

2002 UPPER COLORADO RIVER WATER QUALITY MANAGEMENT PLAN

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UPPER COLORADO RIVER WATER QUALITY MANAGEMENT PLAN

1.0 WATERSHED OVERVIEW

1.1 Geography and Hydrology

The Colorado River headwaters watershed in this plan is defined as the continental divide on the east and north, the Williams Fork Mountains ridge to the south and west, and the Gore Range ridge to the northwest (Figure 10). This area is generally defined by Grand County, which encompasses an area of 1,869 square miles (1,196,000 acres) with altitudes ranging from 13,400 feet along the continental divide to 6,800 feet near Radium. The Blue River, which flows into the Colorado River outside of Kremmling, is described in the Blue River Watershed Management Plan.

The major sub-basins in the headwaters of the Colorado River include: the Colorado River, which originates in Rocky Mountain National Park; the Fraser River; Willow Creek; Williams Fork; Troublesome Creek; and Muddy Creek. The Fraser River originates at Berthoud Pass and flows northwest to its confluence with the Colorado River near Granby. Principal tributaries to the Fraser River include St. Louis and Ranch Creeks, flowing westward and joining the Fraser River near Fraser. Other principal tributaries to the Colorado River are: Williams Fork, flowing north and joining the Colorado River near Parshall; Troublesome Creek, flowing south and joining the Colorado River at Troublesome; Muddy Creek, flowing south from Rabbit Ears Pass and joining the Colorado River at Kremmling, and the Blue River, flowing north through Summit County to its mouth below Kremmling.

The lower portion of the upper Colorado watershed includes parts of Routt (Rock Creek drainage), Eagle, and Garfield Counties, and ends at the confluence of the Roaring Fork and Colorado Rivers in Glenwood Springs. Below the confluence of the Blue River, the Colorado River flows through a remote and rural area until it joins with the Eagle River at Dotsero and then parallels the major east-west interstate Highway 70 corridor to Glenwood Springs. Tributaries to this portion of the Colorado River include: the Piney River which flows northwest to the confluence at State Bridge; Rock Creek which flows southwest to the confluence at McCoy; and Sweetwater Creek which flows southeast to the confluence about five miles upstream of Dotsero. Between the confluences of the Eagle and Roaring Fork Rivers, the Colorado River has no major tributaries.

The Colorado River and its tributaries experience widely varying seasonal fluctuations in flows. Most stream flow results from snowmelt [US Geological Survey, Hydrology of Area 58, Northern Great Plains and Rocky Mountain Coal Provinces, Colorado and Utah, 1987].

Figure 9. Upper Colorado River Watershed Map.

The spring runoff period, May through mid-July provides approximately 75% of the total annual flow. During this time there is usually a surplus of available water, however, during the late summer and fall when stream flow is low, demand continues or increases and often exceeds supply [US Forest Service, Rock Creek/Muddy Creek Draft Environmental Impact Statement, 1987]. The annual average annual runoff of the Colorado River at various locations is listed in Table 18 below.

Table 18. Upper Colorado Drainages and Average Annual Runoff*

Drainage	Area (square miles)	Water Years (Oct.- Sept.)	Annual Runoff (acre-feet)
Colorado @ Hot Sulphur Springs	825	1982-2000	207,800
Blue near Kremmling	645	2000	298,700
Colorado nr Kremmling	2,382	1962-2000	755,000
Eagle blw Gypsum	945	1947-2000	419,100
Colorado blw Dotsero	4,394	1941-2000	1,543,000
Roaring Fork @ Glenwood Spr	1,451	1972-2000	905,400
Colorado blw Glenwood Sprs	6,013	1967-2000	2,522,000

*Data comes from Water Resources Data Colorado Water Year 2000, US Geological Survey, 2001

The major storage facilities in the Upper Colorado watershed are: Shadow Mountain Reservoir, Lake Granby, Windy Gap Reservoir, Willow Creek Reservoir, Williams Fork Reservoir, and Wolford Mountain Reservoir (66,000 acre feet). In addition, a number of tunnels and diversions transport approximately 272,000 acre-feet per year to the eastern side of the continental divide [Colorado Water, League of Women Voters, 1992]. These diversions include the Gumlick and Vasquez Tunnels owned by the Denver Water Department, the Moffat Tunnel, currently owned by the Colorado Department of Local Affairs, and the Adams Tunnel, owned by the US Bureau of Reclamation and operated by the Northern Colorado Water Conservancy District.

1.2 Land Uses and Population Characteristics

The predominant land uses are woodland or rangeland and are managed by the US Forest Service (USFS) and Bureau of Land Management (BLM). The USFS manages approximately 892 square miles (Arapaho and Routt National Forests) [Statistical Abstract of Colorado, University of Colorado, Boulder, Business Research Division, 1987] and the BLM manages approximately 175 square miles, accounting for 60% of the headwaters watershed.

The economy of the headwaters watershed is based mainly on recreation. The Fraser River sub-basin, located in southeastern Grand County, contains major ski areas (Winter Park, Sol Vista, Devil's Thumb, Young Life Camp and Snow Mountain Ranch). Intensive recreation includes golf courses and camps.

Extensive development of condominiums and vacation homes has occurred along the Fraser River between Winter Park and Granby in the vicinity of the ski areas and recreational facilities.

The Three Lakes region, an important recreational area in the northeast part of the county, includes Lake Granby, Shadow Mountain Lake, and Grand Lake. The

economies of the Fraser River sub-basin and the Three Lakes region are based primarily on recreation (including significant motorized recreation) while the economy of the remaining parts of the watershed is based mostly on agriculture. Ranching, timber production, and gravel mining, are the major activities from Granby to Glenwood Springs. Recreational boating and fishing are also economic drivers in the lower area of the basin from “Pumphouse” to Glenwood Springs.

The major population centers in the headwaters portion of the watershed are Winter Park, Fraser, Tabernash, Granby, Grand Lake, Hot Sulphur Springs, and Kremmling. The seasonal population increases significantly at the ski areas in and near Winter Park in the winter, and in the Three Lakes region in the summer. For Grand County, the permanent population between 1980 and 1990 grew 6.6%, and between 1990 and 2000 grew 56.2%.

The lower portion of the upper Colorado River is remote and land uses generally consist of ranching, timbering, recreational boating and fishing, and mineral extraction. Population centers in the lower portion of the upper Colorado River include: Radium, State Bridge, Bond, McCoy, Burns, Dotsero, and Glenwood Springs. Below the confluence of the Eagle River, the River receives little in the way of substantial inflows and point source discharges until the confluence with the Roaring Fork River, but is impacted by its proximity to the highway, towns, and the Shoshone Hydroelectric Power Plant.

In the Upper Colorado River watershed there are 59 community, transient non-community, and non-transient non-community drinking water systems, serving a combined total population of 49,009 persons [Colorado Department of Public Health and Environment, Water Quality Control Division Colorado Open Records Act request, NWCCOG December 10, 2001]. Forty-nine of the systems are reliant upon ground water and ten systems are reliant upon surface water. This information does not include systems serving less than 25 people.

1.3 Watershed Water Quality Management

Organizations in the upper Colorado River watershed that are addressing water resource issues include: the East Grand Water Quality Board; the Upper Colorado Lakes Protection Association; and the Upper Colorado River Alliance. The latter two organizations, along with the Shadow Mountain Home Owners Association combined efforts in 1998 and formed the Three Lakes Watershed Protection Association, which was incorporated as a nonprofit entity. The East Grand Water Quality Board and the Three Lakes Watershed Association are working together to address water quality issues more holistically throughout Grand County.

2.0 WATERSHED WATER QUALITY ASSESSMENT

2.1 Upper Colorado River Headwaters (Stream Segments 1, 2,3, 4, 6a & 9)

Stream Segment 1 of the upper Colorado River includes the mainstem of the Colorado River, including the tributaries, lakes and reservoirs within Rocky Mountain National

Park, or which flow into Rocky Mountain National Park. This stream segment has been designated "Outstanding Waters", and according to regulation "shall be maintained and protected at [its] existing quality".

The USGS, as part of its National Water Quality Assessment program for the Upper Colorado River basin study unit, selected a fixed site in Rocky Mountain National Park on the Colorado River below Baker Gulch [Water Quality at Basic Fixed Sites in the Upper Colorado River Basin National Water-Quality Assessment Study Unit, October 1995-1998, Water Resources Investigation Report 99-4223]. The stream reach in which this is located (segment 1) is composed mostly of forest, tundra, and meadows; a few cabins are located within the basin. Dissolved iron concentrations reflect geologic sources of iron and the reducing environment of large wetland areas in the basin. Suspended-sediment concentrations were low (median of 2 mg/L). Concentrations of ions were fairly dilute, sediment and nutrient concentrations were low, as shown in Table 19.

Table 19. Summary of selected parameters at Colorado River below Baker Gulch Site, 1995-1998 USGS data.

Constituent	Minimum	Median	Maximum
	Mg/L		
Suspended organic carbon	<0.1	0.2	0.9
Dissolved ammonia	<0.2	<0.2	0.06
Dissolved nitrite	<0.01	<0.01	0.02
Dissolved phosphorus	<0.01	<0.01	0.03
Dissolved orthophosphate	<0.01	<0.01	0.02
Dissolved oxygen	7.5	9.3	11.0

The Three Lakes area surrounds Grand Lake, Shadow Mountain Reservoir, and Granby Reservoir. These lakes receive a high degree of recreational usage. The Three Lakes Sanitation District provides wastewater treatment for this area, and numerous homes and businesses that were previously on septic systems have been connected to the wastewater treatment plant. Water quality data is collected by the Upper Colorado Lakes Protection Association, a volunteer effort coordinated by the Water Quality Control Division. Additionally, the US Geological Survey (USGS) and the Northern Colorado Water Conservancy District collect water quality data on these lakes. Water quality data collected from the three lakes has been compiled into a water quality database by the Northwest Colorado Council of Governments. The database is updated on a yearly basis, and contains water quality data collected by these agencies since 1960. The data indicates that water quality in the lakes and reservoir is good. The table below (Table 20) lists average yearly chlorophyll, secchi disk, and total phosphorus levels in the three lakes.

