maintenance Manual" was developed in 2007 that served as a guidance document for winter and summer maintenance operations as they related to highway sanding and sediment control (CDOT, 2007).

The following provides a summary of results from the Berthoud Pass monitoring as it relates to stream water quality.

- Hoop Creek flow is strongly influenced by inflows from the Berthoud Pass Ditch trans-mountain diversion. Discharge from the ditch typically comprises 40 to 70 percent of the flow in Hoop Creek when operating, but can comprise over 80 percent of the Hoop Creek flow at times.
- Discharge from the Berthoud Pass Ditch has resulted in significant slope and channel erosion and sedimentation in Hoop Creek from the headwaters on Berthoud Pass to Floral Park.
- The total sediment load in Hoop Creek is correlated with May-June rising snowmelt flows when higher sediment transport takes place. The higher sediment loads measured in

2007 were not associated with greater snowmelt flows, but instead appear to be related to discharge from trans-mountain diversions and associated stream channel erosion.

- A robust positive correlation between total sediment and phosphorus was established using Hoop Creek water quality data from this study. These results show that suspended sediment concentrations up to 70 mg/L are not likely to cause total phosphorus concentrations to exceed 0.11 mg/L phosphorus interim standard value.
- Hoop Creek specific conductance (a measure of dissolved salt concentration) was elevated approximately one order of magnitude higher than background tributaries in the watershed, especially during the winter and early spring. Salt concentrations consisting primarily of sodium-chloride are elevated in Hoop Creek and in the Horseshoe Bend Fen from the use of sand/salt mixtures associated with winter highway maintenance. Results show a trend of higher stream chloride concentrations in recent years along with an increased frequency of standard exceedence in Hoop Creek.
- Both ambient (non-storm event) and runoff event dissolved metal concentrations (copper, manganese, zinc) remained low or below detection limits in Hoop Creek samples throughout the study.
- The Horseshoe Bend Fen shows a seasonal variation in groundwater-surface water interaction, with a decreasing trend in groundwater levels in the MW-2 and MW-5 areas. The ground surface elevation has increased in several areas of the fen as a result of traction sand deposition. This has modified the hydrology by lowering the groundwater table and drying-out certain areas of the fen, which will alter the vegetation type over time.
- Highway maintenance BMP data indicate that approximately 50 to 60 percent of the traction sand applied to Berthoud Pass East is now being captured and removed, a significant improvement from previous years. The information gathered from this monitoring program will be valuable for other high-elevation highways with similar maintenance and water quality conditions.

<u>Hydrologic Modification from Berthoud Pass Ditch Flows</u>

The Berthoud Pass west-east trans-mountain diversion ditch discharges to a swale at the Berthoud Pass Summit. The discharge has eroded a tributary branch to Hoop Creek between the Summit and Floral Park. The Berthoud Pass Ditch mean daily discharge for years 1932 to 2009 were obtained from the Colorado Division of Water Resources. These data show that ditch typically discharges to Hoop Creek from June to August each year with flows ranging from 5 to 20 cfs. However, in June 1997 the mean daily ditch discharge was 47 cfs, which constituted 100 percent of the Hoop Creek flow.

The percentage of Hoop Creek flow (at HC-5) contributed by the Berthoud Pass Ditch from 2001 to 2009 is illustrated in Figure 4-6. Data show that 40 to 70 percent of the flow in Hoop Creek is contributed by the ditch in June, coinciding with the highest sediment transport rates in Hoop Creek (CDOT, 2010).

Berthoud Pass Ditch discharges to a swale that has experienced severe erosion over the years (see Figures 4-7 to 4-9). Stabilization efforts were undertaken in 2005 to reduce erosion rates at the ditch discharge near the summit by the Cities of Northglenn and Golden. While these efforts were beneficial in reducing erosion near the discharge, additional work through the entire affected area is needed as shown by the continued erosion in 2007 (Figure 4-9). The stabilization efforts did not extend far enough downstream and channel erosion has continued between the summit and Floral Park. This hydrologic modification is causing overbank flows, severe bank erosion, down-cutting of the channel, and excessive sediment transport in Hoop Creek and West Clear Creek.

Figure 4-6: Hoop Creek and Berthoud Ditch

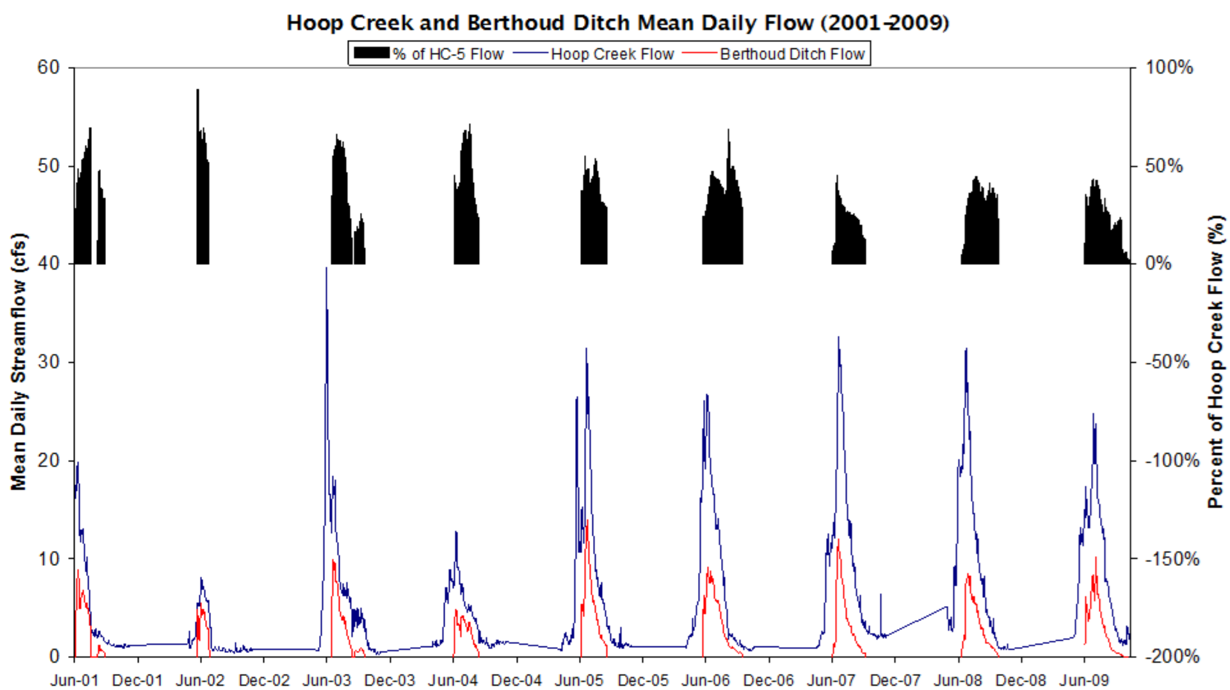


Figure 4-7: Berthoud Pass Ditch discharge channel showing massive soil loss September 25, 2001

Figure 4-8: Berthoud Pass Diversion channel during construction June 17, 2005

Figure 4-9: Berthoud Pass channel bank stabilization showing downstream erosion July 27, 2007

4.12.2 Interstate 70

An Interstate 70 Mountain Corridor Programmatic Environmental Impact Statement (PEIS) was conducted to assess alternatives to improve mobility on I-70 between Golden and Glenwood Springs, Colorado, a distance of approximately 150 miles. As part of the PEIS, a water quality study was conducted to better understand what influence the operation and maintenance of I-70 has on receiving stream water quality within the mountain corridor.

The Interstate 70 (I-70) mountain corridor Storm Water/Snowmelt Water Quality Monitoring Program was conducted from 2001to 2009 for selected streams along the highway. The monitoring program was conducted under the direction of CDOT with results reported in bi-annual reports (CDOT, 2011). The study evaluated the effects of I-70 on receiving stream water quality related to maintenance practices and material (sand and salt) that is constantly changing to meet the demands of the traveling public.

The objective of the monitoring program was to provide baseline information on potential water quality effects of suspended sediment, phosphorus, trace metals, and dissolved salts (sodium and magnesium chloride) on streams within the study corridor. These are contaminants of concern that may originate from the road surface and highway rights-of-way of I-70. The focus of the monitoring effort was to collect water quality information during snowmelt and rainfall runoff conditions. Generally, contaminants associated with highway runoff are mobilized and transported to receiving streams under these surface water hydrologic conditions.

Several monitoring sites were established on Clear Creek for the I-70 study. Water quality results from the highway monitoring report are summarized below.

<u>Highway Runoff</u>

- Total phosphorus concentrations were greater than 1 mg/L during several events at highway runoff Stations CC-231 and CC-239 in Clear Creek County. Dissolved phosphorus concentrations were less than 0.4 mg/L in all highway runoff samples, with an average concentration of 0.06 mg/L.
- Data show a strong correlation between suspended solids and total phosphorus, indicating phosphorus is associated with particulate sediment.
- Results suggest that because the phosphorus is primarily in particulate form associated with sediment, implementation of standard sediment control best management practices (BMPs) would be effective in reducing total phosphorus transport from I-70 to receiving streams.
- High chloride concentrations were measured in highway snowmelt runoff that is associated with sand/salt used on I-70 during winter. Although liquid magnesium chloride deicer is used in several areas of the study corridor, sample results show that highway runoff chemistry was dominated by sodium chloride.
- Copper, manganese, and zinc concentrations in I-70 runoff were greater at mineralized rock cuts in the Idaho Springs area, showing this area has uniquely higher dissolved metal concentrations when compared to national urban highway study results.

Upper Clear Creek

- Upper Clear Creek had the greatest frequency of rain-induced turbidity events of the high elevation I-70 corridor stations with an average of nine events per year at CC-1. Observations indicate the source of sediment may be both unconsolidated traction sand deposited along I-70 and US-6, and erosion of dirt parking lots at Loveland Ski Area.
- Mean concentrations of suspended solids and total phosphorus were typically higher than downstream Clear Creek stations during spring. The highest sodium-chloride concentrations sampled in Clear Creek were measured at CC-1. Trace metal concentrations were typically low or less than detection limits in upper Clear Creek storm event/snowmelt samples.
- The spring snowmelt period produced the majority of sediment load in 2006, 2008, and 2009, but summer events produce the majority in 2007. The total load at Station CC-1 ranged from 319 tons in 2007 to 609 tons in 2008 (Table 4-2)
- Total phosphorus concentrations were closely associated with sediment concentrations at upper Clear Creek Station CC-1 (Figure 4-9). Considering the strong correlation between suspended sediment and total phosphorus, results show that phosphorus loading is controlled by sediment transport rather than streamflow.
- A source of dissolved salts enters upper Clear Creek during winter and early spring causing substantial increases in specific conductance. Sampling results indicate the dominant salt composition in upper Clear Creek is sodium chloride rather than magnesium chloride.
- Results indicate a slight increasing trend in chloride concentrations for the period of record at upper Clear Creek Station CC-1 (Figure 4-10).
- Upper Clear Creek Station CC-1 exhibited concentrations of TSS, TP, dissolved salts, and manganese that were higher than background levels. Sources of sediment and dissolved salts include highway traction sand/salt accumulations along I-70 and US-6, and potential erosion of dirt parking lots at Loveland Ski area.
- The data suggest implementation of standard sediment control best management practices (BMPs) as source control measures would be an effective method of reducing total suspended sediment and phosphorus transport in Clear Creek.

Table 4-2: Clear Creek Sediment Loading Summary 2006-2009

Below Hermann Gulch (CC-1)

Year	Sediment Load (tons)	Base Load (tons)	Precipitation (Jul-Sep inches)	Flow Volume (acre-feet)
2006	573	132	7.97	19379
2007	319	71	7.45	10420
2008	609	129	9.72	18995
2009	513	113	3.24	16633

April-October period load and flow; base load assumes TSS conc. =5 mg/L

Figure 4-9: Total Suspended Sediment and Total Phosphorous

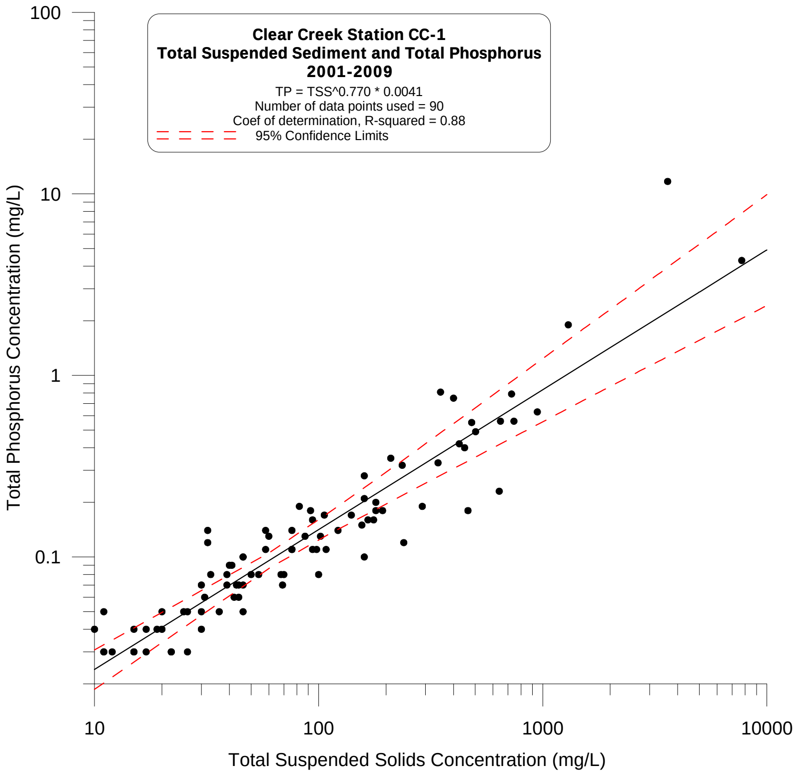
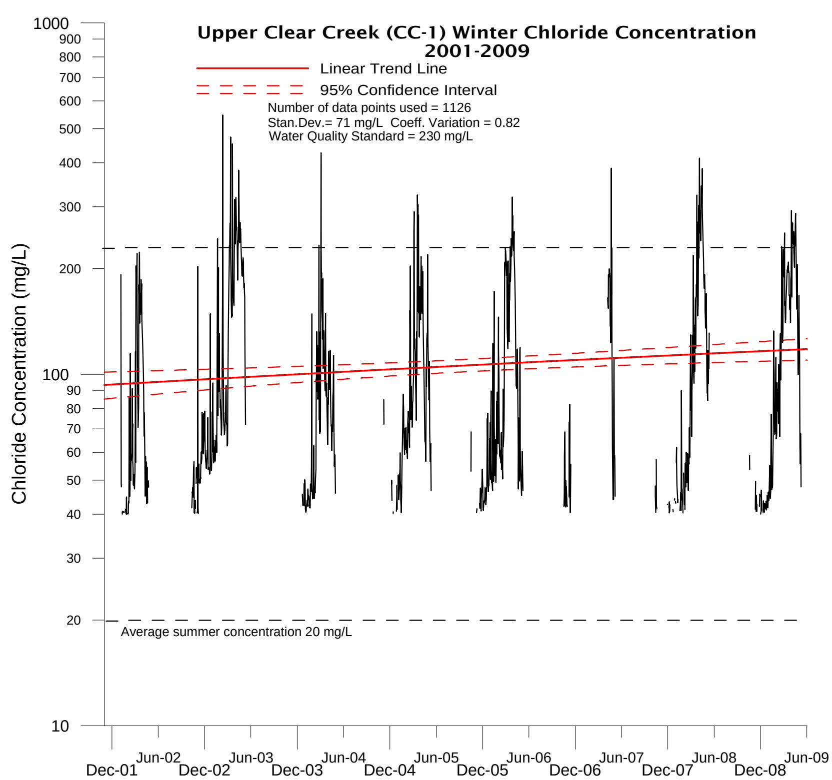


Figure 4-10: Winter Chloride Concentration



4.12.3 I-70 Clear Creek Corridor Sediment Control Action Plan (SCAP)

A *Sediment Control Action Plan* (SCAP) was developed in 2013 for the Interstate 70 (I-70) corridor through a collaborative partnership between the Colorado Department of Transportation (CDOT) and local mountain communities. The SCAP document is a tool for CDOT and other agencies to better manage roadway traction sand and other highway-related sediment sources that can adversely impact the Clear Creek waterway (CDOT, 2013).

Sediment Control is collectively used to refer to all sources of sediment, including hillside erosion, cut and fill embankment erosion, and channel bank erosion. The SCAP study area is entirely within Clear Creek County and covers a 33-mile segment of I-70 from the east portal of the Eisenhower-Johnson Memorial Tunnel (milepost 215) to the eastern side of Floyd Hill at Beaver Brook (milepost 248).

The SCAP document, consisting of a Technical Report and Mapbook, provides the justification, technical basis and approach for controlling sedimentation within the I-70 roadway corridor along Clear Creek. This report describes existing conditions, environmental considerations and requirements, BMP design tools, CDOT's maintenance program, an estimate of costs, and an implementation approach plan. The SCAP developed a menu of applicable BMPs, and suggests how these may be implemented throughout the corridor.

The SCAP document was borne out of meetings with the Stream and Wetland Ecological Enhancement Program (SWEEP) Committee, an advisory committee consisting of fishery biologists, hydrologists and other watershed and water quality-related technical experts, community representatives and other potentially affected parties. SWEEP Committee members are seeking to improve stream and wetland conditions in the I-70 Mountain Corridor. The SWEEP Memorandum of Understanding (MOU) dated January 4, 2011 set the foundation for sediment control in the Clear Creek I-70 corridor.

Highway traction sand is a visible and obvious concern to the adjacent Clear Creek waterway, particularly in high elevation areas and narrow corridors where I-70 is in close proximity to the waterway. The primary source of sediment in upper Clear Creek is I-70 traction sand and slope erosion, while the primary source of sediment in lower Clear Creek is I-70 slope erosion, stream bank erosion, and offsite erosion of tributary drainages impacted by historic mining and local access roads. A generalized illustration of sedimentation in the Clear Creek I-70 corridor, taken from the SCAP, is provided in Figure 4-11.

Traction sand, slope erosion, and stream bank erosion are sources of sediment directly related to the operation and maintenance of I-70. The amount of roadway traction sand is generally greatest at higher elevations associated with higher snowpack and colder temperatures. Slope erosion is most prevalent on steep gradient reaches of I-70 and where vehicle traction is most critical.

CDOT has committed to implementing the SCAP for each reconstruction project that is identified and funded; however, full implementation of the SCAP may take 20 years or longer. Therefore, a significant timing gap may exist for implementation of the SCAP recommended BMPs within the corridor. Upper Clear Creek Watershed Association (UCCWA) is the appropriate entity for overall watershed policy leadership. With membership including representatives from all the major water providers in the upper Clear Creek watershed, UCCWA's primary focus is to protect and enhance water quality within the watershed. UCCWA will periodically review the status of individual efforts for sediment control and look for opportunities to partner and leverage efforts to address sediment control facilities not being constructed by CDOT. A priority for sediment control is to capture sediment from the historic mining district. CDOT, as a cooperating partner, can allow the development of BMPs within the right-of-way to benefit water quality in Clear Creek.

Figure 4-12: Generalized Illustration of Sedimentation in Clear Creek (CDOT, 2013)

4.13 ENS Status

Clear Creek County's Office of Emergency Management manages the Clear Creek Emergency Notification System for Downstream Water Users. The Office manages a call list used to notify Clear Creek water users when there has been a contamination that may affect water quality and when the contamination has been contained. The latest ENS call list, updated November 2013, can be found in Appendix A.