This database has been incorporated into the Three Lakes Clean Lakes Assessment Grant, an EPA Section 319 Grant funded project discussed in Chapter 4.1

Table 20. Three Lakes Annual Average Trophic State Indicators

Lake	Monitored by	Year	Chlorophyll	Secchi disk	T. P.
Grand	EPA	1975	4.9 (4)	133.5 (4)	0.018 (15)
	WQCD	1990	6.6 (4)	119 (4)	0.013 (6)
	WQCD	1991	8.8 (6)	111 (6)	0.013 (5)
	WQCD	1996	10.9 (14)	107 (14)	0.010 (14)

	WQCD	1997	N.D.	138 (8)	0.014 (8)
	WQCD	1998	? (5)	78 (5)	? (5)
E. portal of Adams Tunnel	USGS	1993	N.A.	N.A.	<0.01 (6)
	USGS	1995	N.A.	N.A.	<0.01 (6)
	USGS	1996	N.A.	N.A.	0.02 (6)
	USGS	1998	N.A.	N.A.	<0.01 (6)
	USGS	2000	N.A.	N.A.	<0.05 (5)
Shadow Mt.	EPA	1975	5.7 (6)	73 (6)	0.030 (6)
	USGS	1991	N.D.	83 (1)	0.060 (1)
	USGS	1992	7.0 (1)	86 (6)	0.020 (6)
	USGS	1993	2.4 (4)	80 (5)	0.020 (5)
	USGS	1994	3.6 (6)	79 (6)	0.020 (6)
	USGS	1995	6.0 (6)	77 (6)	0.010 (6)
	USGS	1996	1.4 (5)	102 (5)	<0.01 (5)
	USGS	1999	3.2 (4)	104 (4)	<0.05 (3)
	USGS	2000	1.7 (3)	107 (3)	0.017 (3)
Granby	USGS	1992	1.4 (2)	170 (2)	<.01 (2)
	USGS	1993	3.8	102 (7)	0.013 (5)
Combined sites	USGS	1995	4.4 (10)	99 (10)	0.01 (10)
At spillway and	USGS	1998	1.6 (8)	159 (8)	<0.01 (6)
Dam on Granby	USGS	1999	1.2 (8)	159 (6)	<0.05 (8)
	USGS	2000	1.3 (8)	164 (8)	0.036 (8)

Note: the numbers in parentheses in the table indicate the number of samples which make up the annual average value. Chlorophyll: ug/L, chlorophyll a; Secchi Disk: inches; TP: Total phosphorus, mg/L

As reference, the trophic state of the water bodies with these levels of chlorophyll, secchi disk depth (a measure of transparency), and phosphorus, are generally considered "mesotrophic", or having a moderate amount of nutrients. It should be noted that the database for chlorophyll, secchi disk depth, and phosphorus is extremely limited and inconsistent. Considering the limited data, different sources, and sampling locations, statements concerning trends in the lakes cannot currently be well substantiated.

Of the three lakes, dissolved oxygen concentrations pose the greatest concern in Shadow Mountain Reservoir, where values below 4.0 mg/L (affecting fish) are found at depths below 25 feet in summer and fall. In Granby Reservoir, dissolved oxygen concentrations below 4.0 mg/L are found at 40 feet and deeper. The limited data for Grand Lake do not indicate a dissolved oxygen concentration problem in this lake.

Water quality data collected by the Northern Colorado Water Conservancy District at the Windy Gap Pump Station and Colorado River at Station 1 detected the occasional presence of mercury in 1992 and 1993. The values were at or just above the limit of detection. In Shadow Mountain Reservoir manganese occasionally exceeds drinking water standards in the deeper water. There is very little data for metals concentrations in Grand Lake, however the data, which does exist, indicates no metal concerns.

Excessive phosphorus concentrations, bacteriological contamination, and accelerated eutrophication were the primary water quality problems evaluated in a 1970 study by EPA. Previous studies by the Colorado Department of Public Health and Environment (1960) had attributed water quality concerns in the lakes with poorly functioning or failing septic systems producing "nuisance" algae conditions. A subsequent EPA study

conducted in 1974 indicated that no chemical or bacteriological standards were exceeded in any of the samples collected from the lakes or from streams flowing into the lakes. However, nonpoint source runoff from land disturbance increased nutrient and sediment yields to the lakes. During this study, no adverse chemical or biological effects were measured in the lakes as a result of septic systems. The conclusion of this study was that the cause of "nuisance" algae conditions was primarily from nonpoint source runoff, rather than from septic systems in the Three Lakes region. Since 1995 septic system installations have been well documented and tracked by the County.

Land use practices and manmade activities have contributed to the majority of nutrient and sediment problems in the lakes. For example, Shadow Mountain Reservoir was built upon highly productive hay meadows. The lakes are characterized by EPA as being oligotrophic to mesotrophic (small to medium production of biota) with nitrogen the limiting factor in Grand Lake, and phosphorus and nitrogen the limiting factors in Shadow Mountain Lake and Lake Granby. Because other studies have reported excessive blue-green algae production and small dissolved oxygen concentrations in the three lakes, and the oligotrophic status probably should not be considered a stable condition.

A temporary modification for the fecal coliform standard has existed on Segment 2 of the upper Colorado River (Grand Lake, Shadow Mountain, and Granby reservoirs) but was removed in 1987 with the determination that the Recreational Class 1 goal for these waters had been reached.

An aquatic plant mechanical harvester was purchased by the US Forest Service for use on Shadow Mountain Reservoir. This harvester was purchased in order to maintain boating access to the reservoir in shallow areas where excessive plant growth was encroaching on boating channels.

In 2000 Grand County was awarded an EPA 319 "Clean Lakes" Grant to assess and develop a protection strategy for water quality in the Three Lakes. [See Project section – Chapter 4]. According to the draft Phase I Report dated April 19, 2002, using data collected since 1989, Grand Lake exhibits mesotrophy with respect to chlorophyll *a* (summer mean of 5.7 ug/L), total phosphorus (12 ug/L), and secchi disk depth (2.9 meters). No apparent trends over time were associated with these parameters. With respect to Shadow Mountain Reservoir, the water body exhibits mesotrophy with respect to 12 years of chlorophyll *a* (4.0 ug/L), total phosphorus (13.2 ug/L), and secchi disk depth (2.7 meters) data. Granby Reservoir should also be considered mesotrophic based on the data collected since 1989. Chlorophyll *a* (3.1 ug/L, actually suggests oligotrophic conditions), total phosphorus (13ug/L), and secchi disk depth (2.9 meters) values did not show any apparent trends over time.

In 1999 the Shadow Mountain Homeowners Association was awarded an EPA 319 grant to assess and provide direction regarding sediment deposition at the mouth of the Colorado River as it enters Shadow Mountain Reservoir. See Project section – Chapter 4.

2.2 Fraser River (Stream Segments 9 & 10)

A USGS 1976 -1977 study [USGS, Reconnaissance Evaluation of Surface-Water

Quality in Eagle, Grand, Jackson, Pitkin, Routt, and Summit Counties, Colorado, Open File Report 79-420, 1979] found that the Fraser River near its headwaters is relatively unproductive, with a diversity index of only 1.50 for aquatic organisms. There were no apparent differences among downstream sites. Downstream sites had the most organisms collected with 55, but the diversities among the sites were similar at about 2.80.

A four-year monitoring effort by the USGS and funded by the East Grand Water Quality Board was completed in 1994. Use of the Colorado Ammonia Model using the monitoring data has indicated that all three domestic wastewater treatment plants discharging to the upper Fraser River (Winter Park, Grand County Number 1, and Fraser) will have to significantly upgrade their facilities (provide nitrification treatment) in order to comply with instream ammonia standards established to protect the Fraser River fishery. In addition to nitrogen and flow data, conductivity, pH and temperature data has also been collected. Additional discussion on this issue is provided in the Point Source Issues Section (Section 3.1). USGS monitoring at the five stations is ongoing.

Denver Water Department water quality data have been collected at two sites on the mainstem of the Fraser River: downstream of Vasquez Creek and at Tabernash. Data collected between 1993 and 1994 at the site below Vasquez Creek shows the impact of sediment, with Total Suspended Solids (TSS) values of 2 -13 mg/L (compared with Williams Fork sites which have values of less than 1 to 3 mg/L). Total phosphorus values ranged from 0.03 to 0.26, with an average of 0.088 mg/L. In Tabernash, un-ionized ammonia values exceeding the stream standard of 0.02 mg/L occurred twice in five samples. Dissolved oxygen was 4.6 mg/L (standard is 6.0) on one of five sampling dates. Total phosphorus at the site ranged from 0.04 to 0.4 and averaged 0.144. Total suspended solids at this site ranged from 2 - 7 mg/L.

Sedimentation on the Fraser River has been identified by the Colorado Nonpoint Source Assessment Report as an issue, and this segment has been designated "Partially Supporting" designated uses in the State's 1994 305(b) Report. Division of Wildlife data from September 1979 and July 1993 indicates that the coldwater fishery is impacted as a result of stream sedimentation. A similar, but un-impacted stream (Saint Louis Creek) has approximately five to ten times the number of trout, 280-700 per acre, versus seventy per acre below the Denver Water diversion structure on the Fraser. High sediment loads in this drainage are associated with erosion from cut and fill slopes along US Highway 40 on the north side of Berthoud Pass, as well as road sanding practices. A number of entities, including the East Grand Water Quality Board, the Winter Park Recreation Association, the Denver Water Department, the Colorado Department of Transportation, the US Forest Service, and the Water Quality Control Division are exploring options for addressing this problem. Currently, the Colorado Department of Transportation is attempting slope stabilization on highly erosive slope areas at Zero Creek.

As part of this effort, the Forest Service has provided leadership in monitoring the Fraser River, and a "reference site" location in Saint Louis Creek. Fish collection data in October of 2000 found an estimate of 1,570 and 1,051 brook trout per acre in each of these streams, respectively. Fish condition, represented by weigh at a given length, tended to be higher in the Fraser River. Fish biomass was estimated to be 63 and 43 pounds per acre for the Fraser River and Saint Louis Creek. Fine sediment (less than 8 mm) in the Fraser River makes up a significantly higher proportion of the substrate than

in Saint Louis Creek, however, residual pool depths are similar (averages of 1.41 and 1.36, respectively). Macroinvertebrates were sampled in August 2000 at both sites.

A 1986 study of the assimilative capacity of the Fraser River concluded that levels of un-ionized ammonia would exceed toxic levels by 1995 without advanced wastewater treatment at the Grand County #1 wastewater treatment plant discharge. The increasing levels of ammonia are projected due to anticipated growth within the service area. A similar modeling study in 1987 evaluated the instream flow necessary to dilute sewage effluent to meet state water quality standards. Based on a peak population of approximately 40% of the potential capacity in the upper Fraser Valley, the study concluded that enhanced waste water treatment at all upper Fraser Valley facilities, or greater diluting flows in the Fraser River, will be necessary to prevent exceedance of the standard for un-ionized ammonia. Additional release flows of 1.4 cfs in Vasquez Creek and 4.2 cfs in Saint Louis Creek would be required during winter months.

Water quality monitoring data in the Fraser River basin includes that measured by the Colorado Department of Public Health and Environment's Water Quality Control Division at Granby. A review of the data from this station for the period from 1977 to 1987 indicates elevated phosphorus, mercury, cadmium, copper, silver and lead concentrations as well as pH as high as 8.5. In the most recent three years of this period only the average concentrations for lead and mercury exceed state standards. Total phosphorus is above the EPA recommended concentration.

A 1973 assessment of waste loads for the Fraser River indicated that the Fraser River receives less waste than its assimilative capacity, but point source discharges in some instances did not meet effluent standards. Waste loads of approximately twice those of the 1973 loads would cause concentrations of un-ionized ammonia to exceed the toxicity criteria for aquatic life. The 1986 and 1987 annual reports of the Water Quality Control Division list the Fraser River as threatened for un-ionized ammonia indicating that it is currently meeting the designated uses but there is a downward trend.

The USGS 1976-1977 [USGS, 1979] selected sites on the Fraser River between Berthoud Pass and Granby to determine effects from recreation and point source discharges at Winter Park and Fraser. The Fraser River upstream from the Mary Jane Ski Resort was established as a control site to determine the effects of recreational and urban activities in downstream reaches. Water at this site had a maximum dissolved solids concentration of only 68 mg/L. As a result of natural occurrence, concentrations of total cadmium, iron, and zinc exceeded standards for aquatic life downstream of the resort area.

The Fraser River near Granby was assessed for possible effects on water quality from upstream agricultural activities and from septic system use at Tabernash as a part of the USGS study [USGS, 1979]. Nutrient concentrations increased in this reach. The report stated that this increase could be due to seepage of septic systems in Tabernash and cattle grazing.

Because the Fraser River valley contains an underlying clay, sand, and gravel aquifer, the river is partly sustained during low flows by ground water. The water table is generally within a few feet of the bottom of the stream channel.

The 1979 USGS study reported that the nutrient increase in the water downstream from

Tabernash (site GC-7) is probably a result of a hydraulic connection between the stream and ground water containing septic system seepage. The dissolved solids concentrations were less than 100 mg/L. Total cadmium and lead concentrations exceeded standards for aquatic life at that time. Water quality data collected by the Water Quality Control Division between 1988 and 1992 indicates continued detection of cadmium, but at levels well below those that would impact aquatic life. Dissolved lead was not detected in any samples during this time.

The USGS Study [USGS, 1979] found phytoplankton [algae] concentrations consistently increased downstream. The largest increase corresponds with the nutrient increases previously cited. The most productive site was the Fraser River at its confluence with the Colorado River, where 30 types of algae were collected, including seven types of green algae and two types of blue-green algae. Anabaena and Chroococcus were the blue-green algae collected. Both types are considered to be polluted water algae because of objectionable taste and odor and filter clogging characteristics, but their presence alone does not indicate pollution. The phytoplankton diversities were 3.55 at site GC-6 and 3.49 at site GC-9.

The 1989 Colorado Nonpoint Assessment states that water diversions in the Fraser River headwaters, Saint Louis, and Vasquez Creek greatly reduce stream flows effecting the quality and beneficial uses of the river. Low instream flows coupled with point and nonpoint loads reduces the potential of the stream as a trout fishery.

The 1976 USGS study [USGS, 1979] selected sites on the Colorado River and tributaries to the Fraser River to examine possible water quality effects from agricultural and natural runoff. The Colorado River upstream from the Fraser River was assessed for possible water quality effects from agricultural activities upstream. The water was suitable for all uses as concentrations of all constituents were low. Downstream from the Hot Sulphur Springs sewage lagoons, nutrient and bacterial concentrations increased as compared to upstream, probably because of effluent discharges from the sewage lagoons. Total cadmium and lead concentrations exceeded standards for aquatic life.

A Water Quality Control Division (WQCD) monitoring site on the Fraser River near Granby was active between 1979 to 1992. This station showed no exceedances of water quality standards between 1988 and 1992 with the exception of occasional exceedance of the chronic dissolved iron standard (0.3 mg/L) for drinking water supplies: 17 samples collected had a mean value of 0.21 mg/L and a range of 0.10- 0.45 mg/L. There were no detections of lead between 1988 and 1992 (17 samples); no detection of mercury (16 samples); 15 of 17 samples were non-detect for copper (other 2 were at and just above the detection limit). Fecal coliform samples collected between 1979 and 1992 had a maximum of 430 MPN per 100 ml, and average of 47 (the standard is 2,000). For the period 1988 through 1992, the maximum fecal coliform number was 230, with an average of 49 MPN / 100 ml. Total phosphorus between 1979 and 1992 averaged 0.078 mg/L, and between 1988 and 1992 was 0.077 mg/L, which is close to the median value (0.0775 mg/L) for all WQCD stations within the NWCCOG region.

The USGS produced a report titled "Fraser River Watershed, Colorado – Assessment of Available Water-Quantity and Water-Quality Data Through Water Year 1997" [Water Resources Investigation Report 98-4255]. Analysis of limited water quality data in the watershed indicates that changes in the land use/land cover affect the shallow alluvial

ground-water quality. Iron and manganese concentrations in eight shallow alluvial wells exceeded EPA secondary drinking water standards and radon concentrations from these wells exceeded proposed maximum contaminant levels (300 pCi/L). Surface water quality data are sparse, but two samples from two surface water sites exceeded the un-ionized ammonia chronic criteria. Spatial distribution of nutrient species (ammonia, nitrate, nitrite, and total phosphorus) shows that elevated concentrations occur primarily downstream from urban areas. Sites with five or more years of data were analyzed of temporal trends in nutrient data. Downward trends were identified for ammonia and nitrite at three sites. For nitrate one site showed a downward trend and two sites showed no trend. Total phosphorus showed no trend. Total phosphorus concentrations that exceeded 0.1 mg/L were detected in 23% of the phosphorus samples (95 analyses), with the median concentrations being similar for range and urban land uses. The surface water metals data reviewed did not indicate heavy metals concerns.

In 1996-1997 the Water Quality Control Division monitored four sites in the Fraser River basin. These sites were: Fraser River at Granby; Fraser river above Winter Park, Pole Creek near Tabernash, and Saint Louis Creek near Fraser. Nutrients, metals, and inorganic parameters were collected.

The U.S. Geological Survey, in cooperation with the East Grand Water Quality Board, began a data collection effort in August, 1990, primarily to determine existing water quality conditions for selected nutrient parameters, primarily phosphorus and nitrogen compounds. The program has grown over the years from 4 mainstem Fraser River sites sampled in 1991, to 27 sites throughout the Fraser River basin in 2001.

For 2001, periodic samples for surface-water quality were collected at 6 Fraser River sites, 2 Ranch Creek sites, 3 Crooked Creek sites, 7 Pole Creek sites, and 9 Tenmile Creek sites. The types of data collected in WY 2001 include field measurements (stream flow, water temperature, specific conductance, pH, and dissolved oxygen); nutrients (nitrogen and phosphorus compounds), major ions (chloride and dissolved-solids at all sites, calcium, magnesium, and hardness at selected sites); and Fecal coliform bacteria (at selected sites; changing to *Escherichia coli* in 2002). In addition, and in cooperation with other agencies, continuous records of discharge were collected at 8 sites on perennial streams in the basin, and additional surface-water quality data (primarily trace elements) were collected at 1 Ranch Creek site, and 1 Fraser River site.

For 2002, periodic samples for surface-water quality will be collected at 6 Fraser River sites, 1 Ranch Creek site, 2 Crooked Creek sites, 2 Pole Creek sites, and 3 Tenmile Creek sites. The types of data to be collected in WY 2002 include the same measurements collected in 2001. In addition, continuous records of discharge will be collected at 8 sites on perennial streams in the basin, and additional surface-water quality data (primarily trace elements) will be collected at 1 Ranch Creek site, and 1 Fraser River site.

2.3 Willow Creek (Stream Segments 6a, 6b, & 6c)

Willow Creek, a tributary of the Colorado River, which enters just north of Granby, has sediment loads (primarily due to road construction associated with logging activities) which severely impact aquatic life, according to the 1989 Colorado NPS Assessment. Willow Creek is also impacted by intensive recreation land uses in the both the upper

area (motorized and mechanized) and lower area (numerous guest ranches).

An issue currently before the Water Quality Control Commission is the temporary ammonia standard on Segments 6b and 6c. Both segments are designated "Use Protected" due to aquatic life habitat constraints. As of December 1995, the temporary ammonia standard of "ambient" in Segment 6c will remain in effect until December 30, 2000. The temporary standard will allow time for analysis of various alternatives for the Three Lakes Water and Sanitation District, with respect to discharge location (currently to Segment 6b), treatment alternatives, and the potential for coordinated siphon operation and fish management with the Northern Colorado Water Conservancy District (the siphon apparently serves as a significant source of fish to Segment 6c).

A TMDL for segment 6c was completed by the Water Quality Control Division in July 2000 and approved by EPA. The TMDL goal is the attainment of chronic and acute un-ionized ammonia standards at the top of segment 6c.

The temporary standard for ammonia is set to expire in December 2003. Prior to that time it is expected that the Three Lakes Water and Sanitation District's new mechanical wastewater treatment facility, with ammonia removal capability will be operational and meeting its discharge permit requirements. The permit limits are set to ensure protection of the stream standards.