5.0 Sediment, Nutrients and Metals

Monitoring results have shown that high sediment concentrations result in higher nutrient and total trace-metal concentrations in Clear Creek (CCC, 2013b). There are currently no numeric sediment or nutrient standards for Clear Creek. A maximum total phosphorus concentration of 0.10 mg/L has been recommended by EPA for many years to prevent eutrophication in flowing streams. An in-stream total phosphorus concentration interim standard value of 0.11 mg/L has been adopted by CDPHE for Clear Creek.

Trace-metal standards in Clear Creek are largely based on the dissolved form of the metal rather than the total form. Dissolved metal concentrations are regulated primarily to prevent toxicity to aquatic organisms (aquatic insects and trout). Allowable total metal concentrations for drinking water are generally higher than dissolved metal concentrations for aquatic toxicity. However, total metal concentrations associated with sediment can be high enough in Clear Creek to affect public water supplies. The principle concerns and study results involving sediment, nutrients, and metals are discussed in the following subsections of Chapter 5.

5.1 Clear Creek Watershed Management Agreement

Protection of source water quality is becoming increasingly critical in order to protect public health, avoid increased treatment costs, prevent aesthetic water quality problems such as taste and odor events, and to meet new regulatory standards. Disinfection of potable water supplies is critical in preventing waterborne disease. When water is disinfected, undesirable disinfection byproducts are formed. A number of these compounds are known carcinogens, so it is imperative that these compounds are kept at low levels. Since higher concentrations of nutrients and algae in lakes and reservoirs can lead to higher levels of disinfection byproduct precursors in source water, improving control of nutrient sources is important to assure compliance with the new regulations (SWPP, 2010).

In response to the request by the Standley Lake Cities (SLC) for a Rulemaking Hearing to establish water quality standards and resulting nutrient control regulations for Standley Lake, 23 entities developed and agreed to the Clear Creek Watershed Management Agreement (Agreement). This Agreement, adopted in December 1993, sought to address certain water quality issues and concerns within the Clear Creek Basin, focusing on issues that could affect water quality in Standley Lake. The parties to this Agreement are governmental agencies and private corporations having land use, water supply, and/or wastewater treatment responsibilities within the Clear Creek Basin. The Agreement requires the parties to develop a report on an annual basis and submit it to the Water Quality Control Commission (WQCC).

The SLC submitted a proposal to the WQCC for a chlorophyll standard to protect the water quality of Standley Lake. UCCWA supported this and the WQCC approved a chlorophyll standard of 4.0 ug/L with a permissible exceedence threshold of 4.4 ug/L once every five years. Chlorophyll was selected as the control of choice due to uncertainties surrounding the direct response of algae to nutrients (phosphorus and nitrogen) and other factors that may affect this relationship. The intent of the chlorophyll standard is to protect the current classified uses and status quo of the water quality in Standley Lake.

5.2 Sediment and Associated Contaminants

5.2.1 Ambient (non-storm event) Conditions

UCCWA conducts an ambient nutrient monitoring program in Clear Creek. Water samples have been collected at varying frequencies and at multiple locations in Clear Creek and selected tributaries since 1994. Ambient samples are collected according to a pre-determined schedule and hence are not targeted towards any specific daily water quality condition. Most of these water samples were collected under non-storm runoff conditions in Clear Creek and nearly the entire database for trace metals, nutrients, and suspended sediment represents ambient stream conditions. Storm water event sampling in Clear Creek did not start on a regular (yearly) basis until 2001, and event sampling has taken place at only a few select locations (see 5.2.2).

Ambient sediment and nutrient concentrations in Clear Creek are low relative to storm event concentrations. Ambient turbidity is typically less than 5 NTU, and suspended solids concentrations are less than 5 mg/L. Current ambient trace metal conditions were discussed in Section 2.2.

A Nutrient Management Control Regulation (5 CCR 1002-85) was adopted by the Colorado Department of Public Health and Environment, Water Quality Control Commission in July 2012. This regulation includes an in-stream phosphorus interim standard value of 0.11 mg/L and an in-stream nitrogen interim standard value of 0.4 mg/L for Clear Creek.

Clear Creek Consultants (CCC) was tasked to evaluate recent trends in Clear Creek nutrient concentrations using the UCCWA data, and compare results to the proposed interim standard values (CCC, 2011). Total phosphorus and nitrogen sample concentration results have been compiled on an ongoing basis and reported in spreadsheet form. The most recently available compilation (1994-2010) was obtained from UCCWA for use in the analysis. The UCCWA data included time-series data plots (1994-2010) in the spreadsheet provided to data users.

The ambient sampling frequency for nutrients was reduced from eight to two times per year at several locations starting in 2005. The analysis looks at trends over the most recent six years (2005-2010), also the time period in which nutrient reduction measures have been implemented at some wastewater treatment plants in the upper Clear Creek watershed. There are six contiguous locations on Clear Creek that are sampled twice per year (May and October) listed in downstream order:

- Bakerville (CC-05)
- Empire Junction above West Fork (CC-25)
- Lawson (CC-26)
- Idaho Springs above Chicago Creek (CC-34)
- Kermitts Gage (CC-40)
- Golden (CC-60)

The sampling results for these stations are shown in Figure 5-1 for the 2005-2010 period, with conclusions from the report summarized below.

5.2.2 Total Phosphorus

Stream profiles of total phosphorus (TP) concentrations at the six Clear Creek locations by year were developed along with total suspended solids (TSS) results for each sample for comparison. The following conclusions were taken from the TP data profiles:

1) Clear Creek TP concentrations from 2005-2010 were below the interim standard value.
2) No consistent source areas could be identified along the Clear Creek profile.
3) Concentrations generally increase slightly in a downstream direction.
4) TP increases are correlated with increases in TSS concentrations.
5) Concentrations of TP and TSS are typically higher in May than October.
6) There was little or no correlation between TP and TSS at TSS concentrations less than about 10 mg/L. However, a positive relationship between TP and TSS begins to emerge at TSS concentrations greater than 10 mg/L, when TP begins to increase with increasing TSS concentration.

5.2.3 Total Nitrogen

Stream profiles of total nitrogen (TN) concentrations at the six Clear Creek locations by year were developed along with total suspended solids (TSS) results for comparison. The following conclusions were taken from the TN data profiles:

1) Most of the TN found in Clear Creek is already in the stream upstream at Bakerville.
2) TN concentrations from 2005-2010 were near or above the interim standard value.
3) No consistent source areas could be identified along the Clear Creek profile.
4) No temporal patterns were apparent from the data.
5) TN can be correlated with TSS concentrations.
6) In Clear Creek the proposed TN standard can be exceeded at Bakerville and is regularly exceeded at Lawson, Kermitts, and Golden.
7) In West Clear Creek the TN concentrations were generally higher at Berthoud Falls and regularly exceed the proposed standard.
8) In North Clear Creek TN concentrations were typically less than the standard above Black Hawk, but exceed the standard near the mouth.

The results of this analysis indicate that total phosphorus concentrations in Clear Creek were below the interim standard value under ambient (non-storm event) conditions. The total nitrogen interim standard value is not achievable because background levels from nonpoint source areas in the Clear Creek Basin are higher than the interim standard value.

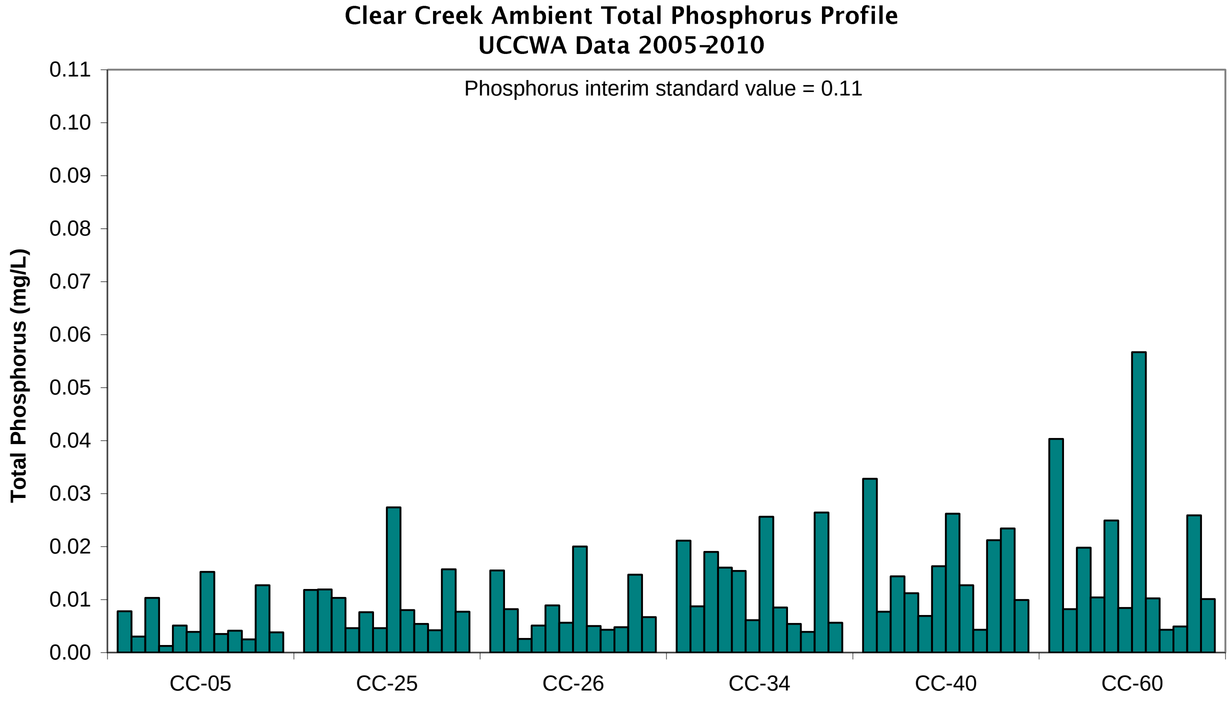


Figure 5-1: Sampling Data for Ambient Total Phosphorus 2005-2010

5.3 Storm Event Conditions

CDOT began a storm event/snowmelt runoff monitoring program in 2001 to assess the impacts of Interstate Highway 70 on Clear Creek water quality. This program generated some of the first routine systematic storm event data at multiple locations on Clear Creek from 2001 to 2009. Hoop Creek, a tributary to West Clear Creek, was also monitored during this period by CDOT to assess water quality conditions related to U.S Highway 40 on Berthoud Pass East. Results from these CDOT studies were reported in a series of annual reports.

UCCWA and CCWF have supported storm event water quality monitoring at the Clear Creek Kermitts gage since 2007 for various mine remediation studies. The City of Golden began a Clear Creek storm event water quality monitoring program at CC-59 in 2005, followed by the SLC in 2008 at three locations including the North Fork.

These monitoring programs are focused on collecting water samples with automated equipment during rainfall-runoff conditions. Clear Creek water quality can change dramatically under these conditions, largely caused by sediment that enters the waterway from multiple sources. The primary sediment sources are roadways and unconsolidated mine waste residuals.

The relationship between suspended solids (sediment) and nutrients for ambient (non-storm event) sample data is consistent with storm event sample data in Clear Creek. High suspended solids result in higher total nutrient concentrations, suggesting that the nutrients are associated with sediment in particulate form. Storm event data for Clear Creek stations CC-40 and CC-59 shown in Figure 5-2 indicate a strong positive correlation between TP and TSS (CCC, 2013b).

While Clear Creek meets the total phosphorus interim standard value under ambient conditions, the interim standard is often exceeded under storm event conditions. The Clear Creek monitoring station with the longest record of storm event data, above Johnson Gulch (CC-40), shows regular exceedences of the proposed standard (Figure 5-3). This data also shows that total phosphorus concentrations are associated with sediment.

To put the nutrient transport conditions into perspective, annual phosphorus loads were calculated for downstream station CC-59 (Clear Creek at Golden). Both the ambient and storm event phosphorus loads are compared for the available period of record 2007-2012 (Figure 5-4). These results indicate that most of the phosphorus load in Clear Creek each year is the result of storm event runoff. Approximately 30-35% of seasonal total phosphorus load is ambient, while 65-70% is attributable to storm event runoff from nonpoint sources (CCC, 2013b).

Metal concentrations including arsenic, cadmium, copper, lead, iron, manganese, and zinc can also be much higher than ambient levels during storm runoff conditions. The Clear Creek CC-59 data for manganese, an impurity in drinking water that can cause taste and odor problems, is shown in Figure 5-5. High manganese concentrations in Clear Creek have caused treatability issues for the City of Golden water supply. These data show that manganese regularly exceeds the drinking water maximum contaminant level (MCL) under storm event conditions.

The relationship between manganese and sediment is illustrated in Figure 5-6, which shows a strong positive correlation between total manganese and suspended solids. A similar relationship exists for cadmium, copper, lead, iron, and zinc.