2.4 Upper Colorado River (Stream Segments 3 & 4)

The USGS 1976 Reconnaissance Study [USGS, 1979] assessed the downstream reaches of the Colorado River were assessed for possible water quality effects from agricultural activities. Dissolved solids and nutrient concentrations generally increased at these sites.

The USGS study also found an area of iron rich sediment which is probably eroded during spring runoff between Hot Sulphur Springs and Troublesome, as the total iron increased from 850 to 11,000 ug/L in this reach of the stream. Some of the rocks along this reach of the stream are iron bearing olivine basalt, which is easily weathered.

A review of the Water Quality Control Division water quality monitoring data for the period from 1977 to 1987 indicates average concentrations for cadmium, copper, and zinc above state standards near Hot Sulphur Springs. Occasional exceedances of silver concentrations were also noted. Fecal coliform and total phosphorus levels were found to be high. However, in the most recent three years of this period concentrations of all the above water quality parameters are reduced. Data collected by the division between 1988 and 1992 indicated no exceedances of copper, zinc, or fecal coliform bacteria. Dissolved cadmium continues to be detected, but at low levels.

A 1975 Colorado Department of Health study of the Colorado River near Hot Sulphur Springs found that concentrations of several constituents exceeded water supply standards. For example, dissolved iron concentrations exceeded water supply standards, with a maximum of 1,500 ug/L. Water Quality Control Division data from 1988 to 1992 (18 samples) showed a maximum concentration of dissolved iron of 260 ug/L and an average of 176 ug/L (the standard is 300 ug/L).

2.5 Williams Fork Sub-basin (Stream Segment 8)

Water quality data in the Williams Fork area have been collected by the Denver Water Department at seven sites beginning in 1974 (one above the Williams Fork Reservoir, and six above the Henderson Mine and mill property). Recent data (from 1993 through 1994) indicates water in the Williams Fork is of excellent quality, with very low nutrients, low metal concentrations, high dissolved oxygen, and low suspended sediments. This data indicates that any previously documented problems with respect to heavy metals have been resolved.

The 1976 USGS study [USGS, 1979] on the Williams Fork near the Urad-Henderson Mine (Amax Corp.) found that the Williams Fork downstream from the west portal of the mine was not polluted by heavy metals. Also, there was no increase in heavy metals concentrations because of mining activities.

The Denver Water Department has been collecting chemical data on the Williams Fork and its tributaries since 1974. All sites evaluated showed that the water was of suitable quality for all uses. At all sites the concentrations of dissolved solids were less than 100 mg/L, and trace element concentrations and bacteria counts also were correspondingly small. Trace element concentrations at sites near the Urad- Henderson Mine did not exceed any water quality standards.

A 1974 study showed effects from the excavation of a tunnel for the Urad-Henderson Mine on the Williams Fork drainage. The Williams Fork upstream from Keyser Creek showed an increase in the concentrations of most trace elements. Concentrations of dissolved copper and lead exceeded drinking water standards and concentrations of pH, total copper, iron, and zinc exceeded aquatic life standards. The 1974 study was done at the time the tunnel was under construction.

The 1989 Colorado Nonpoint Assessment reports cadmium, copper, and silver concentrations above basic standards for aquatic life on the Williams Fork from the source to the confluence with the South Fork of Williams Fork, which carries only cadmium above standards. From the confluence to Williams Fork Reservoir it exceeds the recommended limits for cadmium, copper, and zinc, however, good trout fisheries are reported in the Williams Fork.

These two previous statements indicate that any heavy metals concerns at that time were probably not due to existing mining operations, as metals exceedances were observed above the Henderson Tunnel, where there were no current mining operations.

In the 1999 Upper Colorado River Basin Standards hearing, the point of compliance for the Henderson Mill discharge permit was determined to be a downstream well. Monitoring of the well showed that the stream standard is being attained. Additionally, the Water Quality Control Division in the 2000 Basic Standards hearing changed the aquatic life standards for manganese to a hardness-based equation, which effectively increased the numeric standard to a level, which the Williams Fork River is meeting. The "Water Quality Limited" designation on this segment was removed and reflected in the State's 2000 305(b) report.

The Henderson Mill is, generally speaking, a non-discharging facility. Management of

the facility attempts to estimate the annual water need and capture that amount during the spring runoff. Only under high spring flows does the facility discharge, and then the amount discharged is that amount in exceedance of the process needs.

2.6 Troublesome and Muddy Creeks (Stream Segments 4, 6a, & 7a)

Through the Kremmling area the Colorado River water becomes more mineralized, as evidenced by the larger specific conductance values and sulfate concentrations. This area is underlain by Pierre Shale, parts of which are easily weathered. Red Dirt Creek, which flows into Muddy Creek from the west, also flows through Pierre Shale, but the water was suitable for all uses, although a larger total organic carbon concentration was determined as compared to sites along the Colorado River. This area contains much carbonaceous debris rich in organic material.

The Rock Creek/Muddy Creek Draft Environmental Impact Statement [USFS, 1987] found that in the Muddy Creek drainage "[w]ater quality standard violations (when water quality concentrations exceed state water quality standards) have not been attributed to any specific land use activity. It appears that the geologic input dominates surface water chemistry. Parent materials are predominantly Pierre and Mancos shales" Additionally, occasional water samples were analyzed for heavy metals, with no problems identified. Nitrogen and phosphorus levels were identified as being in higher than expected concentrations (potentially due to natural background sources and poor riparian vegetation along the main channel of Muddy Creek). This, in conjunction with relatively warm water temperatures, has the potential to create water quality problems in Wolford Mountain Reservoir. Muddy Creek suspended sediments upon occasion exceeded 3,000 mg/L, and the waters of Wolford Mountain Reservoir have potential to be turbid, as many of the shoreline soils will be subject erosion from wind generated wave action.

The USGS has two sites at which they collect water quality data on Muddy Creek - one above Antelope Creek, and one at Kremmling. The water quality data from these two stations from 1992-1994 indicates high specific conductance, turbidity, hardness, dissolved solids, sulfate, iron, and suspended sediment. Nutrients are generally at low to moderate concentrations.

The 1989 Addendum to the Colorado Nonpoint Source Assessment Report states that "[e]rosion has been reported by local soil conservation districts along this portion of the Colorado River. In particular, Eightmile Creek, Little Muddy Creek, Big Muddy Creek, Troublesome Creek, and Cottonwood Creek are erosion areas; however, the reach of the river that these creeks are tributary to, just above State Bridge, does not show the effects of sediment loads. Effects within these watersheds require further documentation."

Water quality data is collected at two stations on Muddy Creek by West Grand High School as part of the Division of Wildlife's River Watch Program (at Colburn and Pinto). No metals data has been collected at the sites.

2.7 Colorado River below Blue River (Upper Colorado River Segments 3, 5, 7a, and 7b)

Segment 3 is the Colorado River from Lake Granby to State Bridge, Segment 5 is the mainstem of the Colorado River from State Bridge to the confluence with the Roaring Fork, Segment 7a are all the tributaries to the Colorado River from the Blue River to the Roaring Fork (excluding the Blue and Eagle River watersheds), and Segment 7b is the mainstem of Rock Creek.

The 1989 Addendum to the Colorado Nonpoint Source Assessment Report states that "the Colorado River mainstem begins to show impacts from sediment in the segment downstream from State Bridge. The Eagle County Soil Conservation district has designated a stream bank erosion area. This may explain the elevated sediment levels in this reach."

Rock Creek near Toponas within the Routt National Forest was assessed for possible water quality effects from upstream timber production activities. This site had water suitable for all uses, evidenced by low dissolved solids (less than 100 mg/L) and nutrient concentrations [USGS, 1979].

Although Rock Creek has a temporary modification for the mercury standard which is due to expire in 1996, the Rock Creek/Muddy Creek Reservoir Draft Environmental Impact Statement [US Forest Service Rocky Mountain Region, 1987] states "[w]ater quality analyses for Rock Creek occasionally included heavy metals analyses and, in all cases, metal concentrations were well below water quality standards". USGS monitoring on Rock Creek at McCoy and Crater between 1987 and 1993 did not detect mercury. It appears that the temporary standard for mercury should be removed from this segment.

2.8 Instream Flows

Appendix 14 lists the Colorado Water Conservation Board's (CWCB) instream flow filings in the Upper Colorado River watershed. Colorado statute (CRS § 37-92-102(3)) recognizes that preserving the natural environment to a reasonable degree, through the protection of instream flows and maintenance of natural lake levels in natural lakes, is a beneficial use of water. Under the same statute, the Colorado Water Conservation Board is declared the exclusive agent authorized to appropriate water rights for the purpose of preserving the natural environment. The acquisition of the water rights to protect minimum instream flows has to be made within the context of existing water rights appropriation regulations. Minimum instream flows are therefore subject to appropriation dates, and the CWCB can only call out water rights junior to their own for maintenance of those flows. Most of the appropriation dates in the Upper Colorado River watershed are between 1977 and 1990.

CWCB appropriation flows, determined in consultation with the Division of Wildlife and the Division of Parks and Outdoor Recreation, are the flows necessary "to preserve the natural environment to a reasonable degree" (CRS 37-92-102(3)). The fact that the CWCB has filings for these instream flows does not ensure that stream flows will always exceed the minimum necessary to protect the natural environment, as the water rights associated with these flows have relatively junior appropriation dates. Exercise of water rights that are senior in date to the CWCB instream flow appropriation dates can result in stream flows lower than the CWCB appropriation amount.

A minimum stream flow agreement exists between the US department of the Interior and the Municipal Subdistrict of the Northern Colorado Water Conservation District [Colorado-Big Thompson Windy Gap Projects Colorado Final Environmental Impact Statement, Water and Power Resources Service, US Department of Interior, 1981]. The agreement requires minimum stream flows as follows: from Windy Gap diversion to Williams Fork 90 cfs; from Williams Fork to Troublesome Creek 135 cfs; Troublesome Creek to Blue River 150 cfs. Once every three years, if equivalent flows do not otherwise occur, a flushing flow of 450 cfs for 50 hours, sometime within the months of April, May, and June. Windy Gap water delivered to the Eastern Slope will average about 48,000 acre feet per year. This delivery will be relatively uniform year to year [DOI, 1981].

NCWCD is authorized to take up to 310,000 acre-feet annually, and has averaged 228,000 acre-feet in recent years. The Alva Adams tunnel passed 245,602 acre-feet in water year 2000 [Division 5 Water Resources Annual Report].

3.0 WATER QUALITY ISSUES

The major water quality issues in the upper Colorado River watershed are the impacts of water diversions upon water quality, and sediment and dissolved solids loads from nonpoint sources. In addition, some stream segments require load allocations for point source dischargers in order to meet ammonia standards.

3.1 Point Source Issues

3.1.1 Municipal Discharges

Point source problems were extensively evaluated by the Colorado Department of Health in 1974 as part of the Colorado River Basin 303(e) Plan. Point source treatment needs, consolidation of wastewater treatment facilities, waste load allocations, treatment alternatives and other related matters were addressed in the basin plan. The principal problems addressed included the future need for ammonia removal capability at domestic facilities to protect the Fraser River from ammonia toxicity. Since the adoption of the basin plan in 1974 and the 1978 version of the 208 plan (which incorporated its recommendations), the development of wastewater treatment facilities has generally proceeded in accordance with its recommendations. Facility plans under Section 201 of the Clean Water Act have defined the precise treatment mechanisms and locations for wastewater treatment and have implemented the recommendations of both the 208 and basin plans.

The major point source discharges in the upper Colorado River watershed include municipal or domestic wastewater treatment plants. The larger municipal and domestic wastewater treatment plants (greater than 0.02 Million Gallons per Day, MGD, discharge) are listed in Table 21, along with their Colorado Discharge Permit System number and their hydraulic capacity.

Table 21. Municipal and Domestic Wastewater Permits Over 0.02 MGD

CDPS Permit Number	Facility Name	Responsible Party	Hydraulic capacity, MGD
CO-0037681	Three Lakes WWTF	Three Lakes W&SD	1.3/approved for 2.0
CO-0026051	Winter Park WWTF	Winter Park W&SD	0.45
CO-0032964	Grand County #1 WWTF	Grand County #1 W&SD	0.995
CO-0040142	Fraser WWTF	Fraser SD	1.0 (average)
CO-0045501	Tabernash WWTF	Tabernash Meadows W&SD	0.2
CO-0045411	Young Life WWTF	Young Life Camp	0.034
CO-0023442	Snow Mountain Ranch	YMCA of the Rockies	0.22
CO-0020699	Granby WWTF	Granby SD	0.995
CO-0024350	Hot Sulphur Springs WWTF	Town of Hot Sulphur Springs	0.09
CO-0021636	Kremmling WWTF	Kremmling SD	0.17

Three Lakes Wastewater Treatment Facility

The Three Lakes Water and Sanitation District wastewater treatment facility is a 1.3 MGD aerated lagoon facility that discharges to an unnamed tributary to Willow Creek, Segment 6b of the Upper Colorado River. This stream segment is designated use protected, and the one-day in three year and 30 day in three-year low flow events are both 0.0 cfs (without discharge from the plant, this is an ephemeral stream). The facility consists of two aerated lagoons, one settling cell, and a chlorine contact chamber. Because it is a lagoon type treatment, sludge disposal is intermittent. A temporary modification (set at ambient conditions) on ammonia is in place, while the district completes a permit condition study of ammonia loading. The organic capacity of the facility is rated at 2,200 pounds of BOD per day. Another wastewater treatment facility owned and operated by the Three Lakes District, Sun Valley treatment facility, was being abandoned in 1995, and flows from this area were rerouted through the use of a lift station and connection to the plant discharging to the Willow Creek tributary. The district's discharge permit expires September 30, 2006.

The permit is written for a lagoon capacity at 1.3 MGD and a sequencing batch reactor (SBR) at 2.0 MGD. The 2.0 MGD facility has been rated for an organic capacity of 5,004 pounds of BOD per day. The new SBR has received site approval and is being constructed. The district's discharge permit states that the SBR is scheduled to go on-line in July of 2002.

A temporary standard for ammonia has been assigned to the stream segment below Three Lakes' discharge point, which expires in 2003. The temporary modification allows time for the new facility to be constructed and put on line. The new facility will be meeting ammonia discharge limits of 7.0 to 11.0 mg/l total ammonia.

Point source problems associated with providing wastewater treatment facilities for the Three Lakes Area was also addressed in a 1976 study by EPA. This study addressed alternative means and service areas to provide collection and treatment for domestic waste. A facility plan based upon the conclusions of this study provided the basis for point source treatment in the area.

Winter Park Water and Sanitation District Wastewater Treatment Facility

The Winter Park Water and Sanitation District wastewater treatment plant is a 0.2 MGD aerated lagoon plant that discharges to the upper Colorado River Stream Segment 10 (Fraser River). The district serves the Winter Park Ski area and residential and commercial buildings in the old town area of Winter Park surrounding the ski area.

Infiltration and inflow (I/I) has historically been a problem and the plant does not have the hydraulic capacity to meet peak flows. Notices of violations have been issued and the district is under a compliance schedule to upgrade the facility. A preliminary evaluation of the option of plant consolidation was done in 1994. A water rights evaluation done by Leonard Rice consultants, and a cost estimate of construction of a pipeline for untreated wastes down the valley and a pipeline and pump station to deliver treated effluent back up the valley (to meet water right conditions) suggested that consolidation of this facility was not feasible (the cost of pipelines and pumpback was estimated at \$6.2 million, while the cost of a 0.5 MGD mechanical plant adjacent to Winter Park Ski Area as estimated to be \$3.7 million). In 1997 the State approved Winter Park Water and Sanitation District's site application for a 0.275 MGD mechanical plant with aerated lagoon/activated sludge process with chlorine disinfection and ammonia discharge limits.

In 1997, two nitrification aeration basins, two clarifiers, an alkalinity feed system, and a heating system were constructed in order to meet ammonia standards. In 1999 a third nitrification aeration basin was constructed and plans for headworks were postponed. In 1999 the state approved a site application for a hydraulic capacity of 0.45 MGD and an organic capacity of 1,690 pounds of BOD per day. Permit limits for ammonia discharge range from 1.75 to 8 mg/L. The current permit expires July 31, 2005.

Grand County #1 Water and Sanitation District Wastewater Treatment Facility

Grand County Water and Sanitation District No. 1 (GCSD #1) wastewater treatment plant is a 0.995 MGD aerated lagoon discharging to the upper Colorado River Stream Segment 10 (Fraser River), in the vicinity of the town of Fraser. The facility consists of two aerated lagoons with mixers and baffles, followed by a polishing pond. No disinfection is provided. Infiltration and inflow (I/I) problems have been documented (approximately 65 gallons per day per capita), and the district has an aggressive I/I program in place. Sludge disposal is infrequent due to the lagoon treatment. The facility has an organic capacity rating 1,660 pounds of BOD per day.

Use of the Colorado Ammonia Model by consultants of the East Grand Water Quality Board indicate that stringent ammonia standards will be imposed on all three dischargers (Winter Park Water and Sanitation District, GCWSD #1, and Fraser Sanitation District) in the Upper Fraser River. All of the dischargers will need to provide significant plant upgrades to meet the projected standards. Consolidation of the GCWSD #1 and the Fraser Sanitation District plant at the current Fraser plant site has been identified. The existing permit expires January 31, 2007.

The Grand County Number 1 Water and Sanitation District has concluded that a consolidated facility is the preferred option and is moving forward to have the District's flows treated at an expanded Fraser Sanitation District facility. Consolidated flow treatment is anticipated to begin in the fall of 2002. The discharge permit requires final

compliance with effluent ammonia limits by January 1, 2004.

Fraser and Winter Park West Sanitation District Wastewater Treatment Facility

The Fraser wastewater treatment plant is a 1.0 MGD facility with three lagoons - two aerated and one non-aerated, discharging to the upper Colorado River Segment 10. The facilities consist of a mechanical and manual bar screen, the aerated basins, a polishing pond, chlorination and dechlorination. The organic capacity of the facility has been rated at 2,085 pounds of BOD per day April through November, and 1,334 pounds of BOD per day December through March. Complete mixing occurs in the first stage, requiring sludge removal on a regular basis. Infiltration/inflow problems have been experienced, representing approximately 25% of the influent flow. The facility began rehabilitation of the I/I problem in June 1993. Sludge disposal is accomplished by removal to the sanitary landfill at Granby. Ammonia limits will be required for the facility in order to comply with water quality standards in the Fraser River. The Grand County wastewater treatment facility may be abandoned and if so, consolidation of the two plants would occur at the Fraser Wastewater Treatment Plant site. The Fraser Plant will need to be upgraded to provide nitrification of the wastewater. Currently the existing permit is being rewritten (October 12, 2001). A draft permit was issued May 12, 2000 with an expiration date of July 31, 2005.

The Fraser facility has a discharge permit with a compliance schedule of August 2002 for operational limits meeting ammonia stream standards, with discharge limits ranging from 1.8 to 14.4 mg/l.

Young Life Crooked Creek Camp

Young Life's Crooked Creek Ranch camp has discharge permit for a 0.035 MGD Rotating Biological Contactor (RBC) facility, with a primary clarifier, two aeration/equalization basins, a secondary clarifier, and ultraviolet disinfection with chlorine disinfection back-up. The organic capacity of the plant has been rated at 60 pounds of BOD per day. A compliance schedule has been established for submitting a special ammonia study to the Water Quality Control Division with a due date of November 30, 2003. The discharge permit expires May 31, 2004. In the County's 1041 permit hearing on the approval of this facility, the permittee agreed that the facility would meet an ammonia discharge level of no more than 15 mg/l total ammonia during the months of June, July and August.

Tabernash Meadows

Tabernash Meadows Water and Sanitation District and the community of Tabernash received site approval for a 0.2 MGD new wastewater treatment facility. Currently the facility is operating at 0.1 MGD capacity. The organic capacity of the facility has been rated at 209 pounds of BOD per day. The facility is a Sequencing Batch Reactor (SBR), with manual bar screens, two SBR basins, one clarifier, operating with ammonia removal and ultraviolet disinfection. Ammonia limits vary from 1.8 to 14.0 mg/l total ammonia (at a permitted capacity of 0.1 MGD). The permit expires July 31, 2005.