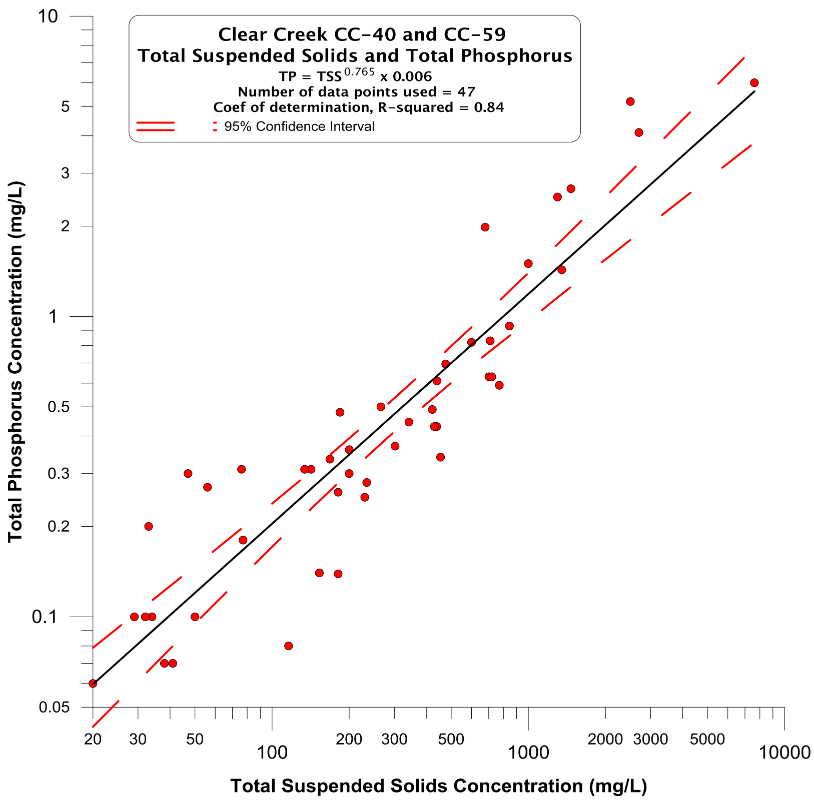


Figure 5-2: Suspended Solids and Total Phosphorus

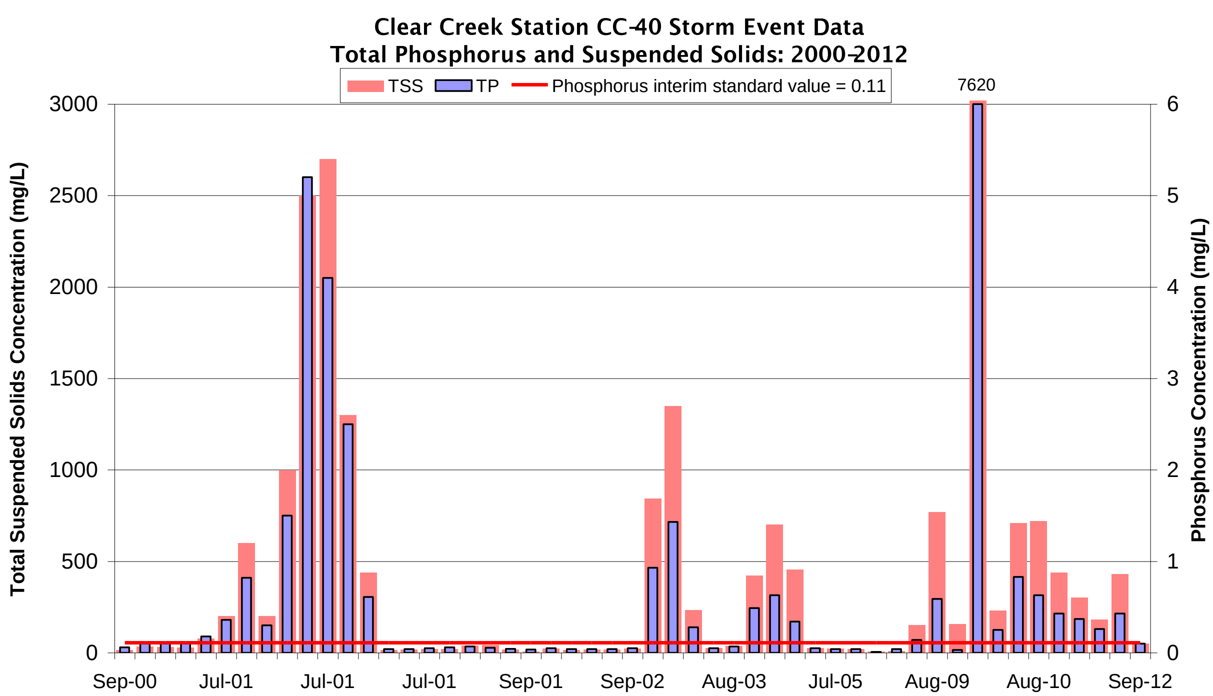


Figure 5-3: Total Suspended Solids and Phosphorus

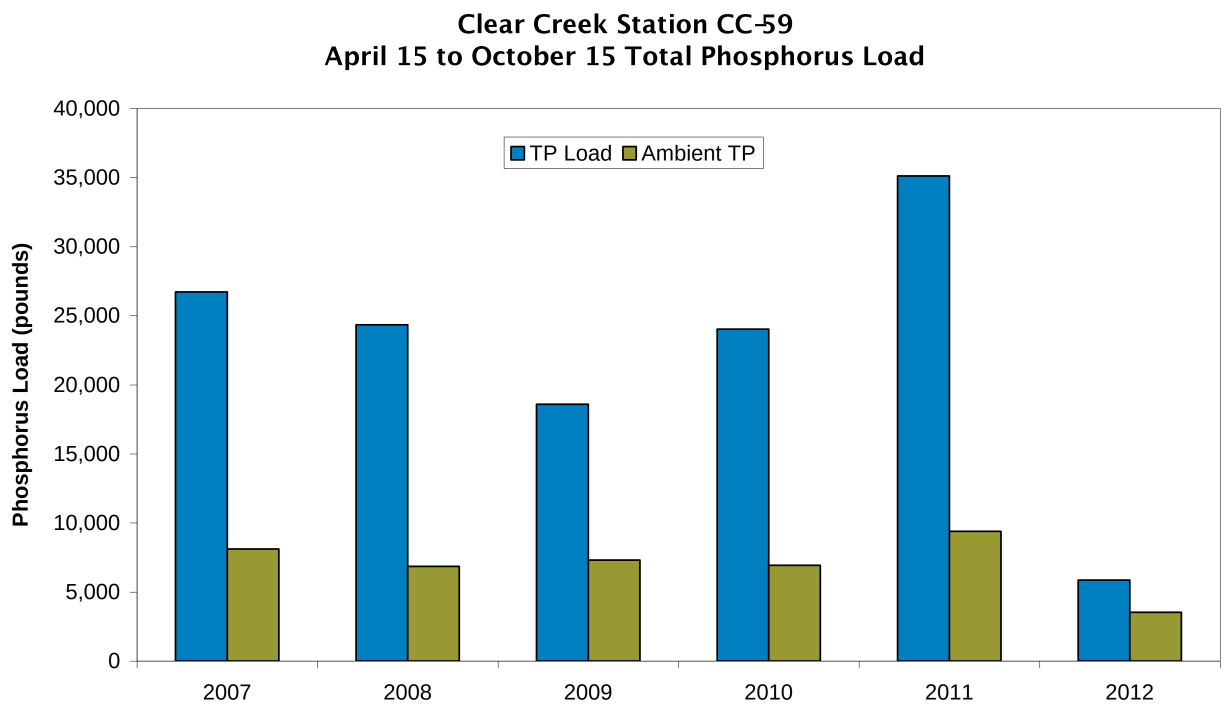


Figure 5-4: Phosphorus Load

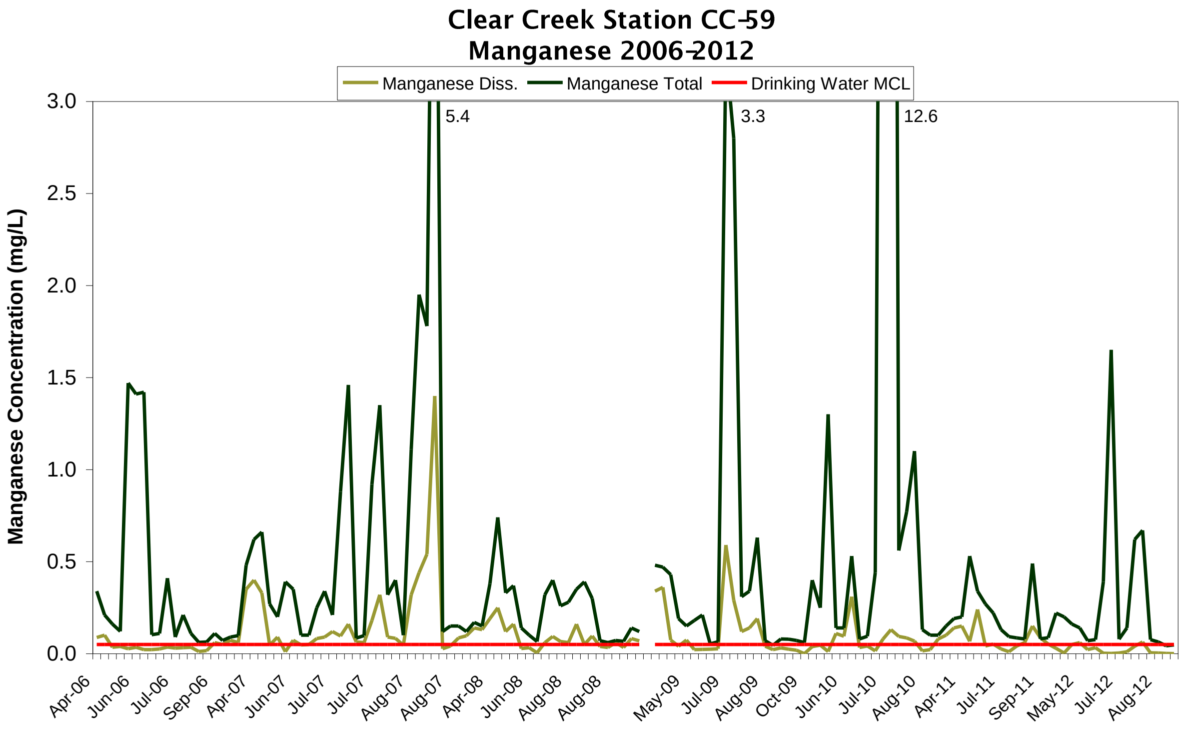


Figure 5-5: Manganese Concentrations

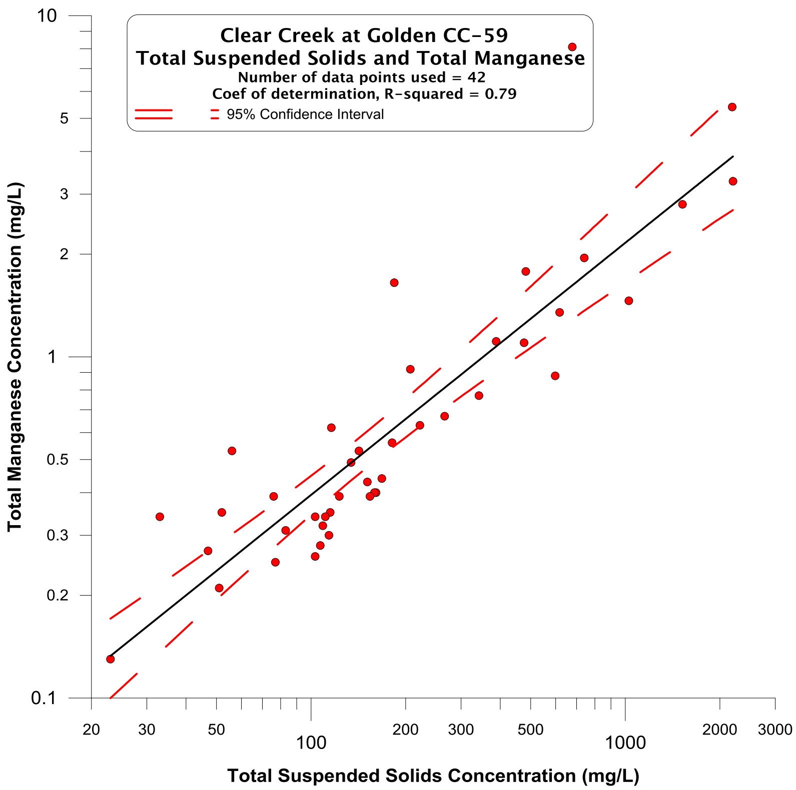


Figure 5-6: Suspended Solids and Total Manganese

6.0 Water Quality Status Summary

The original 2006 watershed plan provides substantial detailed analysis and reference on the status of trace metal conditions in the Clear Creek watershed. All of the CERCLA remedial actions planned for the Clear Creek/Central City Superfund Site had been implemented at the time of the previous plan, with the exception of collection and treatment of the Big 5 and Virginia Canyon drainages, and the National Tunnel and Gregory Incline discharges in the North Fork. These were primarily point source control measures. Dissolved trace metal concentrations have largely decreased or stabilized since these actions were completed.

The Upper Clear Creek Watershed Trace-Metals Data Assessment - 2013 Addendum Fact Sheet concluded that recent-period (2000-2013) remedial actions have achieved additional load reductions when compared to what might be expected due strictly to lower stream flows (TDS Consulting, 2013a). Stream-standard exceedences continue to be notable but relatively infrequent throughout the watershed, as characterized by data for the key monitoring sites.

Several Clear Creek tributaries listed as impaired for dissolved trace metals are now achieving standards including Mad Creek, Hoop Creek, Leavenworth Creek, Fall River, and South Clear Creek. The Clear Creek stream segments between Silver Plume and Mill Creek are very close to meeting dissolved trace metal standards. The remaining problem areas for segments currently listed as impaired include Clear Creek from Mill Creek downstream to Golden, Trail Creek, and North Fork.

Recent data indicates that total metal concentrations can exceed drinking water standards in Clear Creek and in tributaries such as Trail Creek during storm runoff conditions. These metals are associated with suspended sediment. The ultimate fate of these metals is not well understood; however, drinking water supplies are compromised by high metal concentrations. Water impoundment reservoirs such as Georgetown Lake have been shown to attenuate trace metals.

Studies conducted from 1997 to 2001 evaluated the significance of contaminated sediments in several tributaries of the North Fork. The OU4 preferred alternative (Scenario 4B) was modeled with an 80 percent reduction in sediment loads principally contributed by Russell Gulch and Gregory Gulch to the North Fork system.

Sediment is the primary source of nutrient loading for total phosphorus and nitrogen in Clear Creek, causing exceedences of the proposed standard. Seasonal nutrient loads generated by sediment are two to three times greater than ambient (non-storm event) loads each year. The primary sources of sediment include roads and unconsolidated mine waste residuals.

Water Quality Source Area Profile by HUC

The size and complexity of the upper Clear Creek watershed requires the area to be reduced to smaller management units for planning purposes. Hydrologic unit codes (HUC) were developed by the U.S. Geological Survey to enumerate watersheds to the sub-basin level. The 12-unit codes for the upper Clear Creek watershed are shown on the map in Figure 6-1. The HUCs provide convenient divisions for planning according to sub-basin drainage areas. These units are also used by the WQCD in the identification of stream segments for regulatory purposes.

Sources that are known or have the potential to impact water quality in Clear Creek were identified based on previous studies. The seven primary sources were:

- Spills from highways or Publicly Owned Treatment Works (POTW)
- Post-wildfire impacts
- Highway sediment/salt loading
- County road sediment loading
- Metal and aggregate mining
- Point source nutrient loading
- Channel erosion caused by hydrologic modification

Each HUC-12 area was evaluated according to these primary source impacts. Five impact categories ranging from low to high were used to rank each source in each HUC area (Table 6-1). This assessment was based on existing study results, stream data, and knowledge of sources in each sub-basin area. An overall ranking for each HUC area was developed with equal weighting for each of the seven primary sources. This ranking analysis provides an indication of which areas of the watershed have the highest water quality impacts and the greatest need for water quality mitigation.

The results of the source impact analysis indicating the overall rank for each HUC sub-basin area is shown in Figure 6-2. The high and moderately-high priority areas are those in which many future water quality improvements projects should be focused. Two of these, Idaho Springs and North Fork, were identified as high priority in the original 2006 watershed plan. Two others, West Clear Creek and Soda Creek, emerge as moderately-high priority by factoring all primary sources that can impact water quality, rather than trace metals only.

Maps showing the HUC sub-basin ranking results for each of the seven primary water quality impacts are provided in Figures 6-3 through 6-9. Large format maps showing projects and prioritization in the Clear Creek watershed can be found in Appendix B.

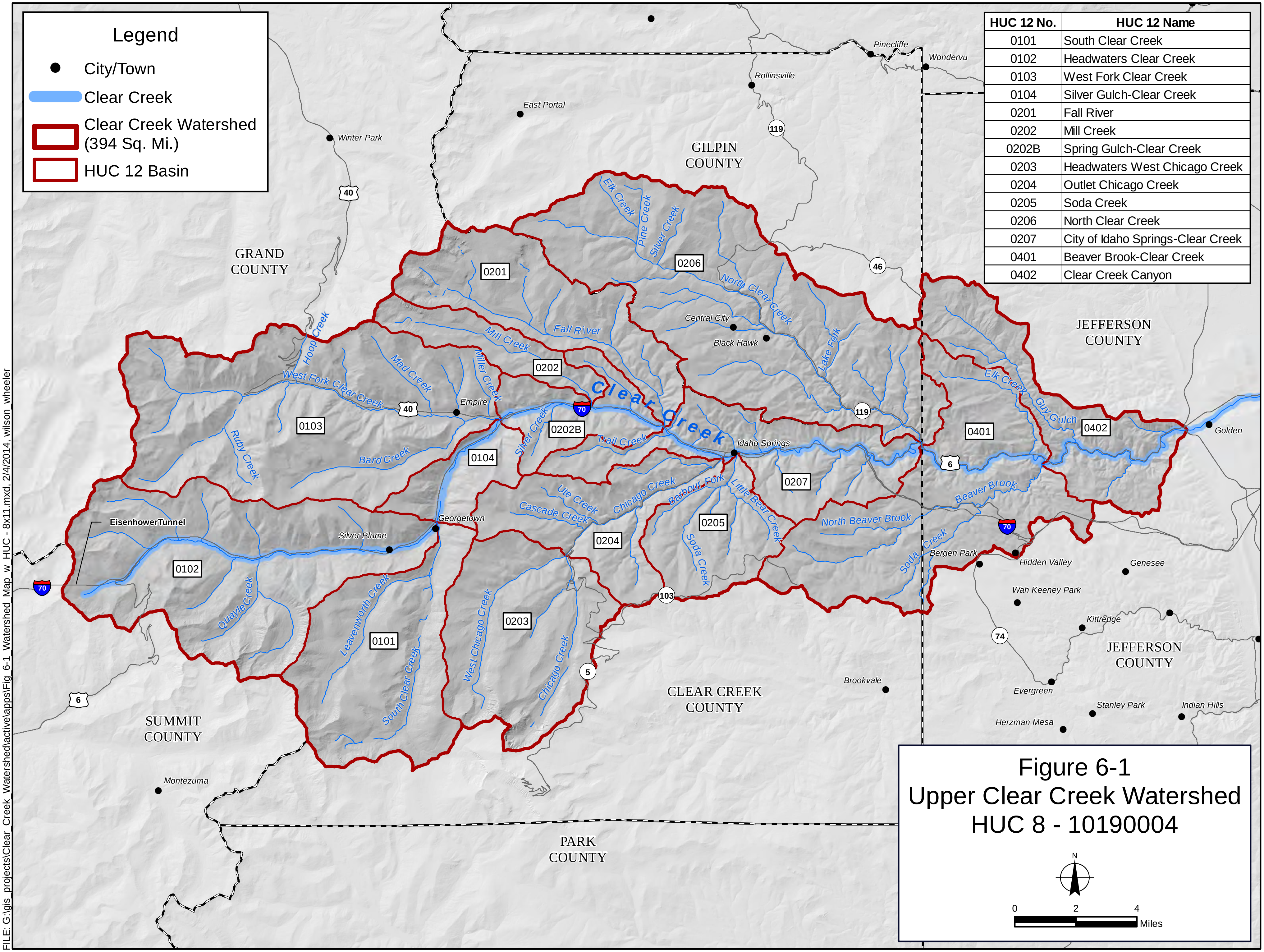
Table 6-1: HUC-12 Sub-basin Source Ranking Matrix

UPPER CLEAR CREEK WATERSHED PLAN UPDATE

HUC-12 Sub-basin Source Ranking Matrix

Primary Sources of Impacts to Water Quality

	Figure 6-3	*Figure 6-4*	*Figure 6-5*	*Figure 6-6*	*Figure 6-7*	*Figure 6-8*	*Figure 6-9*	*Figure 6-2*
HUC-12 SUB-BASIN AREA	**Spills from Highways or POTW**	**Post-Wildfire Impacts**	**Highway Sediment/Salt Loading**	**County Road Sediment Loading**	**Metal and Aggregate Mining**	**Point Source Nutrient Loading**	**Channel Erosion from Hydrologic Modification**	**Overall Rank**
Clear Creek Watershed-wide HUC 10190004	*High*	*Moderate*	*Moderate-High*	*Moderate-High*	*High*	*Moderate-Low*	*Moderate*	*Moderate-High*
Clear Creek Headwaters HUC-0102	*High*	*Low*	*High*	*Low*	*High*	*Moderate-Low*	*Moderate-High*	*Moderate-High*
South Clear Creek HUC-0101	*Moderate*	*Low*	*Moderate-High*	*Low*	*Moderate-High*	*Low*	*Moderate-High*	*Moderate*
Silver Gulch-Clear Creek HUC-0104	*High*	*Low*	*Moderate-Low*	*Low*	*Low*	*Moderate*	*Moderate*	*Moderate-Low*
West Clear Creek HUC-0103	*High*	*Low*	*High*	*Low*	*High*	*Moderate-Low*	*High*	*Moderate-High*
North Clear Creek HUC-0206	*High*	*Moderate*	*Moderate-High*	*Moderate*	*High*	*Moderate-Low*	*Moderate-High*	*Moderate-High*
Lower Clear Creek HUC-0402	*High*	*Moderate*	*High*	*Low*	*Low*	*Moderate-Low*	*Moderate*	*Moderate*
Mill Creek HUC-0202	*Low*	*High*	*Low*	*Moderate*	*Moderate*	*Low*	*Low*	*Moderate-Low*
Spring Gulch-Clear Creek HUC-0202B	*High*	*High*	*Moderate-High*	*Moderate-High*	*Moderate-High*	*Moderate*	*Moderate-High*	*Moderate-High*
Fall River HUC-0201	*Low*	*Moderate*	*Low*	*Moderate*	*Moderate*	*Low*	*Moderate-Low*	*Moderate-Low*
Chicago Creek HUC-0203/0204	*Moderate*	*High*	*Moderate*	*Moderate*	*Moderate*	*Low*	*Low*	*Moderate*
Soda Creek HUC-0205	*Low*	*High*	*Low*	*High*	*Moderate-High*	*Low*	*Low*	*Moderate*
Idaho Springs Area HUC-0207	*High*	*High*	*High*	*High*	*High*	*Moderate*	*Moderate-High*	*High*
Beaver Brook HUC-0401	*High*	*Moderate*	*High*	*Low*	*Low*	*Moderate-Low*	*Moderate*	*Moderate*



HUC 12 No.	HUC 12 Name
0101	South Clear Creek
0102	Headwaters Clear Creek
0103	West Fork Clear Creek
0104	Silver Gulch-Clear Creek
0201	Fall River
0202	Mill Creek
0202B	Spring Gulch-Clear Creek
0203	Headwaters West Chicago Creek
0204	Outlet Chicago Creek
0205	Soda Creek
0206	North Clear Creek
0207	City of Idaho Springs-Clear Creek
0401	Beaver Brook-Clear Creek
0402	Clear Creek Canyon