Snow Mountain Ranch Wastewater Treatment Facility

Snow Mountain Ranch, owned by the YMCA of the Rockies, has a permitted average daily flow capacity of 0.22 MGD and 0.05 MGD annual average non-discharging land application wastewater treatment facility approximately five miles west of Tabernash. The organic capacity of the facility is rated at 500 pounds of BOD per day. The facility consists of three interconnected lagoon systems, including two aerated ponds, four un-aerated ponds, chlorination and a spray irrigation system for application to 8.9 acres. Sludge disposal is intermittent, due to the lagoon treatment. The discharge permit for this facility expired May 31, 1996. A Site Application was received by NWCCOG in January 1998 requesting expansion of the existing facilities to 0.22 MGD with continued land application. The new permit (issued January 13, 2000) is for an average daily flow of 220,000 gallons per day. An expanded area of 24 acres with 205 sprinkler heads is capable of receiving 300,000 gallons per day. The new permit expires on December 31, 2004.

Granby Sanitation District Wastewater Treatment Facility

The Granby wastewater treatment plant is a 0.995 MGD tertiary treatment rotating biological contactor (RBC) mechanical facility, discharging to the Fraser River (upper Colorado River Segment 10), about one mile above the confluence with the Colorado River. The organic capacity of the facility is rated at 1,700 pounds of BOD per day. The plant consists of a mechanical and manual bar screen, two aeration basins, three secondary clarifiers, four RBCs, four sand filters, and chlorination and dechlorination facilities. The facility has ammonia discharge limits. Infiltration/inflow is estimated at 0.2 MGD during May, June and July. Sludge disposal is accomplished by de-watering through the use of a belt press and disposal at the county sanitary landfill in Granby. In 2000 treatment plant capacity in use was 42% of the flows and 43% of the organic capacity as BOD. Granby Sanitation District's discharge permit expires July 31, 2005.

Town of Hot Sulphur Springs Wastewater Treatment Facility

Hot Sulphur Springs' wastewater treatment facility is a 0.09 MGD aerated lagoon that discharges to Segment 3 of the upper Colorado River (Colorado mainstem). The organic capacity of the facility is rated at 247 pounds of BOD per day. An ammonia wasteload allocation study was done to determine if a wasteload allocation was necessary for the Hot Sulphur Springs plant. The resulting calculated limits for ammonia were found to be much higher than expected effluent concentrations, thus no ammonia limits were required. Since this is an aerated lagoon, sludge removal takes place on a limited basis and is not a concern. At the time of the permit renewal in 1998, the Water Quality Control Division imposed a compliance schedule for studies regarding infiltration and inflow and ground water testing in the vicinity of the lagoon system. The facility's discharge permit expires July 31, 2003.

Kremmling Sanitation District Wastewater Treatment Facility

Kremmling Sanitation District's wastewater treatment facility is a 0.17 MGD un-aerated lagoon system, potentially discharging to Muddy Creek, segment 6a of the upper Colorado River. The organic capacity of the facility is rated at 425 pounds of BOD per day. The facility consists of one aerated and three un-aerated lagoons, with a chlorine contact tank that would be used if the facility were to discharge. Currently the facility uses evaporation and exfiltration of the effluent from the lagoons. I/I does not appear to be a problem. A number of conditions were placed upon the most recent permit (issued

August 31, 1992). These conditions include: installation of an influent flow measuring device and groundwater monitoring wells; and the collection of ammonia, pH, and temperature data. -The most recent discharge permit issuance occurred in 1998, with an expiration date of September 30, 2003.

Sanitation facilities below Kremmling

A number of ISDS systems are permitted through Eagle County, including Rancho Del Rio, State Bridge, and Burns. Little information exists on these systems. Dotsero Mobile Home Park is permitted through the Water Quality Control Division. This facility is a Rotating Biological Contactor plant which discharges to ground water.

Two Rivers Village

This project in Eagle County Dotsero area, just below the confluence with the Eagle River, has been granted site approval for a 0.15 MDG facility (1,500 population equivalents). The Colorado Water Quality Control Division has extended the site application permit for this facility to October 9, 2002. The proposed facility includes two lift stations, and an extended aeration activated sludge process (“Aeromod” System) followed by sand filtration and ultraviolet disinfection. [This facility is also mentioned in the Eagle River Water Quality Management Plan]

Below Glenwood Canyon, there is a sanitation district that currently has no collection or treatment facilities.

3.1.2 Population Statistics and Projections

Population statistics and projections for Grand County are listed in Table 22, below. For Grand County, the permanent population between 1980 and 1990 grew 6.6%, and between 1990 and 2000 grew 56.2%. For the other areas in the watershed, (small parts of Routt, Eagle, and Garfield Counties), the population is extremely dispersed, and accounts for probably less than 5% of the total population in the watershed.

Table 22. Grand County Population Statistics and Projections.

ENTITY	Permanent Population ¹					
	1980	1990	2000	2000 projected ²	2010	2020
Grand County	7,475	7,966	12,442	8,412	15,035 ³	20,790 ³
Fraser	470	573	910	677		
Granby	963	966	1,525	1,143		
Grand Lake	382	259	447	299		
Hot Sulpr Spr	405	347	521	412		
Kremmling	1,296	1,166	1,578	1,318		
Winter Park	480	528	662	610		

¹: US Census data, provided by Denver Post, Census 2000 Special Report, March 20, 2001

²: 1996 NWCCOG 208 Plan projections, based on the Department of Local Affairs, State Demographers Office, 1994 projections.

³: Population projections, based on State Department of Local Affairs State Demographer's Office, October 2000 projections.

NOTE: Permanent population projections for the Towns are not available.

Peak Population

Permanent population estimates in the NWCCOG region only partially show the extent of development and growth in the region. Two additional variables also need to be considered regarding development and growth (and infrastructure needs) in the region. One variable is the "transient" visitor to the region who relies on infrastructure (e.g. hotels, motels, etc.), which is not part of the population estimate. The other variable is the second homeowner, who maintains a secondary residence in the region, but does not add to the population estimate. However, there is not adequate data on peak populations.

These two variables are extremely important considerations in growth and development in the region, and again, are not reflected in the population estimates and population growth projections in the watershed plans. For example, in 2001, second homes are estimated to represent 85% of the housing stock in Winter Park, and 70% in Grand Lake.

The major entities in this watershed that are affected by seasonal population fluxes are the Winter Park Water and Sanitation District, Grand County Water and Sanitation District #1, and the Three Lakes Sanitation District due to the seasonal nature of recreational activities in these areas.

3.1.3 Industrial Discharges

Industrial discharges in the Upper Colorado River watershed are generally related to mining activities. Discharge permit holders include Cyprus Climax Metals Company (Henderson Mine and Mill), and numerous gravel and aggregate mining operations. In general, water quality impacts from these dischargers are infrequent and have not been documented to be of significance. Earlier 208 documents (1988 and previous plans) cited water quality impacts from the Henderson Mine (1974 study and 1987 Colorado Nonpoint Source Assessment Report). As previously discussed, recent Denver Water Department water quality data collected in the Williams Fork, indicates excellent water quality. The data does not indicate water quality impacts from the Henderson site.

3.1.4 Point Source Issues - Summary

In summary, the current point source water quality issues in the upper Colorado River watershed are:

Un-ionized ammonia in the Fraser River.

Meeting the Recreation Class 1 fecal coliform standard for discharge issued prior to November 30, 1999 when the recreation class 2 standard was changed to Class 1.

3.2 Point Source Recommendations

NWCCOG has no recommendations at this time.

3.3 Nonpoint Source Issues

Nonpoint source water quality issues in the upper Colorado River watershed include: the loss of stream flows due to trans-basin diversions which reduces the amount of high quality water in the basin; impacts related to urban land uses (including roads and construction activities); water quality impacts associated with recreational activities including snow making, golf course irrigation, and increased visitor impacts; sediment and nutrient loads due to urban runoff and agricultural activities, including logging; and sediment loads associated with gravel mining operations.

3.3.1 Hydrologic Modification Activities

3.3.1.1 Trans-basin Diversion

In 1993, approximately 274,427 acre-feet of water were diverted from the Upper Colorado River watershed to the eastern plains (Denver Water letter to NWCCOG, March 13, 2002 from Chris Schuyler-Rossie). The major water diverters from this watershed are the Denver Water Department and the Northern Colorado Water Conservancy District. The ten-year average of these diversions is 313,854 acre-feet [State Engineer's Office, District V Engineer's Office, 1994]. The Denver Water records for the 1993 ten-year average for this same area indicate 313,185 acre-feet were diverted. The annual flow at the USGS gage above Gore Canyon for the 1993 water year (subtracting the Blue River flow) was 532,200 acre feet. This suggests that approximately one-third of the annual stream flow in the upper Colorado River watershed is diverted out of the drainage. This water use is 100% consumptive, i.e. none of it is returned to the stream system from which it came. The withdrawal of this amount of water from the streams in the watershed has impacts on water quality including: decreased dilution flows; decreased spring runoff "flushing flows" which move accumulated sediments and impact fish spawning habitat (particularly in the Fraser River); decreased aquatic life habitat; increased stream temperature and other water quality concerns associated with changes to channel morphology, and loss of high quality "headwaters" with low pollutant concentrations.

In water year 2000 (November – October), trans-basin diversions from the Upper Colorado River watershed were 321,725 acre-feet. This included 18,673 acre-feet from the Grand ditch, 245,602 from the Alva Adams Tunnel, and 57,450 acre-feet from the Moffat Tunnel. The 10-year average of diversions from the watershed for 2000 is 264,614 acre-feet [2000 Annual Report, Division 5 Water Resources, State Engineers Office].

Some of the reservoirs and structures in the upper Colorado River watershed, which are used to enable, and sometimes mitigate the consequences of trans-basin diversions (Wolford Mountain), include the following.

Granby Reservoir is the major Colorado-Big Thompson storage reservoir (owned by the Bureau of Reclamation and operated by the Northern Colorado Water Conservancy

District). The reservoir inundates about 7,300 acres and has 539,760 acre-feet of storage capacity. The active capacity is 465,600 acre-feet.

Shadow Mountain Reservoir is contiguous with Grand Lake at normal operating elevation. The two lakes have about 1,852 surface acres and 18,400 acre-feet of storage. Grand Lake's surface elevation fluctuation is limited to one foot by legislation. This limitation provides 1,839 acre-feet of regulation in both lakes [US Department of the Interior Water and Power Resource Service, Colorado-Big Thompson Windy Gap Projects Colorado Final Environmental Impact Statement, 1981]. Grand Lake has a surface area of 507 acres and a maximum depth of approximately 200 feet. Grand Lake, which is a natural lake, is used as a conduit as part of the Colorado-Big Thompson Project.

Willow Creek Dam and Reservoir total storage capacity of 10,550 acre-feet, and an active capacity of 9,067 acre-feet (300 surface acres).

Windy Gap and Willow Creek transfer systems are operated by Northern Colorado Water Conservancy District and divert approximately 50,000 acre feet of water annually to Lake Granby [Surface-Water Quality Evaluation Windy Gap Project 1994 Monitoring Program, Harlan & Associates, Inc. June 1995]. It should be noted that "since the entire Colorado-Big Thompson Project was designed and physically built to handle an average of 310,000 acre feet per year, and yields to date have averaged less than 245,000 acre feet per year..." [DOI, 1981], significantly more water could be diverted using the existing western slope system. Middle Park Water Conservancy District owns 3,000 acre-feet of Windy Gap water.

In the Fraser River drainage, Denver Water Department operates a diversion above Winter Park. This diversion structure takes water from the Williams Fork, Vasquez and Saint Louis Creek drainages as well as the Fraser River and sends it to the eastern slope (Gross Reservoir) via the Moffat Tunnel. The annual average diversion (1982-1993) through the Moffat tunnel is 62,325 acre-feet. The City of Thornton owns the Berthod Pass Ditch high on the Fraser River, which diverts an annual average of 614 acre-feet.

Williams Fork Reservoir is owned and operated by the Denver Water Department, and is used to meet downstream calls which could call out Denver's use of Blue River water.

Wolford Mountain Reservoir was constructed in 1994 and 1995 by the Colorado River Water Conservancy District on Muddy Creek. This Reservoir was constructed to hold 60,000 acre-feet and has a surface area of 1,447 acres. Of the 60,000 acre-feet, Denver Water Department owns 24,000 acre-feet (40%), and the remainder is available for lease by the Colorado River Water Conservancy District.

3.3.2 Urban and Construction Activities

The areas of most concentrated urban activities in the watershed occur in the upper Fraser River and in the Three Lakes area. Some of the urban and construction activities which can impact water quality include: increased road sanding and salting; increased nutrient loads from lawn irrigation; increased organic and metals loads due to increased traffic; pesticide and herbicide applications; increased sediment from construction sites

and new roads; etc.

3.3.3 Recreational Activities

Recreational activities potentially impacting water quality include water diversions for snow making and golf course irrigation which can increase pollutants in runoff and increase consumptive water use. Riparian area disturbance due to fishing, boating, etc., can lead to increased sediment and nutrient loads to streams in the watershed.

3.3.4 Agricultural Activities

Most of the watershed is rural in nature with agricultural activities, mainly grazing and logging, as the predominant land use. Although this land use has not been documented to have impacts upon water quality in this watershed, due to the percentage of land use in this category, and due to the lower stream flows due to trans-basin diversions, it is appropriate to recommend Best Management Practices (BMPs) to minimize the nutrient and sediment loads to the streams in the watershed.

3.3.5 Nonpoint Source Issues - Summary

The major nonpoint source water quality problems of streams and lakes in the upper Colorado River watershed include:

Nutrients and suspended sediment which carry nutrients and cause "nuisance" algae and aquatic "weed" conditions in Grand Lake, Shadow Mountain Lake, and Lake Granby as a result of natural and man - induced runoff from the surrounding area.

Increases in sediment in the Fraser River as a result of erosion and traction sanding along State Highway 40 (Berthoud Pass), as well as other land use practices which increase sediment movement in to water bodies above natural conditions.

Increased nutrient inputs from land development activities in the Fraser River basin. This is exacerbated due to trans-basin diversion of high quality water in the headwaters of the watershed. Loss of high quality "dilution flows" results in increased in-stream nutrient concentrations lower in the Fraser River.

Excessive concentrations of total iron and suspended sediment in the Colorado River downstream from Troublesome Creek as a result of natural runoff from iron rich and easily eroded geologic formations.

Increased water development activities associated with the trans-basin diversion of water. These projects significantly modify the hydrology of the Fraser and Williams Fork Rivers. Modification of the hydrology downstream of point source discharges on the Fraser and upper Colorado Rivers increase the average concentration of pollutants, including concentrations of ammonia and chlorine downstream of municipal sources.

3.4 Nonpoint Source Recommendations

Implementation of Policies 1, 2, 3, 4, 5, and 6 of this Plan (see table of contents for

Volume I for titles of policies).

4.0 WATERSHED IMPROVEMENT PROJECTS

4.1 Existing Projects

4.1.1 Clinton Reservoir Agreement

An agreement between the Denver Water Department and numerous "West Slope Parties" enables additional flows in the Fraser River using Clinton Reservoir, in the Tenmile drainage of the Blue River watershed. A maximum of 920 acre feet of "bypass" water has been made available by the Denver Water Department to Grand County users, available September 15 through May 15.

4.1.2 Berthoud Pass Sediment Control Projects

The Colorado Department of Transportation (CDOT) is working on a slope stabilization project adjacent to Zero Creek on the north side of Berthoud Pass. In addition, the Forest Service and CDOT cooperated in a project at the base of the pass, which prevents snow storage immediately adjacent to the Fraser River, and provided vegetative stabilization of the stream bank in the vicinity of the bottom switchback.

NWCCOG was the recipient of a 1997 EPA 319 Grant to coordinate and implement a project which is designed to reduce the sediment load in the upper Fraser River. The project intends to capture a portion of the sediment load during the post-runoff period of late summer and early fall when river flows are not sufficient to carry the sediment load through the system, by utilizing the detention area next to the Denver Water Board diversion structure for the Moffat tunnel.

4.1.3 Three Lakes Water Quality Monitoring Database

In 1993, a water quality database for the Three Lakes (Grand, Shadow Mountain and Granby) was developed by NWCCOG. The database includes data collected by the USGS, the Colorado Water Quality Control Division (including samples collected by the Upper Colorado Lakes Protection Association), and the Northern Colorado Water Conservancy District. The database is updated annually, and will be used by NWCCOG to produce annual summaries of water quality in the three lakes. This database was used to assist in the following project, and has been incorporated into the following effort.

4.1.4 Three Lakes Clean Lakes Watershed Assessment Grant

In 2000 Grand County was awarded an EPA 319 grant for \$135,000 to perform a "Clean Lakes Assessment" of Grand Lake, Shadow Mountain and Granby Reservoirs. The project is designed to document trophic status, and define needed programs to restore or protect beneficial uses of the Three Lakes.

4.1.5 Sheephorn Creek Riparian Improvement Project

The goal of this 2001 project was to reduce stream bank cutting on a ¼ mile section of Sheephorn Creek and increase sub-surface water in a meadow area on Piney Peak Ranch in Grand County about 18 miles southwest of Kremmling. The project was funded by a \$10,000 matching grant from the State Soil Conservation Board, and developed \$30,000 worth of stream and stream bank improvements. Structures included several instream V-shaped rock weirs, “J- hooks”, and embedded logs. The lower one-third of the project area was fenced to provide a buffer zone for comparison of grazing vs. non-grazing in a riparian habitat. Project coordinators were Mark Volt of the Natural Resources Conservation Service Middle Park Soil Conservation district conservationist, and Darcee Biekert.

4.1.5 Shadow Mountain Reservoir Delta Formation

In 1999 the Shadow Mountain Homeowners Association was awarded an EPA 319 grant to assess and provide direction regarding sediment deposition at the mouth of the Colorado River as it enters Shadow Mountain Reservoir. [Project section – Chapter 4]

4.2 Future Project Needs

4.2.1 Berthoud Pass Sediment Control Projects

Additional work to minimize sediment impacts to the Fraser River as a result of slope erosion and road sanding practices on Berthoud Pass is necessary.

4.2.2 Instream Flow Improvement Projects

Projects designed to minimize or mitigate the impact of hydrologic modifications in the upper Colorado River watershed are needed.

4.2.3 Agricultural Best Management Practice Projects

Voluntary projects that minimize impacts or demonstrate new and innovative approaches to protecting water quality impacts from agricultural practices (including logging activities) are needed, especially in areas of high soil erodability.

4.2.4 Urban Runoff Water Quality Improvement Projects

Projects designed to improve water quality, especially sediment and nutrient reduction, from existing and future land development areas are encouraged in the Fraser Valley and Three Lakes area.

5.0 LAND USE REGULATIONS APPLICABLE TO WATER QUALITY

PROTECTION AND IMPROVEMENT

Grand County's Planning Commission has adopted the 208 Plan as a guidance document and requests NWCCOG's comments on development proposals with respect to how the proposals comply with the 208 Plan. Grand County requires a 30 foot building setback from streams, intermittent streams, and lakes if the building is on central sewer. A 150 foot setback from waterbodies is required for septic systems.

Grand County has adopted "1041" regulations for permitting of new and expanded water and wastewater projects.

Beginning in 1996 Grand County and the towns within Grand County undertook a Growth Strategy project, which identified water quality protection as a key concern. The NWCCOG has provided Grand County with the model Water Quality Protection Standards (Appendix 10) as an example for a watershed wide water quality protection regulation.