Figure 6-1
Upper Clear Creek Watershed
HUC 8 - 10190004

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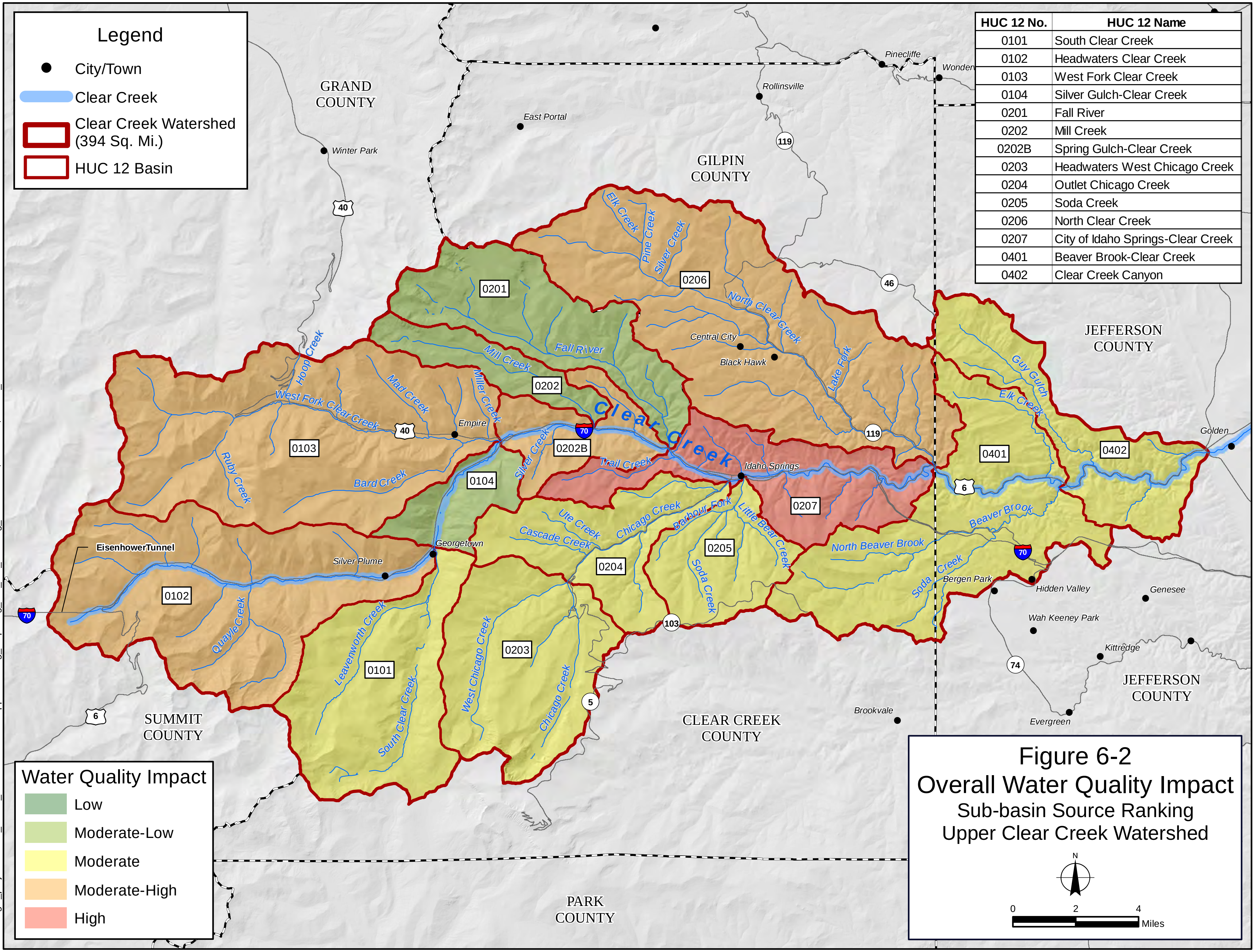

HUC 12 No.	HUC 12 Name
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0103	West Fork Clear Creek
0104	Silver Gulch-Clear Creek
0201	Fall River
0202	Mill Creek
0202B	Spring Gulch-Clear Creek
0203	Headwaters West Chicago Creek
0204	Outlet Chicago Creek
0205	Soda Creek
0206	North Clear Creek
0207	City of Idaho Springs-Clear Creek
0401	Beaver Brook-Clear Creek
0402	Clear Creek Canyon

Figure 6-2
Overall Water Quality Impact
Sub-basin Source Ranking
Upper Clear Creek Watershed

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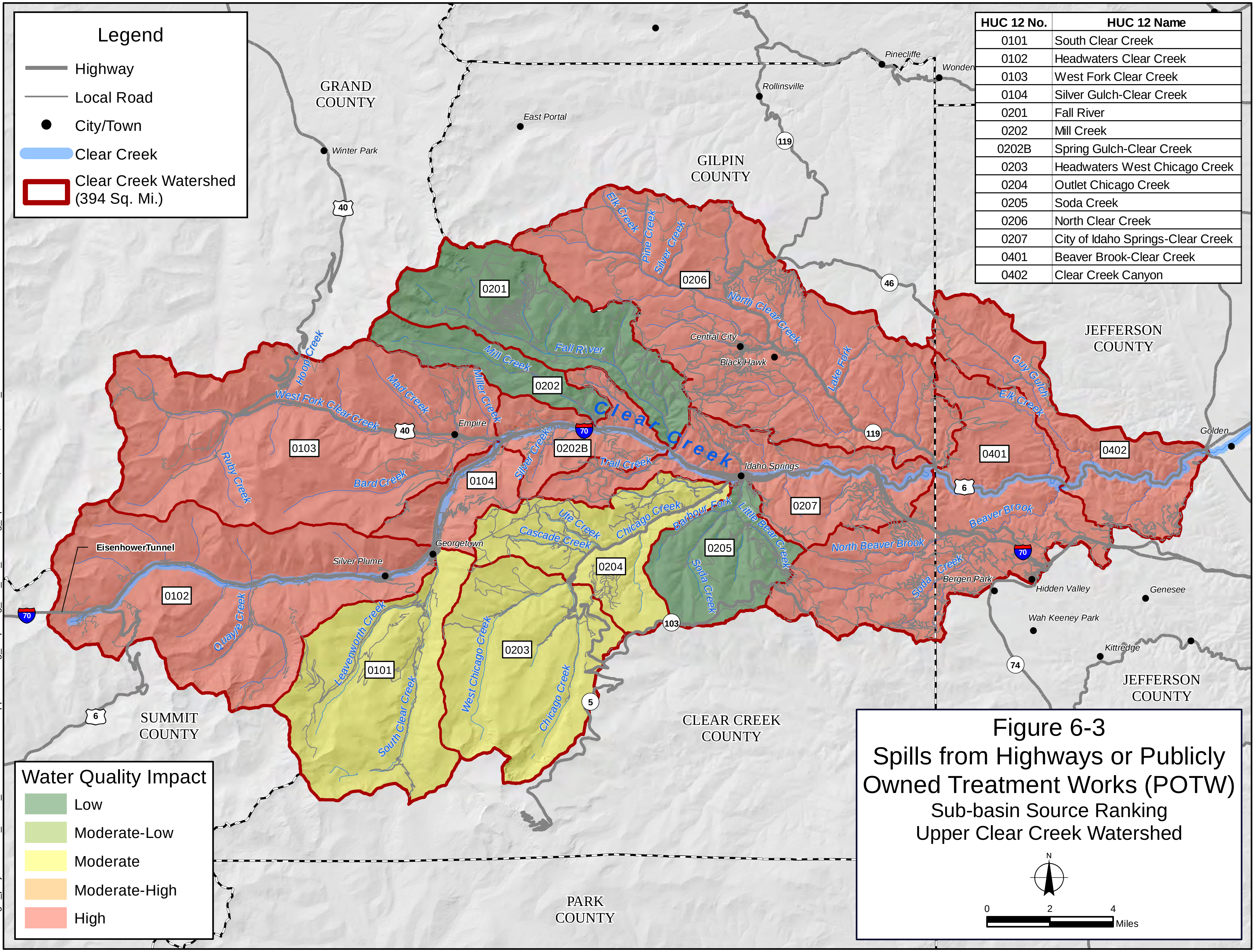

HUC 12 No.	HUC 12 Name
0101	South Clear Creek
0102	Headwaters Clear Creek
0103	West Fork Clear Creek
0104	Silver Gulch-Clear Creek
0201	Fall River
0202	Mill Creek
0202B	Spring Gulch-Clear Creek
0203	Headwaters West Chicago Creek
0204	Outlet Chicago Creek
0205	Soda Creek
0206	North Clear Creek
0207	City of Idaho Springs-Clear Creek
0401	Beaver Brook-Clear Creek
0402	Clear Creek Canyon

Figure 6-3
Spills from Highways or Publicly Owned Treatment Works (POTW)
Sub-basin Source Ranking
Upper Clear Creek Watershed

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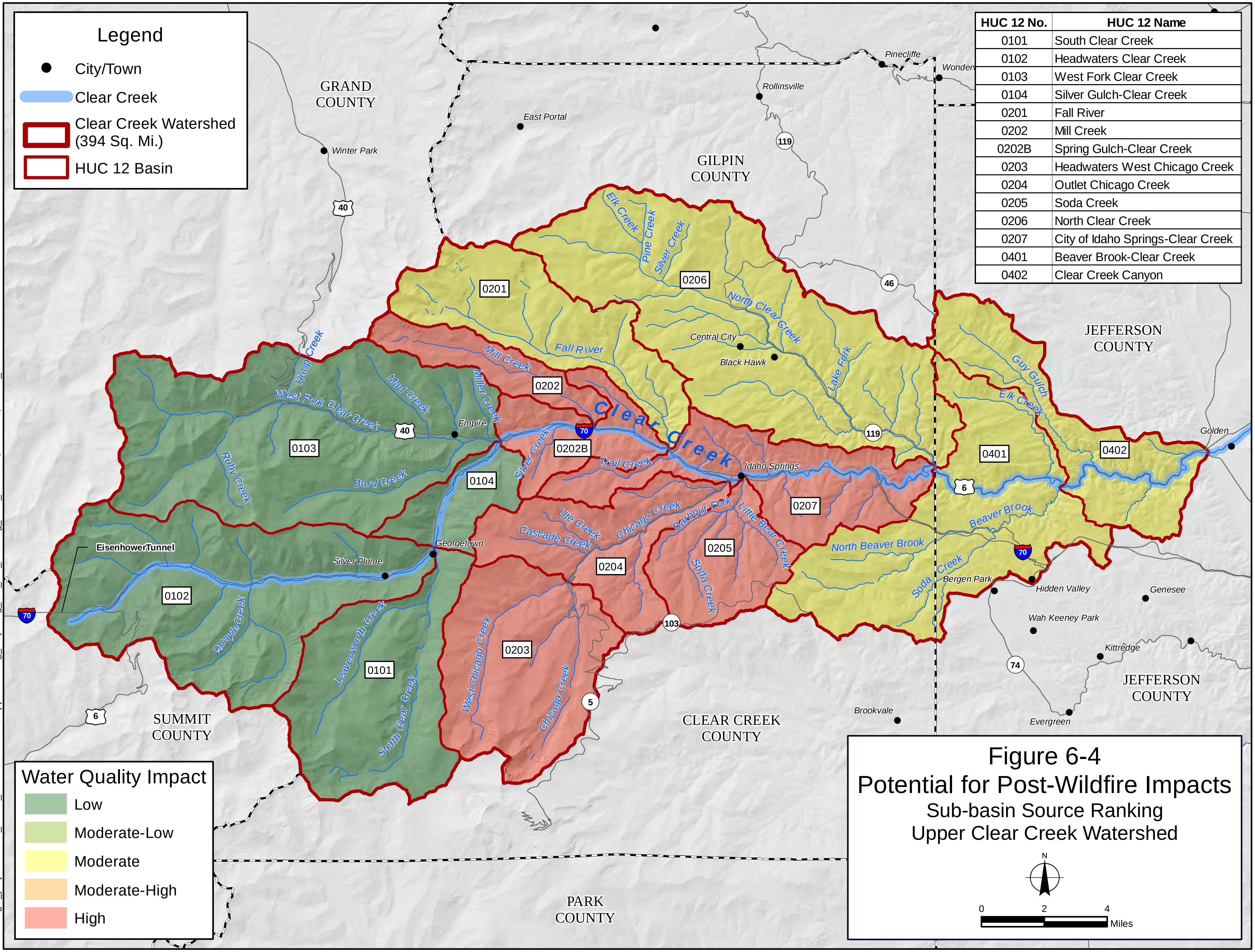

HUC 12 No.	HUC 12 Name
0101	South Clear Creek
0102	Headwaters Clear Creek
0103	West Fork Clear Creek
0104	Silver Gulch-Clear Creek
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0202	Mill Creek
0202B	Spring Gulch-Clear Creek
0203	Headwaters West Chicago Creek
0204	Outlet Chicago Creek
0205	Soda Creek
0206	North Clear Creek
0207	City of Idaho Springs-Clear Creek
0401	Beaver Brook-Clear Creek
0402	Clear Creek Canyon

Figure 6-4
Potential for Post-Wildfire Impacts
Sub-basin Source Ranking
Upper Clear Creek Watershed

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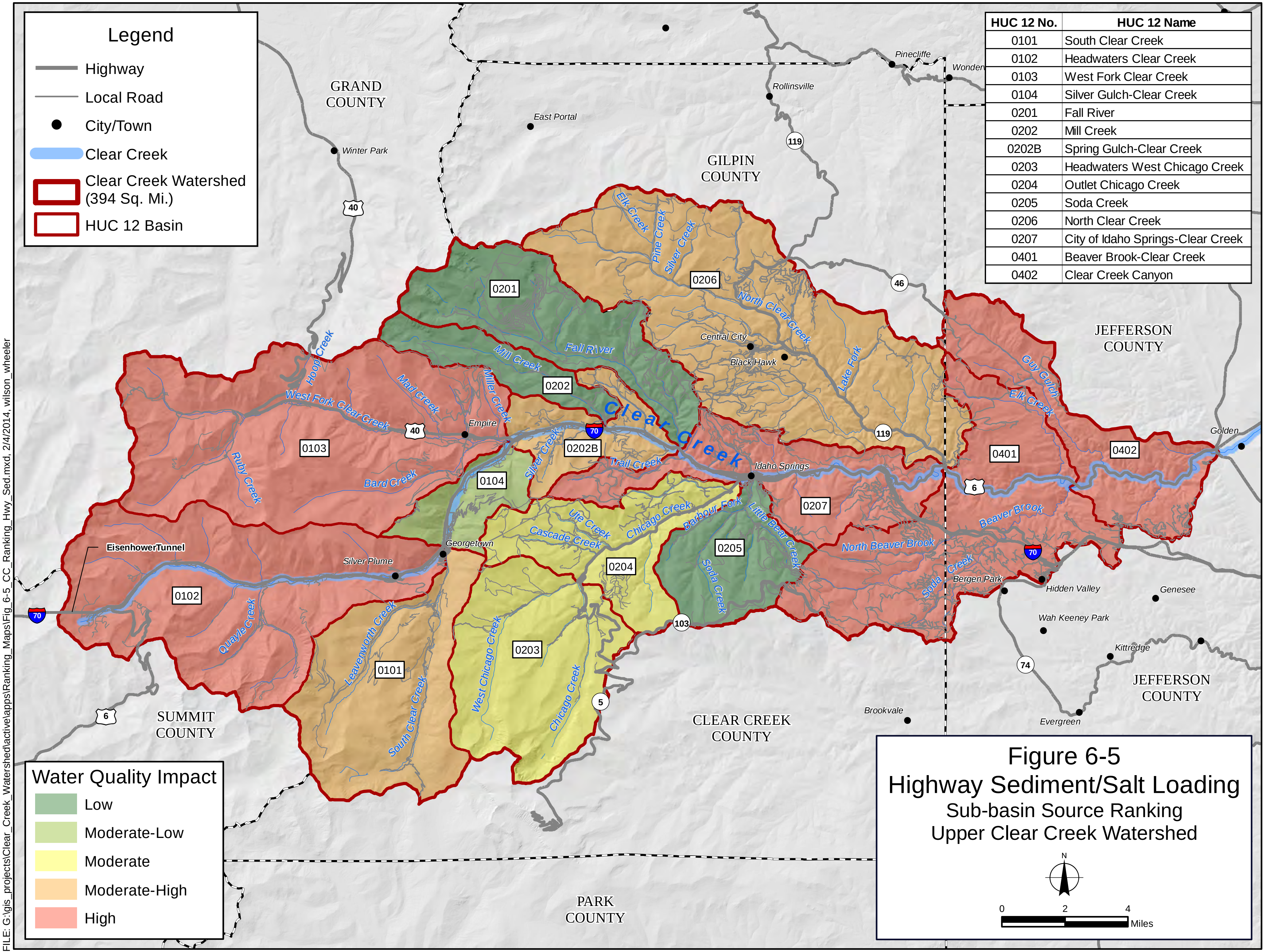
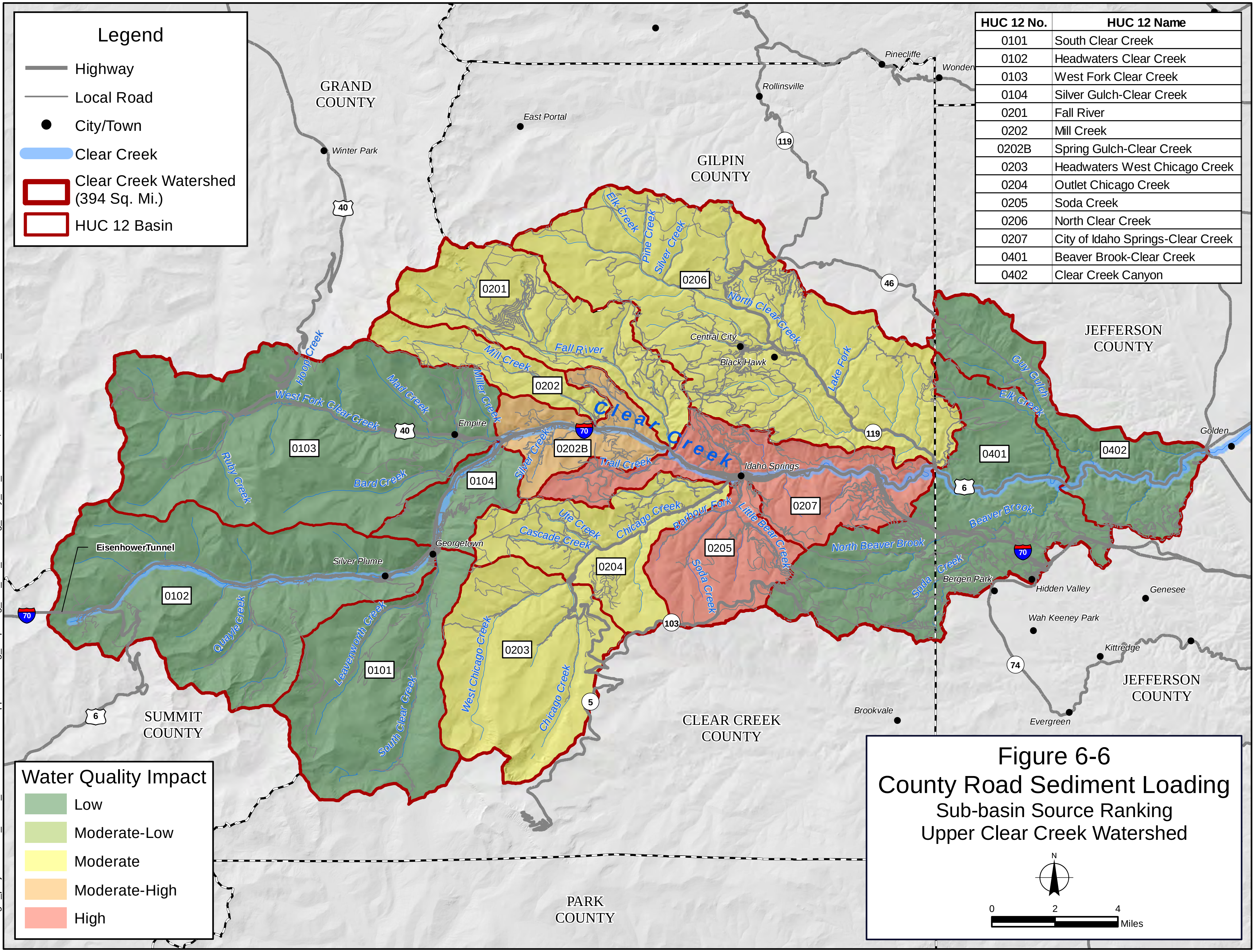


HUC 12 No.	HUC 12 Name
0101	South Clear Creek
0102	Headwaters Clear Creek
0103	West Fork Clear Creek
0104	Silver Gulch-Clear Creek
0201	Fall River
0202	Mill Creek
0202B	Spring Gulch-Clear Creek
0203	Headwaters West Chicago Creek
0204	Outlet Chicago Creek
0205	Soda Creek
0206	North Clear Creek
0207	City of Idaho Springs-Clear Creek
0401	Beaver Brook-Clear Creek
0402	Clear Creek Canyon