6.0 WASTELOAD ALLOCATIONS

The Three Lakes Sanitation District has been conducting a Use Attainability study to determine appropriate water quality standards for the unnamed tributary of Willow Creek in which they discharge (upper Colorado River segment 6b), and the segment downstream of Willow Reservoir Road to the confluence with Willow Creek (Segment 6c). The Use Attainability Analysis was completed and a TMDL has been established for Segment 6c. The TMDL goal is the attainment of chronic and acute un-ionized ammonia standards at the top of segment 6c. The wasteload allocation for the Three Lakes wastewater treatment facility is:

Three Lakes Sanitation District @ 2.0 MGD (chronic limits):

January	7.5
February	7.0
March	6.0
April	8.0
May	7.0
June	9.5
July	8.5
August	11.0
Sept.	7.0
Oct.	6.0
Nov.	6.0
December	7.0

Wasteload allocations have been established for point source discharges in the Fraser River drainage. The East Grand Water Quality Board contracted with Regulatory Management, Inc. (RMI) to model the upper Fraser River drainage and estimate ammonia effluent limits for the wastewater treatment plant discharges to the upper Fraser River. RMI reported estimated ammonia effluent limits for effluent limits based on the Colorado Ammonia Model (CAM) adjusted with a wasteload allocation procedure that considered the relative impact of the CAM results on each discharger. A wasteload

allocation agreement has been proposed between Winter Park W&SD, Grand County W&SD No. 1, and Fraser SD which will limit Winter Park W&SD ammonia discharge to levels that will meet winter time concentrations at the downstream discharger's outfall(s) of 0.5, 0.5, 0.4, and 0.3 mg/L (January - April).

The CAM modeling and wasteload allocation analysis was performed for a number of alternative wastewater discharge flow rates for each wastewater plant and alternative locations for the dischargers. The final determination of the ammonia limits for each discharger will be based on wasteload allocation negotiations between the dischargers and the Water Quality Control Division.

A summary of the estimated ammonia effluent limits reported by RMI is presented below:

Point Sources: Allowable Ammonia Discharge (mg/L as N)

Winter Park Water and Sanitation District (based on a downstream consolidated facility at Fraser):

	@ 0.37 MGD	@ 0.45 MGD	@ 0.750 MGD
January	8.5	5.0	5.1
February	11.2	8.0	5.9
March	8.1	5.7	4.6
April	6.1	2.4	3.7
May	7.7	3.3	4.3
June	10.4	6.1	6.4
July	13.5	4.1	10.1
August	15.6	2.8	9.9
September	13.9	2.3	10.3
October	13.9	1.8	9.6
November	11.2	2.3	7.0
December	12.3	6.7	7.7

Grand County #1 and Fraser Sanitation District, based on a consolidated facility- if consolidation does not take place allocations are likely to be equal for each facility, and the effluent limits would be based on the sum of the two plant design flows.

	@ 2.0 MGD	@ 3.0 MGD	@ 4.0 MGD
January	10.1	7.7	6.5
February	9.8	7.4	6.3
March	11.7	8.9	7.4
April	3.1	2.5	2.2
May	2.8	1.9	1.5
June	2.8	1.9	1.6
July	3.1	2.5	2.1
August	2.4	1.9	1.7
September	2.5	1.9	1.6
October	2.0	1.5	1.2
November	1.5	1.2	1.0
December	11.2	8.4	7.0

Young Life Camp @ 0.034 MDG

August	20
September	20
October	20

Note: Young Life has agreed with Grand County in its 1041 permit to limit its ammonia discharge to 15 mg/L from June through August.

Tabernash Meadows Water and Sanitation District @ 0.1 MGD

January	Report
February	Report
March	Report
April	2.4
May	3.3
June	6.1
July	4.1
August	2.8
Sept.	2.3
Oct.	1.8
Nov.	2.3
December	14.0

Granby Sanitation District @ 0.995 MGD:

January	Report
February	Report
March	Report
April	19.1
May	19.7
June	9.5
July	8.8
August	7.5
Sept.	9.7
Oct.	12.7
Nov.	20.7
December	Report

7.0 WATER QUALITY MONITORING

7.1 Existing Monitoring Efforts

Existing ambient water quality monitoring efforts in the upper Colorado River watershed include:

USGS sampling of three sites in the Three Lakes area (paid for by Northern Colorado Water Conservancy District) and other sites - Hot Sulphur Springs, Muddy Creek, and below the Blue River confluence;

USGS sampling in Rocky Mountain National Park as part of National Water Quality Assessment Program;

Northern Colorado Water Conservancy District's Surface Water Quality Evaluation of the Windy Gap Project [Harlan and Associates];

Colorado River Water Conservation District's Wolford Mountain Reservoir monitoring program;

East Grand Water Quality Board's sponsored USGS monitoring of the Fraser River;

Denver Water Board monitoring of the Williams Fork and Fraser drainages;

Division of Wildlife's River Watch program (West Grand High School monitors two stations on Muddy Creek (and two on the lower Blue River);

Colorado Dept. of Public Health and Environment Water Quality Control Division - volunteer monitoring program on Grand Lake (Upper Colorado Lakes Protection Association).

Three Lakes 319 Clean Lakes Project

Additional information on specific water quality sampling locations and data is in Appendix 5.

7.2 Water Quality Monitoring Needs

There is a need for continued monitoring of phosphorus and other nutrient concentrations and associated phytoplankton counts in Grand Lake, Shadow Mountain Lake and Lake Granby. Although much of this work was conducted through the Three Lakes Clean Lakes study, continued monitoring would aid in establishing a long-term picture of the lakes' trophic status and cause and effect relationships.

Evaluation of the Fraser River downstream of Winter Park to establish water quality conditions important to the maintenance of the fishery would be helpful to establish quality criteria necessary for protection of this resource. In particular, there is a concern with regard to the effect of diminished stream flows over the stability of the stream channel and the ability of the stream to flush out accumulated sediment with a diminished frequency of bank full conditions. Field evaluation of channel cross sections would assist in a determination of criteria important to the maintenance of channel stability.

Locating sources of and monitoring concentrations of total iron and suspended sediment entering the Colorado River, principally from Troublesome Creek and downstream of State Bridge, would aid in determining if remedial measures to control runoff from iron rich and easily eroded geologic formations can be achieved. Analyses of iron in bed and suspended sediment samples need to be made to determine how much iron is transported with the sediment.

8.0 WATER QUALITY STANDARDS

8.1 Existing Classification and Standards

Streams in the Fraser River Basin are classified for protection of cold water aquatic life (Class I), primary and secondary contact recreation, water supply and agricultural uses. The Williams Fork River and tributaries are classified for primary contact recreation, cold water aquatic life (Class I), water supply and agriculture. Streams in Rocky Mountain National Park are designated as "Outstanding Waters" and receive special protection under Colorado Water Quality standards (no degradation is allowed). Streams in the Indian Peaks Wilderness Area currently have higher quality water than the numeric criteria necessary to protect the designated uses included in state standards are reviewable under the state's antidegradation rule.

Grand Lake, Shadow Mountain Reservoir and Granby Reservoir have previously been classified as threatened segments because of concern for a downward trend in water quality measured by an increased concentration of phosphorus and other nutrients increases in chlorophyll a concentrations, and a decreasing level of water clarity. However, the provision of a regional wastewater treatment system serving the area has eliminated this trend and the segment is no longer classified as threatened.

Streams in the lower portion of the watershed are classified for the protection of aquatic life, primary and secondary contact recreation, water supply, and agriculture uses. All waters in this area are reviewable under antidegradation regulations except for the unnamed tributary to Willow Creek (Segments 6b and 6c of the upper Colorado River).

8.1.1 Designated Use Impairment Stream Segments

The state has listed one stream segment in the Upper Colorado River watershed as "Use Impaired" in the 305(b) report. That segment, as well as the identified constituent is listed in Table 22. This list indicates stream segments in which water quality is, or may be a concern.

Segment 6c, Tributary to Willow Creek is impacted by un-ionized ammonia.

8.1.2 303(d) List

The Clean Water Act requires the state to list those stream segments or waterbodies that require Total Maximum Daily Load (TMDL) allocations in order for the segment to attain or maintain water quality standards. The state's 1994 304(b) report lists the current 303(d) list (Table 23). In the upper Colorado River watershed, one stream segment is identified, Segment 6c, tributary to Willow Creek. A TMDL has been completed for this section, and once the Three Lakes Water and Sanitation District facility is operational, it is expected that this segment will be in compliance with standards and will be deleted from the State's 303(d) list.

Table 23. 303(d) Listed Segment in the Upper Colorado River Basin

Segment	Description	Status	Impairment	Priority
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COUCUC06c	Un-named tributary to Willow Creek	Partially supporting	Ammonia	L (TMDL completed)
COUCUC08	Williams Fork, source to the mouth	Partially supporting	Mn	

A TMDL is the estimated assimilative capacity of a waterbody, which estimates how much of a pollutant may enter a water body without affecting its designated uses. The TMDL represents the sum of the point sources, the nonpoint sources, and a margin of safety (which can include anticipated future pollutant loadings).

NWCCOG has recommended deletion of the Williams Fork segment from the 1998 303(d) list. This segment is meeting standards and designated uses.

A number of segments in the Upper Colorado River watershed have been included in the State's 303(d) list appendix for monitoring and evaluation. These segments, potentially impacted by sediment, have been identified by the Forest Service, and include: Corral Creek, Gore Creek, Upper Rock Creek watershed, Little Rock Creek, Smith Ditch, Red Dirt Creek watershed, and Muddy Creek.

NWCCOG recommends the addition of the Fraser River from Berthoud Pass to Winter Park to the State's 303(d) List Appendix - monitoring and evaluation list.

8.2 Recommendations on Standards

8.2.1 Support of Existing Classifications and Standards

Water quality standards (including use designations and criteria) for the upper Colorado River watershed are generally adequate to protect the existing uses under current conditions.

NWCCOG is supportive of the State's antidegradation provision and protection of high quality waters. NWCCOG is concerned, however that currently classified Recreation Class 2 waters will be reclassified as Recreation Class 1a unless a Use Attainability Analysis (UAA) is completed. It is likely that Recreation Class 2 is the appropriate classification for some of these segments. It is also unlikely that UAAs will be completed for these segments, due to financial and time constraints. In the Upper Colorado River watershed these waters are:

Segment 6a – All tributaries to the Colorado from L. Granby to the Blue not on National Forest lands

Segment 7 – All tributaries to the Colorado from the Blue to the Roaring Fork

There are permitted discharges to these segments.

8.2.2 Outstanding Water Designation

Designation of the following stream segments as "Outstanding Waters" under the system established by the Water Quality Control Commission:

NWCCOG does not currently recommend any additional waterbodies to the list of

“Outstanding Waters” designation. If Congress approves new wilderness areas within the watershed, NWCCOG recommends investigations of waterbodies within those areas for appropriate ness of “outstanding waters” designation.

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