Figure 6-5
Highway Sediment/Salt Loading
Sub-basin Source Ranking
Upper Clear Creek Watershed

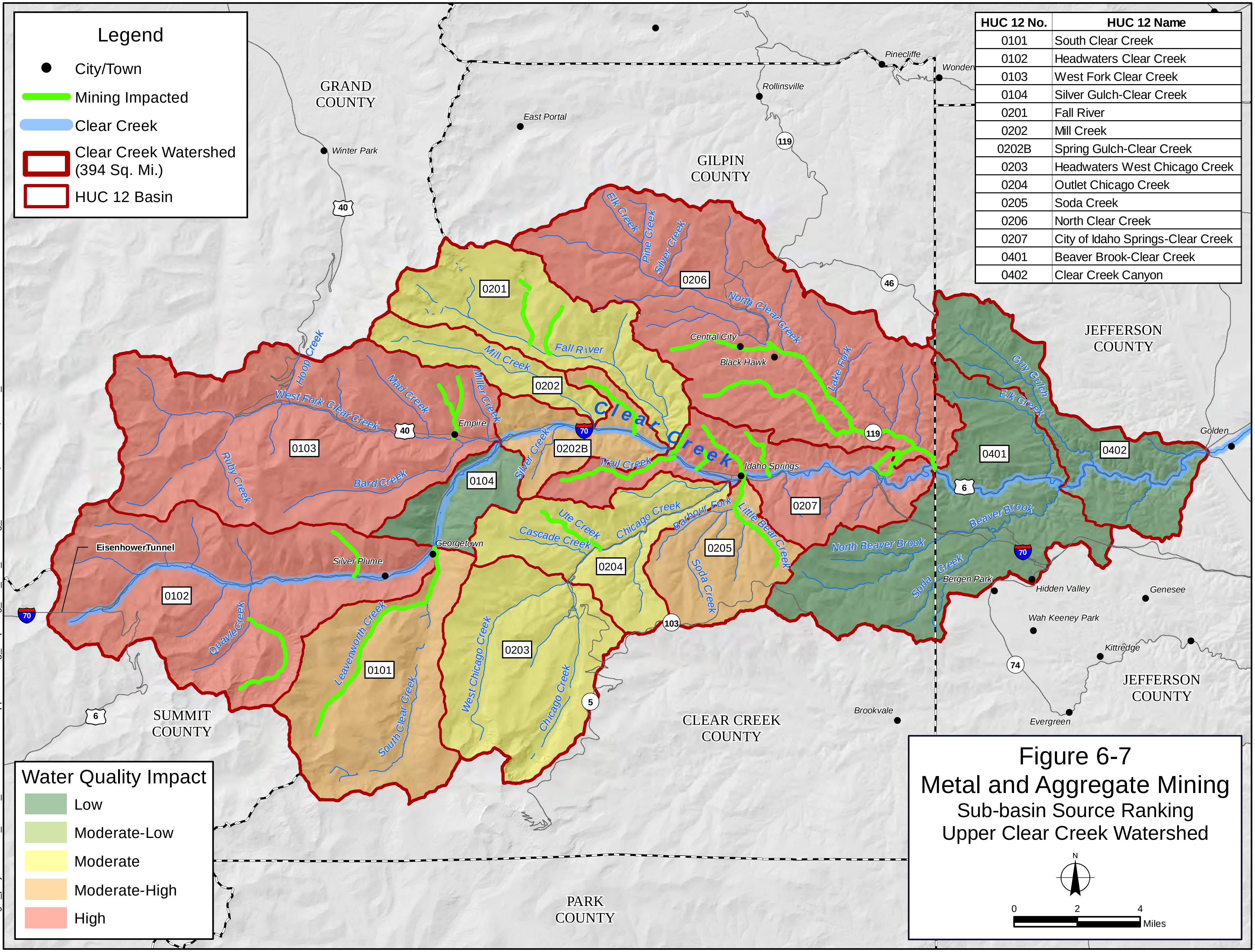
FILE: G:\gis_projects\Clear_Creek_Watershed\active\apps\Ranking_Maps\Fig_6-5_CC_Ranking_Hwy_Sed.mxd, 2/4/2014, wilson_wheeler



HUC 12 No.	HUC 12 Name
0101	South Clear Creek
0102	Headwaters Clear Creek
0103	West Fork Clear Creek
0104	Silver Gulch-Clear Creek
0201	Fall River
0202	Mill Creek
0202B	Spring Gulch-Clear Creek
0203	Headwaters West Chicago Creek
0204	Outlet Chicago Creek
0205	Soda Creek
0206	North Clear Creek
0207	City of Idaho Springs-Clear Creek
0401	Beaver Brook-Clear Creek
0402	Clear Creek Canyon

Figure 6-6
County Road Sediment Loading
Sub-basin Source Ranking
Upper Clear Creek Watershed

FILE: G:\gis_projects\Clear_Creek_Watershed\active\apps\Ranking_Maps\Fig_6-6_CC_Ranking_Cnty_Rd_Sed.mxd, 2/4/2014, wilson_wheeler



HUC 12 No.	HUC 12 Name
0101	South Clear Creek
0102	Headwaters Clear Creek
0103	West Fork Clear Creek
0104	Silver Gulch-Clear Creek
0201	Fall River
0202	Mill Creek
0202B	Spring Gulch-Clear Creek
0203	Headwaters West Chicago Creek
0204	Outlet Chicago Creek
0205	Soda Creek
0206	North Clear Creek
0207	City of Idaho Springs-Clear Creek
0401	Beaver Brook-Clear Creek
0402	Clear Creek Canyon

Figure 6-7
Metal and Aggregate Mining
Sub-basin Source Ranking
Upper Clear Creek Watershed

FILE: G:\gis_projects\Clear_Creek_Watershed\active\apps\Ranking_Maps\Fig_6-7_CC_Ranking_Metals.mxd, 2/4/2014, wilson_wheeler

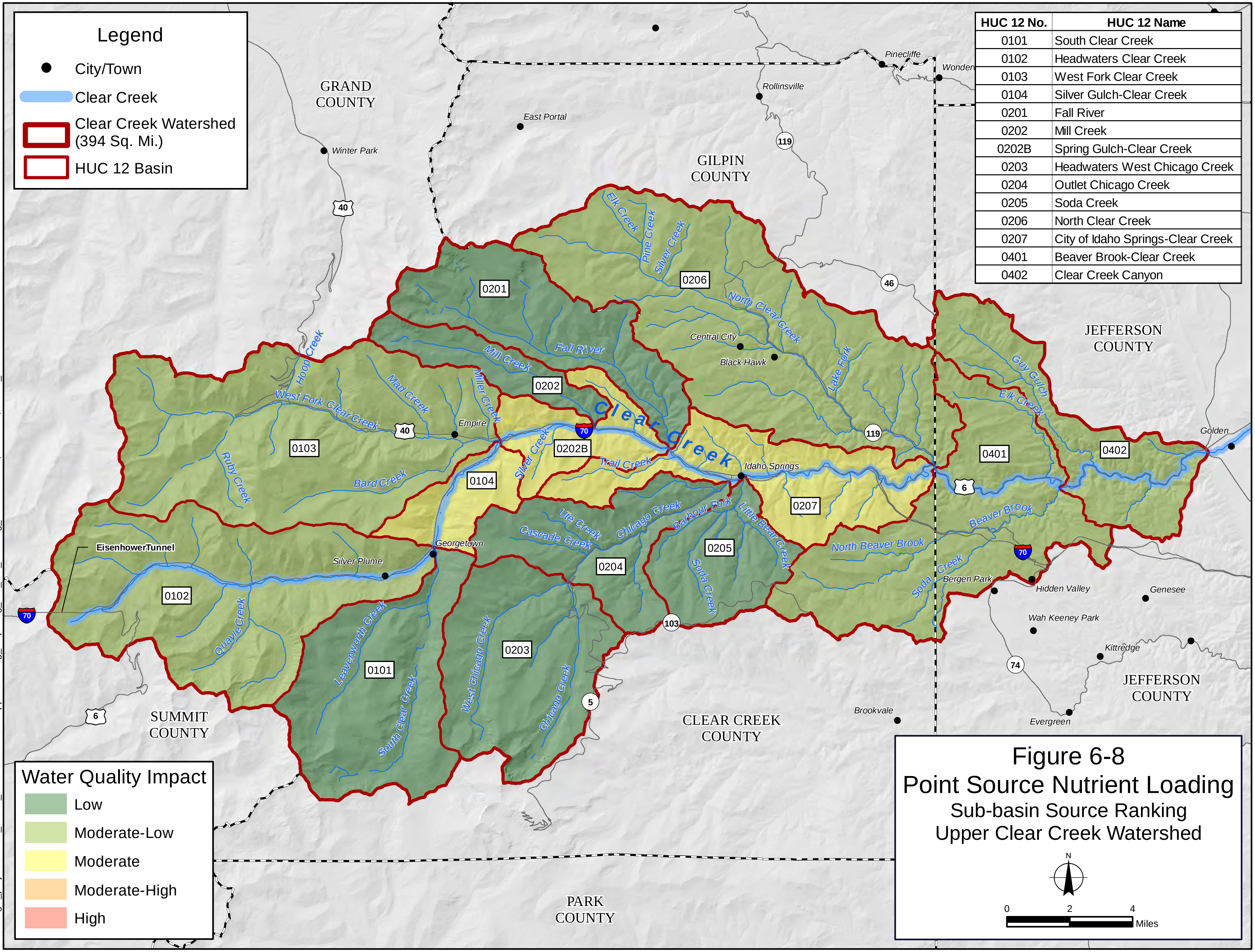
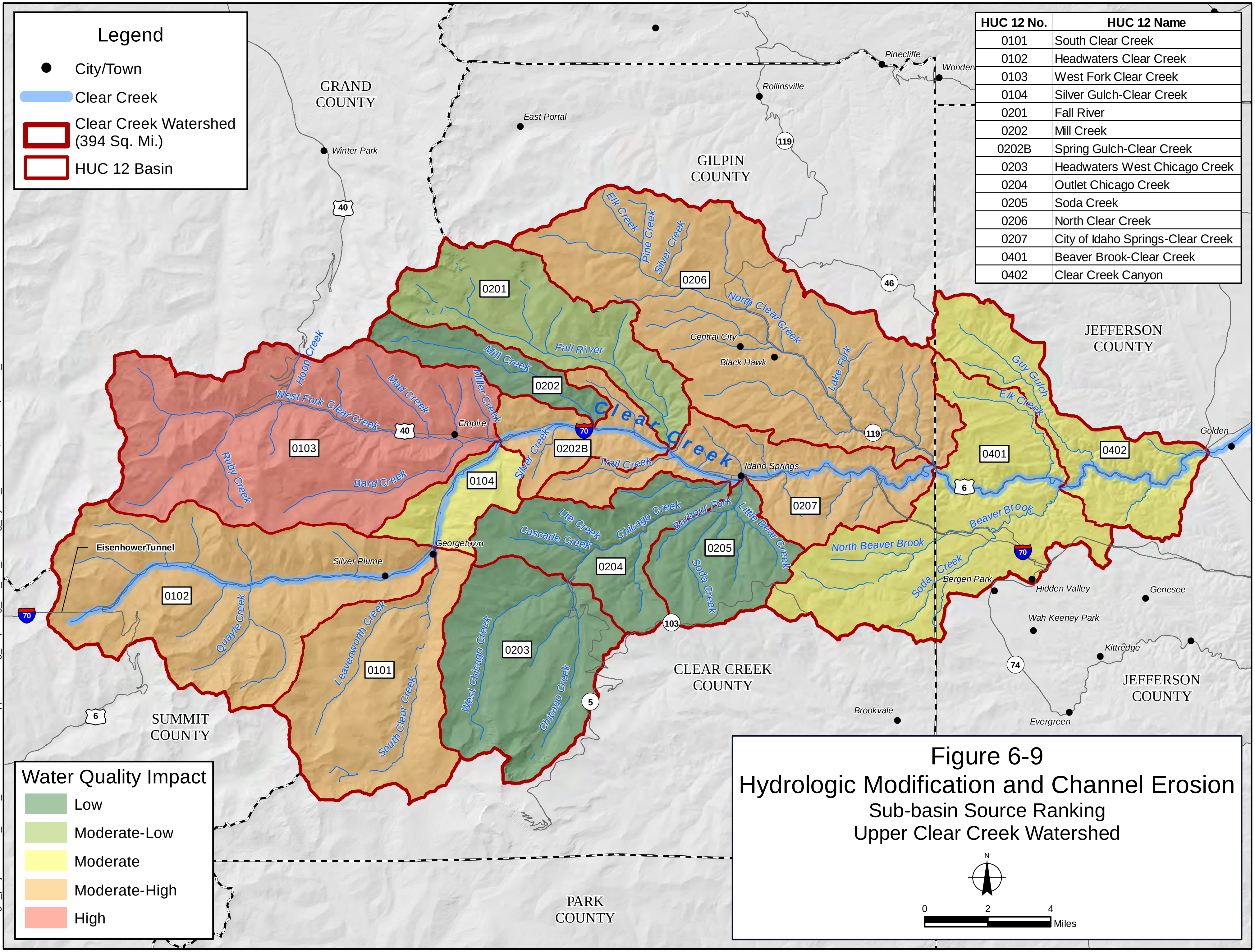


Figure 6-8
Point Source Nutrient Loading
Sub-basin Source Ranking
Upper Clear Creek Watershed

HUC 12 No.	HUC 12 Name
0101	South Clear Creek
0102	Headwaters Clear Creek
0103	West Fork Clear Creek
0104	Silver Gulch-Clear Creek
0201	Fall River
0202	Mill Creek
0202B	Spring Gulch-Clear Creek
0203	Headwaters West Chicago Creek
0204	Outlet Chicago Creek
0205	Soda Creek
0206	North Clear Creek
0207	City of Idaho Springs-Clear Creek
0401	Beaver Brook-Clear Creek
0402	Clear Creek Canyon

FILE: G:\gis_projects\Clear_Creek_Watershed\active\apps\Ranking_Maps\Fig_6-8_CC_Ranking_Nutrients.mxd, 2/4/2014, wilson_wheeler



HUC 12 No.	HUC 12 Name
0101	South Clear Creek
0102	Headwaters Clear Creek
0103	West Fork Clear Creek
0104	Silver Gulch-Clear Creek
0201	Fall River
0202	Mill Creek
0202B	Spring Gulch-Clear Creek
0203	Headwaters West Chicago Creek
0204	Outlet Chicago Creek
0205	Soda Creek
0206	North Clear Creek
0207	City of Idaho Springs-Clear Creek
0401	Beaver Brook-Clear Creek
0402	Clear Creek Canyon

Figure 6-9
Hydrologic Modification and Channel Erosion
Sub-basin Source Ranking
Upper Clear Creek Watershed

FILE: G:\gis_projects\Clear_Creek_Watershed\active\apps\Ranking_Maps\Fig_6-9_CC_Ranking_Hydro_Mod.mxd, 2/6/2014, wilson_wheeler

7.0 Stakeholder Comments and Recommendations for Water Quality Improvement

The UCCWA membership was invited to attend a watershed plan stakeholder meeting which was held on August 8, 2013. The goal of the meeting was to gather input from watershed stakeholders on ideas, concepts, and projects for improving water quality in Clear Creek. Participants were asked to provide information of specific projects, plans, studies, ideas or concerns and, where possible, locate these on a watershed map. This information was compiled and summarized in tabular form by HUC area (Appendix C). Stakeholder comments were received from representatives of the following organizations:

- Town of Silver Plume
- Town of Georgetown
- City of Black Hawk
- Colorado Department of Public Health and Environment
- Colorado Department of Transportation
- Clear Creek County
- Clear Creek Watershed Foundation
- Loveland Ski Area
- Molson-Coors
- Freeport-McMoRan Copper & Gold – Henderson Operations
- City of Golden
- City of Northglenn
- City of Arvada
- City of Westminster
- Xcel Energy

The Stakeholder Comments listing in Appendix C specifies the location in the watershed, water quality concern, a brief description of the project or issue, and the lead agency or proponent. Many of the stakeholder comments and input did not involve specific projects but included implementation of institutional or programmatic controls, existing plans, and recommended studies or assessments. To facilitate further analysis for the watershed plan, comments were assigned one of five categories as described below.

- New Projects – these are new projects proposed as part of this plan.
- Institutional or Programmatic Controls – examples are regulatory options, training, public outreach and education, wastewater treatment optimization.
- Implementation of Existing Plans – USFS watershed restoration EA, EPA/CDPHE CERCLA actions, and CDOT SCAP.
- Studies or Assessments
- General Concerns

The total number of comments received for each of these five categories is listed by HUC sub-basin area in Table 7-1. Institutional or programmatic controls, and general concerns expressed in the stakeholder comments apply to the Clear Creek watershed as a whole. This analysis provides insight into the number and location of new projects, new studies and assessments, or existing plan implementation that was recommended. In addition, the sub-basin priority ranking result is shown to indicate where new projects, studies, or plan implementation may need to be prioritized within the watershed.

Table 7-1: Stakeholder Recommended Water Quality Projects, Controls, and Assessments

UPPER CLEAR CREEK WATERSHED PLAN UPDATE					
Stakeholder Recommended Water Quality Projects, Controls, Assessments, or Concerns					
HUC-12 SUB-BASIN AREA	**New Projects**	**Institutional or Programmatic Controls**	**Implement Existing Plans**	**New Studies or Assessments**	**General Concerns**
Clear Creek Watershed-wide HUC 10190004	0	4	3	1	3
Clear Creek Headwaters HUC-0102	3	1	2	3	0
South Clear Creek HUC-0101	2	0	1	0	0
Silver Gulch-Clear Creek HUC-0104	0	0	1	0	0
West Clear Creek HUC-0103	3	0	1	1	0
North Clear Creek HUC-0206	3	0	2	1	0
Lower Clear Creek HUC-0402	0	0	0	2	0
Mill Creek HUC-0202	0	0	0	1	0
Spring Gulch-Clear Creek HUC-0202B	0	0	1	1	0
Fall River HUC-0201	0	0	0	1	0
Chicago Creek HUC-0203/0204	0	0	1	1	0
Soda Creek HUC-0205	1	0	0	1	0
Idaho Springs Area HUC-0207	3	0	2	0	0
Beaver Brook HUC-0401	0	0	1	1	0

Priority Ranking Key:	
	Moderate-Low
	Moderate
	Moderate-High
	High

8.0 Watershed Priorities for Water Quality Improvement

The Clear Creek watershed is faced with a myriad of challenges. It is one of the most heavily utilized water resources in the Colorado Front Range, with demands for high quality drinking water, industrial water supply, recreation, fisheries, wildlife and aesthetics. Urban growth and development in the major population centers will continue to stress local water supplies and stream water quality in the future.

Significant progress has been made in the control of point source pollution, and ambient (non-storm event) water quality conditions in Clear Creek are likely better than they have been in more than a century. However, many challenges remain to correct past impacts from mining and road development. Future water quality will depend not only maintaining the improvements related to point source control, but also on addressing non-point source pollution through effective source control BMPs.

The sub-basin source ranking analysis indicates the Idaho Springs area (HUC-0207) has the highest ranking for water quality impacts to upper Clear Creek. Moderate-high priority areas include Clear Creek Headwaters (HUC-0102), West Clear Creek (HUC-0103), and North Clear Creek (HUC-0206). These results are generally consistent with the 2006 watershed plan for trace metals, which recommended further remedial investigations in Trail Creek, Virginia Canyon, and North Fork.

The sub-basin priority ranking analysis was combined with the stakeholder comments to develop water quality project recommendations according to sub-basin priority. These recommendations are based on data reports, stakeholder input, and the results of analysis presented in this plan.

The listings presented in this plan are not intended to be all inclusive, and it is anticipated that other important water quality mitigation projects could be identified and developed in the watershed. These include the institutional controls presented in the stakeholder matrix (Table 7-1). The intent of this plan is to establish a priority framework for future projects aimed at addressing the most problematic water quality impacts facing the Clear Creek Watershed.

High Priority – Idaho Springs (HUC-0207)

- Provide effective sediment control in Trail Creek, Hukill Gulch, Virginia Canyon, and Spring Gulch
- Control erosion, off-site sedimentation, and dust from the Frei Quarry
- Implement CDOT SCAP

Moderate-High Priority Clear Creek Headwaters (HUC-0102)

- Conduct recommended study assessments and develop mitigation projects
- Implement CDOT SCAP and USFS Watershed Restoration EA
- Remove accumulated sediment from Georgetown Lake lagoon and forebay on South Clear Creek
- Install passive groundwater treatment system in Silver Plume

Moderate-High Priority West Clear Creek (HUC-0103)

- Conduct recommended study assessments and develop mitigation projects
- Complete SCAP implementation for U.S. 40 Berthoud Pass East and Horseshoe Bend Fen
- Mitigate and prevent future channel erosion from Berthoud Pass Ditch
- Control sedimentation and non-point source pollution from mines in Lion Creek
- Implement CDOT SCAP and USFS Watershed Restoration EA

Moderate-High Priority North Clear Creek (HUC-0206)

- Conduct recommended study assessments and develop mitigation projects
- Control sediment impacts from Russell Gulch
- Control sediment impacts from Frei Quarry on North Clear Creek
- Steam habitat and brown trout fishery restoration
- Implement remaining OU4 remedy

All Moderate and Moderate-Low Impacted HUC Areas

- Conduct recommended study assessments and develop mitigation projects
- Complete mine drainage treatment and reclamation at Waldorf
- Remove accumulated sediment from forebay on South Clear Creek
- Control impacts from historic mining and implement mitigation BMPs in Soda Creek
- Implement CDOT SCAP and USFS Watershed Restoration EA

9.0 References

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CCC. (2011a). "Trail Creek Water Quality Results, 2007-2010". Technical Report to the Clear Creek Watershed Foundation, by Clear Creek Consultants, Inc.

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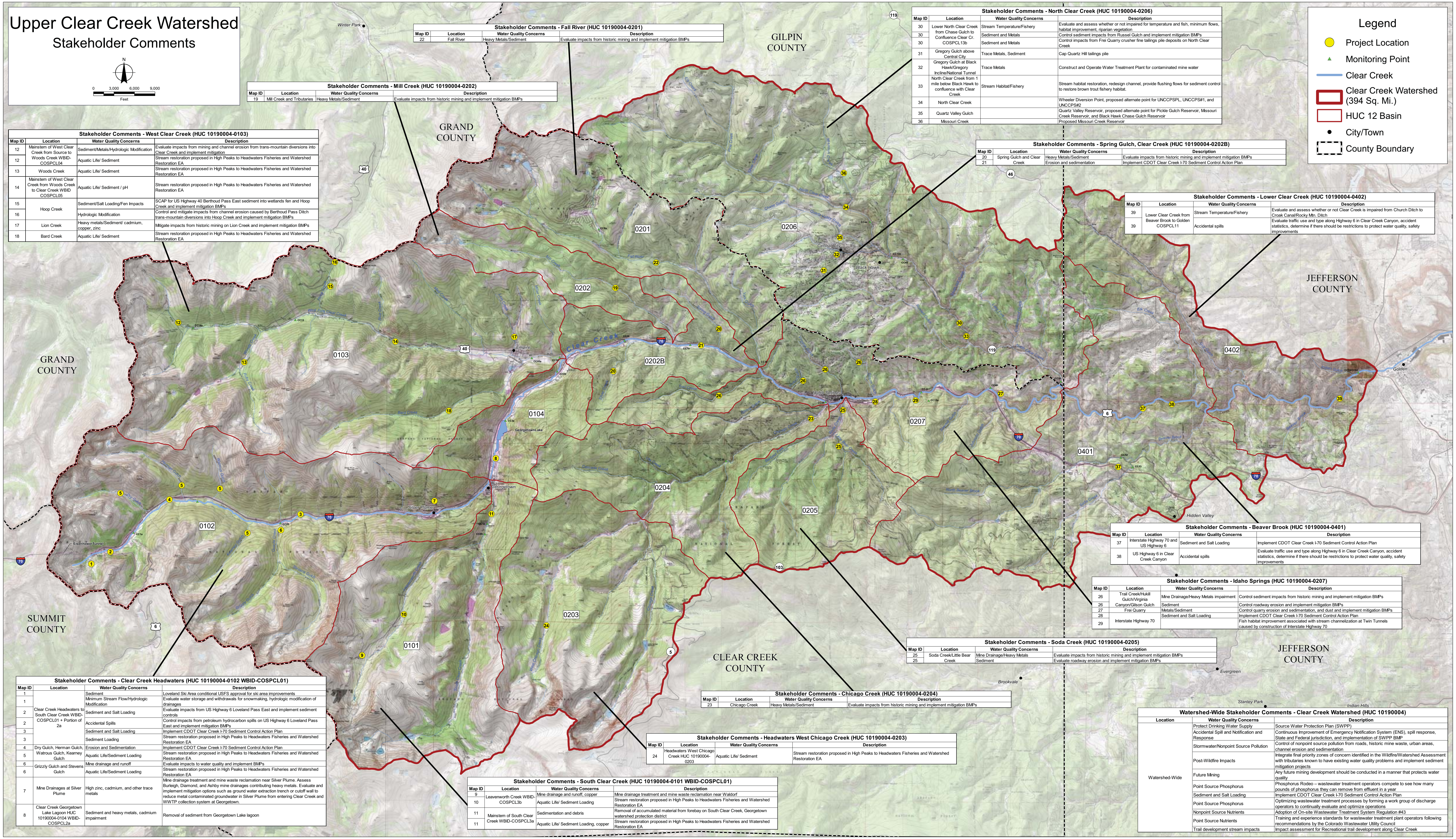
Appendix A – 2013 Clear Creek County ENS Call List

VERSION DATE 11/04/2013	CLEAR CREEK COUNTY MASTER LIST *Corrected / Updated / New*	DOWNSTREAM WATER USERS NOTIFICATION DATABASE							
CONTACT	**BUSINESS / ENTITY**	**HOME PHONE**	**WORK PHONE**	**CELL PHONE**	**CELL PROVIDER**	**OTHER / PAGER**	**PROVIDER**	**OTHER EMAIL**	**WORK EMAIL**
Robert Breckenridge	A1 Wildwater		970-224-3379	970-402-4454					breck@a1wildwater.com
Jack Barker	AAA Operations	303-944-1914	303-567-9500						aaa_admin@aaaoperations.com
Monte Deatric	Adams County / Tri County Health		720-322-1502						mdeatric@tchd.org
Peter Acker	Ag Ditch Co. / Lee Stewart & Eskins - Director	303-278-1349	303-278-1349	303-419-8978	SPRINT				No Email
Office	Agricultural Ditch Co.		303-987-2166						agditch@mseapc.com
Gary Theander	Agricultural Ditch Co. - Water Manager			303-419-8977	SPRINT				Requests No Email Listing
Jed Ward	All American Adventures Rafting Co		303-552-2584	970-333-8595					jed@raftdenver.com
Greg Rogers	Allen / Reno Ditch - Ditch Rider		303-437-8362						No Email
Brandon Gonski	Arkansas Valley Adventures Rafting Co.		970-760-0179	406-396-6455	VERIZON	970-760-0182	LANDLINE	info@coloradorafting.net	brandon@coloradorafting.net
Duke Bradford	Arkansas Valley Adventures Rafting Co.	719-486-2827	800-370-0581			970-406-0321		dmama@coloradorafting.net	duke@coloradorafting.net
Larry Hack	Arvada, City of - Ralston Treatment Plant		720-898-7833						lhack@arvada.org
Cliff Deeds	Arvada, City of - Water Supply & Operations	Requests Contact By Email Only							cliff-d@arvada.org
Ken Paterson	Arvada, City of - Water Supply Coordinator	Requests Contact By Email Only							ken-p@arvada.org
Judy Schmidt	Arvada, City of - Water Quality Manager	Requests Contact By Email Only							judy-sc@arvada.org
Brad Wyant	Arvada, City of - Chief WT Plant Operator	Requests Contact By Email Only							bwyant@arvada.org
Del Hartman	Arvada, City of - Water & Supply Ops, Constr Sup	Requests Contact By Email Only							del-h@arvada.org
Gary Williamson	Arvada, City of - Water & Supply Ops, Utility Control Sup	Requests Contact By Email Only							gwilliamson@arvada.org
Bobby Oligo	Aurora, City of - Manager of Water Treatment		303-739-6740						boligo@auroragov.org
Sherry Scaggiari	Aurora, City of - Water Quality Supervisor		303-739-6767						sscaggia@auroragov.org
Water Flow Control Center	Aurora, City of - 24 x 7 Number		720-427-7806						No Email
Clinton Dattel	Bayou Ditch Assoc.		303-403-4268	303-913-9830					No Email
Stan McInturf	Black Hawk Water Dept. Treatment Plant - Hidden Valley		303-567-0510	303-506-1344		303-567-2314	LANDLINE		smcinturf@cityofblackhawk.org
Jason Fredrick	Black Hawk Water Treatment - Supervisor		303-567-2314	303-883-3216					jfredricks@cityofblackhawk.org
Police Dispatch	Black Hawk, City of		303-582-5878						No General Email
Jim Ford	Black Hawk, City of - Project Manager/Water System Sup		303-582-2237						jford@cityofblackhawk.org
Main Office-Tom Isbester	Black Hawk, City of - Public Works Dept		303-582-2289						tisbester@cityofblackhawk.org
Mike Korsvold	Blackhawk, City of - Water Operator			303-889-9913					mkorsvold@cityofblackhawk.org
Tom Urban	Blackhawk, City of - Water Operator	Requests Contact By Email Only							turban@cityofblackhawk.org
Michael Sutton	Blackhawk, City of - Water Operator	Requests Contact By Email Only							msutton@cityofblackhawk.org
Don Smith	Brantner/Brighton Ditch	303-857-4746	720-849-8952						No Email
Byron Brown	Browns Canyon Rafting		719-275-2890	970-688-0041	AT&T	970-389-2134 970-389-3242	AT&T	clearcreek@raftbrownscanyon.com	admin@raftbrownscanyon.com
Clark Roberts	CDOT Reg 1 Transportation	720-870-1086	303-364-7330	303-349-5042	VERIZON	303-365-7330	LANDLINE		clark.roberts@dot.state.co.us
Hotline - OEM Greg Stasinos	CDPHE - Environmental Release & Reporting Line		877-518-5608			303-692-3022			greg.stasinos@state.co.us
David Kurz	CDPHE Water Quality Control Div - Lead Wastewater Engineer		303-692-3552	303-981-6216	VERIZON				david.kurz@state.co.us
Kelly Jacques	CDPHE Water Quality Control Div - Field Unit Manager		303-692-3588	303-808-0436	AT&T				kelly.jacques@state.co.us
Jim Manley	Church Ditch Water Authority		303-252-0014	303-419-5538					jmanley@northglenn.org
Clear Creek Dispatch Center	Clear Creek County Communications Dispatch Center		303-679-2393						communications@clearcreeksheriff.us
Mitch Brown	Clear Creek County - Environmental Health		303-679-2335	303-908-6685	AT&T				mbrown@co.clear-creek.co.us
Charlotte Hampson	Clear Creek County - Environmental Health		303-679-2420	303-748-4022	AT&T				champson@co.clear-creek.co.us
Rick Albers	Clear Creek County - Major Special Services		303-679-2380	303-435-3295	SPRINT				ralbers@clearcreeksheriff.us
Jane Thomas	Clear Creek County - OEM Deputy Director	303-567-2741	303-679-4237	720-352-1740	T-MOBILE				jthomas@co.clear-creek.co.us
Kathleen Krebs	Clear Creek County - OEM Director	303-569-2523	303-679-2320	303-601-9060	AT&T				kkrebs@co.clear-creek.co.us
Judy Wilson	Clear Creek County - Road & Bridge (PW Dept)		303-679-2466	720-641-2416	VERIZON				jwilson@co.clear-creek.co.us
Tim Allen	Clear Creek County - Road & Bridge (PW Dept)		303-679-2317	720-641-2418	VERIZON				tallen@co.clear-creek.co.us
Don Krueger	Clear Creek County - Sheriff	303-567-2568	303-679-2379	303-435-3293	SPRINT				dkrueger@clearcreeksheriff.us
Kelly Babeon	Clear Creek Fire Authority - Chief			303-994-7806	SPRINT				kb@clearcreekfire.com
Mark Abrahamson	Clear Creek Fire Authority - Deputy Chief			303-519-0174	SPRINT				ma@clearcreekfire.com
John Rice	Clear Creek Rafting Co.		303-567-1000	303-358-0240	VERIZON	303-570-0124	T-MOBILE	dale@clearcreekrafting.com	john@clearcreekrafting.com
Gray Samenfink	CO Div Water Res - Dist 7 Div 1 Water Commissioner	303-828-4314		303-947-3523					Gray.Samenfink@state.co.us
Gene Brienza	CO Div.Water Res - Deputy Water Commissioner	303-882-9168		303-748-9306					Eugene.Brienza@state.co.us
Steve McFadden	Colorado Ag Ditch - Director		303-913-4948	303-255-7750					Requests No Email Listing
Dick Wolfe	Colorado Div.Water Res - Deputy St Engineer		303-866-3581	303-898-7873					dick.wolfe@state.co.us
Greg Stasinos	Colorado Environmental Release & Reporting Line		(see CDPHE)						(See CDPHE/OEM)
Michael Queen	Consolidated Mutual Water Co.- President		303-238-0451			303-238-0453			mqueen@cmwc.net
Andy Rogers	Consolidated Mutual Water Co.- Chief Engineer			Email Only					arogers@cmwc.net
Chris Jones	Consolidated Mutual Water Co.- Water Treatment Mngr			Email Only					cjones@cmwc.net
Dianna Reimer	Consolidated Mutual Water Co.- Water Supply Specialist			Email Only					dreimer@cmwc.net
General	Coors Water Treatment Plant Control Room		303-277-2889						No General Email
Pat McDonald	Coors Water Treatment Plant		303-277-3262						pat.mcdonald@millercoors.com
Ryan Kiley	Coors Security		303-277-3838						ryan.kiley@millercoors.com
Coors Dispatch Center	Coors Security -24 hr.		303-277-2749						gmsecuritydispatch@millercoors.com
Neal Santangelo	Coors Water Resources		303-927-3687						Neal.santangelo@molsoncoors.com
Terry Lewis	Croke Canal			303-434-7681	AT&T				fricoterry@frii.com
Chip Billerbeck	Farmers Highline		303-466-8429	303-210-2467					billerbeckinco@msn.com
Jeramie Cook	Farmers Highline		303-301-5231	303-210-2476					jc.service@live.com
Gene Brienza	Fisher Ditch Co.	303-289-1734	303-882-9168						gb1733@q.com
George McDonald	Fulton Ditch		303-288-1621						Requests No Email Listing
Bruce Becker	Geo Tours Rafting Co.		303-756-6070	303-717-6918	DO NOT TEXT			bruce@georafting.com	georafting@msn.com
George Weidler	Georgetown, Town of - Police Chief	303-582-3776		303-518-3093	VERIZON				gtownpd@earthlink.net
John Curtis	Georgetown, Town of - Water Supervisor			720-341-0305	VERIZON				gtownutilities@earthlink.net
Gilpin Dispatch Center	Gilpin County		303-582-5500						No General Email
Kevin Walker	Glenn Creighton Mutual Ditch & Res Co			720-936-7486					kevin@o3forhealth.com
Police Dispatch	Golden, City of		303-384-8045						No General Email
Treatment Plant	Golden, City of		303-384-8187						WaterTreatmentPlantOperators@cityofgolden.net
John Cantamessa	Highside Adventure Tours		970-945-6737	970-390-0566 **TEXT ONLY - NO CALL TO CELL**	VERIZON				info@raftingcolorado.com
Office	Idaho Springs, City of Treatment Plant		303-567-4458						wwsuper@idahospringsco.com
Dave Wohlers	Idaho Springs, City of - Police Chief			303-419-5268	SPRINT				policechief@idahospringsco.com
John Bordoni	Idaho Springs, City of - Public Works		303-567-2400	303-961-6508	SPRINT				pw@idahospringsco.com
(VACANT)	Idaho Springs, City of - Water/Wastewater		303-567-2400						wwsuper@idahospringsco.com
Mike Whittington/Scott Ledwith	Independent Whitewater, Inc.		719-539-7737	719-207-3145		719-207-3146			twodogs@salida.net
Craig Sanders	Jefferson County - Environmental Health		303-271-5700						csanders@jeffco.us
After Hours Number	Jefferson County - Health Dept					303-232-6301			No General Email
Dispatch Center	Jefferson County - Sheriff's Office		303-271-0211						No General Email
Jim Jehn	Jehn Water Consultants		303-321-8335	720-291-9815					jjehn@jehnwater.com
Alan Gillan	Kershaw Ditch	303-489-8038							Requests No Email Listing
Eddie/Carol Bohn	Kershaw Ditch	303-429-3748		303-880-3166					Requests No Email Listing
Chris & Christy Campton	KODI Rafting		970-668-1548	970-390-3536	AT&T	970-389-5784	AT&T	campy@whitewatercolorado.com	info@whitewatercolorado.com
Police Dispatch	Lakewood, City of		303-987-7111						No General Email
Alan Blado	Liquid Descent. LLC		970-372-2870	970-393-0158	VERIZON				alan@liquiddescent.com
Bob Magrino	Loveland Water Plant - Operations	970-668-3637		303-519-0178					bobmagrino@skiloveland.com
Mike Pinkston	Loveland Water Plant - Operations			303-435-1973					mike.pinkston@skiloveland.com
Rich Dewitt	Lower Clear Creek Ditch Co.		303-469-9940	303-910-7596					rich.dewitt@cityofthornton.net
Dan Stonebraker/Suzen Raymond	Mile Hi Rafting, LLC		303-567-0717	303-972-3585	NO TEXT				info@milehighrafting.com
Kevin Walker	New Kellogg's Ditch Co.			720-936-7486					kevin@o3forhealth.com
ADCOM - Dispatch Center	Northglenn, City of		303-288-1535						No General Email
Treatment Plant	Northglenn, City of		303-451-1289						No General Email
Tami Moon-Carlson	Northglenn, City of		303-450-4070	303-887-8080	VERIZON				tmoon@northglenn.org
Kevin & Mary Jo Foley	Performance Tours, Inc		800-328-7238	970-390-9225 **TEXT ONLY - NO CALL TO CELL**	VERIZON			ptbreck@aol.com	raft@performancetours.com
Tom Fletcher	Reno-Juchem Ditch Co.	303-420-2157		303-263-8876					Requests No Email Listing
Charles Richardson	Reno-Juchem Ditch Co.			303-810-1017					Requests No Email Listing
Willian Colon	River Masters, Inc.			719-429-7238	AT&T			kizzy@raftmasters.com	will@raftmasters.com
Dennis Wied	River Masters, Inc.		719-275-6645			303-567-2044	LANDLINE	dennis@raftmasters.com	fun@raftmasters.com
Nathan McCoy	Rocky Mt / Wannamaker Ditch Co		720-289-5025						Request No Email Listing
Neal Santangelo	Rocky Mt / Wannamaker Ditch Co		303-886-1150						Request No Email Listing
Town Clerk	Silver Plume, Town of		303-569-2363						townofsilverplume@msn.com
Main Office 24x7	South West Water Co.								dallen@swwc.com
Shilo Williams	South West Water Co.		303-912-3856						swilliams@orcllc.com
Treatment Plant	Thornton, City of		303-255-7769						No General Email
Walt Jenkins	Thornton, City of - Water Supply Supervisor		303-947-4116						walt.jenkins@cityofthornton.net
Greg Kelchner / Lisa Reeder	Timberline Tours		970-476-1414	970-390-4481				lisa@timberlinetours.com	info@timberlinetours.com
Laura Archuletta	U.S. Fish & Wildlife - Reg Office		719-655-6121	719-850-1196					Requests No Email Listing
Stephen Smith	U.S. Fish & Wildlife - Rocky Mtn Arsenal		303-289-0451	303-253-1177					Requests No Email Listing
Main Number	U.S. Forest Service - District Ranger Office		303-567-3000						No General Email
Main Office - Phyllis Adams	Upper Clear Creek Watershed Association			303-918-7033					uccwa@live.com
Main Office	Urban Drainage & Flood Control District		303-455-6277						udfcd@udfcd.org
Greg Rogers	Wadsworth Ditch Co.- Ditch Rider			303-437-8462					No Email

Appendix B – Clear Creek Watershed Project Maps

Upper Clear Creek Watershed

Stakeholder Comments



Stakeholder Comments - Fall River (HUC 10190004-0201)

Map ID	Location	Water Quality Concerns	Description
22	Fall River	Heavy Metals/Sediment	Evaluate impacts from historic mining and implement mitigation BMPs

Stakeholder Comments - Mill Creek (HUC 10190004-0202)

Map ID	Location	Water Quality Concerns	Description
19	Mill Creek and Tributaries	Heavy Metals/Sediment	Evaluate impacts from historic mining and implement mitigation BMPs

Stakeholder Comments - West Clear Creek (HUC 10190004-0103)

Map ID	Location	Water Quality Concerns	Description
12	Mainstem of West Clear Creek from Source to Woods Creek WBID-COSPCL04	Sediment/Metals/Hydrologic Modification	Evaluate impacts from mining and channel erosion from trans-mountain diversions into Clear Creek and implement mitigation
12		Aquatic Life/ Sediment	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA
13	Woods Creek	Aquatic Life/ Sediment	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA
14	Mainstem of West Clear Creek from Woods Creek to Clear Creek WBID COSPCL05	Aquatic Life/ Sediment / pH	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA
15	Hoop Creek	Sediment/Salt Loading/Fen Impacts	SCAP for US Highway 40 Berthoud Pass East sediment into wetlands fen and Hoop Creek and implement mitigation BMPs
16		Hydrologic Modification	Control and mitigate impacts from channel erosion caused by Berthoud Pass Ditch trans-mountain diversions into Hoop Creek and implement mitigation BMPs
17	Lion Creek	Heavy metals/Sediment/ cadmium, copper, zinc	Mitigate impacts from historic mining on Lion Creek and implement mitigation BMPs
18	Bard Creek	Aquatic Life/ Sediment	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA

Stakeholder Comments - North Clear Creek (HUC 10190004-0206)

Map ID	Location	Water Quality Concerns	Description
30	Lower North Clear Creek from Chase Gulch to Confluence Clear Cr. COSPCL13b	Stream Temperature/Fishery	Evaluate and assess whether or not impaired for temperature and fish, minimum flows, habitat improvement, riparian vegetation
30		Sediment and Metals	Control sediment impacts from Russel Gulch and implement mitigation BMPs
30		Sediment and Metals	Control impacts from Frei Quarry crusher fine tailings pile deposits on North Clear Creek
31	Gregory Gulch above Central City	Trace Metals, Sediment	Cap Quartz Hill tailings pile
32	Gregory Gulch at Black Hawk/Gregory Incline/National Tunnel	Trace Metals	Construct and Operate Water Treatment Plant for contaminated mine water
33	North Clear Creek from 1 mile below Black Hawk to confluence with Clear Creek	Stream Habitat/Fishery	Stream habitat restoration, redesign channel, provide flushing flows for sediment control to restore brown trout fishery habitat.
34	North Clear Creek		Wheeler Diversion Point, proposed alternate point for UNCCPSPL, UNCCPS#1, and UNCCPS#2
35	Quartz Valley Gulch		Quartz Valley Reservoir, proposed alternate point for Pickle Gulch Reservoir, Missouri Creek Reservoir, and Black Hawk Chase Gulch Reservoir
36	Missouri Creek		Proposed Missouri Creek Reservoir

Stakeholder Comments - Spring Gulch, Clear Creek (HUC 10190004-0202B)

Map ID	Location	Water Quality Concerns	Description
20	Spring Gulch and Clear Creek	Heavy Metals/Sediment	Evaluate impacts from historic mining and implement mitigation BMPs
21		Erosion and sedimentation	Implement CDOT Clear Creek I-70 Sediment Control Action Plan

Stakeholder Comments - Lower Clear Creek (HUC 10190004-0402)

Map ID	Location	Water Quality Concerns	Description
39	Lower Clear Creek from Beaver Brook to Golden COSPCL11	Stream Temperature/Fishery	Evaluate and assess whether or not Clear Creek is impaired from Church Ditch to Croak Canal/Rocky Mtn. Ditch
39		Accidental spills	Evaluate traffic use and type along Highway 6 in Clear Creek Canyon, accident statistics, determine if there should be restrictions to protect water quality, safety improvements

Stakeholder Comments - Beaver Brook (HUC 10190004-0401)

Map ID	Location	Water Quality Concerns	Description
37	Interstate Highway 70 and US Highway 6	Sediment and Salt Loading	Implement CDOT Clear Creek I-70 Sediment Control Action Plan
38	US Highway 6 in Clear Creek Canyon	Accidental spills	Evaluate traffic use and type along Highway 6 in Clear Creek Canyon, accident statistics, determine if there should be restrictions to protect water quality, safety improvements

Stakeholder Comments - Idaho Springs (HUC 10190004-0207)

Map ID	Location	Water Quality Concerns	Description
26	Trail Creek/Hukill Gulch/Virginia Canyon/Gilson Gulch	Mine Drainage/Heavy Metals impairment	Control sediment impacts from historic mining and implement mitigation BMPs
26		Sediment	Control roadway erosion and implement mitigation BMPs
27	Frei Quarry	Metals/Sediment	Control quarry erosion and sedimentation, and dust and implement mitigation BMPs
28	Interstate Highway 70	Sediment and Salt Loading	Implement CDOT Clear Creek I-70 Sediment Control Action Plan
29			Fish habitat improvement associated with stream channelization at Twin Tunnels caused by construction of Interstate Highway 70

Stakeholder Comments - Soda Creek (HUC 10190004-0205)

Map ID	Location	Water Quality Concerns	Description
25	Soda Creek/Little Bear Creek	Mine Drainage/Heavy Metals	Evaluate impacts from historic mining and implement mitigation BMPs
25		Sediment	Evaluate roadway erosion and implement mitigation BMPs

Stakeholder Comments - Chicago Creek (HUC 10190004-0204)

Map ID	Location	Water Quality Concerns	Description
23	Chicago Creek	Heavy Metals/Sediment	Evaluate impacts from historic mining and implement mitigation BMPs

Stakeholder Comments - Headwaters West Chicago Creek (HUC 10190004-0203)

Map ID	Location	Water Quality Concerns	Description
24	Headwaters West Chicago Creek HUC 10190004-0203	Aquatic Life/ Sediment	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA

Stakeholder Comments - Clear Creek Headwaters (HUC 10190004-0102 WBID-COSPCL01)

Map ID	Location	Water Quality Concerns	Description
1	Clear Creek Headwaters to South Clear Creek WBID-COSPCL01 + Portion of 2a	Sediment	Loveland Ski Area conditional USFS approval for ski area improvements
1		Minimum Stream Flow/Hydrologic Modification	Evaluate water storage and withdrawals for snowmaking, hydrologic modification of drainages
2		Sediment and Salt Loading	Evaluate impacts from US Highway 6 Loveland Pass East and implement sediment controls
2		Accidental Spills	Control impacts from petroleum hydrocarbon spills on US Highway 6 Loveland Pass East and implement mitigation BMPs
3		Sediment and Salt Loading	Implement CDOT Clear Creek I-70 Sediment Control Action Plan
3		Sediment Loading	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA
4	Dry Gulch, Herman Gulch, Watrous Gulch, Kearney Gulch	Erosion and Sedimentation	Implement CDOT Clear Creek I-70 Sediment Control Action Plan
5		Aquatic Life/Sediment Loading	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA
6	Grizzly Gulch and Stevens Gulch	Mine drainage and runoff	Evaluate impacts to water quality and implement BMPs
6		Aquatic Life/Sediment Loading	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA
7	Mine Drainages at Silver Plume	High zinc, cadmium, and other trace metals	Mine drainage treatment and mine waste reclamation near Silver Plume. Assess Burleigh, Diamond, and Ashby mine drainages contributing heavy metals. Evaluate and implement mitigation options such as ground water extraction trench or cutoff wall to reduce metal contaminated groundwater in Silver Plume from entering Clear Creek and WWTP collection system at Georgetown.
8	Clear Creek Georgetown Lake Lagoon HUC 10190004-0104 WBID-COSPCL2a	Sediment and heavy metals, cadmium impairment	Removal of sediment from Georgetown Lake lagoon

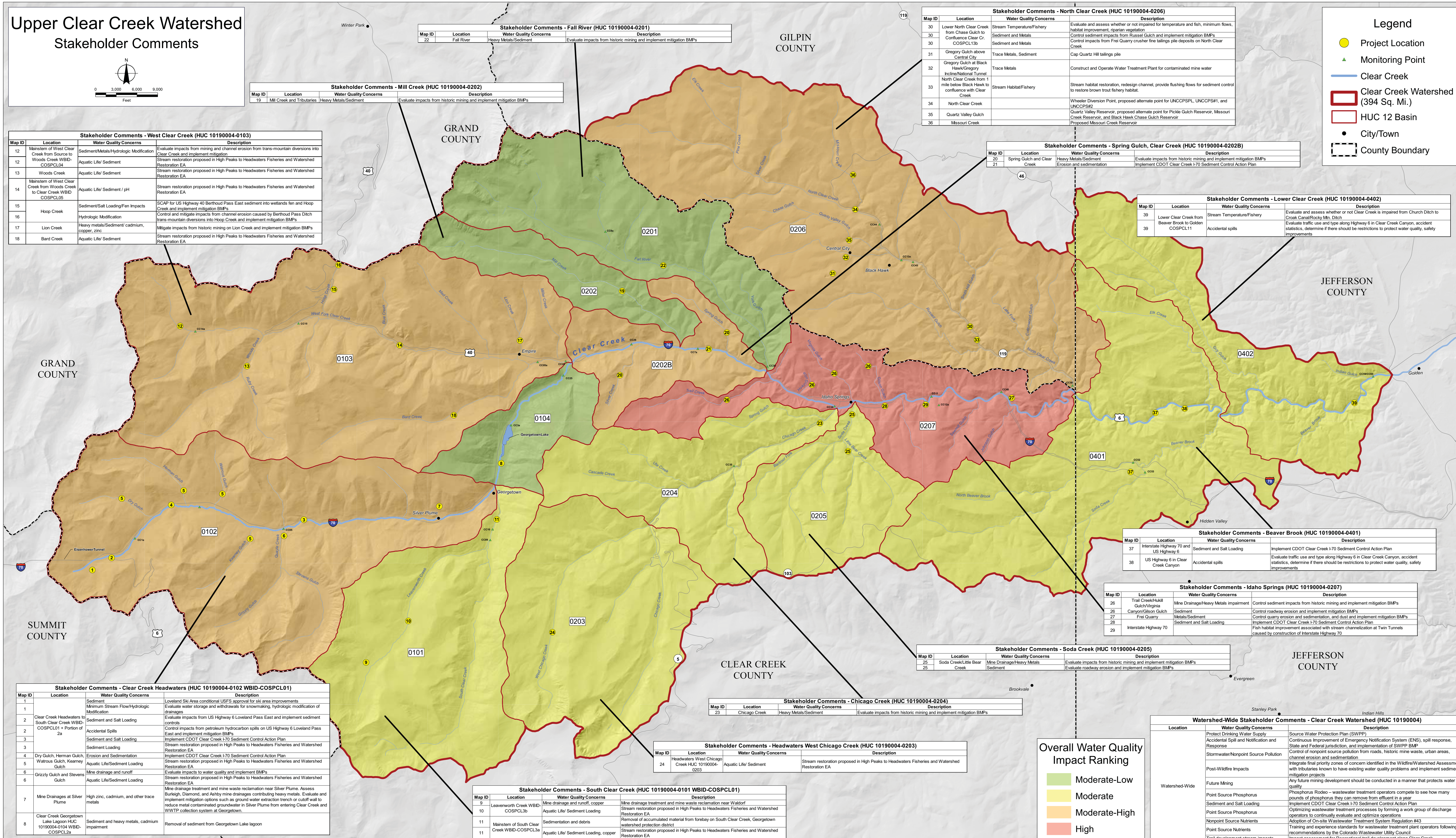
Stakeholder Comments - South Clear Creek (HUC 10190004-0101 WBID-COSPCL01)

Map ID	Location	Water Quality Concerns	Description
9	Leavenworth Creek WBID-COSPCL3b	Mine drainage and runoff, copper	Mine drainage treatment and mine waste reclamation near Waldorf
10		Aquatic Life/ Sediment Loading	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA
11	Mainstem of South Clear Creek WBID-COSPCL3a	Sedimentation and debris	Removal of accumulated material from forebay on South Clear Creek, Georgetown watershed protection district
11		Aquatic Life/ Sediment Loading, copper	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA

Watershed-Wide Stakeholder Comments - Clear Creek Watershed (HUC 10190004)

Location	Water Quality Concerns	Description
Watershed-Wide	Protect Drinking Water Supply	Source Water Protection Plan (SWPP)
	Accidental Spill and Notification and Response	Continuous Improvement of Emergency Notification System (ENS), spill response, State and Federal jurisdiction, and implementation of SWPP BMP
	Stormwater/Nonpoint Source Pollution	Control of nonpoint source pollution from roads, historic mine waste, urban areas, channel erosion and sedimentation
	Post-Wildfire Impacts	Integrate final priority zones of concern identified in the Wildfire/Watershed Assessment with tributaries known to have existing water quality problems and implement sediment mitigation projects
	Future Mining	Any future mining development should be conducted in a manner that protects water quality
	Point Source Phosphorus	Phosphorus Rodeo – wastewater treatment operators compete to see how many pounds of phosphorus they can remove from effluent in a year
	Sediment and Salt Loading	Implement CDOT Clear Creek I-70 Sediment Control Action Plan
	Point Source Phosphorus	Optimizing wastewater treatment processes by forming a work group of discharge operators to continually evaluate and optimize operations
	Nonpoint Source Nutrients	Adoption of On-site Wastewater Treatment System Regulation #43
	Point Source Nutrients	Training and experience standards for wastewater treatment plant operators following recommendations by the Colorado Wastewater Utility Council
	Trail development stream impacts	Impact assessment for Recreational trail development along Clear Creek

Upper Clear Creek Watershed
Stakeholder Comments



Stakeholder Comments - Fall River (HUC 10190004-0201)

Map ID	Location	Water Quality Concerns	Description
22	Fall River	Heavy Metals/Sediment	Evaluate impacts from historic mining and implement mitigation BMPs

Stakeholder Comments - Mill Creek (HUC 10190004-0202)

Map ID	Location	Water Quality Concerns	Description
19	Mill Creek and Tributaries	Heavy Metals/Sediment	Evaluate impacts from historic mining and implement mitigation BMPs

Stakeholder Comments - West Clear Creek (HUC 10190004-0103)

Map ID	Location	Water Quality Concerns	Description
12	Mainstem of West Clear Creek from Source to Woods Creek WBID-COSPCL04	Sediment/Metals/Hydrologic Modification	Evaluate impacts from mining and channel erosion from trans-mountain diversions into Clear Creek and implement mitigation
12		Aquatic Life/ Sediment	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA
13	Woods Creek	Aquatic Life/ Sediment	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA
14	Mainstem of West Clear Creek from Woods Creek to Clear Creek WBID COSPCL05	Aquatic Life/ Sediment / pH	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA
15	Hoop Creek	Sediment/Salt Loading/Fen Impacts	SCAP for US Highway 40 Berthoud Pass East sediment into wetlands fen and Hoop Creek and implement mitigation BMPs
16		Hydrologic Modification	Control and mitigate impacts from channel erosion caused by Berthoud Pass Ditch trans-mountain diversions into Hoop Creek and implement mitigation BMPs
17	Lion Creek	Heavy metals/Sediment/ cadmium, copper, zinc	Mitigate impacts from historic mining on Lion Creek and implement mitigation BMPs
18	Bard Creek	Aquatic Life/ Sediment	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA

Stakeholder Comments - North Clear Creek (HUC 10190004-0206)

Map ID	Location	Water Quality Concerns	Description
30	Lower North Clear Creek from Chase Gulch to Confluence Clear Cr. COSPCL13b	Stream Temperature/Fishery	Evaluate and assess whether or not impaired for temperature and fish, minimum flows, habitat improvement, riparian vegetation
30		Sediment and Metals	Control sediment impacts from Russel Gulch and implement mitigation BMPs
30		Sediment and Metals	Control impacts from Frei Quarry crusher fine tailings pile deposits on North Clear Creek
31	Gregory Gulch above Central City	Trace Metals, Sediment	Cap Quartz Hill tailings pile
32	Gregory Gulch at Black Hawk/Gregory Incline/National Tunnel	Trace Metals	Construct and Operate Water Treatment Plant for contaminated mine water
33	North Clear Creek from 1 mile below Black Hawk to confluence with Clear Creek	Stream Habitat/Fishery	Stream habitat restoration, redesign channel, provide flushing flows for sediment control to restore brown trout fishery habitat.
34	North Clear Creek		Wheeler Diversion Point, proposed alternate point for UNCCPSPL, UNCCPS#1, and UNCCPS#2
35	Quartz Valley Gulch		Quartz Valley Reservoir, proposed alternate point for Pickle Gulch Reservoir, Missouri Creek Reservoir, and Black Hawk Chase Gulch Reservoir
36	Missouri Creek		Proposed Missouri Creek Reservoir

Stakeholder Comments - Spring Gulch, Clear Creek (HUC 10190004-0202B)

Map ID	Location	Water Quality Concerns	Description
20	Spring Gulch and Clear Creek	Heavy Metals/Sediment	Evaluate impacts from historic mining and implement mitigation BMPs
21		Erosion and sedimentation	Implement CDOT Clear Creek I-70 Sediment Control Action Plan

Stakeholder Comments - Lower Clear Creek (HUC 10190004-0402)

Map ID	Location	Water Quality Concerns	Description
39	Lower Clear Creek from Beaver Brook to Golden COSPCL11	Stream Temperature/Fishery	Evaluate and assess whether or not Clear Creek is impaired from Church Ditch to Croak Canal/Rocky Mtn. Ditch
39		Accidental spills	Evaluate traffic use and type along Highway 6 in Clear Creek Canyon, accident statistics, determine if there should be restrictions to protect water quality, safety improvements

Stakeholder Comments - Beaver Brook (HUC 10190004-0401)

Map ID	Location	Water Quality Concerns	Description
37	Interstate Highway 70 and US Highway 6	Sediment and Salt Loading	Implement CDOT Clear Creek I-70 Sediment Control Action Plan
38	US Highway 6 in Clear Creek Canyon	Accidental spills	Evaluate traffic use and type along Highway 6 in Clear Creek Canyon, accident statistics, determine if there should be restrictions to protect water quality, safety improvements

Stakeholder Comments - Idaho Springs (HUC 10190004-0207)

Map ID	Location	Water Quality Concerns	Description
26	Trail Creek/Hukill Gulch/Virginia Canyon/Gilson Gulch	Mine Drainage/Heavy Metals impairment	Control sediment impacts from historic mining and implement mitigation BMPs
26		Sediment	Control roadway erosion and implement mitigation BMPs
27	Frei Quarry	Metals/Sediment	Control quarry erosion and sedimentation, and dust and implement mitigation BMPs
28	Interstate Highway 70	Sediment and Salt Loading	Implement CDOT Clear Creek I-70 Sediment Control Action Plan
29			Fish habitat improvement associated with stream channelization at Twin Tunnels caused by construction of Interstate Highway 70

Stakeholder Comments - Soda Creek (HUC 10190004-0205)

Map ID	Location	Water Quality Concerns	Description
25	Soda Creek/Little Bear Creek	Mine Drainage/Heavy Metals	Evaluate impacts from historic mining and implement mitigation BMPs
25		Sediment	Evaluate roadway erosion and implement mitigation BMPs

Stakeholder Comments - Chicago Creek (HUC 10190004-0204)

Map ID	Location	Water Quality Concerns	Description
23	Chicago Creek	Heavy Metals/Sediment	Evaluate impacts from historic mining and implement mitigation BMPs

Stakeholder Comments - Headwaters West Chicago Creek (HUC 10190004-0203)

Map ID	Location	Water Quality Concerns	Description
24	Headwaters West Chicago Creek HUC 10190004-0203	Aquatic Life/ Sediment	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA

Stakeholder Comments - Clear Creek Headwaters (HUC 10190004-0102 WBID-COSPCL01)

Map ID	Location	Water Quality Concerns	Description
1	Clear Creek Headwaters to South Clear Creek WBID-COSPCL01 + Portion of 2a	Sediment	Loveland Ski Area conditional USFS approval for ski area improvements
1		Minimum Stream Flow/Hydrologic Modification	Evaluate water storage and withdrawals for snowmaking, hydrologic modification of drainages
2		Sediment and Salt Loading	Evaluate impacts from US Highway 6 Loveland Pass East and implement sediment controls
2		Accidental Spills	Control impacts from petroleum hydrocarbon spills on US Highway 6 Loveland Pass East and implement mitigation BMPs
3		Sediment and Salt Loading	Implement CDOT Clear Creek I-70 Sediment Control Action Plan
3		Sediment Loading	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA
4	Dry Gulch, Herman Gulch, Watrous Gulch, Kearney Gulch	Erosion and Sedimentation	Implement CDOT Clear Creek I-70 Sediment Control Action Plan
5		Aquatic Life/Sediment Loading	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA
6	Grizzly Gulch and Stevens Gulch	Mine drainage and runoff	Evaluate impacts to water quality and implement BMPs
6		Aquatic Life/Sediment Loading	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA
7	Mine Drainages at Silver Plume	High zinc, cadmium, and other trace metals	Mine drainage treatment and mine waste reclamation near Silver Plume. Assess Burleigh, Diamond, and Ashby mine drainages contributing heavy metals. Evaluate and implement mitigation options such as ground water extraction trench or cutoff wall to reduce metal contaminated groundwater in Silver Plume from entering Clear Creek and WWTP collection system at Georgetown.
8	Clear Creek Georgetown Lake Lagoon HUC 10190004-0104 WBID-COSPCL2a	Sediment and heavy metals, cadmium impairment	Removal of sediment from Georgetown Lake lagoon

Stakeholder Comments - South Clear Creek (HUC 10190004-0101 WBID-COSPCL01)

Map ID	Location	Water Quality Concerns	Description
9	Leavenworth Creek WBID-COSPCL3b	Mine drainage and runoff, copper	Mine drainage treatment and mine waste reclamation near Waldorf
10		Aquatic Life/ Sediment Loading	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA
11	Mainstem of South Clear Creek WBID-COSPCL3a	Sedimentation and debris	Removal of accumulated material from forebay on South Clear Creek, Georgetown watershed protection district
11		Aquatic Life/ Sediment Loading, copper	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA

Watershed-Wide Stakeholder Comments - Clear Creek Watershed (HUC 10190004)

Location	Water Quality Concerns	Description
Watershed-Wide	Protect Drinking Water Supply	Source Water Protection Plan (SWPP)
	Accidental Spill and Notification and Response	Continuous Improvement of Emergency Notification System (ENS), spill response, State and Federal jurisdiction, and implementation of SWPP BMP
	Stormwater/Nonpoint Source Pollution	Control of nonpoint source pollution from roads, historic mine waste, urban areas, channel erosion and sedimentation
	Post-Wildfire Impacts	Integrate final priority zones of concern identified in the Wildfire/Watershed Assessment with tributaries known to have existing water quality problems and implement sediment mitigation projects
	Future Mining	Any future mining development should be conducted in a manner that protects water quality
	Point Source Phosphorus	Phosphorus Rodeo – wastewater treatment operators compete to see how many pounds of phosphorus they can remove from effluent in a year
	Sediment and Salt Loading	Implement CDOT Clear Creek I-70 Sediment Control Action Plan
	Point Source Phosphorus	Optimizing wastewater treatment processes by forming a work group of discharge operators to continually evaluate and optimize operations
	Nonpoint Source Nutrients	Adoption of On-site Wastewater Treatment System Regulation #43
	Point Source Nutrients	Training and experience standards for wastewater treatment plant operators following recommendations by the Colorado Wastewater Utility Council
	Trail development stream impacts	Impact assessment for Recreational trail development along Clear Creek

Appendix C – Clear Creek Watershed Stakeholder Comments

Stakeholder Comments - Clear Creek Watershed (HUC 10190004)					
Map ID	**Location**	**Water Quality Concerns**	**Project Description**	**Lead Agency/ Proponent**	**Comment Category**
--	Watershed-Wide	Protect Drinking Water Supply	Source Water Protection Plan (SWPP)	CDPHE/All water users	Implement
--		Accidental Spill and Notification and Response	Continuous Improvement of Emergency Notification System (ENS), spill response, State and Federal jurisdiction, and implementation of SWPP BMP	Clear Creek County/CDPHE/Coast Guard/All water users	Implement
--		Stormwater/Nonpoint Source Pollution	Control of nonpoint source pollution from roads, historic mine waste, urban areas, channel erosion and sedimentation	Upper Basin Integrated Stormwater Management Coordinating Council	General
--		Post-Wildfire Impacts	Integrate final priority zones of concern identified in the Wildfire/Watershed Assessment with tributaries known to have existing water quality problems and implement sediment mitigation projects	All water users	General
--		Future Mining	Any future mining development should be conducted in a manner that protects water quality	All water users	General
--		Point Source Phosphorus	Phosphorus Rodeo – wastewater treatment operators compete to see how many pounds of phosphorus they can remove from effluent in a year	Standley Lake Cities	Institutional
--		Sediment and Salt Loading	Implement CDOT Clear Creek I-70 Sediment Control Action Plan	FHWA/CDOT	Implement
--		Point Source Phosphorus	Optimizing wastewater treatment processes by forming a work group of discharge operators to continually evaluate and optimize operations	Standley Lake Cities	Institutional
--		Nonpoint Source Nutrients	Adoption of On-site Wastewater Treatment System Regulation #43	CDPHE	Institutional
--		Point Source Nutrients	Training and experience standards for wastewater treatment plant operators following recommendations by the Colorado Wastewater Utility Council	CDPHE/CWUC	Institutional
--		Trail development stream impacts	Impact assessment for Recreational trail development along Clear Creek	Jefferson County/Clear Creek County	Study/Assess

Stakeholder Comments - Clear Creek Headwaters (HUC 10190004-0102 WBID-COSPCL01)					
Map ID	**Location**	**Water Quality Concerns**	**Project Description**	**Lead Agency/ Proponent**	**Comment Category**
1	Clear Creek Headwaters to South Clear Creek WBID-COSPCL01 + Portion of 2a	Sediment	Loveland Ski Area conditional USFS approval for ski area improvements	USFS/Loveland Ski Area	Institutional
1		Minimum Stream Flow/Hydrologic Modification	Evaluate water storage and withdrawals for snowmaking, hydrologic modification of drainages	USFS/Loveland Ski Area	Study/Assess
2		Sediment and Salt Loading	Evaluate impacts from US Highway 6 Loveland Pass East and implement sediment controls	FHWA/CDOT	Study/Assess
2		Accidental Spills	Control impacts from petroleum hydrocarbon spills on US Highway 6 Loveland Pass East and implement mitigation BMPs	FHWA/CDOT	New Project
--		Sediment and Salt Loading	Implement CDOT Clear Creek I-70 Sediment Control Action Plan	FHWA/CDOT	Implement
--		Sediment Loading	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA	USFS	Implement
--	Dry Creek, Herman Gulch, Watrous Gulch, Kearney Gulch	Erosion and Sedimentation	Implement CDOT Clear Creek I-70 Sediment Control Action Plan	FHWA/CDOT	Implement
--		Aquatic Life/Sediment Loading	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA	USFS	Implement
3	Grizzly Gulch and Stevens Gulch	Mine drainage and runoff	Evaluate impacts to water quality and implement BMPs	EPA/CDPHE	Study/Assess
3		Aquatic Life/Sediment Loading	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA	USFS	Implement
4	Mine Drainages at Silver Plume	High zinc, cadmium, and other trace metals	Mine drainage treatment and mine waste reclamation near Silver Plume. Assess Burleigh, Diamond, and Ashby mine drainages contributing heavy metals. Evaluate and implement mitigation options such as ground water extraction trench or cutoff wall to reduce metal contaminated groundwater in Silver Plume from entering Clear Creek and WWTP collection system at Georgetown.	EPA/CDPHE/Town of Silver Plume/Town of Georgetown	New Project
5	Clear Creek Georgetown Lake Lagoon HUC 10190004-0104 WBID-COSPCL2a	Sediment and heavy metals, cadmium impairmen	Removal of sediment from Georgetown Lake lagoon	FHWA/CDOT	New Project

Stakeholder Comments - South Clear Creek (HUC 10190004-0101 WBID-COSPCL01)					
Map ID	**Location**	**Water Quality Concerns**	**Project Description**	**Lead Agency/ Proponent**	**Comment Category**
6	Leavenworth Creek WBID-COSPCL3b	Mine drainage and runoff, copper impairment	Mine drainage treatment and mine waste reclamation near Waldorf	EPA/CDPHE	New Project
--		Aquatic Life/ Sediment Loading	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA	USFS	Implement
7	Mainstem of South Clear Creek WBID-COSPCL3a	Sedimentation and debris	Removal of accumulated material from forebay on South Clear Creek, Georgetown watershed protection district	Town of Georgetown	New Project
--		Aquatic Life/ Sediment Loading, copper	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA	USFS	Implement

Stakeholder Comments - West Clear Creek (HUC 10190004-0103)					
Map ID	**Location**	**Water Quality Concerns**	**Project Description**	**Lead Agency/ Proponent**	**Comment Category**
--	Mainstem of West Clear Creek from Source to Woods Creek WBID-	Sediment/Metals/Hydrologic Modification	Evaluate impacts from mining and channel erosion from trans-mountain diversions into Clear Creek and implement mitigation	Henderson Mine/ Denver Water Board	Study/Assess
--		Aquatic Life/ Sediment	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA	USFS	Implement
--	Woods Creek	Aquatic Life/ Sediment	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA	USFS	Implement
--	Mainstem of West Clear Creek from Woods Creek to Clear Creek WBID COSPCL05	Aquatic Life/ Sediment / pH	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA	USFS	Implement
8	Hoop Creek	Sediment/Salt Loading/Fen Impacts	SCAP for US Highway 40 Berthoud Pass East sediment into wetlands fen and Hoop Creek and implement mitigation BMPs	FHWA/CDOT	New Project
9		Hydrologic Modification	Control and mitigate impacts from channel erosion caused by Berthoud Pass Ditch trans-mountain diversions into Hoop Creek and implement mitigation BMPs	City of Northglenn/ City of Golden	New Project
10	Lion Creek	Heavy metals/Sediment/ cadmium, copper, zinc	Mitigate impacts from historic mining on Lion Creek and implement mitigation BMPs	EPA/CDPHE	New Project
--	Bard Creek	Aquatic Life/ Sediment	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA	USFS	Implement

Stakeholder Comments - Mill Creek (HUC 10190004-0202)					
Map ID	**Location**	**Water Quality Concerns**	**Project Description**	**Lead Agency/ Proponent**	**Comment Category**
--	Mill Creek and Tributaries	Heavy Metals/Sediment	Evaluate impacts from historic mining and implement mitigation BMPs	EPA/CDPHE	Study/Assess

Stakeholder Comments - Spring Gulch-Clear Creek (HUC 10190004-0202B)					
Map ID	**Location**	**Water Quality Concerns**	**Project Description**	**Lead Agency/ Proponent**	**Comment Category**
--	Spring Gulch and Clear Creek	Heavy Metals/Sediment	Evaluate impacts from historic mining/county roads and implement mitigation BMPs	Clear Creek County EPA/CDPHE	Study/Assess
--		Erosion and sedimentation	Implement CDOT Clear Creek I-70 Sediment Control Action Plan	FHWA/CDOT	Implement

Stakeholder Comments - Fall River (HUC 10190004-0201)					
Map ID	**Location**	**Water Quality Concerns**	**Project Description**	**Lead Agency/ Proponent**	**Comment Category**
--	Fall River	Heavy Metals/Sediment	Evaluate impacts from historic mining and implement mitigation BMPs	EPA/CDPHE	Study/Assess

Stakeholder Comments - Chicago Creek (HUC 10190004-0204)					
Map ID	**Location**	**Water Quality Concerns**	**Project Description**	**Lead Agency/ Proponent**	**Comment Category**
--	Chicago Creek	Heavy Metals/Sediment	Evaluate impacts from historic mining and implement mitigation BMPs	EPA/CDPHE	Study/Assess
--	Headwaters West Chicago Creek HUC 10190004-0203	Aquatic Life/ Sediment	Stream restoration proposed in High Peaks to Headwaters Fisheries and Watershed Restoration EA	USFS	Implement

Stakeholder Comments - Soda Creek (HUC 10190004-0205)					
Map ID	**Location**	**Water Quality Concerns**	**Project Description**	**Lead Agency/ Proponent**	**Comment Category**
--	Soda Creek/Little Bear Creek	Mine Drainage/Heavy Metals	Control impacts from historic mining and implement mitigation BMPs	EPA/CDPHE	New Project
--		Sediment	Evaluate roadway erosion and implement mitigation BMPs	Clear Creek County	Study/Assess

Stakeholder Comments - Idaho Springs (HUC 10190004-0207)					
Map ID	**Location**	**Water Quality Concerns**	**Project Description**	**Lead Agency/ Proponent**	**Comment Category**
--	Trail Creek/Hukill Gulch/Virginia Canyon	Mine Drainage/Heavy Metals impairment	Control sediment impacts from historic mining and implement mitigation BMPs	EPA/CDPHE	New Project
--		Sediment	Control roadway erosion and implement mitigation BMPs	Clear Creek County	New Project
12	Frei Quarry	Metals/Sediment	Control quarry erosion and sedimentation, and dust and implement mitigation BMPs	Frei Quarry /CDPHE/Clear Creek County	New Project
--	Interstate Highway 70	Sediment and Salt Loading	Implement CDOT Clear Creek I-70 Sediment Control Action Plan	FHWA/CDOT	Implement
13			Fish habitat improvement associated with stream channelization at Twin Tunnels caused by construction of Interstate Highway 70	CDOT/CPW/Trout Unlimited	Implement

Stakeholder Comments - North Clear Creek (HUC 10190004-0206)					
Map ID	**Location**	**Water Quality Concerns**	**Project Description**	**Lead Agency/ Proponent**	**Comment Category**
--	Lower North Clear Creek from Chase Gulch to Confluence Clear Cr. COSPCL13b	Stream Temperature/Fishery	Evaluate and assess whether or not impaired for temperature and fish, minimum flows, habitat improvement, riparian vegetation	Black Hawk/Central City Sanitation District	Study/Assess
		Sediment and Metals	Control sediment impacts from Russel Gulch and implement mitigation BMPs	EPA-CERCLA	New Project
14		Sediment and Metals	Control impacts from Frei Quarry crusher fine tailings pile deposits on North Clear Creek	Frei Quarry/CDPHE	New Project
15	Gregory Gulch above Central City	Trace Metals, Sediment	Cap Quartz Hill tailings pile	EPA-CERCLA	Implement
16	Gregory Gulch at Black Hawk/Gregory Incline/National Tunnel	Trace Metals	Construct and Operate Water Treatment Plant for contaminated mine water	EPA-CERCLA	Implement
--	North Clear Creek from 1 mile below Black Hawk to confluence with Clear Creek	Stream Habitat/Fishery	Stream habitat restoration, redesign channel, provide flushing flows for sediment control to restore brown trout fishery habitat.	Gilpin County & City of Black Hawk	New Project
17	North Clear Creek		Wheeler Diversion Point, proposed alternate point for UNCCPSPL, UNCCPS#1, and UNCCPS#2	City of Black Hawk	
18	Quartz Valley Gulch		Quartz Valley Reservoir, proposed alternate point for Pickle Gulch Reservoir, Missouri Creek Reservoir, and Black Hawk Chase Gulch Reservoir	City of Black Hawk	
19	Missouri Creek		Proposed Missouri Creek Reservoir	City of Black Hawk	

Stakeholder Comments - Beaver Brook (HUC 10190004-0401)					
Map ID	**Location**	**Water Quality Concerns**	**Project Description**	**Lead Agency/ Proponent**	**Comment Category**
--	Interstate Highway 70 and US Highway 6	Sediment and Salt Loading	Implement CDOT Clear Creek I-70 Sediment Control Action Plan	FHWA/CDOT	Implement
20	US Highway 6 in Clear Creek Canyon	Accidental spills	Evaluate traffic use and type along Highway 6 in Clear Creek Canyon, accident statistics, determine if there should be restrictions to protect water quality, safety improvements	FHWA, CDOT, Frei Quarry, Gaming Industry	Study/Assess

Stakeholder Comments - Lower Clear Creek (HUC 10190004-0402)					
Map ID	**Location**	**Water Quality Concerns**	**Project Description**	**Lead Agency/ Proponent**	**Comment Category**
--	Lower Clear Creek from Beaver Brook to Golden COSPCL11	Stream Temperature/Fishery	Evaluate and assess whether or not Clear Creek is impaired from Church Ditch to Croak Canal/Rocky Mtn. Ditch	Coors/Trout Unlimited	Study/Assess
21		Accidental spills	Evaluate traffic use and type along Highway 6 in Clear Creek Canyon, accident statistics, determine if there should be restrictions to protect water quality, safety improvements	FHWA, CDOT, Frei Quarry, Gaming Industry	Study/Assess